KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)

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KARPAGAM
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(Established Under Section 3 of UGC Act, 1956)

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Registrar

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Eachanari Post,Pollachi Main Road,Coimbatore -641021

COURSE OF STUDY AND SCHEME OF EXAMINATION
M.Phil. & Ph.D. COURSE IN ASTROLOGY
2015-2016

PART-I COURSE WORK SYLLABUS FOR M.Phil. & Ph.D COURSE IN ASTROLOGY - (2015-2016)

SI.NO	TITLE OF THE COURSE	NO.OF THE SUBJECT	CREDIT	EXAM HOURS	MARKS
1.	PAPER I	01	4	3	100
2	PAPER II	01	4	3	100
3	PAPER III	01	4	3	100
	TOTAL	03	12	9	300

PART-I COURSE WORK SYLLABUS FOR Ph.D COURSE IN ASTROLOGY
(2015 - 2016)

SUB.CODE	TITLE OF THE COURSE	NO.OF THE SUBJECT	CREDIT	EXAM HOURS	MARKS
PAPER-I (COMPULSORY)					
15RAS101	RESEARCH METHODOLOGY	01	4	3	100
PAPER –II (COMPULSORY)					
15RAS201	PREDICTION ASTROLOGY	01	4	3	100
PAPER-III (ANY ONE)					
15RAS301	HISTORY OF ASTROLOGY	01	4	3	100
15RAS302	ASTROLOGY PREDICTIONS IN K.P METHOD	01	4	3	100
15RAS303	WESTERN ASTROLOGY	01	4	3	100
15RAS304	MARRIAGE MATCHING	01	4	3	100
15RAS305	CASE STUDIES IN HOROSCOPE	01	4	3	100

நோக்கங்கள்

1. ஆய்வேட்டின் கட்டமைப்பை புரிந்துக் கொள்வது.

2. ஆய்வாளனுக்குரிய தகுதியை புரிந்துக் கொள்வது.

3. ஆய்வு சிக்கலை புரிந்துக் கொள்வது.

4. கள ஆய்வை பற்றி தெரிந்துக் கொள்வது.

5. ஆய்வின் வகைகளை தெரிந்துக் கொள்வது.

6. ஆய்வின் நெறிமுறைகளை புரிந்துக் கொள்வது.

பயன்கள்

1. ஆய்வேட்டினை உருவாக்க உறுதுணையாக விளங்கும்.

2. ஆய்வேட்டை உருவாக்க பல்வகை நிலைகளை புரிந்துக் கொள்ள பயன்படும்.

3. நேர்காணல், வினாநிரல் ஆகியவற்றை செய்வதற்கு பயன்படும்.

4. கற்றலில் உள்ள படிநிலைகள், கற்பித்தலில் உள்ள படி நிலைகள்ஆகியவற்றை
புரிந்துக் கொள்ள பயன்படும்.

5. கல்வித்துறையில் நுட்பங்கள் பற்றிய அறிவு கிடைக்கும்.

6. பல்வேறு வகையான கருத்தரங்குகளில் கலந்துக் கொள்ள பயன்படும்

அலகு : 1

ஆய்வு என்பதன் விளக்கம் - ஆய்வாளனுக்குரிய தகுதிகளும் உளப்பாங்கும் -
ஆய்வுக்குரிய களம் - ஆய்வு நோக்கினைச் சுட்டல் - ஆய்வுச் சிக்கல் - ஆராயும் பொருள்
பற்றி தெளிதல் - ஆய்வுப் பொருள் பற்றி அதுவரை செய்யப்பட்ட ஆய்வுகள் பற்றிய
தொகுப்புரையும் மதிப்பிடும்.

அலகு : 2

முதன்மைக் கூறுகள் (Primary Sources) துணை நிலைக் கூறுகள் (Secondary
Sources) இவற்றைத் தொகுத்தலும் பகுத்தலும் - பல்வேறு தொகுப்பு முறைகள் -
நேர்காணல் - வினாத்தொகுதி (Questionaire) மாதிரிகள் (Samples) முதலியவை பற்றிய
விளக்கம் கன ஆய்வு வகைகள் - கள ஆய்வுக்குத் தேவையான பொருட்கள் - கள
ஆய்வில் ஈடுபடுவோர் தகுதிகள் - நேர்காணல். வினாநிரல் ஆகியவற்றின் விளக்கம் -
எழுத்து பட ஆதாரம் - புகைப்படம், திரைப்படம், நாடா ஒலிப்பதிவு, ஓவியம், அரும்
பொருள்கள் ஆகியவற்றைப் பயன்படுத்தும் முறைகள்.

அலகு : 3

ஆய்வு நெறிமுறைகள் வகைகள் - ஆய்வேட்டை உருவாக்கும் பல்வகை நிலைகள் மாதிரி வரைவு – பொறியாளர் அறிஞர்களின் கருத்தறிதல் - கலந்துரையாடல், மாதிரி வரைவை மறுபார்வை செய்தல் - திருத்தல் - செம்மையாக்கல்- ஆய்வேட்டின் அமைப்பு – பகுதிகள் - இயல் பிரிப்பு – சுருக்கக் குறியீடு, அடிக்குறிப்புகள், அட்டவணை, விளக்கப்படங்கள், பின்னிணைப்பு முதலியன- ஆய்வேட்டின் கட்டமைப்பும் புறத்தோற்றமும்.

அலகு : 4

உயர்கல்வி நோக்கம் - கற்றலில் உள்ள படிநிலைகள் - கற்பித்தல் படிநிலைகள் - கற்றலைத் தூண்டுதல் - கற்பித்தல் தொழில் நுட்பங்களைத் திட்டமிடுதல் - கருத்தாக்கம் - கற்பித்தல் தொழில்நுட்பத்தில் உள்ள வாய்ப்பு – அடிப்படைத் திட்டங்கள்.

அலகு : 5

குழுவாகக் கற்பித்தல் - பல்வேறுவகைக் கருத்தரங்குகள் - ஆய்வுத்திட்ட முயற்சிகள் - பயிலரங்குகள் - ஒரு சிக்கல் குறித்து விவாதமும் - கருத்துக்கணிப்பும் - குரு – தனித்திட்டப் பகுப்புகளை மேற்கொள்ளுதல் - கணினி வழிப் பயனறிதல் - கல்வித்துறையில் நுட்பங்கள் பற்றி அறிதல்.

பார்வை நூல்கள்:

1. ஆய்வியல் அறிமுகம் - டாக்டர் தமிழண்ணல், டாக்டர் எம்.எஸ்.இலக்குமணன்
2. ஆய்வு கட்டுரை எழுதும் முறை – டாக்டர் முத்துச் சண்முகம், டாக்டர் சு. வேங்கட்ராமன்
3. நாட்டார் வழக்காற்றியல் ஆய்வு – டாக்டர் தே. லூர்து
4. கள ஆய்வியல் சில அனுபவங்கள் - டாக்டர் சரசுவதி வேணுகோபால்
5. ஆராய்ச்சி நெறிமுறைகள் - டாக்டர் ச. வே. சுப்பிரமணியம்
6. ஆய்வு நெறிமுறைகள் - டாக்டர் ஈ.சு.விசுவநாதன்
7. திறனாய்வுக்கலை – தி.சு. நடராஜன்

நோக்கங்கள்

1. பிறப்பு ஜாதகத்தில் லக்னத்தை கொண்டு பலன் கூறுதல்.

2. பன்னிரு பாவக அதிபதிகள் மற்ற பாவகங்களில் மாறியிருப்பதால் ஏற்பட கூடிய நன்மை, தீமை அறிதல்.

3. பாதகாதிபதி கொண்டு பலன்கள் நிர்ணயித்தல் .

4. கோள்களின் சேர்க்கையை கொண்டு பலன் நிர்ணயம் செய்தல்.

5. கோள்கள் பன்னிரு பாவகங்களில் நின்று ஏற்படுத்தும் பலன்களை நிர்ணயித்தல்.

6. 6/8/12- ல் நிற்கும் பாவாதிபதிகளில் நிலையறிந்து பலன்களை நிர்ணயித்தல்.

பயன்கள்

1. சார, ஆதிபத்ய முறைகளில் பலன்கள் நிர்ணயம் செய்ய பயன்படும்.

2. யோக பலன்களை நிர்ணயம் செய்ய முடியும்.

3. கோள்களின் பார்வை பலன்களை நிர்ணயம் செய்ய முடியும்.

4. திதி சூண்யம் அடைந்த பாவகம், பாவகாதிபதி கொண்டு பலன்களை கூற முடியும்.

5. கோள்கள் ஆட்சி, உச்சம், நீச்சம் அடைவதால் ஏற்படும் பலன்களை நிர்ணயிக்க முடியும்.

6. கேந்திர, திரிகோணங்களில் கோள்கள் நிற்பதால் ஏற்படும் பலன்களை நிர்ணயிக்க முடியும்.

அலகு -1

பன்னிரு இலக்ன சாதகங்களில் இலக்னாதிபதியின் நிலை கொண்டு மற்ற பாவகங்களின் தன்மை, கோள்கள், பன்னிரு பாவகத்தில் இருப்பதால் ஏற்படும் பலன்கள். பன்னிரு இலக்னங்களில் பிறந்தவர்களின் பலன்களை சாரம், ஆதிபத்ய முறையில் பலன்களை எழுதுதல். பிறப்பு லக்னத்தில் உள்ள நட்சத்திர அடிப்படையிலான பலன்கள். லக்னத்தில் ஆட்சி, உச்சம், நீச்சம் பெறும் கோள்களினால் ஏற்படும் பலன்கள்.

அலகு -2

பன்னிரு பாவக அதிபதிகளும் மற்ற பாவகங்களில் மாறியிருப்பதால் ஏற்படக் கூடிய நன்மை, தீமைப் பலன்கள். பாதகாதிபதி, மாரகாதிபதி, யோகத்தை கொடுக்கும் பாவாதிபதிகள், யோக பலனை தடுக்கும் பாவதிபதிகள். பாவாதிகள் ஆட்சி, உச்ச, நீச்ச பகை ராசிகளில் நிற்பதால் ஏற்படும் பலன்கள்.

அலகு -3

கோள்கள் தங்களுக்குள் இணைந்திருக்கும் பலன்கள், பாவக அடிப்படையில் கோள்கள் இணைந்திருக்கும் பலன்கள். கேந்திரங்களின் இணையும் கோள்கள் -திரிகோணங்களின் சேரும் கோள்களின் பலன்கள் யோகத்தை தரும் கோள்கள், அவயோகத்தை தரும் கோள்கள்.

அலகு -4

தீய பாவாதிபதிகள், நல்ல பாவகத்தில் இருப்பதினால் ஏற்படும் பலன்கள், நல்ல பாவக அதிபதிகள் தீய பாவகத்தில் இருப்பதால் ஏற்படும் பலன்கள். திதி சூன்ய பாவகத்தினால் ஒவ்வொரு திதியிலும் பிறந்தவர்களின் பலன்கள். ராகு,கேது கோள்கள் பாவாதிபதிகளுடன் இணைவால் ஏற்படும் பலன்கள்.

அலகு – 5

தீய பாவாதிபதிகளின் திசையில் ஏற்படும் பலன்கள், நற்பாவாதிபதிகளின் திசைகளில் ஏற்படும் பலன்கள். ராசியில் 6/8/12-இல் நிற்கும் கிரகங்களின் திசா புத்தி காலங்களில் ஏற்படும் பலன்கள் வர்க்க சக்கரங்களில் 3/6/8/12-ல் நின்று தசை அல்லது புத்தி நடத்தும் கிரகங்களால் ஏற்படும் நன்மை, தீமைகள்.

Reference Nooks:

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கிரகங்களின் பலம் அறியும் வழிகள் - சுப. சுப்பிரமணியன
அனுபவ ஜோதிட பலன்கள்   - கிரிடாதி ஆனந்தா

நோக்கங்கள்

1. மேற்கத்திய நாடுகளில் ஜோதிடவியலின் தோற்றம் வளர்ச்சியை அறிந்துக் கொள்வது.

2. சீனா, அரேபியா, இசுலாம் நாடுகளில் ஜோதிட வளர்ச்சியை அறிந்துக் கொள்வது.

3. இந்திய ஜோதிடவியலின் தோற்றம், வளர்ச்சியை அறிந்துக் கொள்வது.

4. வராகமிகிரர், கல்யாணவர்மா ஆகிய இந்திய ஜோதிட மேதைகளின் நூற்களை படிப்பது.

5. தமிழ் இலக்கிய ஜோதிட வரலாற்றை புரிந்துக் கொள்வது.

6. தற்கால ஜோதிட வளர்ச்சியை புரிந்துக் கொள்வது.

பயன்கள்

1. ஜோதிடவியலில் ஆய்வேட்டை உருவாக்க வரலாற்று பகுதியை எழுதுவதற்கு உதவும்.

2. மேற்கத்திய ஜோதிட முறைக்கும், இந்திய ஜோதிட முறைக்கும் உள்ள வேறுபாட்டை புரிந்துக் கொள்ள உதவும்.

3. எண்கணிதம், கைரேகை, வாஸ்து போன்ற ஜோதிடம் சார்ந்த துறைகளில் அறிவை பெற முடியும்.

4. தற்கால ஜோதிடவியலின் நிலையை புரிந்து பலன்கள் சொல்ல முடியும்.

5. பழங்கால ஜோதிடவியல் நூற்களின் பெருமைகளை புரிந்துக் கொள்ள முடியும்.

6. தமிழ் ஜோதிட நூற்களின் பெருமை புரியும்.

அலகு : 1

மேற்கத்திய நாடுகளில் சோதிடவியல் தோற்றம் சுமேரியர், மெசபடோமியர், ஆசீரியர், பாபிலோனியர், சால்தியர், எகிப்து, சீனா, அரேபியா, இசுலாம் நாடுகள் சோதிட வளர்ச்சி.

அலகு : 2

இந்திய சோதிட வரலாறு வேத சோதிடம் (வான சாத்திரம்) ஆர்யபட்டர், வால்மீகி இராமாயணம், வராகமிகிரர், பட்டோத்பலர், ப்ருதுயஜஸ், கல்யாணவர்மர், ஸ்ரீபதி பத்ததி, துண்டிராஜ் போன்றோரின் சோதிட நூல்களில் காணப்படும் சோதிட வளர்ச்சி.

அலகு : 3

தமிழ் இலக்கிய சோதிட வரலாறு பண்டைய தமிழ் இலக்கிய நூல்களில் காணப்படும் வானசாத்ர சோதிட செய்திகள், கம்பராமாயணம், தொல்காப்பியம், சிலப்பிகாரம், பரிபாடல்.

அலகு : 4

பிற்கால தமிழ் சோதிட நூல்களின் வரலாறு, கீரனூர் நடராசர், முத்துக்குமாரசுவாமி ஆசாரியார், தில்லை சேகரம், நடேசய்யர், முருகையா சோதிடர், கே.வி. வெங்கட்ராம அய்யர், இரகுநாத அய்யர், சி.வி. ராஜன், இரத்தினநாயக்கர் & சன்ஸ், கூடலிங்கம்பிள்ளை, அரங்கசாமி பிள்ளை போன்றோரின் நூற்கள்.

அலகு : 5

தற்கால சோதிட வளர்ச்சி, மேற்கத்திய சோதிடமுறை, கே.பி. கிருஷ்ணமூர்த்தி சோதிட முறை, எண் கணிதம், கைரேகை, ஆருடம், நட்சத்திர பலன், பஞ்சாங்க விளக்கம், மனைவிதி விளக்கம்.

பார்வை நூல்கள்:

1. வால்மீக இராமாயனத்தில் சோதிடவியலின் கோட்பாடுகள் 2008 டாக்டா தி.விமலன்
2. இலக்கியத்தில் சோதிடவியல் டாக்டர். தி.மகாலட்சுமி
3. A Religious history of Ancient India (1985) – Goyal S.R.
4. Astrology History (MA.,Paper 2003) – Pottisree Ramulu University Hyderabad
5. Indian Astronomers,(1991) R. Krishnmurthi
6. Issues in Vedic Astronomy and Astrology (1992) – Haribhai Pandya Somdutt Dikshit Kansara, M.N.
7. Ancient Hindu Astrology for the Modern Western Astrologer(1986)- james T. Braha
8. The people's chronologies(1980) James Trager
9. Founders of sciences in Ancient India (1965) – sathyaprakash

நோக்கங்கள்

1. கே.பி முறைக்கும், இந்திய ஜோதிட முறைக்கும் உள்ள வேறுபாட்டை புரிந்துக் கொள்வது.

2. உபநட்சத்திராதிபதிகளின் மூலம் பலன்கள் நிர்ணயம் செய்வது.

3. ஆருட முறையில் கேள்வியாளர்களின் கேள்விகளுக்கு பதில் கூறுதல்.

4. 249 உபநட்சத்திராதிபதிகளின் தொழில்களை அறிவது.

5. கே.பி முறையில் பல்வேறு கேள்விகளுக்கு பதில் கூறுவது.

6. ஆளும் கிரகங்களை கொண்டு கால நிர்ணயம் செய்தல்.

பயன்கள்

1. பலன்களை துல்லியமாக நிர்ணயம் செய்ய பயன்படும்.

2. பலன்கள் நடக்கும் காலங்களை துல்லியமாக கணிக்க பயன்படும்.

3. பிரசன்ன கேள்விகளுக்கு உரிய பதிலையும், காலத்தையும் கூறப்பயன்படும்.

4. கே.பி முறையில் கோள்களின் பார்வையை கொண்டு பலன்கள் கூறமுடியும்.

5. நட்சத்திர அதிபதிகளை கொண்டு பலன்கள் நிர்ணயம் செய்ய பயன்படும்.

6. குறிகாட்டிகளைக் கொண்டு பலன்கள் நிர்ணயம் செய்ய பயன்படும்.

அலகு: 1

இலக்ன உபநட்சத்திரப் பலன்கள், மேசம், ரிசபம், மிதுனம், கடகம், சிம்மம், கன்னி, துலாம், விருச்சிகம், தனுசு, மகரம், கும்பம், மீனம் ஆகிய இராசிகளில் இலக்ன உபநட்சத்திரம் இருந்தால் ஏற்படும் பலன்கள்,

அலகு: 2

வினாக்களுக்குப் பலன்கள் பன்னிரு பாவகத் தொடர்பினால் ஏற்படும் வினாக்களுக்குப் பலன் கூறும் முறைகள். பன்னிரு பாவாதிபதிகள் மற்ற பாவகங்களில் மாறி நிற்பதால் ஏற்படும் பலன்கள். பாவதிபதிகள் தனது சொந்த நட்சத்திரத்தில் நிற்பது.

அலகு: 3

மேச இராசி முதல் மீனம் வரை உள்ள 249 உபநட்சத்திரங்களுக்குரிய தொழில்கள், இருப்பிடங்கள் பிரிக்கப்படும் தன்மைகள். 249 உபநட்சத்திரங்கள் பிரிக்கும் முறைகள்- அதன் சிறப்பு அம்சங்கள் - அதனுடைய பயன்களை துல்லியமாக கணக்கிடும் முறைகள்.

அலகு: 4

கே.பி முறையில் தயாரிக்கப்பட்ட பல்வேறு சாதகங்களுக்கு பன்னிரு பாவகத் தன்மையில் ஏற்படும் வினாக்களுக்கு பதில் அளிக்கும் முறைகள். ஆயுள் - ஆரோக்யம் - தனம் - திருமணம். குழந்தை பிறப்பு — வேலை — சொந்த தொழில். பொருட்கள் காணாமல் போதல் பற்றிய வினாகளுக்கு பதில் அளிக்கும் முறைகள்.

அலகு: 5

பிரசன்ன கேள்விகள், கேள்வி நேர்த்தின் கோள்கள், பாவகங்களின் தன்மைகள், கிருஷ்ணமூர்த்தி முறை பிரசன்ன விதிகள், பிரசன்ன ஜாதகம் தயாரித்தல், கேள்விகளுக்கு பாவகங்களின் தொடர்பு விம்சோத்தரி தசாவில் செயல் நடைபெறும் பன்னிரு பாவகத்தின் குணத்தைக் கொண்டு கேட்கப்படும் கேள்விகளும் அதற்குரிய பதில்களும்.

Reference Books:

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2. திருமணமும், திருமண வாழ்க்கையும், குழந்தைகளும்
3. பிரசன்ன சோதிடம்
4. சோதிடம் விஞ்ஞானமே
5. சாதக பலன் சொல்வது எப்படி (3 பாகங்கள்)
6. கிருஷ்ணமூர்த்தி பத்ததி ஓர் வழிகாட்டி (6 பாகங்கள்)
7. கிருஷ்ணமூர்த்தி பத்ததி முறைப்படி சாதகம் கணிப்பது எப்படி?
8. பாவ ஆரம்ப முனை கிரகம் மற்ற பாவங்களிலிருந்தால் என்ன?
    கிருஷ்ணமூர்த்தி பள்ளிகேசன்ஸ். ஏ. 21-பு, முதல் தளம், ஸ்பென்சர் பிளாசா, பேஸ்-1,769 அண்ணாசாலை, சென்னை -2
        கே.பி. சோதிட கணிதம்
        கே.பி. சோதிட இரகசியங்கள் பகுதி 1-4
        ஆளும் கிரகங்களும் அற்புதங்களும்
        சோதிட பொக்கிசம் 1-6
        கே.பி.உயர்தர நட்சத்திர சோதிடம் 1-3
        கிருஷ்மன் அன்.கோ.நெ.804 அண்ணாசாலை, எல்.ஐ.சி. எதிரில், சென்னை -2

நோக்கங்கள்

1. மேற்கத்திய ஜோதிட முறைகளின் அடிப்படை விதிகளை புரிந்துக் கொள்வது.

2. யுரேனஸ், நெப்ட்யூன், புளுட்டோ ஆகிய கோள்களின் குணங்களை

  புரிந்துக் கொள்வது.

3. ராசிகள் சுட்டிகாட்டும் ஊர்கள், நாடுகள், நகரங்கள் ஆகியவற்றை தெரிந்துக்

கொள்வது.

4. சூரியன் நிற்கும் ராசியை லக்னமாக கொண்டு பலன்கள் கூறுவது.

5. பன்னிரு ராசிகளின் பொதுவான குணங்களையும், தொழில்களையும்

 புரிந்துக் கொள்ளுதல்.

6. கோள்களின் பார்வை பலன்களை நிர்ணயித்தல்.

பயன்கள்

1. இயற்கைச் சீற்றங்கள் – நில அதிர்வு – பேரலைகள் – தொற்று நோய்கள்
ஆகியவற்றினால் மக்களுக்கு ஏற்படும் பாதிப்பை அறிவதற்கு பயன்படும்.

2. கோள்களின் சேர்க்கையால் பார்வையால் ஏற்படும் பலன்கள் நிர்ணயம்

 செய்ய பயன்படும்.

3. இகலோக ஜோதிடவியலுக்கான பலவிதிகளை எடுத்து பயன்படுத்த உதவும்.

4. தொழில் நிர்ணயம் செய்ய பயன்படும்.

5. சூரியரின் முக்கியத்துவம் நன்கு புலப்படும்.

6. வாழ்நாள் பலன்களை நிர்ணயம் செய்ய முடியும்.

அலகு : 1

    மேற்கத்திய சோதிட முறை அடிப்படை விதிகள், சாயன முறை, சூரியனின்
முக்கியத்துவம், சூரியன், சந்திரன், செவ்வாய், புதன், குரு, சுக்கிரன், சனி, யுரேனஸ்,
நெப்ட்யூன், புளுட்டோ கோள்களின் குணங்கள். ராசிகள், சுட்டிகாட்டும் ஊர்கள், நாடுகள்,
நகரங்கள். மனிதன் பயன்படுத்தும் பொருட்கள்.

அலகு : 2

இராசிகளின் குணங்கள், சூரியமுறையில் பன்னிரு ஆகிய இராசிகளின் பொது, ஆண், பெண், குழந்தை, முதலாளி, தொழிலாளியின் குணங்கள். இராசிகள் குறிப்பிடும் விலங்குகள், பறவைகள் பாவகங்களில் கோள்களின் இணைவால் ஏற்படும் பலன்கள். பன்னிரு இலக்னங்களில் படிப்பதால் ஏற்படும் பயன்கள் - சூரியனின் முக்கியத்துவம்.

அலகு : 3

பார்வைப் பலன்கள் - சூரியன், சந்திரன், புதன், சுக்கிரன், செவ்வாய், குரு, சனி, யுரேனஸ், நெப்டியூன், புளுட்டோ ஆகிய கோள்கள் ஒன்றுடன் ஒன்று இணைந்த பாகையில் ஏற்படுத்தும் பலன்கள். ஒவ்வொரு கோளின் பலம் பலஹீனம் நிர்ணயிக்கும் முறைகள். கோள்கள் சுட்டிகாட்டும் பொருட்கள் - நிகழ்வுகள் - நிலஅதிர்வு - இயற்கை சீற்றங்களால் ஏற்படும் ஆபத்துகள்.

அலகு : 4

பார்வைப் பலன்கள் - சூரியன், சந்திரன், புதன், சுக்கிரன், செவ்வாய், குரு, சனி, யுரேனஸ், நெப்டியூன், புளுட்போ ஆகிய கோள்கள் ஒன்றுடன் ஒன்று கேந்திரம், திரிகோணம் பார்வைகளில் ஏற்படுத்தும் பலன்கள். கோள்களின் வலிமையான பார்வை, தீமையைத் தரும் பார்வைகள். மேற்கத்திய கோள்களின் பார்வைக்கான பெயர்களும் விளக்கங்களும்.

அலகு : 5

மேற்கத்திய பார்வை முறையில் இயற்கைச் சீற்றங்கள் ஏற்பட்ட காலங்களில் உள்ள கோள்களின் நிலைகள் அவற்றின் பலன்கள். நில அதிர்வு ஏற்படுவதற்கான விதிகள். பேரலைகள் ஏற்படுவதற்கான விதிகள் - பெரும் தொற்று நோயினால் ஏற்படும் உயிர் இழப்புகளை சுட்டும் விதிகள்.

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- மணிமேகலை பிரசுரம், சென்னை.
- கிரகங்கள் டிகிரி முறையில் தரும் யோகங்கள்   - சுப்பிரமணியன் எஸ்.பி
- நர்மதா பதிப்பகம், சென்னை
- கிரேக்க சோதிடமும் அணுகுமுறைகளும்   - பிரகஸ்பதி. ஏ
                                                        மணிமேகலை பிரசுரம், சென்னை

நோக்கங்கள்

1. நட்சத்திர பொருத்தம் பார்க்கும் முறையை தெரிந்துக் கொள்வது.

2. கணவன் மனைவியின் அன்னோன்யத்தை புரிந்துக் கொள்வது.

3. கோள்களினால் ஏற்படும் தோஷங்களை புரிந்துக் கொள்வது.

4. தம்பதியர்களின் யோகம், அவயோகம் ஆகியவற்றை புரிந்துக் கொள்வது.

5. தம்பதியர்களின் மன பொருத்தம், மக்கட் செல்வம், நோய்கள்

   ஆகியவற்றை கணிப்பது.

6. விவாகரத்து, திருமண வாழ்க்கையில் ஏற்படும் நன்மை தீமைகளை ஆராய்வது.

பயன்கள்

1. பொருத்தமான கணவன், மனைவியை தேர்ந்தெடுப்பது.

2. திருமண வாழ்க்கையில் ஏற்படும் சாதக, பாதகங்களை கூறி பரிகாரங்களின் மூலம் தோஷத்தை நீக்குவது.

3. திருமணத்திற்கு பிறகு வளர்ச்சி அல்லது சிக்கல்களை முன்கூட்டியே

   அறிவது.

4. திருமண தடை, தாமதம், இவைகளை கண்டறிந்து வழிகாட்டுதல்.

5. வரன் தேடும் முறை, வரன் அமையும் முறையை எடுத்து கூறுவதற்கு

   பயன்படும்.

6. நவாம்சத்தின் மூலம் வாழ்க்கை துணையின் நிலையை அறிதல்.

அலகு : 1

திருமணப் பொருத்தம் பார்க்கும் விதிகள், சாதக பொருத்தம் பார்க்கும் அமைப்பு, கணவன் - மனைவி சாதக பலன்கள். திணப் பொருத்தம் - கணப் பொருத்தம் - மகேந்திர பொருத்தம் -ஸ்திரி பொருத்தம் - யோனிப் பொருத்தம் - ராசி பொருத்தம் - ராசி அதிபதி பொருத்தம். வசிய பொருத்தம் - ரச்சுப் பொருத்தம் - வேதைப் பொருத்தம் - ஏக நட்சத்திரப் பொருத்தம் - ஸ்திரி பூர்வம்.

அலகு : 2

கணவன் - மனைவி சாதகத்தில் பொருளாதாரம், மக்கட் செல்வம், தெய்வீக ஈடுபாடு, இல்லற வாழ்வு, வெற்றி பெற்ற வாழ்வு. ஆயுள் - ஆரோக்கியம் - இருவருக்கும

அன்னோன்யம் கணவனால் மனைவிக்கு யோகம் - மனைவியால் கணவனுக்கு யோகம் - தாம்பத்ய சுகத்தில் ஏற்படும் மனநிறைவு. தம்பதியர்களின் குணாதிசயங்கள்.

அலகு :3

தம்பதியர் சாதகத்தில் திருமணத்திற்குப் பின் ஏற்படும் மனைவியின் முன்னேற்ற நிலை, பின் தங்கிய நிலை, கணவரின் முன்னேற்ற நிலை, பின்னேற்ற நிலை. நவாம்ச லக்னம் - நவாம்ச லக்னாதிபதியின் பலம் பலவஹீனம்- நவாம்சத்தில் அவயோகங்கள் சுக்கிரன் பலம் நவாம்சத்தில் சுக்கிரன் 6/8/12 – ல் மறைவு பெருதல்.

அலகு : 4

மக்கட் செல்வம் இல்லாமை, முன்னேற்றமற்ற பொருளாதாரம், உறவினர் பகை, கடன் தொல்லைகள், நோய் தொல்லைகள், வழக்குகள், விபத்துக்கள், எதிர்பாராதத் துன்பங்கள். வர்க்க சக்கரங்களாகிய D2,D3,D4, D6,D7,D9,D10,D11 மூலம் முக்கிய பலன்களாகிய தனம் -வீர்யம் - சொத்து – நோய்கள் - புத்ர பாக்கியம் - திருமண வாழ்க்கை – வேலை – சொந்த தொழில் ஆகியவைகளின் தரம் நிர்ணயித்தல்.

அலகு : 5

கணவன் - மனைவி பிரிவுடன் கூடிய வாழ்வு, விவாகரத்து, விதவை, விதவன், ஒற்றுமையின்மை, கணவனை விட்டு மனைவி வேறு திருமணம், மனைவியை விட்டு கணவன் வேறு திருமணம், அடிமை வாழ்வுகள், சிக்கல்கள், பெரும் தொந்தரவுகள். இரண்டு திருமணம் - கணவன், மனைவி வரும் திசை, படிப்பு, குணங்கள், வேலையின் அமைப்பு- ஆகியவற்றை முடிவு செய்தல்.

Reference Books

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கோச்சார கிரகங்கள் தரும் பலன்கள்	எஸ்.பி. சுப்பிரமணியன்
கோசார பலன்கள் நிர்ணயம்	மு. மாதேஸ்வரன்
கோசார தீபிகை	சி.ஜி. ராஜன்
சனிபகவான் வழிபாடும் பரிகாரமும்	காழியூர் நாராயணன்
சனிபகவானும் பரிகாரமும்	முருகு இராசேந்திரன்
சகல காரிய சித்தி தரும் சித்தர் எண்யந்திரங்கள்	பாலஷண்முகானந்தா
சாதக ஜாலங்கள்	குடந்தை நாதன்
சாதக அமைப்பும் இல்லற வாழ்க்கையும்	புலியூர் பாலு
சாதகப்படி ஆரோக்கிய நிலை	ரிஷபானந்தர்
சாதகப் பொருத்தம் பார்க்கும் கணிதம	எஸ்.பி. சுப்பிரமணியன்
சாதகப் பலா பலன்கள் கூறுவது எப்படி	ஏ. பிரகஸ்பதி
சாதகப்படி ஆயுள் பாவம்	ரிஷபானந்தர்

KARPAGAM ACADEMY OF HIGHER EDUCATION
M.Phil/Ph.D ASTROLOGY
Paper –III – Special Paper IV
CASE STUDY IN HOROSCOPES
EFFECTIVE FROM ACADEMIC YEAR 2015 – 2016

நோக்கங்கள்

1. பல்வேறு முறையில் தொழில் நிர்ணயம் செய்தல்.

2. இலக்னத்தை கொண்டு தொழில் நிர்ணயம் செய்தல்.

3. தொழில் முனைவோர் ஜாதகங்களை ஆய்வு செய்யும் முறை.

4. தொழிலில் ஏற்படும் முன்னேற்றங்கள், பின்னடைவுகளை அறிதல்.

5. குடும்ப வாழ்க்கை, திருமண வாழ்க்கை ஆகியவற்றை மாதிரி ஜாதகங்களை கொண்டு ஆய்வு செய்தல்.

6. பொறியாளர்கள், வக்கில், மருத்துவர்களின் ஜாதகங்களை ஆய்வு செய்தல்.

பயன்கள்

1. ஜாதகர்களின் தொழிலை முடிவு செய்ய பயன்படும்.

2. வியாபாரிகளின் ஜாதகங்களை ஆய்வு செய்து சொந்த தொழில் செய்ய கூடிய அமைப்பை கூறுதல்.

3. திருமண வாழ்க்கையில் ஏற்படும் நன்மை தீமைகளை விளக்க முடியும்.

4. ஜாதகர்களின் பொருளாதார நிலைகளை நிர்ணயம் செய்ய பயன்படும்.

5. படித்த படிப்புக்கு ஏற்ற வேலை கிடைக்குமா என்பதை கூறமுடியும்.

6. தலைப்புக்கு ஏற்ற ஜாதக மாதிரிகளை ஆய்வு செய்யும் முறைகளை தெரிந்துக் கொள்வது.

அலகு -1

நெருப்பு இலக்ன சாதகர்கள் தங்களுக்குரிய தொழில்களில் ஏற்பட்ட முன்னேற்றங்களும், பின்னடைவுகளும், 1,10 பாவகங்களுக்கு தொடர்பில்லாத தொழில்களை செய்வதால் ஏற்படும் பலன்கள். வேலை, சொந்த தொழிலை நிர்ணயிக்கும் முறைகள் - ப்ருகு நந்தி நாடி முறை — பராசரர் முறை -ஜெயமினி முறை — தசாம்சம் - ஏகாதசாம் கொண்டு முடிவு செய்தல் - கே.பி.முறை.

அலகு -2

நிலம் இலக்ன சாதகர்கள் தங்களுக்குரிய தொழில்களில் ஏற்பட்ட முன்னேற்றங்களும், பின்னடைவுகளும். 1,10 பாவகங்களுக்கு தொடர்பில்லாத தொழில்களை செய்வதால்

ஏற்படும் பலன்கள். ஜாதகன் படித்த படிப்பிற்கும் செய்யும் வேலை அல்லது தொழிலுக்கும் சம்பந்தம் உண்டா? இல்லையா? என்பதை முடிவு செய்தல்.

அலகு -3

காற்று இலக்கன சாதகர்கள் தங்களுக்குரிய தொழில்களில் ஏற்பட்ட முன்னேற்றங்களும், பின்னடைவுகளும். 1,10 பாவகங்களுக்கு தொடர்பில்லாத தொழில்களை செய்வதால் ஏற்படும் பலன்கள். ஜாதகனுக்கு ஏற்படும் கடன் -நோய் - கஷ்டங்கள் - கண்டங்கள் பற்றிய விதிகள். மருத்துவ ஜோதிட கருத்துக்கள் பிரச்சினை- நோய்களுக்கான பரிகாரங்கள்.

அலகு − 4

நீர் இலக்கன சாதகர்கள் தங்களுக்குரிய தொழில்களில் ஏற்பட்ட முன்னேற்றங்களும், பின்னடைவுகளும் 1,10 பாவகங்களுக்கு தொடர்பில்லாத தொழில்களை செய்வதால் ஏற்படும் பலன்கள். ஜாதகனின் படிப்பு, குடும்ப வாழ்க்கை திருமணத்தினால் ஏற்படும் கணவன், மனைவி அன்னோன்யம் - பிரிவினை − குழந்தைகளால் இன்பமா? துன்பமா?

அலகு -5

பிரபலமடைந்த சாதகங்களில் உள்ள கோள்களின் நிலையும், அவற்றினால் ஏற்படும் பலன்களின் மாற்றங்களும். தொழில் முனைவோர் - அரசாங்க வேலையில் உள்ளவர்களின் ஜாதகங்கள் -மருத்துவர்கள் - பொறியாளர் ஜாதகங்கள். வக்கில் - கணக்கர் - உணவு பொருள் வியாபாரம் ஐவுளி வியாபாரம் செய்யும் ஜாதகங்களின் அமைப்பு.

Reference Books

கோட்சாரப் பலனை ஜாதகப் பலனுடன் இணைத்துப் பார்ப்பது எப்படி   ஏ. பிரகஸ்பதி
கோசார கிரகங்கள் தரும் பலன்கள்   எஸ்.பி.சுப்பிரமணியன்
கோசார பலன்கள் நிர்ணயம்   மு. மாதேஸ்வரன்
கோசார தீபிகை   சி.ஜி.ராஜன்
சனிபகவான் வழிபாடும் பரிகாரமும்   காழியூர் நாராயணன்
சனிபகவானும் பரிகாரமும்   முருகு இராசேந்திரன்
சகல காரிய சித்தி தரும் சித்தர் எண்யந்திரங்கள   பாலஷண்முகானந்தா
சாதக ஜாலங்கள்   குடந்தை நாதன்
சாதக அமைப்பும் இல்லற வாழ்க்கையும்   புலியூர் பாலு
சாதகப்படி ஆரோக்கிய நிலை   ரிஷபானந்தர்
சாதகப் பொருத்தம் பார்க்கும் கணிதம்   எஸ்.பி. சுப்பிரமணியன்
சாதகப் பலன்கள் கூறுவது எப்படி   எ. பிரகஸ்பதி
சாதகப்படி ஆயுள் பாவம்   ரிஷபானந்தர்

KARPAGAM ACADEMY OF HIGHER EDUCATION
COIMBATORE-641021

M.Phil / Ph.D– BIOCHEMISTRY
(Effective from the academic year 2015 - 2016 and onwards)

PREAMBLE

• The degree of Master of Philosophy [M.Phil] /Doctor of Philosophy (Ph.D) is awarded to a candidate who has submitted a thesis on the basis of original and independent research in any biochemistry field of research.

• This makes a contribution to the advancement of knowledge, which can be useful to the society.

KARPAGAM ACADEMY OF HIGHER EDUCATION
COIMBATORE-641021

Course code	Name of the course	Instruction hours / week	credits	Maximum Marks (100)
15RBC101	Research Methodology and Pedagogy	4	4	100
15RBC201	Advanced paper in Biochemistry	4	4	100
15RBC301A	Enzyme and Enzyme technology	4	4	100
15RBC301B	Cancer Biology and immunology			
15RBC301C	Medicinal Plants and Plant therapeutics			
15RBC301D	Clinical Biochemistry and Toxicology			
15RBC301E	Plant Molecular Biotechnology			
15RBC301F	Animal Tissue Culture			
15RBC301G	Fish nutrition and tissue culture			
Program Total		12	12	300

15RBC101   RESEARCH METHODOLOGY & PEDAGOGY   4H-4C

Instruction hours/week: L: 4   T: 0 P: 0   **Marks: 100**
                                                                 End Semester Exam: 3 Hours

Course Objective:
Equip the students with:
•   The availability of tools for literature search
•   Usage of tools and documentation of available research
•   Identification of lacunae in the literature
•   Processing of data and evaluating statistical significance
•   Nuances of scientific writing
•   Dissemination of research data

Course Outcome:
After successful completion, the students will understand
1.   Scopus, Cochrane, Pubmed databases
2.   Collation of available research and exportation to appropriate format
3.   Methods involved in the identification of lacunae in the literature
4.   How to Process data and evaluate statistical significance
5.   Nuances of scientific writing
6.   Dissemination of research data

UNIT- I

Fluorescent Antibody assay – Histochemical localization, ELISA techniques – Principles & Applications. Immuno radiometric assay – Principles & Applications
Natural Products – Detection of bioactive molecules by gas chromatography, HPLC and HPTLC , Mass spectrometry, NMR. Emission Spectroscopy – Fluorescence, Phosphorescence and Chemiluminescence. X-Ray diffraction and Flow injection analysis.

UNIT- II

Flow Cytometry – Principles, Abnormal chromosome analysis, Karyotyping, Comet assay. DNA Fragmentation analysis – Microfabrication techniques and uses in biological applications. PCR methodology – Design of primers – RTPCR. PCR in genomic analysis and diagnostic applications. PFGE – Principles, techniques and applications.

UNIT -III

Biological database- DNA sequence database, protein sequence database SRS – Similarity searching, BLAST, FASTA Local and Global alignment, Multiple sequence alignment – Phylogeny. Structure database – Secondary structure prediction. Predicting 3D folds (Threading) Visualisation tool.

UNIT- IV

Scientific writing – writing methodology, results & discussion, presentation.
Correlation & regression. Sampling distribution – Students t test
Experimental design – CRD, RBD. Analysis of experimental results – ANOVA and its interpretation. Duncan's Multiple Range Test.
Microsoft Windows: Macintosh versions, **Microsoft Word** - Characteristics - Document statistics- Typical usage, **Microsoft Excel** - Basic operation – Charts - Using other Microsoft applications - Using external data, **Microsoft Power Point** –power point viewer – versions – uses, **Microsoft Access** –Uses – Features.

UNIT- V
Pedagogical methods in higher education
Objectives and role of higher education- Important characteristics of an effective lecture- Quality teaching and learning- lecture preparation- characteristics of instructional design- Methods of teaching and learning: Large group- Technique – lecture, seminar, symposium, team teaching, project, small group technique- simulation, role playing demonstration, Brain storing, Case discussion, and assignment, methods of evaluation- self evaluation, student evaluation, diagnostic testing and remedial teaching- question banking- electronic media in education:- 'e' learning researches- web based learning.

REFERENCES

1. Adrian Slater, Neigel Scott and Maark Fowler (2008), Plant Biotechnology – Genetic manipulation of plants, 2nd edition, Oxford University Press, New York

2. Akay M. (Ed) Genomics and Proteomics Engineering in Medicine and Biology 2007 Wiley- Interscience John Wiley & sons, Inc. Publication, USA.

3. Deepak Bhariog (2006). Fundamentals of Information Technology, 3rd Edition Excel Books India.

4. Hall, Christopher; Tews, Carey (Retrieved 7 November 2010). "Mac Office matches Windows — almost". InfoWorld. p. 117.

5. Hung T. Nguyen (2006), Fundamentals of mathematical statistics, Springer Berlin Heidelberg publishers.

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7. Lodish H., Berk A., Kaiser CA., Kriger M .,Scott M.P.,Bretscher A., Ploegh H., Matsudaira P (2008) Molecular Cell Biology,6th edition, W.H.Freeman and Company, New York.

8. Sensen C.W. [Ed.] (2007) Essentials of Genomics and Bioinformatics. Wiley-VCH, 419 pages. ISBN 978-3527612642

15RBC201   **ADVANCED PAPER IN BIOCHEMISTRY**   **4H-4C**

Instruction hours/week: L: 4   T: 0 P: 0   **Marks: 100**
                                         End Semester Exam: 3 Hours

Course Objective:
Equip the students with:
•   Applications and limitations of antibody-based assays
•   Applications and limitations of fluorescence-based assays
•   Applications and limitations of microscopic assays
•   Applications and limitations of nucleic acid analysis
•   Analysis of protein using wet lab and computational methods
•   Basic methodology of animal and plant tissue culture methods

Course Outcomes:
After successful completion, the students will understand
1.   Appropriate antibody-based assays for a specific research question
2.   Appropriate fluorescence-based assays for a specific research question
3.   Specific microscopic assays for a research question
4.   Appropriate nucleic acid analysis for a specific research question
5.   Usage of wet lab and computational methods for a specific research question
6.   General methodology of animal and plant tissue culture methods

UNIT I
Metabolism
Carbohydrate metabolism: TCA Cycle, Glycolysis, HMP, Gluconeogenesis,
Lipid Metabolism: Fatty acid synthesis and Beta oxidation and Chain elongation
Nucleic acid metabolism: Purine and Pyrimidine metabolism
Protein metabolism: Urea cycle, Aliphatic and aromatic amino acid metabolism

UNIT II
Cell Biology and Molecular Biology
Replication,transcription and translation in pro and eukaryotes. RNA editing, miRNA and RNAi and its applications. Antisense RNA Technology,signal sequence hypothesis.
General principle of cell communication- G-protein coupled receptor-structure and functions ,cyclic AMP and other second messengers-Phosphatidyl inositol, Diacyl glycerol, Inositol 1,4,5 triphosphate,Ca^{2+};receptor tyrosine kinases-structure and functions, importance of Ras, MAP kinase cascade.

UNIT -III
Genomics and Proteomics
Human Genome project-History, techniques and applications: Anatomy of prokaryotic and human genome: genetic mapping and genetic markers-RFLP, Mini and micro satellite, STS and EST, SSCP, RAPD, AFLP, SNPs, Analysing gene expression- DNA micro array.
Proteome analysis- 2D gel electrophoresis: protein-protein interactions- yeast two-hybrid system and protein micro arrays.

UNIT -IV
Plant Biotechnology
Tissue culture media, composition and preparation, primary culture, callus and suspension cultures, somoclonal variation, micro propagation, organogenesis, Somatic embryogenesis, artificial seeds, Transfer and establishment of whole plants in soil, Haploidy: Protoplast fusion and somatic hybridization.

UNIT –V
Animal Biotechnology
Media: Natural media, balanced salt solution and simple media, serum and protein free chemically defined media. Primary cell culture,(chick, mouse and human biopsy)and methods of desegregations of tissues; continuous or established cell culture, tissue culture, organ culture; three dimensional culture, feeder layer, cell separation; cell synchronization; cryopreservation and revival.

REFERENCES

1. Alberts, B. et al. (2008). Molecular Biology of the Cell. 5th Ed. Garland Publishing House, USA.

2. Becker. (2009). The World of the Cell. 7th Ed. Benjamin-Cummings, USA.

3. Clark, D. P. (2005). Molecular Biology. Elsevier. USA.

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6. Karp G. (2012), Cell and Molecular Biology: Concept and Experiments. John Willy, New York, USA.

7. Lodish et.al. (2013) Molecular Cell Biology, 7th edition, W.H.Freeman and Company, New York.USA.

8. Watson, J. D., Baker, T. A. & Bell, S. P. (2007). Molecular Biology of the Gene. 6th Ed. Benjamin Cummings.USA.

15RBC301   ENZYMES AND ENZYME TECHNOLOGY   4H-4C

Instruction hours/week: L: 4 T: 0 P: 0   **Marks: 100**
                                                     End Semester Exam: 3 Hours

Course Objective:

Equip the students with:

- Techniques involved in the analysis of protein structure and function
- The applications and limitations of methods involved in isolation of enzymes
- The applications and limitations of methods involved in purification of enzymes
- Physical, Chemical and Biological methods of enzyme immobilization
- Clinical significance of enzyme analysis
- Biotechnological applications of enzymes

Course Outcomes:

After successful completion, the students will understand

1. X-Ray crystallographic, Spectrophotometric analysis of enzymes
2. How to estimate the fold purity during isolation of an enzyme
3. Enzyme purification techniques
4. Physical, Chemical and Biological methods of enzyme immobilization
5. The clinical significance of enzyme analysis in analyzing the vital organ functions
6. Applications of enzymes in the area of medical and industrial biotechnology

UNIT- I
Protein and enzymes
Protein structure, functions, compositions and conformation of proteins. Enzyme catalysis-Acid base catalysis, covalent catalysis, an example, serine proteases. Enzyme kinetics – Michaelis menton equation, Line weaver Burk plot, Hills equation, Hans plot.

UNIT -II
Isolation and purification of enzymes
Sources of enzymes for industry, extraction of enzymes for scientific and industrial purposes. Downstream processing of enzymes, uses of soluble enzymes. Study of enzymes in aqueous biphasic systems. Factors affecting the enzyme activity -Substrate concentration, Enzyme concentration, pH, temperature etc.,

UNIT- III
Enzyme immobilization and their applications.
Techniques employed for immobilizing enzymes, kinetics of immobilized enzymes. Advantages and disadvantages in the utilization of soluble enzymes, Immobilized enzymes and immobilized cells. Different types of reactors of immobilized enzymes and their applications.

UNIT -IV
Clinical analysis of enzymes
Application of ELISA and EMIT in clinical analysis. Different types of Biosensors-potentiometric, amperometric, piezo - electric and immuno biosensors. Electro analytical applications of enzymes, Methods of coenzyme regeneration. Biochips and Biocomputers.

UNIT -V
Enzymes in Biotechnology
Enzyme catalysis in organic solvents, Restriction endonucleases, DNA ligases, DNA polymerase and their uses in Biotechnology. Site directed mutagenesis, artificial enzymes, ribozymes and Abzymes and their uses.

REFERENCES

1. Bommarius A.S., B.R. Riebel. 2004. Biocatalysis – Fundamentals and Applications, Wiley-VCH, Weinheim, Germany.

2. Buchholz K., V. Kasche, U.T. Bornscheuer. 2005. Biocatalysts and Enzyme Technology, Wiley-VCH, Weinheim, Germany.

3. Cook P. F., W.W. Cleland. 2007. Enzyme Kinetics and Mechanism, Garland Science Publishing, London, England and New York, USA.

4. Irwin Segel. 2004. Biochemical Calculations, John Wiley and Sons, California, USA.

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2. http://www.Isbu.ac.uk? biology/enztech.
3. http://www.Science direct.com/science
4. http://www.woodhead publishing.com/en/book.asp.

15RBC302   CANCER BIOLOGY AND IMMUNOLOGY   4H-4C

Instruction hours/week: L: 4   T: 0 P: 0   **Marks: 100**
                                               End Semester Exam: 3 Hours

Course Objectives:
Equip the students with:
•   Etiology of cancer
•   Steps involved in the progression of cancer
•   Changes in the cell division during oncogenesis
•   Programmed cells death
•   Immune surveillance strategy
•   Techniques involved in the assessment of cancer development and progression

Course Outcomes:
After successful completion, the students will understand:
1.   The reasons for the development of cancer
2.   Factors involved in the advancement of cancer
3.   Targeting the cell division for the treatment of cancer
4.   Targeting apoptosis for the treatment of cancer
5.   Methods of enhancing immune surveillance for cancer treatment
6.   Usage of appropriate techniques for assessment of cancer stages

UNIT I

Biology of cancer-Phenotype of a cancer cell causes of cancer-DNA tumor viruses, RNA tumor viruses, cell cycle and its control-role of protein kinases, checkpoints, kinase inhibitor and cellular response.

UNIT II
Programmed cell death (Apoptosis)-Intracellular proteolytic cascade, cascade of caspase proteins, adapter proteins, Bcl-2, IAP family proteins, extra cellular control of cell division, tumor necrosis factor and related death signals.

UNIT III
Genetic basis of cancer-oncogenes, tumor suppressor genes, aberrations in signaling pathways. oncogenic mutations in growth promoting proteins, Mutations causing loss of growth –inhibiting and cell cycle control, Role of carcinogens and DNA repair in cancer.

UNIT IV
Immunity- Active, passive, humoral and cell mediated immunity. Therapeutic uses of cytokines and cytokine receptors. Test for lymophocyte function. B cell and T cell immuno deficiency disorder. Clinical laboratory methods for the detection of antigens and antibodies test for histocompatability antigens, neoplasm of the immune system.

UNIT V

Techniques-FISH techniques, Real time PCR, Western blotting, ELISA assay, immunocytochemistry,immunohistochemistry, flow cytometry, fluroscent microscopy and confocal microscopy.

REFERENCES

1.Alberts, B. et al. (2008). Molecular Biology of the Cell. 5th Ed. Garland Publishing House. USA.

2.Benjamin Lewin (2007) Genes VIII, Prentice Hall. USA.

3.Brown T.A. (2010), Gene Cloning & DNA Analysis, 6nd Edition, Wiley-Blackwell, New York.

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15RBC303   MEDICINAL PLANTS AND PLANT THERAPEUTICS   4H-4C

Instruction hours/week: L: 4   T: 0 P: 0   **Marks: 100**
                                                                    End Semester Exam: 3 Hours

Course Objectives
Equip the students with:
•   Methods to identify plants/herbs with a specific biological activity
•   Evaluating the presence/absence of flavonoids, terpenoids, glycosides and steroids
•   Analysis of the crude extract in vitro to evaluate its free radical scavenging activity
•   Fractionation methods to isolate a specific compound and its evaluation
•   Enhancing the production of secondary metabolite using plant tissue culture
•   Assessment of the efficacy of a specific plant metabolite using animal cell culture

Course Outcomes:
After successful completion, the students will understand:
1.   The availability of traditional knowledge search resources
2.   Identify flavonoids, terpenoids, glycosides and steroids
3.   Analyze the crude extract in vitro for its free radical scavenging activity
4.   Column chromatography, TLC
5.   How to enhance the production of secondary metabolite using plant tissue culture
6.   Animal cell culture

UNIT I

Medicinal plants-bioactive principles in medicinal plants methods of extraction, isolation, separation and screening, pharmacologically active plants-CNS, CVS, Hypoglycemic, Hepatoprotective, anti allergic, anticancer, immunoactive
plants, plants protecting against oxidative stress, chemotherapeutic products.

UNIT II

Free radicals –types, sources, importance, production, free radicals induced damages, lipid peroxidation, measurement of free radicals, disease caused by radicals, reactive oxygen species, antioxidant defence system, enzymic and nom-enzymic antioxidants, role of antioxidants in prevention of diseases, phytochemicals as antioxidants.

UNIT III

Alkaloids, flavanoids, terpenoids, phenols-Occurrence ,distribution & functions ,Production of secondary metabolite in plants, stages of secondary metabolite production, uses of tissue culture techniques, elicitation, biotransformation- production of pharmaceutical compounds.

UNIT IV

Principles-callus, meristem and organ culture, culture methods, culture media & preparations ,plant regeneration, protoplast technology, micropropogation in plants, somatic embryogenesis, somoclonal selection.

UNIT V

Animal cell culture: Culture media, Serum and protein free defined media and their application. Functions of different constituents of culture medium. Role of carbon dioxide, growth factors, glutamine in cell culture. Cell lines, primary culture and culture maintenance. Experimental animals and Animal handling, Sacrification, collection of sample. Ethical issues for animal handling.

REFERENCES

1. Dubey R.C. 2009.Text book of Biotechnology, S. Chand & Company Ltd. New Delhi

2. Freshney, R. I., & Freshney, M. G. (2010). In Freshney, R. I. (ed.), Animal cell culture: a practical approach, 2nd ed. IRL Press at Oxford University Press.USA.

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5. Singh.M.P and Panda.H (2005).Medicinal Herbs with their formulations, Daya Publishing House, NewDelhi

15RBC304 CLINICAL BIOCHEMISTRY AND TOXICOLOGY 4H-4C

Instruction hours/week: L: 4 T: 0 P: 0 **Marks: 100**
End Semester Exam: 3 Hours

Course Objectives:

Equip the students with:
- The collection of blood, serum and plasma
- Analyzing the inflammatory markers
- Clinical significance of enzyme assays
- Role of oxidative stress in physiological and pathological state
- Enzymatic and non enzymatic antioxidants
- Toxicological studies

Course Outcome:
After successful completion, the students will understand:
1. The different anti-coagulants used for the isolation of plasma and its significance
2. Assessment of inflammation
3. Role of enzymes to predict vital organ functioning
4. Regulation of oxidative stress
5. Significance of endogenous antioxidant system
6. Principles and applications of histo-chemical analysis

UNIT-I
Clinical Enzymology: Clinical significance of Phosphatases, transmainases, 5'nulceotidase, Gamma –glutamyl transferase, Lactate Dehydrogenase, Creatine Phospho kinase
Diagnostic enzymes in hepatobiliary disease, Atherosclerosis, Myocardial infarction, renal dysfunction. Cancer markers for oral, prostate, colorectal breast and GI tract cancer, oncofetal cancer markers.

UNIT-II
Formation of free radicals, autoxidation initiated by oxygen radicals, Influence of free radicals in metal toxicity. Free radicals and cancer .Oxidative process in tissue injury. Detection of free radicals and radical ions. Role of free radicals in diseases.

UNIT-III
Enzymic antioxidants- Chemistry, mechanism, antioxidant effect of SOD, catalase, Glulathione Peroxidase.
Non Enzymic antioxidants- source, chemistry, toxicity, biochemical functions, bioavailability, bioassays, Antioxidant effects of Vit A, Vit C, Vit E, glutathione and selenium.
Trace elements -Introduction, sources, biochemical functions of zinc, copper and magnesium & iron.

UNIT-IV
Medicinal plants-bioactive principles in medicinal plants methods of extraction, isolation, separation and screening ,Pharmacologically active plants-CNS,CVS, Hypoglycemic, Hepatoprotective ,anti allergic ,anticancer, immunoactive plants, plants protecting against oxidative stress, chemotherapeutic products.

UNIT-V

Effects of physiochemical and biological factors on heavy metal toxicity, toxic mechanism-Carcinogenesis, teratogenesis & immunotoxicity. Bioassays for heavy metal toxicity, pathological Histopathological examinations for heavy metal toxicity.

REFERENCES

1. Chatterjee M.N. and Rana Sinde, (2006) Text Book of Medical Biochemistry, 6th Edition, Jaypee Brothers, Medical Publishers, New Delhi

2. Harper's Illustrated Biochemistry 200928th Edition McGraw Hill, Mumbai

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15RBC305   PLANT MOLECULAR BIOTECHNOLOGY   4H-4C

Instruction hours/week: L: 4   T: 0 P: 0   **Marks: 100**
                                                               End Semester Exam: 3 Hours

Course Objectives:
Equip the students with
- The organization of plant genome
- Molecular markers of plant tissues
- Growth regulators of plant
- Cloning strategies
- Transformation methods
- Manipulation of plant nucleic acids

Course Outcomes:
After successful completion, the students will understand:
1. Organization of plant genome
2. Molecular markers of plant tissues
3. Growth regulators of plant
4. Cloning strategies
5. Transformation methods
6. Manipulation of plant nucleic acids

UNIT-I
Plant genome: Plant genome organization, structural features of a representative plant gene. Organization of chloroplast genome and mitochondrial genome. Molecular markers (AFLP,ISSR and RAPD) . plant tissue culture media, plant hormones and growth regulators in tissue culture, preparation of suitable explants. Micropropagation of plants - somatic embryogenesis, protoplast culture, somatic hybridization and synthetic seeds.

UNIT-II
Cloning strategies - Tools for cutting and joining of DNA; gene transfer techniques;Methods of selection and screening of recombinant DNA. Construction of genomic libraries and cDNA libraries - probe construction and labelling (radio and non-radio).Molecular mechanism of anti-sense technology - inhibition of splicing , disruption of RNA structure & capping - application of anti-sensing technology.
UNIT-III
Gene regulation: Inducible enzymes, regulatory mutations, repressor, operon, promotor, catabolic repression, repressible enzyme systems, control by attenuation, positive control, gene regulation in eukaryotes, transcriptional regulation, post transcriptional regulation, hormones & gene expression; viruses & gene expression, genetic control of pattern formation in plant development.

Unit IV – Plant transformation technology: Symbiotic nitrogen fixation in legumes by rhizobia - biochemistry and molecular biology. Binary vectors, Use of 35s & other promoters genetic markers methods of nuclear transformation viral vectors & their

applications, Use of reporter gene, Particle bombardment ,Electroporation, Microinjection, Chloroplast transformation, Transformation of monocots, Transgene stability & gene silencing in Plant transformation.

UNIT-V
Plant manipulation and its applications: Transgenic plants - for– biotic (weeds, insects, viruses, fungi and bacteria) and abiotic (drought, salt, temperature, poor soil quality and oxidative) stress tolerance.Production of secondary metabolites production. Molecular farming (improvement in protein, lipids, carbohydrates. Plant antibodies, vaccines, therapeutic proteins and active principles. Biofortication of important crops (rice and banana).

REFERENCES

1. Altman A, Hasegawa P M . 2012 "Plant Biotechnology and agriculture. Prospect for the 21st century" Academic press,USA

2. Brown T. A.. 2010. Gene Cloning and DNA Analysis: an introduction, 6th edition, Wiley-Blackwell Publisher, UK.

3. Chawla H.C. 2009 Introduction to Plant Biotechnology 3r^{d} Edition, Oxford & IBH publication Pvt .Ltd, New Delhi.

4. Davies K. 2004. Plant Pigments and their Manipulation – Annual plant reviews, vol 14 Blackwell Publication, UK

5. Glick and Paster mark, 2002. Molecular Biotechnology - Principles and Applications in Recombinant DNA, . Panima Publishing Co-operation, Banglore

6. Primrose S.B and R.M.Twyman. 2003. Principles of Genome Analysis.Blackwell Publishing, Oxford.

7. Slater A, Scott NW, Fowler MR. 2008 Plant Biotechnology: the genetic manipulation of plants, Oxford Press, UK

8. Winnacker E.. 2003. From Gene to Clones ; Introduction to gene technology, 4th edition, Panima Publisher, India

15RBC306   **ANIMAL TISSUE CULTURE**   **4H-4C**

Instruction hours/week: L: 4 T: 0 P: 0   **Marks: 100**

End Semester Exam: 3 Hours

Course Objectives:

Equip the students with:
- Applications and limitations of cell based studies
- Aseptic methods to perform animal cell culture
- Types of cell culture techniques
- Assessment of cell proliferation
- Assessment of cell differentiation
- Scale up technologies

Course Outcomes:

After successful completion, the students will understand:
1. The need and circumstances for the cell based studies
2. Sterile working culture
3. Suspension and adherent cell culture
4. Thymidine incorporation, WST-1 Assays
5. Galactosidase staining, von-kossa, and alizarin red staining
6. Organ culture

UNIT I

Introduction, importance, history of cell culture development, different tissue culture techniques including primary and secondary culture, continuous cell lines, suspension culture, organ culture, advantages and limitations medical/pharmaceutical products of animal cell culture-genetic engineering of animal cells and their applications. Risks in a tissue culture laboratory and safety - biohazards.

UNIT II

Different types of cell culture media, growth supplements, serum free media, balanced salt solution, other cell culture reagents, culture of different tissues and its application. Facilities for animal cell culture-infrastructure, equipment, culture vessels. Biology and characterization of cultured cells-cell adhesion, proliferation, differentiation, morphology of cells and identification.

UNIT III

Primary cell culture techniques - mechanical disaggregation, enzymatic disaggregation, separation of viable and non-viable cells. Mass culture of cells - manipulation of cell line selection - types of cell lines -maintenance of cell lines - immobilization of cells and its application - synchronization of cell cultures and cell division - production of secondary metabolites - biotransformation - Induction of cell line mutants and mutations - cryopreservation – germplasm conservation and establishment of gene banks.

UNIT IV

Animal cell culture scale up: Scale up in suspension - stirrer culture, continuous flow culture, air-lift fermentor culture; Scale up in monolayer - Roller bottle culture, multi surface culture, multi array disks, spirals and tubes - monitoring of cell growth. Organ culture - whole embryo culture - specialized culture techniques - measurement of cell death.

UNIT V

Tissue engineering: Design and engineering of tissues - tissue modeling. Embryonic stem cell engineering - ES cell culture to produce differential cells - Human embryonic stem cell research. Transgenic animals-transgenic animals in xenotransplantation

REFERENCES

1. Butler. M. 2004. Animal Cell Culture and Technology, BIOS Scientific Publishers, Taylor and Francis Group. U. K.

2. Freshney, R. I., & Freshney, M. G. 2010. In Freshney, R. I. (ed.), Animal cell culture: a practical approach, 2nd ed. IRL Press at Oxford University Press.

3. Gupta P.K. (2010), Biotechnology & Genomics, 5th Reprint, Rastogi Publications Meerut.

4. Ranga M.M., Animal Biotechnology, (2007) Agrobios, India.

5. Satyanarayana, U., 2006 Biotechnology,. Books and Allied (P) Ltd. India.

DEPARTMENT OF BIOTECHNOLOGY
FACULTY OF ARTS, SCIENCE AND HUMANITIES
RESEARCH PROGRAM – M. Phil / PhD in Biotechnology
(2015–2016 Batch and onwards)

Code	Course	Objectives and Outcomes		Ins*	Marks	Exam Hrs	Credit
		PEO´s	PO´s & PSO´s	hours / week	Total		
15RBT101	**Paper – I:** Research Methodology and Pedagogy	I, II, III	a, c, e	4	100	3	4
15RBT201	**Paper – II:** Recent Trends in Biotechnology	I, II	b, d	4	100	3	4
Paper – III *							
15RBT301	Paper – III: Animal Biotechnology	II, III	d, f, g	4	100	3	4
15RBT302	Paper – III: Biotechnology for crop improvement	II, III	d, f, g				
15RBT303	Paper – III: Environmental Biotechnology	II, III	d, f, g				
15RBT304	Paper – III: Immunology	II, III	d, f, g				
15RBT305	Paper – III: Medicinal Plant Biotechnology	II, III	d, f, g				
15RBT306	Paper – III: Plant Tissue Culture	III, IV	f, g, h, i				
G. total				12	300	9	12

Blue – Employability   Green – Entrepreneurship   Red-   Skill Development

15RBT101   Paper – I: Research Methodology and Pedagogy   4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0   Marks: Internal: **0** External: **100** Total: **100**
End Semester Exam: 3 Hours

Course Objectives
The main objectives of the course are
- To impart the knowledge on Identification of research requirements
- To apply the state of art knowledge for dissertation writing
- To become familiarize with Experiment design
- To understand the methods of data collection and analysis
- To grasp knowledge on Objective and roll of higher education
- The students will learn overall the basic concept in Characteristics of instructional design

Course Outcomes
On completion of the course, students are able
1. To understand principles of formulation of objectives and hypothesis
2. To explain Guidelines for review of literature
3. To get insight to Use of software for graphics
4. To production of therapeutic proteins in transgenic animals
5. To explain the Ethical issues in animal biotechnology
6. To explain the methods of teaching and learning

Unit I Analysis and Identification of research requirements:
Prioritization of research area. Review of work done in identified area - time scheduling - laboratory facilities, Research duration –choice of research topic – formulation of objectives- formulation of hypothesis– Methodology – Procedure, experiment design.

Unit II Dissertation writing:
Guidelines for review of literature - Materials and methods, results and discussion. Interpretation of results, presentation of results, summary, presentation of references and appendix.

Unit III Experiment design:
Regarding observation. Types of observation. Laboratory setting sample; Data collection – Presentation of and analysis of collected data. Preparation of result reports and Publication of research findings in prier reviewed journals, impact factor.

Unit IV Methods of data collection and analysis:
classification and tabulation. Frequency distribution. Measures of central tendency – Mean, median and mode; Measures of dispersion – Standard deviation, standard error, and variance. Correlation and regression – simple correlation, correlation co-efficient, simple

and linear regression analysis. Test of significance (F, t test), chi-square test, ANOVA, DMRT, SPSS. Introduction to computer, MS office. Data handling – Use of software for graphics, slide making, scanning gels, photography X-ray photography and autoradiogram perspective.

Unit V Objective and roll of higher education
Important characteristics of an effective Lecture - Quality teaching and learning – Lecture Preparation - Characteristics of instructional design – Methods of teaching and learning: Large group – Technique – Lecture, Seminar, Symposium, Team teaching, Project, Small Group Technique – Simulation, role playing Demonstration, Brain storing, case Discussion, and assignment, Methods of evaluation – Self evaluation, Student evaluation, Diagnostic testing and remedial teaching – Question banking – Electronic media in education : 'e' learning researches – web based learning.

SUGGESTED READINGS
1. Sandhu, T. (1990). Research Techniques in Biological Sciences. Anmol Publishers, New Delhi.
2. Palanivelu, P. (1999). Analytical Biochemistry and Separation Technique. 3rd Ed, 21st Century Publications, Madurai.
3. Sundar Rao, P.S.S and Richard, J. (2006). Introduction to Biostatistics and Research Methods. PHI Publications, New Delhi.
4. Kothari, C. R. (2004). Research Methodology – Methods and Techniques. 2nd Ed. New Age International Pvt. Ltd, New Delhi.
5. Attwood, T. K. and Parry Smith, D. J. (2002). Introduction to Bioinformatics. Pearson Education Ltd, Singapore.

15RBT201   Paper – II: Recent Trends in Biotechnology   **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0   **Marks:** Internal: **0** External: **100** Total: **100**
                                                                    End Semester Exam: 3 Hours

Course Objectives
The main objectives of the course are
  • To impart the knowledge on UPGMA based analysis
  • To apply the state of art knowledge for Molecular cloning
  • To become familiarize with Protein engineering
  • To understand the methods of Pharmaceutical and Nano Biotechnology
  • To grasp knowledge on Upstream and downstream processes
  • The students will learn overall Stem cells research

Course Outcomes
On completion of the course, students are able
  1. To understand principles of cloning in microorganisms and higher organisms
  2. To explain Metabolic engineering
  3. To get insight to Use the Transgenic plants
  4. To production of therapeutic proteins in transgenic animals
  5. To explain the organic synthesis in drug discovery
  6. To explain Stem cell therapy

Unit I Biotechnological tools:
UPGMA based analysis –RFLP, RAPD, AFLP, STS, ISSR. Protein and Nucleic acid sequencing and Micro-array. New generation sequencing approaches, Basic Principles and applications. Bioinstrumentation: Microscopy, Electrophoresis, Centrifugation, ELISA, RIA, FISH. Separation techniques: HPLC, GC, HPTLC, LC-MS and application. Spectrophotometry – UV-VIS, FT-IR, Flame photometry, Fluorimetry, Flow cytometry and AAS.

Unit II Molecular cloning:
Vectors in gene cloning: Types of plasmids, vectors; modifying enzymes, polymerase chain reaction, DNA/Protein sequencing, Genomic/cDNA library construction and screening, cloning in microorganisms and higher organisms: Direct and indirect gene delivery systems.

Unit III Applications of Genetic Engineering:
Protein engineering – Site Directed Mutagenesis; Recombinant protein; *De novo* design; computational design and rational design. Metabolic engineering – Metabolic Flux Analysis, production of secondary metabolites; Molecular breeding of plants – Production of interferon – rDNA vaccines. Transgenic plants – disease- and virus resistance. Transgenic animals- Production, application.

Unit IV Pharmaceutical and Nano Biotechnology:
Biotechnology as a new frontier in health; drug design and discovery; drug development; random screen up, target identification and validation; organic synthesis in drug discovery.

Drug delivery; Protein targets for drug design. Molecular modeling using computers. Nucleic acid, Protein - based Nano structure; Lab-on-a-chip; Micro contact printing.

Unit V Advances in Biotechnology:
Fermentation - Types of fermenters- Upstream and downstream processes. Gene targeting; Gene splicing; Gene pool; Genome mapping; Human genome project; Stem cells research-Fundamentals of stem cells- Stem cell therapy.

SUGGESTED READINGS
1. Bernald R Glick, and Jack J Paternack (1996) Molecular Biotechnology, Panima Publication, New Delhi.
2. Brown TA (2000) "Gene cloning - An introduction, 3rd Edition, Stanley thrones Publishers Ltd, New York.
3. Brown TA (1999). "Genomes", John Wiley and Sons Asia Pvt Ltd, New York.
4. Daan J A Crommelin and Robert D Sindelar (2002). Pharmaceutical Biotechnology, 2nd Edition, Routledge Taylor and Francis Inc, New York
5. James D Watson, Michael Gilman, Jan Witkowski. (2000). Recombinant DNA, 2nd edition, Freeman Publication, New York.
6. Palanivelu P. (2004). Analytical Biochemistry and Separation Techniques, 21st Century Publications, Madurai, India.
7. Primrose SB, Twyman, R. M. and Old, R. W. (2001). Principles of gene manipulation, 6th Edition, Blackwell Science Publishing Company, Germany.
8. Ratner and Daniel Ratner (2005). Nanotechnology a Gentle Introduction to the Next Big idea by Mark, Pearson Education, Inc.
9. Stanbury P F., A Whitaker and S J Hall, (1997). Principles of Fermentation Technology, Adithya Book Pvt Ltd, Chennai.

15RBT301   Paper – III: **Animal Biotechnology**   **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0   **Marks:** Internal: **0** External: **100** Total: **100**
                                                 End Semester Exam: 3 Hours

Course Objectives
The main objectives of the course are
- To impart the knowledge on basic animal tissue culture techniques
- To apply the state of art knowledge of subject for the production of tissues, introducing modern drug delivery or vaccination methods.
- To become familiarize with the ethical practices in animal biotechnology
- To understand the laboratory design and requirements for animal tissue culture
- To grasp knowledge on molecular techniques in animal cell culture
- The students will learn overall the basic concept in embryology

Course Outcomes
On completion of the course, students are able to
1. To understand principles of animal culture, media preparation
2. To explain Invitro fertilization and embryo transfer technology
3. To get insight in applications or recombinant DNA technology
4. To production of therapeutic proteins in transgenic animals
5. To explain the Ethical issues in animal biotechnology
6. To handle and maintain the animal models in animal houses

Unit I Laboratory design and requirements for animal tissue culture:
Animal tissue culture media, Physical, chemical and metabolic functions of different constituents of culture medium serum free defined media and their applications. Types of tissue culture; disaggregation of tissue and primary cell culture, established culture, suspension culture, organ culture, three-dimensional culture

Unit II Cell separation:
Cell counting Cell synchronization. cryopreservation. Cell lines - cell banks. Tissue engineering. Biology and characterization of cultured cells, tissue typing; cell – cell interaction; measuring parameters of growth; measurement of cell death – apoptosis and its determination; cytotoxicity assays.

Unit III Characterization:
Need for characterization, Morphology, Chromosome analysis, DNA Content, RNA, Protein, Enzyme and Antigenic Markers. Lymphocyte preparation, Somatic cell fusion.

Unit IV Molecular cell techniques in cell culture:
Cell transformation- physical, chemical and biological methods; manipulation of genes; cell cloning and micro manipulation; hybridoma technology and its applications; gene targeting. Gene Therapy. Green fluorescent protein and its application, Oncogenes and tumour suppressor genes and their regulation

Unit V Embryology:

Collection and preservation of embryos; culturing of embryos; gametogenesis and fertilization in animals; types of cleavage pattern. *In vitro* fertilization and stem cell research. Transgenesis: Transgenic animals; production and application; transgenic animals as models for human diseases, transgenic in industry; Vaccine production. Ethical issues in animal biotechnology.

SUGGESTED READINGS

1. Ranga, M. M. (2003). Animal Biotechnology. 2nd Edition, Agrobios (India), Jodhpur.
2. Primrose, S. B., Twyman, R. M. and Old, R. W. (2001). 6th Ed, Principles of Gene Manipulation. Blackwell Science Publishing Company, Germany.
3. Freshney, R.I.(2000). Culture of Animal cell: A practical approach, 4th Edition, John Wiley Publications, New York.
4. Jennie, P. Mather and David Barnes. (2001). Methods in Cell Biology. Academic Press, New York.

15RBT302   Paper – III: Biotechnology for Crop Improvement   4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0 Marks: Internal: **0** External: **100** Total: **100**
                                                                           End Semester Exam: 3 Hours

Course Objectives
The main objectives of the course are,
- To learn about Molecular Markers
- To learn the strategies for gene transfer in plants and animals
- To acquire knowledge on genome mapping
- To familiarize the student with emerging field of biotechnology
- To acquaint the students to techniques employed in Molecular breeding
- To learn the history and recent developments in Molecular genetics

Course Outcomes
On completion of the course, students are able to
1. Outline the fundamental steps in a genetic engineering procedure
2. Describe the mechanism of action and the use of restriction enzymes in biotechnology research and recombinant protein production
3. Explain the usefulness of Molecular breeding in crop development
4. Discuss about the Molecular genetics
5. Conceptualize C-DNA clones, gene libraries, cloning of DNA sequencing.
6. Summarize various applications of cloning of DNA sequencing.

Unit I Molecular Markers:
Morphological, Biochemical and DNA based markers (RAPD, RFLP, AFLP, SSLP, SSR, VNTRS, and SNP). Development of maps, mapping populations, (F2'S Back crosses, RILs, NILs, and DHs) marker assisted selection, bioinformatics tools in mapping and comparative mapping.

Unit II Genetic Engineering:
Tools of genetic engineering, transformation techniques, gene transfer systems:-*Agrobacterium*-mediated gene transfer, vector mediated gene transfer, micro injuction, Electroporation, direct DNA - uptake, gene gun technique, selectable markers and reporter system., evaluation of transgenics, stabilization and release, biosafety and regulatory issues, intellectual property rights, bioinformatics and bioinfirmation tools.

Unit III Genetic engineering and biotechnology:
Introduction to plant genetic engineering and biotechnology, gene identification, gene isolation, synthesis of gene and gene cloning, restriction enzymes and vectors, regeneration in crop plants, application of plant genetic engineering and biotechnology, transgenic crops, application of rDNA technology - current status and future prospects, regulation mechanism for genetically modified crops, biosafety issues of transgenic crops,

Unit IV Molecular breeding:

Molecular mapping and tagging of agronomically-important traits, QTL analysis in crop plants, marker assisted selection for qualitative and quantitative traits, gene pyramiding, genetic engineering, Application in crop improvement.

Unit V Molecular genetics:

Recombination in bacteria and viruses, molecular mechanism of recombination and repair, episomic and transposable elements, genomes in prokaryotes and eukaryotes, genome organization - euchromatin and heterochromatin, DNA content variation. Types of DNA sequences - unique and repetitive sequences, C-DNA clones, gene libraries, cloning of DNA sequencing.

SUGGESTED READINGS

1. Bernald R Glick, and Jack J Paternack (1996). Molecular Biotechnology" Panima Publication, New Delhi.
2. Brown TA. (1999). Genome John Wiley and Sons Asia Pvt. Ltd, New York.
3. Brown TA. (2000). Gene Cloning-An Introduction 3rd Edition, Stanley thrones Publishers Ltd, New York.
4. James D Watson, Michael Gilman, Jan Witkowski. (2000). Recombinant DNA" 2nd edition, Freeman Publication, New York.
5. Joshi P. (2007). Genetic Engineering and it's Application 2nd Edition, Agro Bios, India.
6. Primrose SB, Twyman, R.M. and Old R.W. (2001). Principles of gene Manipulation 6th Edition, Blackwell Science Publishing Company, Germany.
7. Purohit S.S. (2008). Biotechnology, Fundamentals and Applications 4th Edition, Agro Bios, India.
8. Varma P.S and Agarwal V.K. (2006). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand Publications.

15RBT303   Paper – III: Environmental Biotechnology   4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0   Marks: Internal: **0** External: **100** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

The main objectives of the course are
- To obtain basic concepts of biotechnology to solve the environmental pollution problems
- To ascertain the knowledge about solid waste management and wastewater treatment.
- To gain information about Environmental nanotechnology.
- To gain knowledge about the biological and biotechnological measures for restoring environment.
- To involve in the present scenarios and find valuable solutions for remedy
- To update about the management strategies followed up by the industries and government.

Course Outcomes

On completion of the course, students are able to apply their knowledge on
1. Water Pollution Monitoring
2. Pollution and pollution control
3. Environmental significance of genetically modified microbes, plants and animals
4. Solid waste management systems
5. Treatment of municipal waste and Industrial effluents
6. Biotechnologically important intracellular products

Unit I Environmental Pollution:

Concept of Environmental Pollution; Origin of pollution; Classification and nature of Environmental Pollutants; Major sources; Environmental Pollution at local regional and global level. Environmental Quality Assessment and Monitoring, Deterioration of environmental quality with reference to anthropogenic impact; Environmental Impact Assessment (EIA)

Unit II Water Pollution Monitoring:

Pollutant analysis in water – Physiochemical parameters, Microbiological examination, APDC and MIBK analyses. Methods of monitoring; Biological methods; Detection methods for DO, BOD, Pathogen monitoring by heterotrophic plate count; Multiple tube method; Membrane filtration methods; Strategies for controlling pathogen transfer; Chemical methods- Detection methods for COD, pH, alkalinity, TSS, TDS, Total organic carbon, oil, grease etc.; Biosensors to monitor pollution.

Unit III Effluent treatment and Solid waste management systems:

Sewage and waste water treatments systems; Primary, secondary and tertiary treatments- Pycoremediation; Measurement of treatment efficiencies; Biological treatments - aerobic

versus anaerobic treatments; Environmental pollution control- Bioremediation, Bioaugmentation and Biostimulation; Biofilms in treatment of waste water; Bioreactors for waste water treatments; Reactors types and design; Solid waste management – types of solid waste; Disposal methods – Sanitary, incineration, land-fill, composting, vermicomposting; recovery of energy from solid waste.

Unit IV Environmental Nanotechnology:
Techinques for synthesis of nanomaterials and nanocomposite; mobility of nanomaterials in aqueous environments, surface chemistry of mineral oxide and carbon nanoparticles, development of nanostructured membranes, mechanisms of nanoparticle bio- degradation, development of nanostructured ceramic bodies for environmental separations and catalysis, nanomaterial-based adsorbents for water treatment, possible mutagenic properties of nanoparticles, nanoparticle bioaccumulation.

Unit V Environmental Microbiology:
Microbes in the environment, measurement of bacterial growth, collection and processing of environmental samples. Media Formulation; Sterilization; Thermal death kinetics Primary and secondary metabolites; Extracellular enzymes; biotechnologically important intracellular products; exopolymers; biopolymer production.

Suggested Readings:
1. Agarval, S. K (2002). Environmental Biotechnology. APH Publishing Corporation, New Delhi.
2. Mark J Hammer (2000). Water and Waste Water Technology. 4th Edition, Prentice Hall of India Pvt Ltd, New Delhi.
3. Yadav, P. R. and Shubhrata R Mishra. (2004). Environmental Biodiversity. Discovery Publishing House, New Delhi.
4. Singh, M. P., Soma Dey and Bijay S Singh. (2004). Conservation of Biodiversity and Natural Resources. Daya Publishing House, New Delhi.
5. Bailey J E and D F Ollis (1986). Biochemical Engineering fundamentals. 2nd Ed. Chapters 13 & 14, McGraw – Hill.
6. Charles P Poole Jr., Frank J Owens. (2007). Introduction to Nanotechnology. John Wiley & sons Asia Pvt. Ltd. New Delhi.
7. Alans Scragg (2005). *Environmental Biotechnology*. Oxford University Press. Inc. New York.

15RBT304	**Paper – III: Immunology**	**4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0   **Marks:** Internal: **0** External: **100** Total: **100**
                                                        End Semester Exam: 3 Hours

Course Objectives

The main objectives of the course are
- To understand the basic concepts of immunology
- To expose students to use these principles of immune system to combats infections
- To gain the information about the auto immune diseases
- To identify the cellular and molecular basis of immune responsiveness
- To describe the roles of the immune system in both maintaining health and contributing to disease
- To demonstrate a capacity for problem-solving about immune responsiveness

Course Outcomes

On successful completion of the course the students will be able to
1. Gain about the various cells and organs involved in the immune system
2. Understand the molecular mechanisms of antigen-antibody interactions
3. And also, the molecular mechanisms behind the immune response evoked after infection by various pathogens
4. Learn the theoretical basis for the various immunological techniques
5. Apply immunological laboratory techniques to understand principles of antigen-antibody reaction
6. Use different immunological test to study the immune effector function and immune development

Unit I Immune System:
Origin and formation of blood cells. Structure, Classification of blood cells. Primary and secondary immune response. Lymphoid organs**:** Primary and secondary lymphoid organs. antigen- antibody interactions. Humoral and cell mediated immunity**.**

Unit II Cellular Defenses:
Blood Coagulation, Phagocytosis, Nodule formation, Encapsulation, Cytotoxicity reactions. Lysins, Hemagglutinins, Lymphokine-like substances, Antimicrobial Factors.

Unit III Hybridoma technology:
Hybridoma technology and monoclonal antibodies, immuno-diagnosis and application of monoclonal antibodies in biomedical research, human monoclonal antibodies and catalytic antibodies, Xeno transplantation from various species.

Unit IV Vaccine technology:
DNA vaccines, identification of B and T epitopes for vaccine development. Immunodiagnosis of infectious diseases, immuno screening of recombinant library. recombinant vaccines, bacterial vaccines, viral vaccines, vaccines to other infectious agents.

Unit V Introduction to immunodiagnostics:
Passive & active immunization– RIA, ELISA and their types, Haemagglutination assay,
Double immunodiffusion test. Rocket immunoelectrophorosis.

SUGGESTED READINGS

1. Rockstein, M. (Ed). (1974). The Physiology of Insecta, Vol 5. Academic Press, New York.
2. Gupta, A.P. (Ed). (1979). Insect Hemocytes. Cambridge University Press, Cambridge.
3. Ratcliffe, N.A. and A.F. Rowley. (1981). Invertebrate Blood Cells, Vol. I & II. Academic Press.
4. Kerkut, G.A. and L.I. Gilbert (Eds). (1985). Comprehensive Insect Physiology,Biochemistry and Pharmacology, Vol 3. Pergamon Press, Oxford.
5. Cohen, W.D. (Ed). (1985). Blood Cells of Marine Invertebrates: Experimental Systems in Cell Biology & Comparative Physiology.
6. Brehèlin, M. (Ed). (1986). Immunity in Invertebrates. Springer-Verlag, Berlin.
7. Brey, P.T. and D. Hultmark (Eds). (1998). Molecular Mechanisms of Immune Responses in Insects. Chapman & Hall, London.

15RBT305   Paper – III: Medicinal Plant Biotechnology 4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0   Marks: Internal: **0** External: **100** Total: **100**
End Semester Exam: 3 Hours

Course Objectives

The main objectives of the course are

- To understand the basic concepts of phytochemistry
- To expose students to use these principles of general extraction and isolation techniques
- To gain the information about production of secondary metabolites
- To identify the bioactive molecules in the plants
- To describe the roles of plant products and herbal formulations.
- To demonstrate the organic cultivation of medicinal plants

Course Outcomes

On successful completion of the course the students will be able to

1. Gain knowledge about the major secondary metabolites from plants
2. Understand the techniques involved in extraction of phytochemicals
3. Learn the theoretical basis for the Chemical fingerprinting
4. Apply Authentication of medicinal plants to understand the variation
5. Use the knowledge in DNA bar coding

Unit I Phytochemistry:

Screening of major secondary metabolites from plants. Biosynthesis of primary and secondary metabolites - alkaloids, terpenoids, Phenolic compounds and coumarins. Classification and sources of alkaloids. Major classes in phenolic compounds – carotenoids, flavonoids, tannins and phenolic acids. Classification of terpenoids.

Unit II General extraction and isolation techniques:

Alkaloids, sesquiterpenoids, flavonoids and other phenolic compounds from plants. Techniques involved in extraction of phytochemicals – Perculation, Soxhlet extraction, reflux and other methods. Isolation and purification techniques – Thin layer- and Column chromatography, HPLC and HPTLC.

Unit III Biotechnology of medicinal plants:

Production of secondary metabolites from cultured plant cells, elicitation, immobilization, biotransformation, continuous culture and product recovery. DNA bar coding. DNA fingerprinting of medicinal plants – DNA isolation and fingerprinting techniques. Chemical fingerprinting by HPTLC.

Unit IV Bioactive studies:

Anticancer, antidiabetic, anti-inflammatory, hepatoprotectives, antimicrobials from medicinal plants. Antioxidants of plant origin – Reactive Oxygen Species (ROS), antioxidant polyphenols. Toxicity studies on medicinal plants, plant products and herbal formulations.

Unit V Pharmacognosy:
Authentication of medicinal plants – Organoleptic and other pharmacognostic studies. Anatomical studies. Intellectual Property rights (IPR) - patents, copy rights, trade marks. Patenting of biological material. Organic cultivation of medicinal plants. Recent advancements.

SUGGESTED READINGS
1. Harborne, J.B. (1998). Phytochemical methods to modern techniques of plant analysis Chapman and Hall, London.
2. Trease GE, Evans, M.C. (1979). Textbook of Pharmacognosy 12th ed. Balliere-Tindal, London.
3. Irfan A. Khan and Atitya Khanum. (2004). Role of Biotechnology in medicinal and Aromatic plants, Vols. I-X. Ukaaz Publications, Hyderabad.

15RBT306 **Paper – III: Plant Tissue Culture** **4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0 **Marks:** Internal: **0** External: **100** Total: **100**
End Semester Exam: 3 Hours

Course Objectives
The main objectives of the course are,
- To introduce biotechnological methods for Plant Tissue Culture
- To give knowledge about various methods of Shoot and Root induction.
- To cognize and get the knowledge on Suspension Culture in generating plants.
- To explain the basics of the Secondary Metabolites
- To use basic biotechnological techniques to explore general extraction and isolation techniques
- To understand the processes involved in Molecular docking

Course Outcomes
On completion of the course, students are able to
1. Understand the growth conditions required to culture the plants in *invitro* conditions.
2. Inculcate the deep understanding of generating plants in PTC labs
3. Acquire knowledge on Solvent Extraction Methods
4. Inculcate the deep knowledge the processes involved in Structure Prediction
5. Learn the structure and organization of plant genome
6. Learn the basic techniques for hybridization in producing plantlets

Unit I Introduction to Plant Tissue Culture:
Laboratory organization, Sterilization techniques. Plant cell culture media - Media preparation, Plant growth regulators, Role of hormones in plant morphogenesis. Choice of explants. Plant Genome Organization - Chloroplast, Mitochondria, and Nucleus.

Unit II Shoot and Root induction:
Callus culture- types, organ culture, Plant regeneration, Micropropagation, Embryogenesis, Organogenesis, Somatic hybridization and cybridization, haploid Production, Protoplast isolation, Protoplast fusion, Cryopreservation, Synthetic seeds, Somoclonal selection. Hardening of plants Biotransformation- Agrobacterium mediated gene transformation, Ti - plasmid, Ri -Plasmid, Transgenic plant, Resistant plants, Strategies in bioconversion. Production of pharmaceutical compounds.

Unit III Suspension Culture:
Cell suspension - Types of cell suspension- Uses of cell suspension culture - Culture methods- Mass cultivation of plant cells in small Laboratory Scale and Industrial. Secondary metabolite Production from Suspension Culture, Bioreactors - Photo bioreactor. Production of secondary metabolite in plants, stages of secondary metabolite production, uses of tissue culture techniques in secondary metabolites, uses of secondary metabolites elicitation.

Unit IV General extraction and isolation techniques:

Alkaloids, sesquiterpenoids, flavonoids and other phenolic compounds from plants. Techniques involved in extraction of phytochemicals -Perculation, Soxhlet extraction, reflux and other methods. Secondary Metabolites Isolation and Purification - Solvent Extraction - TLC, GLC, HPLC, HPTLC, GC-MS Methods. Production of secondary metabolites from cultured plant cells, elicitation, immobilization and biotransformation. Structure Prediction - UV, IR, NMR, Mass Spectroscopy.

Unit V Bioactive studies:

Antiulcer, Anticancer, Antidiabetic, Anti-inflammatory, Hepatoprotectives, Antimicrobials from Medicinal Plants. Antioxidants of Medicinal Plant. plant products and herbal formulations. Clinical Application of Medicinal Plant. Organic cultivation of medicinal plants. Drug utilization, Nucleotide database, Molecular docking - Types of docking, Pubchem Compound.

SUGGESTED READINGS

1. Sam Brook, J., E.F Fritsch and T. Maniatis. (2000). Molecular Cloning: A Laboratory manual, Cold Spring Harbor Laboratory Press, New York.
2. Glick, B.R and J.J. Patemack. (1996). Molecular Biotechnology, Panima, New Delhi,
3. Brown, T.A. (1999). Genome, John Wiley and Sons Asia Pvt Ltd. New York.
4. Slater,A., N.W. Scott and M. R. Fowler (2008). Plant Biotechnology, Oxford University Press, Oxford.
5. Nigel Halford and N.G.Halford (2006). Plant Biotechnology: Current and Future Applications of Genetically Modified Crops. Wiley, John & Sons, Incorporated, New Jersey.
6. Maliga, P. (1995). Methods in Plant Molecular Biology. A Laboratory Course, New Age Enterprises. New Delhi.
7. Martin J Chrispeels, David E. Sadava and David E. Sadava (2002). Plants, Genes, and Crop Biotechnology Jones & Bartlett Publishers, Inc., New Jersey.

KARPAGAM ACADEMY OF HIGHER EDUCATION

Deemed to be University

(Established Under Section 3 of UGC Act 1956)

EachanariPost,Pollachi Main Road,

Coimbatore -641021

COURSE OF STUDY & SCHEME OF EXAMINATION

M.Phil. & Ph.D. COURSE IN CHEMISTRY

2015- 2016

Part-I Course Work Syllabus for M.Phil and Ph.D Chemistry

Subject Code	Title of the Course	Credit	Exam Hours	Marks
Paper-1(Compulsory)				
15RCH101	Research Methodology and Pedogogy	4	3	100
Paper-II(Compulsory)				
15RCH201	Physical Methods in Chemistry	4	3	100
Paper-III(Any One)				
15RCH301 A	Organic Chemistry	4	3	100
15RCH301B	Physical Organic chemistry	4	3	100
15RCH301C	Electro Chemistry	4	3	100
15RCH301D	Environmental Chemistry	4	3	100
15RCH301E	Chemistry of Crystalline solids	4	3	100
15RCH301F	Organometallic Chemistry of Transition metals	4	3	100
15RCH301G	Chemistry of Biomolecules	4	3	100
15RCH301H	Polymer Chemistry	4	3	100

Part I – M. Phil.,/ Ph.D.,

CHEMISTRY

Paper-I: Research Methodology and Pedagogy (Effective from the academic year 2015-2016 and onwards)

Course Objective:

- To learn and practice the literature survey aspects of projects and prepare the scope and goals for the proposed project.
- To learn, practice and improve the research presentation skill and with latest tools
- To learn and understand the research publication ethics
- To learn the tools like LaTeX
- To understand the error analysis
- To learn the emission spectrocopy

Course Outcome:

1. Enable the student potential to organize, coordinate and focus research aptitude with confidence

2. Improve the awareness on indexing, quality evaluation, author index of publications

3. Improve the presentation skills through seminars

4. Expertise in LaTeX tool for report preparation

5. Understood the error analysis

6. Learnt the emission spectroscopy

UNIT I

Research Methodology - Objectives of Research - Types of Research - Criteria for good Research . Defining the Research Problem - Research Design. Dissertation writing- Guidelines for review of literature - Materials and methods, results and discussion. Interpretation of results, presentation of results, summary, presentation of references and appendix.Use of Computers in Research – Data base Operations like creation – updating – indexing/sorting and searching of data, data entries and analysis, graphical applications.

UNIT II

Data Analysis: Errors in chemical analysis - classification of errors – determination of accuracy of methods - improving accuracy of analysis - significant figures - mean, standard deviation-comparison of results : "t" test, "f" test, and "chi" square test – rejection of results-presentation of data.Sampling – introduction – definitions - theory of sampling-techniques of sampling - statistical criteria of good sampling and required size - stratified sampling vs random sampling – minimisation of variance in stratified sampling – transmission and storage of samples.

UNIT III

Definition of problem: Necessity of defining problem, Technique involved in defining a problem. Surveying the available literature. Building up of own literature collection, citation techniques.

Research Design: Subject of study; Place of study; Reason of such study; Type of data required; Method of data collection; Periods of study; Style of data presentation.

Developing a research plan: Research objective; Information's required for solving the problem; Different methods used to solve a problem.

Publication of Journal Articles: Concept, types of journals, components of a journal article, preparation of the manuscript, from manuscript to publication and online submission.

Submission of Research Proposals: Leading funding agencies in India, Submission of research project proposals with prescribed formats.

UNIT IV

Flame emission and atomic absorption spectroscopy and Fluorometric Analysis: Types of atomic spectroscopy – emission methods - absorption methods - fluorescence methods - applications of atomic emission spectroscopy – flames and flamespectra. Fluorescence and phosphorescence – applicationoffluorometricanalysis.

HPLC and Gas Chromatography:Theory of chromatography - detectors - Application of gas/mass analysis. Principles of high performance liquid chromatography - gradient elution, isocratic elution, sampling detectors for liquid chromatography - quantitative analysis by HPLC.

UNIT V

Pedagogical Methods in Higher Education Objectives and roll of higher education – Important characteristics of an effective Lecture – Quality teaching and learning – Lecture preparation – Characteristics of instructional design – Methods of teaching and learning : Large group – Technique – Lecture, Seminar, Symposium, Team Teaching, Project, Small group Technique – Simulation, role playing Demonstration, Brain storing, case discussion, and assignment, Methods

of evaluation – Self evaluation, student evaluation, Diagnostic testing and remedial teaching – Question banking – Electronic media in education: - 'e' learning researches – web basedlearning

References:

1. J. D. Dick,(1973). Analytical chemistry. McGraw Hill, N.Y. also available in International students edition McGraw Hill, Mogakusha.
2. J.Dyer, (1965), Applications of absorption spectroscopy of organic compounds. Prentice-Hall, Englewood Cliffs,N.J
3. S.M Khopkar,(1998), Basic concepts of analytical chemistry, New Age International, New Delhi
4. B. K. Sharma.(2000),Instrumental methods of chemical analysis, Krishna Prakashan Media,2000
5. Skoog.D.A and M. West.(2006), Principles of instrumental analysis, Brookes Cole Publishers,Calefornia
6. Willard.H, L. Merrit Jr and A. Dean.,Instrumental methods ofanalysis
7. Vedanayagam, E.G (1989) Teaching Technology for college teachers. NewDelhi: Sterling Publishers (P)Ltd.,
8. Rajasekar.S (2005) Computer Education and educational computing.Hyderabad: NeelkamalPublications.
9. Kumar K.L. (1997) Educational Technologies, New Delhi: New age International.

Part I – M. Phil.,/ Ph.D.,

CHEMISTRY

Paper-II: Physical Methods in Chemistry (Effective from the academic year 2015-2016 and onwards)

Course Objective:

- To develop fundamental understanding of spectroscopic techniques - their origin from the interaction of radiation with matter.
- Principles and instrumentation of major spectroscopic techniques.
- Application of each spectroscopic technique for chemical structure characterization.
- Develop an ability to rationally exploit a variety of spectroscopic techniques for future research or industrial assignments.
- It is expected that at the end of this course students will be able to decipher the structure of reasonably complex molecules using spectroscopic techniques.
- To discuss about electron spectroscopy and thermal analysis

Course Outcome:

- Develop fundamental understanding of spectroscopic techniques - their origin from the interaction of radiation with matter.
- Principles and instrumentation of major spectroscopic techniques.
- Application of each spectroscopic technique for chemical structure characterization.
- Develop an ability to rationally exploit a variety of spectroscopic techniques for future research or industrial assignments.
- It is expected that at the end of this course students will be able to decipher the structure of reasonably complex molecules using spectroscopic techniques.
- Discussed about electron spectroscopy and thermal analysis

UNIT I

U.V - Visible spectroscopy:

Electronic excitation – origin of different bands - intensity of bands – selection rules – laws of photometry – correlation of electronic absorption with molecular structure – chromophoric groups – conjugated systems – systems of extended conjugation – aromatic systems – empirical rules – experimental methods – photometric methods – photometric titrations.

I.R. spectroscopy: Molecular vibrations – selection rules – force constant – band assignments – applications –organic structures – finger printing – identification of common functional groups – applications.

UNIT II

1H and 13C NMR spectroscopy: Proton chemical shifts – aromatic ring systems – anisotropic effects – 13Carbon chemical shifts – mechanisms of spin - spin coupling – vicinal, geminal and long range proton – proton coupling.

Analysis of NMR spectra: Accumulation of spectra by the pulsed NMR technique – nuclear relaxation – Fourier transformation – the pulsed FT NMR spectrometer.

Double resonance technique and relaxation mechanisms: Homonuclear decoupling – heteronuclear decoupling – proton decoupling technique in 13C spectrum – INDOR and Nuclear overhausser effect (NOE) – 13C relaxation mechanisms – measurement of relaxation times – spin-lattice relaxation (T1)spin-spin relation (T2) measurements – assignment technique in 13C spectra – chemical shift correlation quantitative measurement in 13C – NMR – relaxation reagents – intensity standards.

UNIT III

ESR Spectroscopy: Theory – instrumentation –derivative curves 'g' values – 'g' shift – origin of

hyperfine splitting – isotropic systems – anisotropic systems – anisotropic effect zero field splitting – Krammers degeneracy – applications to organic and inorganic systems – identification of free radicals. X-ray PhotoelectronSpectroscopy: Introduction – Theory of XPS – Instrumentation – Applications of XPS to organic and inorganic systems.

UNIT IV

Mass Spectrometry: Theory – instrumentation – various types of mass spectrometers – magnetic focusing instruments – sample handling – production and reactions of gaseous ions – isotopic abundance – determination of molecular weights and formulae – metastable peaks – nitrogen rule – ion fragmentation mechanisms – rearrangements – use of mass spectrometry in the structural elucidation of organic compounds – mass spectra of compounds containing different functional groups.

UNIT V

Instrumental Methods Thermal Methods: Principle and applications of Differential Thermal analysis (DTA), Differential Scanning Calorimety (DSC), Differential Thermal Gravimetry (DTG) and Thermo Gravimetry (TG). Effects of experimental conditions on the course of thermo analytical curves. Diffraction Methods: Fundamentals of X-Ray Diffraction- Powder and Rotating crystal methods- use of X-ray powder diffraction data in identifying crystalline solids-

details for cubic systems- Comparison of X- ray, neutron and electron diffractions. Nanoscale Characterization: Principle and applications of SEM and TEM.

References:

1. Becker .K.,(2000). High Resolution NMR. AcademicPress.
2. Cullity. B.D (1975). Introduction to X-Ray Diffraction. Addison-WesleyPublishers
3. Drago,R.S.(1965) Physical methods in Inorganic Chemistry. Reinhold Publishing Corporation.
4. Hamming and Foster (1972). Interpretation of Mass Spectra of Organic Compounds. AcademicPress.
5. Mclafferty (1973). Interpretation of Mass Spectra. Published by BenjaminPress.
6. Raw.Johnstone (1975). Mass Spectrometry for Organic Chemistry. Published by The ChemicalSociety.
7. Scharz (1964).Physical methods in Organic Chemistry. Oliver & BoydPublishers.
8. Weilie Zhou., Zhong Lin Wang.(2006). Scanning Microscopy for Nanotechnology. SpringerPublishers.
9. West, A.R.(1985). Solid state Chemistry and its applications. Published by WileyDefault.

Part I – M. Phil.,/ Ph.D.,
CHEMISTRY
Paper III: Special Paper I – Organic Chemistry (Effective from the academic year 2015-2016 onwards)

Course Objectives

This course enables the students

- To understand theory of concerted reaction.
- To provide a versatile knowledge of different name reactions and their application in synthesis.
- To learn about familiar addition and elimination reactions.
- To gain knowledge about reaction intermediates.
- To understand the principles and reaction mechanisms involving various electrophilic and nucleophilic, addition and elimination reactions.
- To relate the different organic reaction mechanisms.

Course outcomes (CO's)

On the completion of this course, students should have to

1. Learned the concept theory of concerted reactions.
2. Familiarized the various types of electrophilic and nucleophilic substitution reactions and their Mechanism
3. Learned the familiar addition and elimination reactions
4. Learned the concept of reaction intermediates.
5. Understood about synthesize aromatic compounds using electrophilic and nucleophilic substitution, addition and elimination reactions.
6. Described the various organic reaction mechanisms.

UNIT I
Theory of Concerted Reactions: Definitions - molecular orbitals – frontier orbitals – frontier orbital approach – correlation diagrams – the aromatic transition state concept – general rule for pericyclicreactions.
Electrocyclic Reactions: Definition – thermal electrocyclic reactions – photochemical electrocyclic reactions – metal catalysed electrocyclic reactions.
Cycloadditions: Introduction – selection rules for thermal polyene cyclo additions – Diels – Alder reaction – The retro diels – alder reaction – 1,3 Dipolar cycloadditions – Retro 1,3 – dipolar additions.
UNIT II
Modern reagents in Organic synthesis: Sodium cyanoborohydride – osmium tetraoxide – lithium dimethyl copper – thallium trifluoro acetate – sodium hydrogen telluride – silver hexa fluorantimonate – Thiobenzoyl chloride – trichloro silane- vanadium oxytrifluro – phosphonitrile chloride – ruthenium tetraoxide – barium magnaganate – benzene selenic acid – benzene selenyl bromide/chloride, aluminium chloride/phosphoryl chloride.
UNIT III
Stereochemistry, Conformational Analysis & Retrosynthetic analysis Stereoselective,

stereospecific and regiospecific reactions – stereoselectivity in carbonyl addition- Cram's rule – configuration – conformation – torsional strain – Vander waals strain – gauche interaction – allylic strain – conformation analysis of acyclic molecules.

Retrosynthetic Analysis of Simple Organic compounds: Retrosynthetic analysis of mono & difunctional open chain target molecules and monocyclic target molecules.

UNIT IV

Chromatography: Theory, Instrumentation & application in the chemical analysis of column, paper, thinlayer, ion-exchange, Gas chromatography (GC) and High Pressure Liquid Chromatography (HPLC).

Natural products: Extraction, Isolation and structural elucidation (using spectroscopic methods) of terpenes, steroids, alkaloids and phenolic compounds.

UNIT V

Problem solving: Solving the structure of simple organic molecules on the basis of UV, IR, NMR & Mass spectral data. (restricted to organic compound compounds having 12 carbon atoms).

References:

1. Agarwal O.P, (2004). Natural Product Chemistry, Vol. I, Goel Publishing House,Meerut
2. Agarwal O.P, (2004). Natural Product Chemistry, Vol. II, Goel Publishing House,Meerut
3. Mackie R.K. and D.M.Smith, 1982. " Guide book to Organic Synthesis",ELBS,

4. Reagents for Organic synthesis – Feiser & Feiser Vols. I –XII.
5. Silverstein and Webster, 1998. "Spectrometric Identification of Organic Compounds", 6th Ed., Wiley
6. Skoog D.A.and D.M.West, (2004).Fundamentals of Analytical Chemistry, 8th Edition, Thomson book store,Singapore
7. Usharani S., (2002). Analytical Chemistry, Mac Millan India Ltd.,Chennai

Karpagam Academy of Higher Education, Coimbatore-21

Part I – M. Phil.,/ Ph.D.,

CHEMISTRY

Paper III: Special Paper II – Physical Organic Chemistry (Effective from the academic year 2015-2016onwards)

Course Objectives

On successful completion of the course the students should have

- To know about versatile knowledge of rearrangements
- To understand the different organic (radical and concerted) reactions and their applications in synthesis.
- To learn about unimolecular and bimolecular surface reactions and LFER
- To explain the concepts in organic photochemistry
- To describe the basic ideas about pericyclic reactions
- To implement this basic concept to design and produce the new organic molecules

Course outcomes (CO's)

1. Understood the versatile knowledge of rearrangements
2. Understood the different organic reactions (radical and concerted).
3. Learned about the unimolecular and bimolecular surface reactions and LFER
4. Explained about the molecular rearrangements, Pericyclic reactions and Cyclo addition and sigmatropic reactions
5. Described the basic ideas of pericyclic reactions.
6. Designed new form of organic compounds using these basic concepts.

UNIT-I

Theories of Reaction Rates:

Absolute reaction rate theory – thermodynamic treatment of ARRT – Significance of reaction co- ordinate – application of ARRT to simple unimolecular and bimolecular process –potential energy surfaces – partition functions and activated complexes. Eyring equation, estimation of free energy, enthalpy and entropy of activation and their significance – kinetic isotopic effect.

Homogeneouscatalysis

Acid – Base catalysis – Hammed acidity function, Bronsted relationship – enzyme catalysis – mechanism of single substrate reactions – Michaels – Mention law-influence of pH and temperature.

UNIT II

2.1 Reaction in solution

Introduction – Unimolecular & Bimolecular surface reaction (Langmuir & Freundlich adsorption isotherm only)- application of ARRT to solution kinetics – the influence of solvent- the ionization of neutral molecules - kinetics of ionization- primary and secondary salt effect.

2.2. Oxidation & Reduction

Oxidation with chromium and manganese compounds – Oxidation with per acids and other peroxides – oxidation with periodic, lead tetra acetate, mercuric acetate – selenium dioxide.

Catalytic hydrogenation and dehydrogenation metal hydride reductions and related reactions dissolving metal reductions and related reactions-reductions and the hydroactive and its derivatives.

UNIT III

Quantitative structure and Reactivity Relationships

The linear free energy principle – (LFER) linear relationship involving difference reaction - the cettler correlation. The Hammett equation – steric effects – resonance interaction – normal substitutent constants $-\sigma$ - , $\sigma +$ constants – inadequacy of dual hypothesis – regularities in through resonance effect – the Yukawa Tsuno equation – systematic deviation – steric inhabitation of resonance – Taft equation – correlation of aliphatic and aromatic relativities.

UNIT IV

Photo Organic chemistry:

Light absorption – unimolecular photo physical processes – Jablonski diagrams –radioactive transitions – internal conversion – intersystem crossing – energy pooling –excimers and exciplexes. Photochemical reactions:

Introduction –cis – trans Isomerisation – Norrish type I reaction – Norrish type II reaction – Thermal generation of excited states. Zimmerman rearrangement,photochemical rearrangement of enones. photorearrangement of cyclohex – 2 –enones – rearrangements of 2 – cyclopentenones and related compound.

UNIT V

Theory of Concerted Reactions:

Definitions – molecular orbital – frontier orbital – frontier orbital approach –correlation diagrams – the aromatic transition state concept – general rule for pericycle reactions.

Electro cyclic Reactions:

Definition – thermal electro cyclic reactions – photochemical electro cyclic reactions – metal catalyzed electro cyclic reactions.

Cycloadditions:

Introduction – selection rules for thermal polyene cyclo additions – Diels – Alder reaction

– The retro diels – alder reaction – 1,3, - Dipolar cycloadditions – Retro – 1,3 – dipolar cyclo additions.

References:

1. Gilchrist,PL.,and R.C. Storr (1972). Organic Reactions & Orbital Symmetry. CUP ArchivePublishers.
2. Laidler , K.J. , (1975).chemical kinetics, 2nd Ed. Tata Mc. Graw Hill. 3.Louis P. Hammett ., Physical organic chemistry, Mc. Graw Hill Ltd., Tokyo. 4.Moore, W.J., (1982). Physical chemistry 5 th Ed. OrientLongman.
3. 5.Rastoghi K.K. , Mukherjee ., (1978) . Funtamentals of photo chemistry , Wiley Eastern 6.Thomas ,H. Lowry., Kathleen SuhuellerRicharden., Horper., and Rao (1986).
4. Mechanism and Theory in Organic Chemistry. Published by Macmillan.
5. 7.Woodward., and Hofman (1971). The Conservation of Orbital Symmetry. Published by Verlag Chemic.

Karpagam Academy of Higher Education, Coimbatore-21

Part I – M. Phil.,/ Ph.D.,

CHEMISTRY

Paper-III: Special Paper III-Electrochemistry

(Effective from the academic year 2015-2016 and onwards)

Course Objectives

This course enables the students

- To provide knowledge on fundamental understanding of chemical kinetics and to establish a relationship between the rate of reaction and the concentration of the reactants (the rate law, or rate equation).
- To apply the chemical kinetics concept to study the enzyme mechanisms.
- To provide knowledge to the students about coulometric methods and its application.
- To investigate the adsorption, classification of adsorption and factors affecting of adsorption over corrosion application.
- To remember the basic polarography concepts.
- To understand the theories of catalysis and types of catalysis.

Course outcomes

On the completion of this course, students have to

1. Student understood theories of reaction rates, how reaction rates are measured and represented in rate laws.
2. Understood the applications of chemical kinetics in studying enzyme mechanisms
3. Provided the knowledge of coulometric methods and applications.
4. Evaluated the electrochemical principles involved in corrosion and energy storage.
5. Remembered the basic polarography techniques.
6. Understood the theories of catalysis and types of catalysis

UNIT I

Introduction and Principles:

Definition –Cost of corrosion-importance of corrosion studies-classification of corrosion–expressions for corrosion rate.Electrochemical principles of corrosion : Faraday's laws –Types of electrochemical cells formed in corrosion process. thermodynamic principles of corrosion : Electrochemical series/ standard electrode potentials and thermodynamic corrosion theory-Galvanic series of metals and alloys and limitations. Forms of corrosion (Definition –cause and effects) : Galvanic –Crevice –Pitting -Intergranular – Selective leaching –Erosion-Stress-Hydrogen damage.

UNIT II

Kinetics of Corrosion: Importance –Graphical presentation of kinetic data –exchange current density –different types of polarization of electrodes.Activation polarization and Tafel plots – Mixed potential theory – Application of electrode kinetics to experimental observations-Faradic impedance and corrosion.

UNIT III

Kinetics of Passivity: Introduction-electrochemical behaviour of active/passive metals-Flade potentials-criteria for selecting a metal exhibiting passivity-effects of various factors on electrochemical behaviour and corrosion rate of metal exhibiting passivity-measured versus theoretical anodic polarization behaviour-Theories of passivity.

UNIT IV

Monitoring of Corrosion: Determination of corrosion and corrosion inhibition parameters-Non-elecrochemical methods:Coupon-Electrical resistance-Gasometeric methods:Electrochemical methods: Polarisation-Galvanostatic-Potentiostatic –Potentiodynamic-AC impedance-Hydrogen permeation.

UNIT V

Corrosion control: Metals and alloys-metal purification-non metallic-cathodic and anodic protection – comparison.Alteration of environment : Changing the medium –use of inhibitors-classification of inhibitors –mechanism of inhibition-Coating (Elementary ideas only).

REFERENCES:

1. Herbert H.Uhlig and Winston Review.R. (1984). Corrosion and Corrosion control(An introduction to corrosion science and engineering) ,Third Edition,A Wiley Interscience Publication, NewYork.
2. Mars Fontana G. (1984).Corrosion Engineering, Third Edition, Mc.Graw HillBook Company,Singapore.
3. Mercer A.D. (1985).Test methods for corrosion inhibitors , J.Corr.Science,85.
4. Raj Narayan.P. (1983).An introduction to metallic corrosion and its prevention,Oxford and IBH Publishing C., NewDelhi.
5. Schmitt G. (1984). Application of inhibitors for acid media ,Corros.J,73.

Part I – M. Phil.,/ Ph.D.,
CHEMISTRY
Paper-III: Special Paper IV-Environmental Chemistry

(Effective from the academic year 2015-2016 and onwards)

Course Objectives
The course enables the students to
- Understand the industrial gases and inorganic chemicals which have an impact on the environment.
- Study about the general principles of metallurgy.
- Learn the environment and its segments.
- Discuss about the water pollution and water treatment.
- Explain the application of bio-catalysis in energy saving techniques.
- Apply this technique to design energy saving devices with eco-friendly method.

Course Outcomes
The course enables the students to
1. Understood the industrial gases and inorganic chemicals which have an impact on the environment.
2. Studied about the general principles of metallurgy.
3. Learned the environment and its segments.
4. Discussed about the water pollution and water treatment.
5. Explained the application of bio-catalysis in energy saving techniques.
6. Appling this technique to design energy saving devices with eco-friendly method.

UNIT-1

Chemistry of Water and Waste water:

Basic principles and their significance with special reference to colour, turbidity, alkalinity, acidity, chemical coagulation, hardness, water softening, disingection, residual chlorine and chlorine demand, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, nitrogen, phosphate, sulphate, gas analysis, enzymes, factors affecting enzyme activity, bio-chemistry of carbohydrates, proteins, fats and oils under aerobic and anaerobic conditions, detergents and their degradation, composition and characteristics ofsewage.

UNIT II

Chemistry of air pollutants-I

Introduction, definition, classification of air pollutants, effect of air pollutants on man, materials, animals and plants, ambient air quality standards, harmful concentrations, geographical and meteorological factors in air pollution control, measurement of gas flows, volume, quantity and velocity.

UNIT III

Chemistry of air pollutants-II

Methods of sampling, particulate collection by liquid scrubbing, centrifugal spray scrubbers, venturi scrubbers, foam scrubbers; field sampling techniques such as deposition, absorption, filteration, condensation, adsorption, adhesion, electrostatic precipitation, thermal precipitation, analysis of air pollutants such as particulates sulphur dioxide, carbon monoxide, oxides of nitrogen, hydrogen sulphide, etc., control measures.

UNIT IV

Chemistry of solid wastes:Chemistry of composting: mechanism involved in the decomposition of organic materials like hemicellulose, proteins, carbohydrates, food materials, organic insecticides, form wastes, etc., by aerobic and anaerobic processes.

UNIT V

Chemistry of Incineration and Pyrolysis: Incineration; definition; Incineration of solid waste; combustion characteristics of various inorganic and organic materials; heating values-determination of heating values of combustible liquidandsolidwastes;airrequirementforcombustion;fateoftraceconstituentssuchassulphur during incineration; gaseous pollutants; definition of pyrolysis; chemical changes taking place in organic and inorganic materials during pyrolysis; importance of pyrolysis in the solid waste disposal; chemistry of recycling of solid waste; recycling and reuse of materials such as paper, plastic, glass, etc.

References:

1. American Public Health Association Inc., New York, (1976). Standard methods for the examination of water and wastewater.
2. Hagerty, D.J.,J.L.Pavoni and J.E.Heer, (1973). Jr., Solid waster management,Van Nostrand Reinhold Co., Newyork.
3. Jacobs, M.B., (1960). Chemical analysis of Air pollutants, Interscience, New york.
4. Leithe, W. (1971). Translated by R.Kenor, The analysis of air pollutants, Ann Arbor

5. Ross, R.D,(1972). Air pollution and Industry, Van Nostrand Reinhold Co.,New York
6. Sawyer,C.N. and PL.Mccerty,(1978). Chemistry of Environmental Engineers,Mc.Graw HillPublishers.
7. Stern, A.C., Ed.,(1968). Air pollution, Vol.1, 2 and 3,Academic press, New York.
8. Strauss, W.Ed.,(1978). Air pollution control,part 1,2 and 3, Wiley Interscience, New york,
9. Stumm.W. and J.J.Morgan,(1972). Aquatic Chemistry, Wiley Interscience.
10. 10.Wilson, D.G,(1977). Hand book of solid waste management, Van NostrandReinhold
    i. Co., New york.

Part I – M. Phil.,/ Ph.D.,
CHEMISTRY
Paper-III: Special Paper V- Chemistry of Crystalline solids
(Effective from the academic year 2015-2016 and onwards)

Course Objectives
The course enables the students to
- To understand the crystal system
- To learn about X-ray diffraction studies
- To know about crystal phenomena
- To understand the various types of solids and its properties
- To learn about conductors and insulators
- To gain knowledge about phase transition and its classification and transformations.

Course Outcomes
The course enables the students to
1. Understood the crystal structure
2. Learnt about X-ray diffraction studies
3. Knowledge about crystal phenomena
4. Understand the various types of solids and its properties
5. Learnt about conductors and insulators
6. Gained knowledge about phase transition and its classification and transformations

UNIT I

The crystal systems – lattices and crystal structures – symmetry properties – crystal classes – space groups – experimental methods of X-ray diffraction for powder and singlecrystal samples – structural analysis and refinement – electron and neutron diffraction in thedetermination of structures.

UNIT II

Crystal growth phenomena – introduction – nucleation – theories of nucleation –classical theories of nucleation – Gibbs Thomson equation for vapour – modified Thomson'sequation for melt – Gibbs Thomson's equation for solution – energy of formation of anucleus – spherical nucleus – cylindrical nucleus – heterogeneous nucleation – cap shapednucleus, disc shapednucleus.

UNIT III

Types of solids – close packing of spheres – binding in crystals – the bond model –non-stoichiometry – defects in solids – imperfection and physical properties – electrical,opticalmagnetic and mechanical properties – magneticmaterials– mixed oxides – spinels,insulators – semiconductors and superconductors.

UNIT IV

Low temperature solution growth- solution, solubility and super solubility –expression of super saturation – methods of crystallization – by slow cooling of solutions –by solvent evaporation – temperature gradient method. crystal growth system – constanttemperature bath – crystallizer – filtration assembly – seed, seed mount platform and crystalrevolution – unit – gel growth – introduction – principle of gel growth – various types of gel– structure of gel – growth of crystals in gels – importance of gel technique – experimentalprocedure – single diffusion method – double diffusion method – chemical reduction method– solubility reduction method – growth from the melt – Bridgman technique – Czochralskitechnique – zone refining.

UNIT V

Phase transitions – definition – Burger's classification – thermodynamic classification– Landau theory of phase transition – first order and second order transitions – structural changes with increasing temperature and pressure – martensitic transformations – order –disorder transitions.Thermal analysis – basic Principles – instrumentation – applications of thermogravimetry – differential thermal analysis and differential scanning calorimetry.

REFERENCES:

1. Anthony R.West (1987),Solid State Chemistry and its applications — John Wileyand Sons.
2. Azarof,L.V, (1960), Introducation to solids.
3. Chakrabarthy.D.K,(1966) Solid State Chemistry — New Age internationalpublishers
4. Charles Kittel, Principles of solid statePhysics.
5. Cheetham A.K. and Peter Day (1991). Solid State Chemistry Techniques – Edited by–OxfordSciencePublications.
6. Dent Glasser.L.S (1982)Crystallography and its applications –-ELBS.
7. John Enemark, (1988) Introducing Chemists to X-ray Structure Determination,Journal of Chemical education,June.
8. Moore.W.J, (1962),PhysicalChemistry.
9. Dr..Santhana Raghavan.P and Dr.P.Ramasamy ,Crystal Growth Process and Methods–K.R.V.Publication

Part I – M. Phil.,/ Ph.D.,

CHEMISTRY

Paper-III: Special Paper VI- Organometallic Chemistry of Transition metals

(Effective from the academic year 2015-2016 and onwards)

Course objectives
This course enables the students
- To learn about nature of the bonding between organic ligands and metals.
- To understand about the metal alkyl complexes.
- To learn about the alkene and cyclopentadienyl complexes.
- To understand about the usage of organometallic compounds as catalysts
- To learn about the organometallic compound used as the catalyst in hydrogenation and hydroxylation of olefins.
- To study the concept of oxidation and polymerization of olefins.

Course Outcomes
On the completion of the course
1. Learned about the Alkyls and Arene complexes
2. Understood the bonding in olefin, acetylene and allyl systems
3. Known about the concepts of synthesis, structure and bonding in metallocenes
4. Understood the Organometallic reaction mechanisms and its applications
5. Learned about the Catalysis, hydrogenation of olefins and oxoprocess
6. Studied the concept of oxidation of olefins and polymerization

UNIT I

Definition of organometallic compound – 18 electron rule – effective atomic number rule – classification of organometallic compounds – the metal carbon bond types –ionic bond – sigma covalent bond – electron deficient bond – delocalised bond –dative bond – metal carbonyl complexes – synthesis, structure and reactions of metalcarbonyls – the nature of M-CO bonding – binding mode of CO and IR spectra of metal carbonyls – metal carbonyls – metal carbonyl anions– metal carbonyl hydrides– metal carbonyl halides – metal carbonyl clusters – Wades rule and isolobalrelationship – metal nitrosyls – dinitrogen complexes – dioxygen complexes.

UNIT II

Metal alkyl complexes – stability and structure – synthesis by alkylation of metal halides, by oxidative addition, by nucleophilic attack on coordinated ligands – metal alkyl and 18 electron rule– reactivity of metal alkyls – M-C bond cleavage reactions– insertion of CO to M-C bonds – double carbonylation – insertions of alkenes andalkynes – insertions of metals with C-H bonds – alkylidene and alkylidyne complexes– synthesis of alkylidene complexes in low oxidation states and in high oxidationstates – bonding in alkylidene complexes – synthesis and bonding in alkylidynecomplexes – reactivity of alkylidene and alkylidynecomplexes.

Alkene complexes – synthesis of alkene complexes by ligand substitution, by reduction and by metal atom synthesis – bonding of alkenes to transition metals –bonding in diene complexes – reactivity of alkene complexes – ligand substitution –reactions with nucleophiles – olefin hydrogenation – hydrosilation – Wacker process– C-H activation of alkenes – alkyne complexes – bonding in alkyne complexes –reactivity of alkynes – alkyne complexes in synthesis – cobalt catalysed alkynecycloaddition.

UNIT III

Cyclopentadienyl complexes – metallocenes – synthesis of metallocenes – bonding in metallocenes – reactions of metallocenes – CpFe/Cp2Fe+ couples in biosensors – bent sandwich complexes – bonding in bent sandwich complexes – metallocene halides and hydrides – metallocene and stereospecific polymerization of 1-alkenes –cyclopentadiene as a non-spectator ligand – monocyclopentadienyl (half-sandwich) complexes – synthesis and structures of allyl complexes – arene complexes –synthesis, structure and reactivity of arene complexes – multideckercomplexes.

UNIT IV

Role of organometallic chemistry in catalysis: Coordinative unsaturation – oxidative addition – addition reactions of specificmolecules – hydrogen addition – HX addition – addition of X2 – addition of RX –addition reactions of Si-H, C- C, C-Si and Si-Si bonds – elimination reactions - eliminations – alkane activation – intramolecular and intermolecular C-H activation– activation ofsulphur heterocycles – insertion of carbon monoxide – isocyanideinsertion – alkene insertion – alkyne insertion.

UNIT V

Homogeneous catalysis by transition metal complexes: Hydrogenation reactions – reversible cis-dihydro catalysts – monohydride catalysts – hydrogenation of alk-1-ene – asymmetric hydrogenation –role of ruthenium complexes in 2001 Nobel Prize for chemistry- transfer hydrogenations – hydrosilation and hydroboration reactions – water gas shift reaction – reduction of carbon monoxide by hydrogen – hydroformylation of alkenes – alcohol carbonylation –

decarbonylation reactions – C-C cross coupling and related reactions – alkene oligomerisations and polymerizations – Zeigler-Natta polymerization – alkene dimerisation and oligomerisations – valence isomerisation of strained hydrocarbons – alkene and alkyne metathesis – oxidations of alkanes and alkenes – oxygen transfer reactions – supported homogeneous and phase transfer catalysis.

References

1. Bockmann.M,(1996),Organometallics 1, complexes with transition metal-carbon bonds, Oxford science publications, Oxford.
2. Bockmann.M,(1996),Organometallics 2, complexes with transition metal-carbon bonds, Oxford science publications, Oxford.
3. Cotton.F.A, G. Wilkinson, C. A.Murillo and M. Bochmann, (1999).Advanced Inorganic Chemistry, Sixth Edition, John Wiley and sons, Inc, NewYork.
4. Haiduc.I and J. J. Zuckerman, Walter de Gruyter,Brelin, (1985).Basicorganometallic chemistry.
5. Huheey.E, Harpe(1978). Inorganic chemistry – Principles of structure and reactivity, JInternational Edition, Harper and Rone, NewYork.
6. Huheey J.E, E.A.Keiterand R.L. Keiter, (2000). Inorganic chemistry – Principles of structure and reactivity, Addison-Wesley Publishing Company,NewYork.

Part I – M. Phil.,/ Ph.D.,

CHEMISTRY

Paper- III: Special Paper VII: Chemistry of Biomolecules

(Effective from the academic year 2015-2016 and onwards)

Course Objectives

The students enable to

- Identify their chemical elements and the difference between simple sugars and complex carbohydrates.
- Compare and contrast the structure and function of the following carbohydrates and where they are found: glucose, glycogen, starch, cellulose, chitin.
- Determine presence of biomolecules like carbohydrates, proteins, lipids, etc. in known• and unknown samples.
- Determine the extent of adulteration in samples containing biomolecules.
- Identify their chemical elements and functional groups .Recognize the structure of an amino acid and the peptide bond that connects di-, tri, and polypeptides. Recognize the presence of 20 amino acids and that not all are essential amino acids.
- Identify their chemical elements and learn their property of insolubility in water.

Course Outcomes

The students have knowledge that

1. Identify their chemical elements and the difference between simple sugars and complex carbohydrates.
2. Compare and contrast the structure and function of the following carbohydrates and where they are found: glucose, glycogen, starch, cellulose, chitin.
3. Determine presence of biomolecules like carbohydrates, proteins, lipids, etc. in known• and unknown samples.
4. Determine the extent of adulteration in samples containing biomolecules.
5. Identify their chemical elements and functional groups .Recognize the structure of an amino acid and the peptide bond that connects di-, tri, and polypeptides. Recognize the presence of 20 amino acids and that not all are essential amino acids.
6. Identify their chemical elements and learn their property of insolubility in water.

UNIT-I

SUGARS: Introduction, classification of sugars. Sugars in edible nuts-cashew Synthetic sugars.

UNIT II

NON SUGARS: Classification-characterisation-reactions-structural elucidation of starch and cellulose. Starch in edible nuts-cashew-analysis of starch: anthrone, phenol-sulphuric acid, O-toluidine methods.

UNIT III

PROTEINS: Classification-characterisation, reactions of proteins.1o,2o,3o,4o-structurestudies ofproteinsbyX- ray crystallography. Proteins in edible nuts-aibumin-biological importance. Analysis of proteins: Biurette method, F olin-lowry,Kjeldhal method, Bradford'smethod.

UNIT IV

ALLERGENTS: Introduction-tree nut allergents-analysis of tree nut allergen ts ELISA method, hyper sensitivity- types of hyper-sensitivity.

UNIT V

TECHNIQUES OF FOOD PRESERVATION: Preservatives: introduction, classification: class1, class II preservatives. Processing and packaging of food items with specific cases of edible nuts-cashew. Application of preservatives in packaging and value added products of edible nut-cashew.

References:

1. Organic chemistry of natural products: Gurdeep.R-Chatwal.
2. Text book of Biochemistry: Edward Staunton, JohnTvanbrnggel, WibrtStodd.
3. Immunology:Kuby.
4. Text book of Biochemistry with clinical correlation:Devlin.
5. Proteins in Chemistry: Henry.O.Daley J.R.,Robert.F.O'Malley.

Part I – M. Phil.,/ Ph.D.,
CHEMISTRY
Paper- III: Special Paper VIII: Polymer Chemistry
(Effective from the academic year 2015-2016 and onwards)

Course Objectives

The course enables the student

- To study about the basic concepts of polymerization.
- To explains the coordination polymerization and apply the Ziegler-natta catalyst in polymer synthesis.
- To understand the molecular weight determination methods of the polymer and apply it identifies the polymer properties.
- To discuss about the polymer processing and properties of commercial polymers
- To apply the polymer processing technique to prepare the polymer products
- To list out the commercial polymers and its application

Course outcomes

The students have

1. Studied about the basic concepts of polymerization.
2. Explained the coordination polymerization and apply the Ziegler-natta catalyst in polymer synthesis.
3. Understood the molecular weight determination methods of the polymer and apply it identifies the polymer properties.
4. Discussed about the polymer processing and properties of commercial polymers
5. Applied the polymer processing technique to prepare the polymer products
6. Remembered the commercial polymers and its application

UNIT-I

Chemistry of Polymerization

Addition polymerization – Free radical polymerization – Initiation, Propagation and termination – i9nhibitors and retarders. Ionic polymerization – cationic and anionic-Living polyers. Co-ordination polymerization – Zeigler – Natta catalysts. Condensation polymerization – Extend of reaction and DP – Carother's equation and its significance. Three dimensional polymerization – cross linking – gel point – Ring scission polymerization.

UNIT II

Kinetics of Polymerization

Kinetics of free-radical polymerization- Kinetic chain length and DP. Derivation for rate expression and expression for kinetic chain length and hence degree of polymerization. Kinetics of polycondensation with polyester as example. Simple kinetic expression – catalyzed and uncatalyzedpolycodensation.

UNIT III

Techniques of Polymerization

Bulk polymerization – solution polymerization – Suspension polymerization – Emulsion polymerization – Advantages and disadvantages of these techniques – comparison of the above.

UNIT IV

Characterization of Polymers

Molecular weight determination – Method based on colligative property measurements – cryoscopy – ebullioscopy – osmometry – membrane osmometry- vapour –pressure osmometry – Methods based on viscosity. Measurements – viscometry –Light scattering method – ultracentrifuge technique- End group analysis – GPC method. Thermal methods of analysis in polymers – TGA, DTA,DSC.

UNIT V

Polymer structure and Physical Properties

Crystalline melting point, Glass transition temperature – Properties involving deformations.

References:

1. Billmeyer, F.W. (1984) A Text Book of Polymer Science, Wiley – IntersciencePublication
2. Gowariker V.R Viswanathan. N.V Sreedhar. J (1986) Polymer Science, New Age International (P) LtdPublishers
3. Odian G. (2004) Principles of Polymerization, Wiley IntersciencePublications
4. Cowie J.M.G. (1991) Polymers: Chemistry & Physics of Modern Materials, 2nded. Chapman &Hall

5. Arora. M.G Singh M., Yadav M.S (1994) Polymer Chemistry, Anmol Publishers Pvt.Ltd.,

KARPAGAM ACADEMY OF HIGHER EDUCATION – COIMBATORE – 641 021
Part I – M. Phil.,/ Ph.D.,
COMMERCE
Paper-I: Research Methodology and Pedagogy
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

To make the researchers

1. To understand the concept of research, Research Process, research design, sampling techniques, hypothesis writing and report writing.
2. To analyse the research problem and design the blue print to capture data and analyse the same using appropriate statistical techniques and apply the learning lifelong.
3. To Critically formulate the research design and sampling design suitable for the problem.
4. To communicate orally and written form the research problem,research design, sampling techniques.
5. To design a report to communicate the findings
6. To understand the objectives and roll of Higher education.

COURSE OUTCOMES:

Learners should be able to

1. Comprehend the meaning of research, theory of induction, deduction, research process, research design, sampling techniques, hypothesis writing and report writing
2. Analyze the research problem and design the blue print to capture data and analyse the same using appropriate statistical techniques and apply the learning lifelong.
3. Critically formulate the research design and sampling design suitable for the problem.
4. Communicate orally and written for the research problem, research design, sampling techniques.
5. Design a report to communicate the findings.
6. Understand the objectives and roll of Higher education

UNIT I

Research - Scope and Significance - Types of Research – Research Process - Characteristics of Good Research - Identifying Research problem – Sampling Design – meaning – Steps in sampling-criteria for good sample design – Types of Sample Design-Probability and non-probability sampling methods. Measurement-Meaning – types of scales.

UNIT II

Review of Literature – Data Collection-Types of Data-Sources –Methods of Data Collection- Observation, Interview Schedule, Questionnaire – Steps for Constructing a Questionnaire-Establishing, reliability and validity-data processing-Coding-editing and tabulation of data.

UNIT III

Mean, Median and Mode-Parametric Test-Hypothesis testing-Z-test, t-test, F-test, Chi-square test-ANOVA-Correlation, Multiple Regression, Factor Analysis, Non-Parametric tests-Basic of Psychometric Test: Sign test, H test, U test and Run test.

UNIT IV

Report Writing: Meaning, Techniques and Precautions of Interpretation - Significance of Report Writing - Difference Steps in Writing Report - Layout of Research Report - Types: Technical Report, Popular Report - Mechanics of Writing a Research Report- Precautions for writing report-Norms for using Tables, Charts and diagram. Appendix:-Index, Bibliography.

UNIT V

Objectives and roll of higher education – Important characteristics of an effective Lecture – Quality teaching and learning – Lecturer preparation –Characteristics of instructional design – Methods of teaching and learning; Large group – Technique – Lecturer, Seminar, Symposium, Team Teaching, Project, Small group Technique –Simulation, role playing Demonstration, Brain storing, Case discussion and assignment, Methods of evaluation – Self evaluation, student evaluation, Diagnostic testing and remedial teaching – Question banking – Electronic media in education – 'e' learning researches – web based learning.

REFERENCES:

1. Donald R.Cooper (2000). Business Research Methods, Tata Mc graw Hill, New Delhi
2. Gupta S.P. (2000), Statistical Methods, Sultan Chand& Sons, New Delhi.
3. Kothari, C.R (2002), Research Methodology, WishwaPrakasam, New Delhi
4. Krishnaswami, (2003), Mewthodology of research in social Sciences, himalaya Publishing House, New Delhi
5. Pannerselvam, R. (2004 Research Methodology, Prentice Hall of India, New Delhi
6. Sterling (2003), Research Methods for Management and Commerce, Tata MC Graw Hill, New Delhi
7. Vedanayagam, E.G (1989) Teaching technology for college teachers. New Delhi: Sterling Publishers(P) Ltd.,
8. Rajasekar S (2005) Computer Education and Educational computing, Hyderabad, Neelkamal Publications
9. Kumar K.L (1997) Educational Technologies, New Delhi, New Age International.
10. KanthiSwarup P.K Gupta, Man Mohan "Operations Research", Sultan Chand and sons, New Delhi.

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KARPAGAM ACADEMY OF HIGHER EDUCATION – COIMBATORE – 641 021
Part I – M. Phil.,/ Ph.D.,
COMMERCE
Paper- II: Subject Paper: Statistical Analysis for Business Research
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

To make the researchers
1. To understand and apply the descriptive analytical tools
2. To know the univariate tools and its application
3. To comprehend the application of Bivariate analysis
4. To understand and compute the multivariate analysis.
5. To understand the correlation analysis
6. To understand the Importance of SPSS and the features for entering the data according to the variable type

COURSEOUTCOMES:

Learners should be able to
1. Compute descriptive statistics and graphically represent the data.
2. Perform univariate and bivariate analysis.
3. Perform multivariate analysis.
4. Perform the correlation analysis
5. Demonstrate capabilities of problem-solving, critical thinking, and communication skills to infer the output.
6. Understand the Importance of SPSS and the features for entering the data according to the variable type

UNIT I

Business Statistics – Meaning and Definition – Scope and Functions – Advantages and Limitations – Meaning of Data, Variables, Random Variable, Population and Sampling Techniques – Measures of Central Tendency – Mean, Median – Measures of Dispersion- Standard Deviation and Co-efficient of Variation.

UNIT II

Correlation Analysis – Simple Rank, Partial and Multiple Correlation – Auto Correlation – Regression Analysis – Simple Liner Regression, use of dummy variables.

UNIT III

Testing of Hypothesis – Z test, T test – Chi Square Test – F test and ANOVA – Excel and SPSS packages for statistical applications.

UNIT IV (Theory Only)

Multivariate Analysis; Principle Component Analysis – Factor Analysis –Discriminate Analysis and Path Analysis.

UNIT V

Non Parametric Statistics in Data Analysis – The Sign Test – Runs Test – Mann Whitney – U Test – Kruskal – Wallys Test – Time Series Analysis.

Note: The question paper shall cover 20% theory & 80% problem.

REFERENCES

1. Gupta S.P (2006) Statistical methods, Sultan Chand& Sons, New Delhi.
2. Manoharan.M (2005) statistical Methods, Asian Publishing House, New Delhi.
3. Levin and Rubin (2006). Statistics for management, Asian Publishing House, New Delhi.
4. Kendall (2006) Multivariate analysis, Himalaya publishing House, Mumbai.
5. Sanchetti&Kapoor(2007) advanced statistical methods, Wiley Eastern, Bombay.

KARPAGAM ACADEMY OF HIGHER EDUCATION – COIMBATORE – 641 021
Part I – M. Phil.,/ Ph.D.,
COMMERCE
Paper- III: Special Paper I: Financial Management
(Effective from the academic year 2015-2016 and onwards)
COURSE OBJECTIVES:
To make the researchers
1. To Understand the Concept of financial management, objective of financial management, the major four decisions taken by finance manager and its impact and enrich the lifelong learning.
2. To analyse the alternatives using appropriate tools and techniques.
3. To solve the problems and take decisions based on the result.
4. To communicate orally and in written formthe concepts and solutions.
5. To analyse cases in a team and exhibit leadership skills.
6. To plan and manage the cash flows.

COURSE OUTCOMES:
Learners should be able to
1. Understand the Concept of financial management, objective of financial management, the major four decisions taken by finance manager and its impact and enrich the lifelong learning.
2. Analyse the alternatives using appropriate tools and techniques.
3. Solve the problems and take decisions based on the result.
4. Communicate orally and in written form the concepts and solutions.
5. Analyse cases in a team and exhibit leadership skills.
6. Plan and Manage the cash flows in companies.

UNIT I
    Financial Management – Meaning - Nature and Scope - Objectives – Role and Functions of Financial Manager- Time value of money – Present Value, Future Value and Compound analysis- Identification of research problems.

UNIT – II
    Cost of Capital- Meaning and importance- Cost of debt, Preference Share, Equity Share and Retained Earnings- Weighted Average cost of capital- Capital Budgeting- Techniques – Pay back period, Net Present Value, Return on Investment and Internal Rate of Return- Identification of research problems.

UNIT – III

Leverage: Meaning – Financial Leverage - Operating Leverage - EBIT- EPS analysis- Capital structure – Theories of Capital Structure – Net Income Approach – Net Operating Income Approach - MM Hypothesis – Traditional Approach – Determinants of capital structure – Optimum Capital Structure- Identification of research problems.

UNIT – IV

Dividend Theories – Walter's model – Gordon and Mm's models – Dividend policy – forms of Dividend – Determinants of dividend policy. Working capital Management – Meaning – Objectives – Importance –Computation of working capital - Determinants of working capital- Identification of research problems.

UNIT – V

Management of Working Capital Components – Cash management – Inventory management - Receivables management. Reports of Various Working capital committees.

Note: The question paper shall cover 50 % theory and 50% problems

REFERENCES
1. Khan and Jain (2006). Financial Management. Tata Mc Graw Hill Publishers Pvt. Ltd., New Delhi.
2. Pandey I.M (2006). Financial Management. Vikas Publications, New Delhi.
3. Kulkarni P.V (2003) Financial Management. Himalaya Publishing house, Mumbai.
4. Maheswari S.N (2005) Financial Management. Sultan Chand& Sons, New Delhi 2005.
5. Sharma Sasi K Gupta (2003) Financial Management. Himalaya Publishing house, Mumbai.

KARPAGAM ACADEMY OF HIGHER EDUCATION – COIMBATORE – 641 021
Part I – M. Phil.,/ Ph.D.,
COMMERCE
Paper- III: Special Paper II - Marketing Management
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

To make the researchers
1. To Understand the Concept of marketing, and 4Ps of Marketing
2. To communicate orally and in written form the concepts of marketing and 4 Ps of marketing
3. To apply the marketing concepts and skills lifelong.
4. To analyse the business case studies and try to apply the theoretical learning into lifelong practice.
5. To Critically evaluate the appropriate alternatives and draw a solution.
6. To Work in team and exhibit leadership skills

COURSE OUTCOMES:
Learners should be able to
1. Understand the Concept of marketing, and 4Ps of Marketing
2. Communicate orally and in written form the concepts of marketing and 4 Ps of marketing
3. Apply the marketing concepts and skills lifelong.
4. Analyse the business case studies and try to apply the theoretical learning into lifelong practice.
5. Critically evaluate the appropriate alternatives and draw a solution.
6. Work in team and exhibit leadership skills

UNIT I

Marketing management- Introduction, Importance- Core Marketing concepts, Product planning and development – Product policy decisions – Product Line and Product Mix – Product Life Cycle – Brand Management. Pricing system – Procedure for Price Determination – Advertisement and Sales promotion- Identification of research areas.

UNIT II

Market segmentation- need for segmentation, benefits of segmentation- base for segmentation – segmenting consumer markets and business markets. Consumer behavior, types of buyer behavior- buying decision of organizational buyers-organizational buying process- Identification of research areas.

UNIT III

Marketing Research- Introduction, Objectives and Importance, Scope of Marketing Research, Marketing Research Process, Applications of Marketing Research- Limitations of Marketing Research – Marketing Information System - Ethics in Marketing Research- Identification of research areas.

UNIT IV

Indian Marketing Environment- Emerging profile of the Indian market, changing the demographic structure-Opportunities in Rural Markets – Rural buying behaviour-Marketing and Society- Social responsibility and Marketing Ethics - Experiences marketing in India - Identification of research areas.

UNIT V

Global Marketing- Introduction, Importance of Global Marketing- The role of Orientations, The forces affecting Global Marketing- Global Marketing Strategy. E-marketing – Introduction, role of the internet, Types of E-Markets, Marketing mix in E-Marketing, Advantages and Limitations of E-marketing- - Identification of research areas.

REFERENCES

1. Karunakaran.Dr (2007). Marketing Management. Himalaya Publishing house, Mumbai.
2. Philip Kotler and Gary Armstrong (2007). Principles of Marketing. Prentice Hall of India Pvt Ltd., New Delhi.
3. Rajan Nair (2006). Marketing Management. Sultan Chand& Sons, New Delhi.
4. Mamoria C.B and SatishMamoria (2006). Marketing Management. Patna. KitabMahal.
5. Naresh K. Malhotra (2002). Marketing Research. Pearson Education, New Delhi.
6. Varshney R.L and Bhattacharya.B (2006) International Marketing Management. Sultan Chand& Sons, New Delhi.
7. Nandagopal and Vivek (2006).Marketing Research. Asian Publications, New Delhi.

KARPAGAM ACADEMY OF HIGHER EDUCATION – COIMBATORE – 641 021
Part I – M. Phil.,/ Ph.D.,
COMMERCE
Paper- III: Special Paper III : Human Resource Management
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:
To make the researchers
1. Describe nature and scope of Human Resources management
2. Evaluate human resource planning, recruitment process and selection methods in the organization
3. Discuss need for motivating employees in an organization.
4. Assess labour relations, industrial disputes and settlement in the organization
5. To know the concept of industrial relations.
6. To know the concept of Collective Bargaining and its significance to a company.

COURSE OUTCOMES:
Learners should be able to
1. Understand the HR environment in India and human resource functions within organizations
2. Plan human resources requirement and formulate HR policy of the organisation with regard to recruitment, selection, training and career planning.
3. Appraise the employee's performance and formulate compensation policy which helps to make organizational excellence.
4. Understand the importance of career planning, job evaluation and factors influencing compensation levels.
5. Analyse the ethical issues in HR management
6. To take decisions in a manner of Collective Bargaining.

UNIT – I
Human Resource Management – Meaning – Significance- Functions –Strategy and tactics-Evolution and Development of HRM- Job design-Job Analysis –Job description – Job specification- Identification of research areas.

UNIT -II
Recruitment-Definitions-Objectives, Corporate Mission-Objectives-strategies, tactics and recruitment-Sources and Techniques of recruitment – E-recruitment. Selection, Placement and Induction- Human Resource Development: Conceptual Analysis - Identification of research areas.

UNIT -III

Performance Appraisal-Methods-System- Counseling – Managerial appraisal. Employee training – Training methods- Training procedure- Evaluation of training Programme – career planning and development-Identification of research areas.

UNIT -IV

Internal Mobility and External Mobility-Organizational change and development- Job Evaluation – Wage and salary administration- Fringe Benefits-Human Relations-Identification of research areas.

UNIT -V

Globalization and Human Resource Management- Introduction- Impact on employment , Human Resource Development, Wages and Benefits, Trade Unions, Collective Bargaining, Participative Management and Quality Circles. Total Quality and Human Resource Management- Identification of research areas.

REFERENCES

1. Gupta C.B (2007) Human Resource Management. Sultan Chand& Sons, New Delhi.
2. Prasad L.M (2000). Human Resource Management. Sultan Chand& Sons, New Delhi.
3. Memoria C.P (2004). Personnel Management. Sultan chand& Sons, New Delhi
4. SubbaRao (2006). Essentials of HRM and Industrial Relation. Himalaya Publishing house, Mumbai.
5. Tripathi P.C (2000). Personnel Management. Sultan chand& Sons, New Delhi.

KARPAGAM ACADEMY OF HIGHER EDUCATION – COIMBATORE – 641 021

Part – I M.Phil., / Ph.D.

COMMERCE
Paper III: Special Paper IV – Entrepreneurial Development
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

To make the researchers

1. To Understand the Concept of entrepreneurship, types of entrepreneurs, entities of business, creating ideas, mobilizing funds and support from government.
2. To communicate orally and in written form the Concept of entrepreneurship, types of entrepreneurs, entities of business, creating ideas, mobilizing funds and support from government.
3. To apply the understanding of entrepreneurship, types of entrepreneurs, entities of business, creating ideas, mobilizing funds and support from government in lifelong practice.
4. To initiate the required skills for entrepreneurial development.
5. To help researchers understand the process of establishing and developing an enterprise
6. To Apply the understanding of entrepreneurship, types of entrepreneurs, entities of business, creating ideas, mobilizing funds and support from government in lifelong practice.

COURSE OUTCOMES:

Learners should be able to

1. Assessthebestsuitableresearchtypeandformulatetheresearchobjectiveforthebusinessproblem.
2. Formulatethesuitableresearchdesignsandselectappropriatesamplingtechniquesfortheresearch.
3. Select the appropriate data collection method for solving the business issue and decide the appropriate measurement scale for designing the instrument for data collection.
4. Apply appropriate analytical tools for the data collected and formulate a suitable suggestion for the business problem.
5. Communicate in oral and written form and prepare business plan and the report. Work in team and exhibit leadership skills.

6. Apply the understanding of entrepreneurship, types of entrepreneurs, entities of business, creating ideas, mobilizing funds and support from government in lifelong practice.

UNIT – I

The Entrepreneurial Culture and Structure – Competing Theories of Entrepreneurship – Entrepreneurial Traits – Types – Behavioral Patterns of Entrepreneurs – Entrepreneurial Motivation – Establishing Entrepreneurial Systems – Ideas Processing , Personnel – Financial – Information and Intelligence , Rewards and Motivation – Role of Industrial Fairs.

UNIT – II

Search for a Business Idea , Sources and Selection – Project Classification and Identification – Constraints – Feasibility, Project Objectives , Design and Appraisal – Network Analysis (PERT, CPM) , Activity Performance – Time Schedules.

UNIT-III

Financial Analysis – Capital Cost, Operating Cost Estimation and Budgeting under uncertainty Risk and Inflation –Social Cost Benefit Analysis, Sources of Project Finance, Credit Facilities – Evaluation by Financial Institutions – Role of Consultancy Organizations – Uses of Leasing Arrangements.

UNIT-IV

Institutions Providing Technical, Financial and Marketing Assistance - Setting Quality Standards - Entrepreneurship Development Programmes in India – Prospects.

UNIT – V

Steps for Starting a Small Industry – Selection of Types of Organization – Central Govt. Schemes and State Govt. Schemes & Incentives to SSI – Registration: Registration and Licensing Requirements for VAT, Excise Duty – Incentives for Export & Imports – Import of Capital Goods and Raw Materials – Sickness and Survival of SSI.

NOTE: The question paper shall cover 100% theory.

REFERENCES:

1. N .S Gupta, "Organisation Theory and Behaviour", Himalayas Publishing House, New Delhi

2. Rudrabasavaraj, "Dynamics for Personnel Administration" Himalayas Publishing House, New Delhi

3. Joseph M Putti, "Personnel Management" S. Chand

4. Michael, "Organisational Behavior & Management Effectiveness"

5. Peeru.H Mohamed &Sagadevan .A, "Customer Relationship Management", Vikas Publication.

6. Badi.K&Badi, "Entrepreneurship Development".

KARPAGAM ACADEMY OF HIGHER EDUCATION – COIMBATORE – 641 021

Part – I M.Phil., / Ph.D.

Paper III: Special Paper V – Accounting and Taxation
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

To make the researchers

1. To Understand the Concept of assessment, assessee, Income heads and the Income Tax laws.
2. To learn the tools and techniques to compute the tax for the various income heads.
3. To select the best ways to compute the income tax based on the income heads for various assessee and to gain a lifelong learning for applying the IT calculation for various income heads based on each case of assessee.
4. To communicate orally and in written form the income tax concepts and computations.
5. To be familiar with the laws pertaining to the Income Tax and apply it lifelong.
6. To be familiar with the customs and utilize for lifelong practical application

COURSE OUTCOMES:

Learners should be able to

1. Comprehend on the concepts related to assessment, assesse , Income heads and the Income Tax laws.
2. Compute Income Tax Returns.
3. Formulate the Income Tax calculations by critically analyzing the assessee's situation under various income heads and deductions and acquire a Lifelong practice for computation of Tax under various income heads and deductions for any assessee
4. Communicate orally and in written the Income tax computation under various income heads and deductions.
5. Familiar with the laws pertaining to the Income Tax and its apply it lifelong.
6. Familiar with the customs and utilize for lifelong practical application

UNIT – I

Accounting Concept - Convention and principles - Scope for Accounting Information- Users' information needs – Inter relationship between Financial, Cost and Management Accounting.

UNIT – II

Role of Accounting Association & Institution - Accounting Standards - International Accounting Standards – Computerized Accounting & Software Packages - Analysis of Financial statements – International Financial Reporting Standards (IFRS) – Accounting for Price level changes.

UNIT –III

Meaning & need for Human Resource Accounting - Objectives and Significance of Human Resource Accounting- Methods of Human Resources Accounting - Human Resources Accounting in India.

UNIT – IV

Basic Concept in Income tax – Income – Assessee - Previous year - Assessment year – Person - Residential Status – Scope of Total Income - Exempted Incomes - Computation of Income from Salary and House Property.

UNIT – V

Computation of Income from Business and Profession, Capital Gains and Income from other Sources - Deduction from Gross Total Income - Set off and Carry forwarded of losses – Computation of Total Income and Tax Liability.

NOTE: The Question Paper shall cover 40% theory and 60% problem.

REFERENCES:
1. Porwal .L.S, "Accounting Theory An Introduction"
2. Shukla .M.C &Grewal .T.S "Advanced Accounting"
3. Khan and Jain "Advanced Accounting"
4. Jain &Narang – " Advanced Accounting"
5. Dr.Vinod K. Singania, "Tax Man"
6. Gaur.V.K, and Narang K.L, "Income Tax Law and Practice"
7. Mehrotra .H.C and Goyal, "Income Tax Law and Practice".

KARPAGAM ACADEMY OF HIGHER EDUCATION – COIMBATORE – 641 021

Part – I M.Phil., / Ph.D.

COMMERCE
Paper III: Special Paper VI – Insurance and Risk Management
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

To make the researchers
1. To Understand the Concept of risk, and insurance a product to mitigate risk, its design and pricing
2. To comprehend on the reforms in Indian insurance industry.
3. To understand the categorization and application of the life and non-life insurance as a risk mitigation instrument,
4. To communicate orally and in written form the understanding of insurance, insurance types, designing and pricing.
5. To understand the Product development in the life and non-life insurance sectors in India
6. To understand the principles of insurance pricing and marketing

COURSE OUTCOMES:
Learners should be able to
1. Understand the Concept of risk, and insurance a product to mitigate risk, its design and pricing
2. Comprehend on the reforms in Indian insurance industry.
3. Understand the categorization and application of the life and non-life insurance as a risk mitigation instrument,
4. Communicate orally and in written form the understanding of insurance, insurance types, designing and pricing.
5. Understand the Product development in the life and non-life insurance sectors in India
6. Understand the principles of insurance pricing and marketing

UNIT – I
Definition – Nature and Function of Insurance – Principles of Insurance – Evolution of Insurance kinds – Insurance Organization in India – Use of Insurance – essentials of insurance contract – Difference between different types of Insurance Contract.

UNIT – II

Nature of Life Insurance contracts – Classification of Policies; According to duration – Premium Payment Participation in Profit – Number of Lives Covered – Method of Payment of Claim Amount on Non-Convention Policies ANNUITIES – Calculation of Premium – Lapses and Renewals – Surrender Values life Insurance for the under privileged –Claims – Double Insurance.

UNIT – III

Risk: Selection of Risk – Factors Affecting Risk – Sources of Risk – Information Classes of Risk – Methods of Risk Classification – Measurement of Risk – Mortality Table – Construction – Types – Types and Treatment of Sub-Standard Risk – Conditions Relating to Commencement of Risk.

UNIT – IV

Marine Insurance: Origin – Definition - Features – Kinds of Policies – Clauses in Policy Premium Calculation – Marine Loss – Settlement of Claims Progress of Marine Insurance Business in India. Fire Insurance: Features – Kinds of Policies – Policies Conditions Rate Fixation – Surveys and Inspection – Payment of Claims – Reinsurance – Renewals Progress of Fire Insurance.

UNIT – V

Miscellaneous Insurance: Motor Insurance – Burglary Insurance – Agricultural Insurance – Personal Accident and Sickness Insurance – Aviation Insurance – Rural Insurance in India – Urban Non Traditional Insurance. IRDA – Private and Foreign Insurance Companies in India.

NOTE: The question paper shall cover 100% theory

REFERENCES:
1. Arifkhon M "Theory and practices of Insurance Education", Book House, Aligah.
2. Kothari and Bahi, "Principles and Practices Insurance".
3. Sharma R.S, "Insurance: Principles and Practices", Vora Bombay.
4. Srinivasan M.N, "Principles of Insurance Law", Ramanujn Publishers, Bangalore.
5. Mishra M.N. "Insurance Principles are Practices" (1999) S.Chand& Co, NewDelhi.

KARPAGAM ACADEMY OF HIGHER EDUCATION – COIMBATORE – 641 021

Part – I M.Phil., / Ph.D.

COMMERCE
Paper III: Special Paper VII – Banking and Financial Services
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

To make the researchers

1. To Understand the Concept of banking and insurance its history, products and regulatory body.
2. To communicate orally and in written form the Concept of banking and insurance its history, products and regulatory body.
3. To apply the Concept of banking and insurance, its products in lifelong practice.
4. To apply the learning of the bank functions and operations lifelong.
5. To comprehend and apply the laws related to banking.
6. To Critically evaluate the appropriate alternative products and services suitable for customer needs and draw a solution.

COURSE OUTCOMES:

Learners should be able to

1. Understand the Concept of banking and insurance its history, products and regulatory body.
2. Communicate orally and in written form the Concept of banking and insurance its history, products and regulatory body.
3. Apply the Concept of banking and insurance, its products in lifelong practice.
4. Apply the learning of the bank functions and operations lifelong.
5. Critically evaluate the appropriate alternative products and services suitable for customer needs and draw a solution.
6. Comprehend and apply the laws related to banking.

UNIT – I

Banking Business in India-Financial services rendered by organized sector-Class Banking v/s Mass Banking-Commercial Banking functions-Micro credit-Emphasis on Rural Development and Agricultural lending.

UNIT – II

Central bank- functions-Role of RBI in Banking Sector-Risk Management –Credit Risk, Market risk and Operational risk- Basel II- Requirements on Capital Adequacy and 3 pillar Approach-Asset Liability Management.

UNIT – III

Merchant Banking-Progress of Merchant Banking in India-Export Finance-Pre Shipment-post shipment Credit-RBI & Export Finance- Exim bank.Private Sector Banks v/s Public Sector Banks-Mergers and Acquisitions-Consolidation.

UNIT – IV

Priority Sector lending in Banks-Small Scale Industries & Tiny Sector-Functions of DICGC.Services of banks – Tele Banking Credit Card-ATM – Core Banking in India. Impact of Globalization on Banking Services

UNIT – V

Project Evaluation – Technical Feasibility - Commercial Feasibility-Financial Feasibility Ratio Analysis-Break-Even Analysis- Working Capital Analysis-Risk Analysis-Profitability Analysis.

NOTE: The question paper shall cover 100% theory

REFERENCES:

1. Radhaswami.M&Vasudevan.S.V "Banking" Schand& Co Ltd.
2. Saravanavel.P, "Modern Banking in India and Abroad", Margan Publications.
3. SubaRao, Himalaya.P, "Principles and Practice of Bank Management" Publishing House
4. Vasanth Desai "Development Banking Issues and Options"
5. "Journal of the Indian Institute of Bankers" Special Issues
6. K.P.M Sundaram Sultan, "Money Banking, Foreign Exchange & International Trade". S.Chand& Sons.

KARPAGAM ACADEMY OF HIGHER EDUCATION – COIMBATORE – 641 021

Part – I M.Phil., / Ph.D.

COMMERCE
Paper III: Special Paper VIII – Enterprise Resource Planning
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

To make the researchers
1. To understand the concept and functions enterprise resource planning.
2. To learn the basics of ERP Modules.
3. To understand the ERP implementation strategies
4. To understand ERP Market place and dynamics

5. To understand ERP and e-business
6. To understand the concept of Energy, Conventional Energy, Waste and Waste to Wealth

COURSEOUTCOMES:
Learners should be able to
1. Understand the concept and functions enterprise resource planning.
2. Learn the basics of ERP Modules.
3. Understand the ERP implementation strategies
4. Ascertain ERP Market place and dynamics
5. Learn on ERP and e-business
6. Understand the concept of Energy, Conventional Energy, Waste and Waste to Wealth

UNIT - I

Overview of Enterprise Systems — Evolution - Risks and Benefits - Fundamental Technology — Issues to be consider in planning design and implementation of cross functional integrated ERP systems.

UNIT - II

Overview of ERP software solutions- Small, Medium and Large Enterprise Vendor Solutions, BPR, and best business practices - Business Process Management, Functional Modules.

UNIT - III

Planning Evaluation and Selection of ERP Systems - Implementation Life Cycle — ERP Implementation, Methodology and Frame work- Training — Data Migration. People Organization in Implementation-Consultants, Vendors and Employees.

UNIT - IV

Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation.

UNIT - V

Natural Resources — Importance and Prudential Use — Sustainable Consumption — Energy — Conventional Energy — Waste — Waste to Wealth — Efficient Use of Natural Resources —Sustainable Development — Objectives.

TEXTBOOK
1. Alexis Leon, ERP demystified, second Edition Tata McGraw-Hill, 2008.

REFERENCES

1. Sinha P. Magal and Jeffery Word, Essentials of Business Process and Information System, Wiley India, 2012
2. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008
3. Alexis Leon, Enterprise Resource Planning, second edition, Tata McGraw-Hill, 2008.
4. MahadeoJaiswal and GaneshVanapalli, ERP Macmillan India, 2009
5. Vinod Kumar Grag and N.K. Venkitakrishnan,

KARPAGAM ACADEMY OF HIGHER EDUCATION – COIMBATORE – 641 021

Part – I M.Phil., / Ph.D.

COMMERCE
Paper III: Special Paper IX – Advertising and Salesmanship
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

To make the researchers

    1. To know about the concepts of advertising.
    2. To know about the various types of advertising
    3. To understand the motivational aspects of salesmen
    4. To understand the concept of sales force management
    5. To know about the social effects of advertising
    6. To know about the promotional strategy.

COURSE OUTCOMES:

Learners should be able to

    1. Knowing the concepts of advertising.
    2. Getting the details about the various types of advertising
    3. Understanding the motivational aspects of salesmen
    4. Understanding the concept of sales force management
    5. Knowing about the social effects of advertising
    6. Knowing about the promotional strategy.

UNIT I

    Marketing: Concepts, Nature, Scope and Importance of Marketing: Evolution of Marketing Concepts - Marketing Mix: Process of Marketing Management - Consumer Behaviour- Theories and Buying Motives- market segmentation - Customer Relationship Marketing (CRM) - Consumerism -Consumer Rights - Consumer Protection Council and its Functions.

UNIT II

    Product Decisions: Product - Concept and Classification; Major Product Decision; New Product Development - Packaging and Labeling; Product Support Service; Branding Decision; Product Life Cycle - Concepts and Appropriate Strategies adopted at different stages.

UNIT III

    Pricing Decisions: Factors affecting Price Determination -- Pricing Policies and Strategies - Methods of Pricing; Discounts and Rebates; Price Adjustment Strategies.

UNIT IV

Distribution Decisions: Channels of Distribution - Concepts and Importance; Different types of appraisal of distribution middlemen and their functions - Channel Management, Selection, Motivation and Performance appraisal of distribution middlemen; Retailing and Wholesaling: Types of retail formats: Retail theories: Retailing strategies: Non-store retailing; Wholesaling -nature and importance, types of wholesalers.

UNIT V

Advertising: Definitions, Nature, Scope, Objectives - Types - Advertising as a communication Process - Advertising Campaign - Advertising Strategies -Advertising Effectiveness- **Sales Promotions :**Promotion Mix - Selling Process - Personal Selling - Qualities of a Salesman - Selection of sales personnel -Sales training - Tools and Techniques of Sales Promotion.

REFERENCES:

1. Kotler, Philip; Keller, Kevin Lane; Koshy, Abraham, and Mithileshwar ha, *Marketing Management: A South Asian Perspective,* Pearson.
2. Lamb, Charles W.; Hair, Joseph F., and Carl McDaniel, *Mktg,* Cengage Learning.
3. Etzel, Michael J., Walker, Bruce J., Staton, William J., and Ajay Pandit, *Marketing Concepts and Cases,* Tata McGraw Hill (Special Indian Edition).
4. Czinkota, Miachel, *Marketing Management,* Cengage Learning.
5. Kazmi, SHH, *Marketing Management Text and Cases,* Excel Books.
6. C.B. Gupta &Rajan Nair- Sultan Chand& Sons, New Delhi.
7. Sherlerkar - Marketing Managemen-Himalaya Publishing House Pvt Ltd.
8. Still, Richard R, Edward W : Sales Management: Decisions. Strategies and cases, Prentice Hall, New Delhi.

KARPAGAM ACADEMY OF HIGHER EDUCATION – COIMBATORE – 641 021

Part – I M.Phil., / Ph.D.

COMMERCE
Paper III: Special Paper X – Service Marketing
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

To make the researchers

1. To know about the concepts of service marketing.
2. To know about the various Purchase Process for Services
3. To understand the concept of Service delivery
4. To understand the concept of Service Quality
5. To know about the service marketing segmentation
6. To know about the Service Strategies for Health, Education, Hospitality,Tourism and Transportation.

COURSE OUTCOMES:

Learners should be able to

1. Know the concepts of service marketing.
2.Know the various Purchase Process for Services
3. Understand the concept of Service delivery
4. Understand the concept of Service Quality
5. Know about the service marketing segmentation
6. Know about the Service Strategies for Health, Education, Hospitality, Tourism and.

UNIT I

Service — Definition - Service Economy - Evolution & Growth of Service Sector - Nature and Scope of Services — Classification of Services & Characteristic of Services — Distinction Between Goods & Services — Challenges and Issues in Services Marketing.

UNIT — II

Purchase Process for Services — Consumption Value — Purchase Model — Service Marketing Opportunities — Expanding Marketing Mix — Service Market Segmentation — Targeting &Positioning - _Marketing of Services & Service -Product , Pricing , Place , Promotion , People , Physical Evidence.

UNIT — III

Service Quality — Principles of Service Quality — Service Expectations — Perceptions of Service — Factor Influencing Service Expectations — Measuring Service Quality — SERVQUAL — S ERVPERF Model — Gap Model of Service Quality — Service Quality Function Development.

UNIT — IV

Service Delivery — Importance of Customers in Service Delivery - Customers Role - Designing Service Delivery System — Service Channel — Service Marketing Triangle Service Marketing Communication⁻ — Communication Strategy — Guidelines for Development.

UNIT — V

Service Strategies for Health — Education — Hospitality — Tourisrim and Transportation —Financial — Information Technology

REFERENCE BOOKS

1. Christopher Lovelock And JochenWirtz, Services Marketing,⁻ Pearson Education, New Delhi.
2. Kenneth E. Clow, David L. Kurtz, Services Marketing, 2e, Operation, Management, and Strategy.
   Valarie A. Z•itharn1,_ Mary Jo Bitner, Services Marketing, Integrating Customer Focus across the Firm, Tata McGraw Hill, and New Delhi.
4. Srinivasan. R; Services Marketing, the Indian Context, Prentice — Hall India, New Delhi.
5. S.M. Jha, Services Marketing, Himalaya Publishing House, Mumbai.

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)
FACULTY OF ARTS, SCIENCE AND HUMANITIES
DEPARTMENT OF COMPUTER SCIENCE
M. Phil.,/ Ph.D.,
(Scheme of Examination for 2015 – 2016 onwards)

Code	Course(s)	ESE(Marks)	Exam Hrs
15RCS101	Research Methodology and Pedagogy	100	3
15RCS201	Advanced Trends in Computer Science	100	3
15RCS301	Cryptography and Network Security	100	3
15RCS302	Advanced Networking	100	3
15RCS303	Data Mining and Warehousing	100	3
15RCS304	Digital Image Processing	100	3
15RCS305	Soft Computing	100	3
15RCS306	Web Technology	100	3
15RCS307	Object Oriented Analysis and Design	100	3
15RCS308	Software Engineering	100	3
15RCS309	Grid Computing	100	3
15RCS310	Mobile Computing	100	3
15RCS311	Cloud Computing		

15RCS101   Paper-I Research Methodology and Pedagogy   4H – 4C
Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
End Semester Exam : 3 Hours

Course Objectives
- To impart knowledge in the concept of problem identification and research methodology
- To familiarize with basic of *research* and the *research* process
- To demonstrate the different types of research and its applicability
- To comprehend the knowledge of social research
- To exhibit in sampling design and sampling techniques
- To enrich the knowledge in writing a good research report.

Course Outcomes (COs)

1. Read, interpret, and critically evaluate social research.
2. Identify, explain, and apply the basic concepts of research, such as variables, operationalization, sampling, reliability, and validity.
3. Recognize the ethical issues involved in research, and practice ethical research standards.
4. Identify and explain the difference between quantitative, qualitative, and mixed methods research and what types of research questions can be answered with each method.
5. Use theory and previous research to create research questions and hypotheses and to identify and analyze the appropriate method and variables needed for research questions.
6. Use a variety of research methods through hands-on experience.

UNIT I - RESEARCH METHODOLOGY

Research Methodology: Meaning of Research – Objectives of Research – Motivation in Research – Types of Research – Research Approaches – Significance of Research – Research methods versus methodology. Research and Scientific Method – Importance of knowing how Research is done – Research process – Criteria for good Research – Problems encountered by Researchers in India. Journal Reading Techniques - Defining the Research problem – What is the Research Problem – Selecting the Problem – Necessity of Defining the problem – Technique involved in Defining the Problem – An illustration – Conclusion.

UNIT II - METHODS OF DATA COLLECTION
Collection of primary data – Collection of data through questionnaires – Schedules – Differentiation between questionnaires and schedules – Other methods of data collection – Collection of secondary data – Selection of appropriate method for data collection– Guidelines for constructing questionnaire/Schedule–Guidelines for successful Interviewing – Difference between survey and experiment – Data Collection using Journals

UNIT III - RESEARCH DESIGN
Need for Research Design – Features of good design – Important concepts relating to Research Design – Different Research Design – Basic principles of Experimental Designs – Conclusion – Developing a Research Plan. Significance of Report Writing – Different steps

in writing Report – Layout of the Research Report – Types of Reports – Oral presentation – Mechanics of writing a Research Report – Precautions for writing a Research Reports – Conclusions.

UNIT IV - STATISTICAL ANALYSIS

Central tend in correlation, auto correlation and regression analysis, curve fitting - probability models-distribution. Testing of hypothesis- Analysis variance, testing means for small and large sequence. Simulation-render generation techniques and distribution monte carlo model. Data Analysis: Mathematical and statistical analysis using software tools.

UNITV - PEDAGOGICAL METHODS IN HIGHER EDUCATION

Objectives and roll of higher education- important characteristics of an effective Lecture- Quality teaching and learning- Lecture preparation Characteristics of instructional design Methods of teaching and learning: Large Group – Technique-Lecture Seminar, Symposium, Tam Teaching, Project, Small group Technique- Simulation, role playing Demonstration, Brain storing, case discussion and assignment, Methods of evaluation- Self evaluation, student evaluation. Diagnostic testing remedial teaching Question banking-Electronic media in education –'e' learning researches web based learning.

SUGGESTED READINGS

1. Deepak Chawla , Neena Sondhi. (2016). Research Methodology: Concepts and Cases. 2nd Edition. Vikas Publishing House Private Ltd, New Delhi.
2. C.R. Kothari. (2018). Research Methodology – Methods and Techniques. 2nd Edition. New Age International (P) Limited. New Delhi.
3. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams . (2018). The Craft of Research . 3rd Edition, University of Chicago Press.
4. C Eileen M. Trauth. (2001). Qualitative Research in IS: Issues & Trends. IDEA Group Publishing. USA/London (ISBN: 1-930708-06-08)
5. www.dcs.gla.ac.uk/~johnson/teaching/research_skills/research.html
6. http://www.csc.liv.ac.uk/~ullrich/COMP516
7. http://www.idi.ntnu.no/~thomasos/paper/interpretive.pdf
8. Vedanayagam, E.G .(1989). Teaching technology for college teachers. Sterling Publishers(P) Ltd., New Delhi.
7. Kumar K.L. (1997) Educational Technologies, New age International. New Delhi.
8. Winkler, Anthony C. & Jo Roy Mc Cuen. (1985). Writing a research Paper: A Handbook, 2nd edition, Harcourt,NY.

15RCS201   Paper II: Advanced Trends in Computer Science   4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100

End Semester Exam : 3 Hours

Course Objectives

- To impart the basic concepts of data structures and algorithms
- To understand concepts about searching and sorting techniques
- To Understand basic concepts about stacks, queues, lists, trees and graphs
- To understand the principles of distributed Component technologies like CORBA and Agile.
- To get a thorough knowledge of J2EE and Web services protocols
- To introduce various techniques of the grid computing

Course Outcomes(Cos)

1. Give a comprehensive introduction of common data structures, and algorithm design and analysis.
2. Understand concepts about searching and sorting techniques
3. Understand basic concepts about stacks, queues, lists, trees and graphs
4. Understand the distributed Component technologies like CORBA and Agile.
5. Get a thorough knowledge of J2EE and Web services protocols
6. Introduce various techniques of the grid computing

UNIT I - ALGORITHMS AND ANALYSIS

Elementary Data Structures, Greedy Method: Knapsack Problem – Job Sequencing With Deadlines – Optimal Merge Patterns, Dynamic Programming: Multistage Graphs Optimal Binary Search Trees – 0/1 Knapsack – Reliability Design – The Traveling Salesperson Problem – Flow Shop Scheduling.

UNIT II - BASIC SEARCH AND TRAVERSAL TECHNIQUES

The Techniques –Code Optimization – Biconnected Components And Depth – First Search. Backtracking: The 8 – Queens Problem – Sum of Subsets – Hamiltonian Cycles – Knapsack Problem.

UNIT III - COMPUTATIONAL MATHS

Mathematical logic : Statements and notation, Connectives, Well formed formulas, Truth Tables, tautology, equivalence implementation, Normal torms. **Graph theory:** epresentation of Graph, DFS,BFS, Spanning Trees, planer Graphs. Graph Theory and Applications, Basic Concepts Isomorphism and Sub graphs Multi graphs and Euler circuits, Hamiltonian graphs, Chromatics Numbers

UNIT IV -DISTRIBUTED OBJECT MANAGEMENT

Object oriented Methodologies-Virtual Programming, Agile, XP, Scrum Process- Object design – design patterns Distributed Objects And Components – From Distributed Objects To Components – 3 Tier Client Server, Object Style – CORBA – Distributed Objects, CORBA Style – OMG's Object Management Architecture – CORBA 2.0 – CORBA Object Services – CORBA Common Facilities – CORBA Business Objects.

J2EE: Overview – Multi – Tier Architecture – The Enterprise Application – Clients – Sessions Management – Web Tier –ELB Tier. Web Services: XML Fundamentals – SOAP – WSDL – UDDI .

UNIT V - GRID COMPUTING

Introduction: Early Grid Activities, Current grid activities, Overview of grid business area, Grid Infrastructure and its relationship with other distributed architectures. Open grid service architecture (OGSA), Data management services, Overview of Globus GT3 Toolkit, Introduction to cloud computing and its issues.

SUGGESTED READINGS

1. Adam Drozdek. (2012). Data Structures and algorithm in C++. 3rd edition. Cengage Learning, New Delhi.
2. Sartaj Sahni. (2011). Data Structures, Algorithms and applications in C++. 2nd edition. Universities Press, New Delhi.
3. Mark Allen Weiss. (2011). Data Structures and Algorithms Analysis in Java.3rd edition. Pearson Education, New Delhi.
4. Sandeep Chatterjee, James Webber. (2010). Developing Enterprise Web Services, 1st Edition, Pearson Education.
5. Prabhu, C.S.R. (2008). Grid and Cluster Computing.Prentice Hall of India , New Delhi.
6. Robert Orfali, DanHarkey, Jan Edwards. (2008). The Essential Client/Server Survival Guide, 2nd edition .Galgotia Publications.
7. Janakiram, D. (2005). Grid Computing – A Research Monograph. TataMcGraw Hill Publishing Company Limited, New Delhi
8. C.J.Date. (1999). An Introduction to Database Systems ,6th edition .Addison Wesley
9. Abraham silberschatz, Henry F.Kortn, S.Sudharsan. (1997). Database System Concepts, 3rd edition.McGrawHill Publication .
10. James Rambaugh. (2001). Object Oriented Modeling and Design, Prentice Hall of India.
11. Peter Coad / Edward Yourdan. (2001). Object Oriented Analysis, 2nd edition. Pearson Education.
12. Joshy Joseph, craiz. (2000). Grid Computing,1st Edition. IBM Press.
13. Thomas H.Corman, Charles E.Leiserson, Ronald L.Rivest. (1998). Introduction to Algorithms , Prentice Hall of India.
14. Ramakrishnan, Gehrke. (2003). Database Management Systems, Mc Graw Hill Publication, 3rd Edition.
15. Grady Booch. (2000). Object Oriented Analysis and Design, Pearson Education, 2nd Edition.

Web Site References:

1. http://cgm.cs.mcgill.ca/~godfried/teaching/algorithms-web.html
2. www.apl.jhu.edu/~hall/java/FAQs-and-Tutorials.html
3. www.microsoft.com/Net
4. www.w3schools.com/ngws/default.asp
5. www.w3.org/XML
6. www.w3schools.com/xml
7. www.compinfo-center.com/apps/rdbms.htm
8. www.grid2002.org
9. www.gridcomputing.com

15RCS301 Paper – III: Special Paper I -Cryptography and Network Security   4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
                                                                  End Semester Exam : 3 Hours

Course Objectives
This course will provide students with a theoretical knowledge to understand the fundamental principles of access control models and techniques and,

- To understand theory of fundamental cryptography, encryption and decryption algorithms
- To know about various encryption techniques.
- To understand various Block Ciphers, DES and AES algorithms
- To understand the concept of Public key cryptography.
- To study about message authentication and hash functions
- To impart knowledge on web security, electronic mail security, firewalls

Course Outcomes (COs)
On successful completion of the course the student should be able to:

1. Classify the symmetric encryption techniques
2. Illustrate various Public key cryptographic techniques
3. Evaluate the authentication and hash algorithms.
4. Summarize the intrusion detection and its solutions to overcome the attacks.
5. Understand basic concepts of system level security
6. Build secure authentication systems by use of message authentication techniques.

UNIT I - INTRODUCTION TO CRYPTOGRAPHY

Services. Mechanisms and Attacks – The OSI Security Architecture – A Model for Network Security – Classical Encryption Techniques –   Symmetric Cipher Model – Substitution Techniques – Transporation Techniques – Rotor Machines – Steganography.

UNIT II - SIMPLIFIED DES

Block Cipher Principles – The Data Encryption Standard – The Strength of DES – Differential and Linear Cryptanalysis – Block Cipher Design Principles – Block Cipher Modes of Operation.

UNIT III – PUBLIC KEY CRYPTOSYSTEM

RSA Algorithm – Key Management – Diffie–Hell man Key exchange – Introduction to Elliptic Curve Cryptography. Message Authentication and Hash functions – Authentication Requirements – Authentication Functions – Message Authentication Codes – Hash Functions – Security of Hash functions and MAC.

UNIT IV - DIGITAL SIGNATURES AND AUTHENTICATION PROTOCOLS

Digital Signature Standard – Authentication Applications – Kerberos – X.509 Authentication services and Encryption Techniques. E–mail Security – PGP – S / MIME – IP Security

UNIT V - WEB SECURITY

Secure Socket Layer – Secure Electronic Transaction. System Security – Intruders and Viruses – Firewalls– Password Security

SUGGESTED READINGS

1. Deepti Mittal, Ajay Raj. (2015). Cryptography and Network Security. 1st Edition, Laxmi Publication Private Ltd, Delhi.
2. K.HarBaskar . (2015). Cryptography and Network Security – A Practical Approach. 1st Edition, Laxmi Publication Private Ltd, Delhi.
3. William Stallings. (2012). Cryptography and Network Security. 4th Edition, Pearson Education, Delhi.
4. Behrouz A. Forouzan. (2010). Cryptography and Network Security. Special Indian Edition, Tata McGraw Hill, Delhi.
5. Roberta Bragg, Mark Rhodes-Ousley and Keith Strassberg. (2004). Network Security. 1st Edition, Tata McGraw Hill, Delhi.
6. Ankit Fadia. (1998). Network Security. 1st Edition, McMillan Publications, Delhi.
7. Bruce Schneir.(1998). Applied Cryptography. 1st Edition. CRC Press, New Delhi.
8. Menezes.A and Van Oorschot and Vanstone .S. (1997). Hand Book of Applied Cryptography". 1st Edition . CRC Press. (Free Downloadable)
9. William Stallings.(1998).Cryptography and Network Security. 3rd Edition, Pearson Education, New Delhi.

Web Site References

1. http://domino.research.ibm.com/comm/research_projects.nsf/pages/security.index.html
2. http://whitepapers.techrepublic.com.com
3. http://www.rsa.com
4. http://www.nsa.gov/home_html.cfm

15RCS302   Paper – III: Special Paper II - Advanced Networking   4H – 4C
Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
                                                          End Semester Exam : 3 Hours

Course Objectives
- To have an architectural overview of the TCP/IP Protocol Suite
- To understand about subnets using IP classes
- To understand the key features and functions of ARP Protocol.
- To understand how basic routing protocol works.
- To understand about Ad–Hoc/Mobile Routing, sensor networks, MANET
- To understand the concepts of Network Service Quality and Resource Reservation and NS2 simulator tool

Course Outcomes (COs)
At the completion of the course, students will:
1. Identify the functions/ services of TCP/IP component and layer
2. Have the ability to analyze and differentiate networking protocols used in TCP/IP protocol suite.
3. Understand the routing IP datagrams and checksum.
4. Exposed to unicast and multicast routing.
5. Understand about Ad–Hoc/Mobile Routing, sensor networks, MANET
6. Understand the concepts of Network Service Quality and Resource Reservation and NS2 simulator tool

UNIT I – INTRODUCTION

Internet Protocol review, Router Basics − forwarding versus routing − ISPs − Evolution of the Internet Architecture − IP Addressing and Allocation Techniques − NAPs − Autonomous Systems.

UNIT II - ROUTING PROTOCOL FOUNDATIONS

Distance vector and link state − Dijkstra's algorithm − IGPs and EGPs − RIP − OSPF − ISIS. Introduction to BGP − EBGP and IBGP

UNIT III - INTERDOMAIN ROUTING AND BGP

Border Gateway Protocol details − messages and state machines − route aggregation. Policy and BGP − BGP decision process − Access lists, prefix lists, AS paths, Community − Route maps − Attributes − AS_Path, local preference, MED, Community, ATOMIC_AGGREGATE, Aggregator, Origin, NEXT_HOP, AS–SET − Route filtering. Architecture and BGP − Redundancy, symmetry, load balancing − Confederations, route reflectors.

UNIT IV - AD–HOC/MOBILE ROUTING

Peer to Peer Overlay Networks − Mesh Networks − Sensor Networks − MANET

UNIT V- NETWORK SERVICE QUALITY AND RESOURCE RESERVATION

Queues and Delays – Queuing and Scheduling – A Reservation Protocol – Differentiated Services Network simulator tools NS2

SUGGESTED READINGS

1. Andrew S. Tannenbaum. (2010). Computer Networks. 5th Edition. Pearson Education.
2. Forouzan, B. A.(2011). Data Communications and Networking .4th edition. THM, New Delhi.
3. Bassam Halabi. Internet Routing Architectures. (2014). Cisco Press, New Riders Publishing, ISBN 1-56205-652-2
4. Christian Huitema. (2000). Routing in the Internet. 2nd Edition, Prentice Hall.
5. J. Stewart. (1999). BGP4 : Inter Domain Routing in the Internet. Addison Wesley.
6. W. Richard Stevens.(2005). TCP/IP Illustrated, Volume 1: The Protocols. Addison Wesley.
7. Pete Loshin. (2004). IPv6Theory, Protocol, and Practice. 2nd Edition, The Morgan Kaufmann Series.

Web Site References:
1. http://www.academ.com/nanog/feb1997/BGPTutorial
2. http://www.ietf.org/html.charters/manet-charter.html
3. http://tools.ietf.org/html/rfc2475
4. http://www.ietf.org/rfc/rfc2205.txt

15RCS303   Paper – III: Special Paper III - Data Mining and Warehousing   4H – 4C
Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
                                                          End Semester Exam : 3 Hours

Course Objectives
- To identify the scope and essentiality of Data Warehousing and Mining.
- To analyze data, choose relevant models and algorithms for respective applications.
- To study spatial and web data mining.
- To develop research interest towards advances in data mining.
- To introduce students to the basic concepts and techniques of Data Mining.
- To develop skills of using recent data mining software for solving practical problems.

Course Outcomes (COs)
1. Understand Data Warehouse fundamentals, Data Mining Principles
2. Design data warehouse with dimensional modeling and apply OLAP operations.
3. Identify appropriate data mining algorithms to solve real world problems
4. Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
5. Describe complex data types with respect to spatial and web mining.
6. Benefit the user experiences towards research and innovation integration

UNIT I - INTRODUCTION: FUNDAMENTALS OF DATA MINING

Data Mining Functionalities - Classification of Data Mining systems - Major issues in Data Mining - Data Warehouse and OLAP Technology for Data Mining Data Warehouse - Multidimensional Data Model - Data Warehouse Architecture - Data Warehouse Implementation - Further Development of Data Cube Technology - From Data Warehousing to Data Mining.

Data Preprocessing: Needs Preprocessing the Data - Data Cleaning - Data Integration and Transformation - Data Reduction - Discretization and Concept Hierarchy Generation - Online Data Storage. Preparing Data for Mining: Variable Measures.

UNIT II - DATA MINING PRIMITIVES

Languages, and System Architectures: Data Mining Primitives - Data Mining Query Languages - Designing Graphical User Interfaces Based on a Data Mining Query Language Architectures of Data Mining Systems.

Concepts Description: Characterization and Comparison: Data Generalization and Summarization - Based Characterization - Analytical Characterization: Analysis of Attribute Relevance - Mining Class Comparisons: Discriminating between Different Classes - Mining Descriptive Statistical Measures in Large Databases.

UNIT III - MINING ASSOCIATION RULES IN LARGE DATABASES

Association Rule Mining - Mining Single -Dimensional Boolean Association Rules from Transactional Databases - Mining Multilevel Association Rules from Transaction Databases - Mining Multidimensional Association Rules from Relational Databases and Data

Warehouses - From Association Mining to Correlation Analysis – Constraint - Based Association Mining.

Classification and Prediction: Issues Regarding Classification and Prediction - Classification by Decision Tree Induction - Bayesian Classification - Other Classification Methods – Prediction - Classifier Accuracy.

UNIT IV -CLUSTER ANALYSIS INTRODUCTION

Types of Data in Cluster Analysis - A Categorization of Major Clustering Methods - Partitioning Methods – Density -Based Methods - Grid-Based Methods - Model-Based Clustering Methods - Outlier Analysis. Machine Learning: Basic Concepts in machine learning - Supervised and Unsupervised Learning. Mining Spatial Databases - Mining Multimedia Databases - Mining Time-Series and Sequence Data - Mining Text Databases - Mining the World Wide Web - Visual Data Mining

UNIT V - OVERVIEW OF DATA MINING TOOLS

Applications:
   Data Mining: Data Mining in Bio Informatics - Data Mining in Banking - Data Mining in Tele communications - Data Mining in Crime Detection - Data Mining in Oil and Gas Industry - Data Mining in Pharmaceutical Industry - Data Mining in Student recruiting and retention - Data Mining in Electronic commerce .
   Defining Privacy for Data Mining - Trends in Spatial data mining.

   Data Warehousing: Case Studies-Data warehousing in Government and Education – Insurance - Manufacturing Industry – Marketing - Multi-Industry.

SUGGESTED READINGS

1. Han, Kamber & Pei.   (2013). Data Mining: Concepts and Techniques. 3rd Edition. University Press.
2.   Zaki & Meira.   (2014) . Data Mining and Analysis Fundamental Concepts and Algorithms. Prentice Hall of India, New Delhi .
3. Agarwal . (2015). Data Mining: The Textbook. Prentice Hall of India, New Delhi
4. K.P.Soman, Shyam Diwakar, V.Ajay. (2006). Insight into Data Mining Theory and Practice, Prentice Hall of India.
5. Jiawei Han & Micheline Kamber. (2001). Data Mining – Concepts and Techniques, Harcourt, India.
5. Arun K Pujari .(2001). Data Mining Techniques, University Press.
6. Michael J. A.Berry, Gordon S.Linoff. (2007). Data mining Techniques, Second Edition.
7. Hillol Kargupta , Anupam Joshi, Krishnamoorthy Sivakumar and Yelena Yesha. (2005). Data Mining Next Generation Challenges and Future Directions, Prentice Hall of India.
8. G.K.Gupta. (2006). Introduction to Data mining with case studies, Prentice Hall of India.

Web Site References:

   1. http://www.the-data-mine.com/bin/view/Misc/ApplicationsOfDataMining
   2. http://www.biomedcentral.com/info/about/datamining
   3. http://www-users.cs.umn.edu/~han/kdd/kdd-info.html

4. http://www.dmreview.com/article_sub.cfm?articleId=1046025

5. http://www.datamining.databasecorner.com/?

6. http://www.web-datamining.net/tools/

7. http://www.thearling.com/text/dmtechniques/dmtechniques.htm

8. http://databases.about.com/od/datamining/a/datamining.htm

9. http://www.dwreview.com/DW_Overview.html

10. www.kdnuggets.com

11. http://www.improvedoutcomes.com/docs/WebSiteDocs/Clustering/Clustering_Overview.

12. http://dms.irb.hr/tutorial/tut_dtrees.php

13. http://www.aaai.org/AITopics/pmwiki/pmwiki.php/AITopics/MachineLearning

14. http://robotics.stanford.edu/~nilsson/mlbook.html

15. http://www.twocrows.com/applics.html

15RCS304   Paper – III: Special Paper IV - Digital Image Processing   4H – 4C
Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
                                                                End Semester Exam : 3 Hours

Course Objectives
- To make the students learn the fundamental theories and techniques of digital image processing.
- To study the mathematical transforms necessary for image processing, image manipulation and a preliminary understanding of Computer Vision.
- To make students to understand the image degradation and enhancement.
- To understand the basic relationships between pixels in an image
- To know various segmentation techniques, and object descriptors.
- To implement pattern recognition to enhance an image.

Course Outcomes(COs)
1. Perform image manipulations and analysis in many different fields.
2. Apply knowledge of computing mathematics science and engineering to solve problems in multidisciplinary research.
3. Implement the understanding in sharpening the image.
4. Perform the image segmentation using the compression method.
5. Understand the image to represent as an region.
6. Analyze the basic algorithms used for image processing &image compression with morphological image processing.

UNIT I – INTRODUCTION

Digital image processing – Origins of digital image processing- Examples of fields that use digital image processing-Fundamental steps in digital image processing- Components of an image processing system-Representing digital image.

UNIT II - BASIC RELATIONSHIPS BETWEEN PIXELS

Basic gray level transformations- Histogram processing - Basic spatial filtering- Smoothing special filtering-Image Degradation/Restoration process-Noise Models.

UNIT III - IMAGE SEGMENTATION: THRESHOLDING

Edge Based Segmentation – Region Based Segmentation – Matching. Image Compression: Error Criterion - Lossy Compression - Lossless Compression.

UNIT IV - SHAPE REPRESENTATION AND DESCRIPTION

Region Identification - Contour Based Representation And Description – Region Based Shape Representation And Description

UNIT V - INTRODUCTION TO INFORMATION CODING

Introduction to image compression techniques Image Recognition: Introduction – Statistical Pattern Recognition - Neural Net- Syntactic Pattern Recognition - Graph Matching - Clustering

SUGGESTED READINGS

1. Rafael C. Gonzalez, Richard E. Woods. (2016). Digital Image Processing, 3rd Edition, Pearson Education, Delhi.
2. T.Veerakumaran, S.Jayakumar.(2009).Digital Image Processing, 1st Edition, Mcgraw Higher Ed, Delhi.
3. Castleman .(2007). Digital Image Processing, 1st Edition, Pearson Education Limited, Delhi.
4. Milan Sonka and Vaclav Hlavac and Roger Boyle. (2004). Image Processing, Analysis and Machine Vision. 2nd Edition. Vikas Publishing House, NewDelhi.
5. Nick Efford. (2000). Digital Image Processing – A Practical introduction using JAVA. 1st Edition , Pearson Education Limited, Delhi.
6. Chanda. B and Dutta Majumder .D. (2000). Digital Image Processing and Analysis. 1st Edition, Prentice Hall of India, New Delhi

Web Site References
1. www.icaen.uiowa.edu/~dip/lecture/lecture.html
2. www.ece.ucsb.edu/~manj/ecei81bso4/reviue(gw2002).pdf
3. www.wikipedia.org/wiki/image_processing
4. http://unjobs.org/authors/rafael-c.-gonzalez/image processing

15RCS305   Paper – III: Special Paper V – Soft Computing   4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
End Semester Exam : 3 Hours

Course Objectives
- To understand the scope and evolution of soft computing
- To learn the various soft computing frame works
- To be familiar with design of various neural networks
- To be exposed to fuzzy sets and fuzzy logic
- To understand fuzzy measures and reasoning
- To learn genetic programming.

Course Outcomes(COs)
1. Understand the scope and evolution of soft computing
2. Learn the various soft computing frame works
3. Be familiar with design of various neural networks
4. Be exposed to fuzzy sets and fuzzy logic
5. Understand fuzzy measures and reasoning
6. Learn genetic programming.

UNIT I - FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS

Biological prototype, Artificial neuron, Single layer artificial, neural networks, multilayer artificial neural networks, training of artificial neural networks.

UNIT II - PERCEPTIONS

Perceptron Representation, perceptron learning, perceptron Training algorithm. Back propagation: Introduction to back propagations and Back propagation training algorithm, counter propagation networks.

UNIT III - KOHONEN SELF-ORGANIZING NETWORKS

Introduction, the Kohonen algorithm, weight training, Grossberg layer, Training the Grossberg Layer.

UNIT IV - HOPFILED NETWORKS

Introduction, The Hopfiled model, Hopfiled network algorithm, Boltzmann's machine applications of Hopfiled Networks,Associative Memories, Bi- directional Associative Memories.Adaptive Resonance Theory: Architecture of Adaptive Resonance Theory,Algorithm, Applicability of Artificial neural Networks to pattern Recognition and Image Processing, Dimensionality of neural Networks for pattern Recognition- Case Studies

UNIT V - FUZZY ARITHMETIC

Fuzzy numbers, linguistic variables, arithmetic operations on intervals, fuzzy numbers, and lattice of fuzzy numbers, Possibility theory**:** fuzzy measures, evidence theory, fuzzy sets and possibility theory, possibility Vs probability theory, Fuzzy logic: Multivalued logics,

propositions, quantifiers, linguistic hedges, inferences. Uncertainty based information, Fuzzy systems: fuzzy controllers, fuzzy systems and neural networks, fuzzy neural networks, fuzzy automata, dynamic systems- Applications

SUGGESTED READINGS

1.Chandra .S.S.V. (2014). Artificial Intelligence and Machine Learning. Kindle Edition.

2. Dr.R.P.Das. (2012). Neural Networks and Fuzzy Logic. 1st Edition, Tata Mcgraw Hill,

Delhi

3. Flasiński, Mariusz. (2016). Introduction to Artificial Intelligence. Tata Mcgraw Hill, Delhi.

4. Dr.R.P.Das. (2012). Neural Networks and Fuzzy Logic. 1st Edition, Tata Mcgraw Hill,

Delhi.

5. Neural computing: Theory and practice – Waserman

6. Sets and Fuzzy logic theory and applications—George J. Klir/Bo Yuan

7. S.N. Sivanandam, S. Sumathi and S. Deepa. (2006). Introduction to Neural Networks using

   MAT LAB 6.0, 1st Edition, Tata Mcgraw Hill, Delhi

8. Simon Haykin. (2003). Neural Networks. 1ST Edition, New Delhi: Pearson Education.

9. An introduction to Neural Computing – I. Alexander and Helen MartWilliam Jackson.
10. Robert J Schaluoss. (1997). Artificial Neural Networks. 1ST Edition, New Delhi: McGraw Hill.
11.Kishan Mehrotra, Chiluvuri K. Mohan and Sanjay Rana. (1997).Elements of Artificial Neural Networks. 1ST Edition, Mumbai: Penaram International.

Web Site References
1.   www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/cs11/report.html
2.   http://www.statsoft.com/textbook/stneunet.html
3.   http://www.fuzzy-logic.com

15RCS306   Paper – III: Special Paper VI: Web Technology   4H – 4C
Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
                                                    End Semester Exam : 3 Hours

Course Objectives
- To understand the fundamentals of HTML, CSS and JavaScript and use different objects
- To understand XML , Namespace and W3C XML Schema
- To know the basics of JSP, its objects and forms
- To relate JSP and Java Bean through its components
- To develop web application that deals with database and website development.
- To get Familiar with Document Object Model for XML

Course Outcomes(COs)
1. Create a client side scripting web application using HTML forms, CSS and Java Script
2. Understand the Document Object Model for XML and JavaScript.
3. Understand XML , Namespace and W3C XML Schema
4. Understand the server side scripting of JSP, its objects and forms
5. Relate JSP and Java Bean through its components
6. Develop web application that deals with database and website development.

UNITI - HTML, DHTML

HTML : Overview of HTML – Basic Concepts – HTML and Images – Lists- Formatting Tags –Links and Addressing – Tables – Frames –Layers –Styles Sheets – Forms –HTML and Media Types. DHTML – Object Model –HTML and Scripting access – CSS.

UNIT II - SCRIPTING LANGUAGES

Java Script : Introduction – Programming Fundamentals – Variables – Data Types – Statements- Functions and Objects – Navigator Object Model – Cookies. CGI &Perl : Concepts of CGI – Perl – Basics – Variables – Arrays – Controlling Program Flow – Perl Functions- File Handling – Database Connectivity.

UNIT III - XML

XML – XML Fundamentals –Creating XML Documents – Well Formed and Valid XML Documents –General Syntax – Components of XML Documents – Elements, Attributes and Entities – XML Data Design – DTD – XML Schema- XSTL.

UNIT IV -SERVLETS AND JSP

Servlet Architecture Overview- Servlet Life cycle- Parameter Data – Sessions- Cookies – Data Storage –Servlet and Concurrency. JSP: Introduction – JSP and Servlets- Running JSP Applications – Basic JSP – Java Bean Classes and JSP – Tag Libraries and Files.

UNIT V -CASE STUDY

Develop Blogging application and transform the Blogging Application from a loose collection of various resources to an integrated web application.

SUGGESTED READINGS
1. David Flanagan. (2014). Javascript: The Definitive Guide (6th ed.). O'Reilly Media.
2. Dave Mercer. (2012). ASP.NET – Beginner's Guide(2nd ed.). New Delhi: MCGraw Hill
3. Thau. (2008). The Book of JavaScript: A Practical Guide to Interactive WebPages.
4. Jeffrey C. Jackson. (2007). Web Technologies, Pearson Education, 1st Edition.
5. David Flanagan. (2006). Javascript: The Definitive Guide. O'Reilly Media.
6. Paul Wilton. (2005). Beginning JavaScript. 2nd Edition. Wiley Dreamtech India(P) ltd, New Delhi.
7. Thomas A Powell. (2000). The Complete SUGGESTED READINGSHTML, 2nd Edition, Tata McGraw Hill Publishing, New Delhi.
8. Rohit Khurana. (2000). Java Script, APH Publishing Corporation. New Delhi.
9. Ivan BayRoss. (2000). HTML, DHTML, Java Script, Perl CGI, BPB Publications, 1st Edition.
10. Sybex. (2001). XML Complete, BPB Publications, 1st Edition.
11. Deitel Nieto. (2000).World Wide Web. 3rd Edition, Pearson Education, New Delhi.

Web Site References
1. http://www.w3schools.com/js/default.asp
2. http://www.w3schools.com/xml/default.asp
3. www.amazon.com/web-server-technology
4. http://www.brics.dk/ixwt

Paper III: Special Paper – VII: Object Oriented Analysis and Design   4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100

End Semester Exam : 3 Hours

Course Objectives

- to use an object-oriented method for analysis and design
- To analyze information systems in real-world settings and to conduct methods such as interviews and observations
- To have a general understanding of a variety of approaches and perspectives of systems development, and to evaluate other is development methods and techniques
- To know techniques aimed to achieve the objective and expected results of a systems development process
- To know different types of prototyping
- To know how to use UML for notation.

Course Outcomes (COs)

Upon the completion of the course students will be able to :-

1. Understand the concepts and terms used in the object-oriented approach to systems analysis and design
2. Use Unified Modeling Language 2.2
3. Perform object-oriented analysis and design
4. Identify the characteristics of the UML and explain UML is relevant to the process development.
5. Draw class Diagrams, Object Diagram and Interaction Diagram.
6. Construct various UML models (including use case diagrams, class diagrams, interaction diagrams, state-chart diagrams, activity diagrams, and implementation diagrams) using the appropriate notation.

UNIT I

The Object Model: The evolution of the object model - Elements of the object model - Applying object model. Classes and Objects: The nature of an object - Relationships among objects.

UNIT II

Classes and Objects: The nature of the class - Relationship among classes - The Interplay of Classes and Objects - On building quality classes and objects. Classification: The Importance of proper classification - Identifying proper classes and objects - Key abstraction mechanism.

UNIT III

UML - Goals of UML - Syntax of Expressions and Diagrams. Nature and purpose of Models: A Model - Levels of Models - Meaning of Model. UML Walkthrough: UML views - Static views - use case view - interaction views - state machine view - activity view - physical view - model management view- extensibility constructs. Static view: Overview - classifiers - relationships - associations - generalizations - realization - dependencies - constraints - instances..

UNIT IV

State machine view: state machine - event - state - transition - composite state. Activity view: activity diagram - activities and other views. Interaction view: collaboration - interaction -

sequence diagram - activation - collaboration diagram - patterns. A design patterns-MVC , Fecade, bridge patterns Physical views: Overview - component - node.

UNITV

Model Management View: Package - Dependencies on Packages - Access and import dependency - model and subsystem. Extension Mechanism: Constraints - tagged value - stereotypes - tailoring UML. UML Environment: Semantics responsibilities - notation responsibilities - programming language responsibilities - modeling with tools.

REFERENCE :
1. Grady Booch. *Object Oriented Analysis and Design.* 2nd Edition, New Delhi: Addison Wesley 2001.
2. James Rumbaugh, Ivar Jcobson, Grady Booch. *The Unified Modeling Language Reference Manual.* 1st Edition, New Delhi: Addison Wesley 2003.
3. Martin Fowler, Kendall Scott. *UML Distilled.* 2nd Edition, New Delhi: Pearson Education, 2004.
Web Site References
1. http://www.ooad.org
2. http://www.devshed.com/c/a/Practices/Introducing-UMLObjectOriented-Analysis-and-Design
3. burks.bton.ac.uk/burks/pcinfo/progdocs/oocourse/oocnotes.htm

15RCS308   Paper – III: Special Paper VII: Software Engineering   4H – 4C
Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
End Semester Exam : 3 Hours

Course Objectives
- To Apply their knowledge of mathematics, sciences, and computer science to the modeling, analysis, and measurement of software artifacts.
- To Work effectively as leader/member of a development team to deliver quality software artifacts.
- To Analyze, specify and document software requirements for a software system.
- To implement given software design using sound development practices.
- To Verify, validate, assess and assure the quality of software artifacts.
- To Design, select and apply the most appropriate software engineering process for a given project, plan for a software project, identify its scope and risks, and estimate its cost and time.

Course Outcomes(COs)
1. Apply their knowledge of mathematics, sciences, and computer science to the modeling, analysis, and measurement of software artifacts.
2. Analyze, specify and document software requirements for a software system.
3. Implement a given software design using sound development practices.
4. Verify, validate, assess and assure the quality of software artifacts.
5. Design, select and apply the most appropriate software engineering process for a given project, plan for a software project, identify its scope and risks, and estimate its cost and time.
6. Express and understand the importance of negotiation, effective work habits, leadership, and good communication with stakeholders, in written and oral forms, in a typical software development environment.

UNIT I - THE EVOLVING ROLE OF SOFTWARE

Software - software crisis - software process model. Component based development: - The formal methods model – fourth generation techniques. Software Project Planning – Project Planning Objectives - Software Scope – Resources. System planning and initial investigation, bases for planning – Investigation

UNIT II - ANALYSIS CONCEPTS AND PRINCIPLES

Requirement analysis principles – The Information domain – modeling – partitioning – Essential and implementation views. Software prototyping methods and tools. Specification: Specification principles – representation – software requirements specification.

UNIT III - DESIGN CONCEPTS AND PRINCIPLES

The Design process: design and software quality – The Evolution of Software Design. Design principles:- Design concepts – effective modular design – the design model – design documentation – Software Architecture.

UNIT IV - SOFTWARE TESTING TECHNIQUES

Testing Techniques/Tools selection process – Selecting Techniques/tools – Structural System Testing techniques- Functional System Testing Techniques – Unit Testing Technique – Functional Testing and Analysis – Functional Testing – Test factor/Test Technique Matrix- The Cost of Computer Testing – Life Cycle Testing concept – Verification and validation in the software. Assess Project Management Development Estimate and Status - Develop Test Plan - Requirements Phase Testing -Design Phase Testing -Program Phase Testing

UNITV - SOFTWARE QUALITY ASSURANCE

Case studies: WinRunner – QTP (Quick Test Professional)

SUGGESTED READINGS:

1. Pressman, R.S. (2009). Software Engineering: A Practitioner's Approach. 7th edition. McGraw-Hill, New Delhi.
2. Aggarwal, K.K., & Singh, Y. (2008). Software Engineering. 2nd edition. New Age International Publishers.
3. Sommerville, I. (2007). Software Engineering. 8th edition. Addison Wesley. New Delhi.
4. Bell, D. (2005). Software Engineering for Students. 4th edition. Addison- Wesley, New Delhi.
5. Mall, R. (2004). Fundamentals of Software Engineering. 2nd edition. Prentice- Hall of India, New Delhi.
6. Richard Fairley. (1997). Software Engineering Concepts. 8th Edition. Tata McGraw Hill Publishing Company, New Delhi.
7. Elias M. Awad.(1996). System Analysis and Design. 2nd Edition. BPB Publication, New Delhi.

Website Reference

1. www.opensourcetesting.org
2. www.onestoptesting.com
3. www.cs.queensu.ca
4. www.ece.cmu.edu

15RCS309   Paper – III: Special Paper VIII: Grid Computing   4H – 4C
Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
                                                                      End Semester Exam : 3 Hours

Course Objectives
- To portray the recent trends in the field of Grid computing and creation and management of Internet-based utility computing infrastructure**.**
- To introduce the principles underlying the function of distributed systems and their extension to grid computing.
- To introduce students to the fundamental components of Grid environments, such as authentication, authorization, resource access, and resource discovery.
- To provide a good understanding of the concepts, standards and protocols in Grid computing
- To enable students to be able to justify the applicability, or non-applicability, of Grid technologies for a specific application.
- To perform analysis, design and implementation of ARC grid computing model.

Course Outcomes (COs)
After successful completion of this course, student will be able to
1. Understand and explain the basic concepts of Grid Computing.
2. Explain the principles underlying the function of distributed systems and their extension to grid computing
3. Explain the advantages of using Grid Computing within a given environment.
4. Identify fundamental components of Grid environments, such as authentication, authorization, resource access, and resource discovery.
5. Understand Data management and transfer in Grid environments.
6. Perform analysis, design and implementation of ARC grid computing model.

UNIT I - IT INFRASTRUCTURE EVOLUTION

Introduction Microprocessor Technology, Optical Networking Technology, Storage Technology, Wireless Technology, Sensor Technology, Global Internet infrastructure,World Wide Web and Web Services, open-source Movement Productivity Paradox and Information Technology –Introduction, Productivity Paradox, Return on Technology Investment , Multi-Story Bureaucracy, Information technology Straightjacket,Consolidation, Outsourcing, Toward a Real-time Enterprise, Opertional Excellence, Business Value of Grid Computing – Introduction,Grid Computing Business Value Analysis,Risk Analysis, grid Marketplace

UNIT II - GRID COMPUTING TECHNOLOGY

An Overview, Introduction,History, High Performance Computing.cluster computing,peer-to-peer computing, internet computing, grid omputing,Grid computing Model,Grid Protocols, Globus Toolkit, Open Grid Services Architecture ,Types of   Grids Application Characteristics

UNIT III - DESKTOP GRIDS

Introduction,Background Desktop Grids Defined, The Desktop Grid Value Proposition, Challenges, Technology-key Elements to Evaluate,Desktop Grid Suitability- Key Areas for

Exploration ,The Grid Server, Role of Desktop Grids in an Enterprise computing Infrastructure, Practicals Uses of Desktop Grids , Cluster Grids- Introduction, cluster,SSI Industry Exmples, HPC Grids –Introduction, Five Steps to Scientific Insight, Application and Architecture, HPC Application Development Environment, Production HPC Reinvented,HBC Grids Acknowledgements

UNIT IV - DESKTOP SUPERCOMPUTING

– Native programming for Grids . Introduction –historical Background-parallel computing, Parallel Programming Paradigms, Problems of Current Parsllel Programming Paradigms, Desktop Supercomputing Programming Paradigm. Parallel Programming in CxC. Parallelzing Existing Applications

UNIT V - GRID-ENABLING SOFTWARE APPLICATION

Introduction.Need of Grid users. Requirements for Grid- Enebling software, Grid programming tools, Application Examples

SUGGESTED READINGS

1. Christophe Cerin, Gilles Fedak . (2012). Desktop Grid computing. CRC Press.
2. Nikoloas . P.Preve. (2011). Grid Computing. Springer.
3 . Venkatesh Krishna . P and V.Saritha . (2010). Grid Computing. Ane Books Private Ltd.
4. Anar Abbas. (2006). Grid computing: A practical Guide to Technology and Applications Firewall Media (an Import of Laxmi Publication Pvt Ltd).
5. Joshy joseph, Craig fellenstien. (2004). Grid Computing , Pearson Education.
6. Rajkumar Buyya. (2008). High performance cluster computing, Architecture and systems Vol-1 , Pearsons Education.

15RCS310   Paper – III: Special Paper IX: Mobile Computing   4H – 4C
Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100
**   End Semester Exam : 3 Hours**

Course Objectives

- To learn about the concepts and principles of mobile computing;
- To explore both theoretical and practical issues of mobile computing;
- To develop skills of finding solutions and building software for mobile computing applications.
- To identify the use of mobile wireless technologies
- To know the types of mobile wireless technologies that are currently being used
- To understand the working of mobile wireless technologies access to network resources.

Course Outcomes (COs)

1. Grasp the concepts and features of mobile computing technologies and applications
2. Have a good understanding of how the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support
3. Identify the important issues of developing mobile computing systems and applications
4. Organize the functionalities and components of mobile computing systems into different layers and apply various techniques for realizing the functionalities;
5. Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools;
6. Organize and manage software built for deployment and demonstration.

UNIT I -   MEDIUM ACCESS CONTROL

Motivation for Specialized MAC-SDMA-FDMA-TDMA-CDMA- Comparison of Access mechanism – telecommunication: GSM-DECT-TETRA-UMTS-IMT-200 - Satellite Systems :Basics – routing- Localization- Handover- Broadcast Systems : Overview _ Cyclic Repetition of Data- digital Audio Broadcasting - Digital Video Broadcasting

UNIT II -   WIRELESS LAN

Infrared Vs Radio Transmission – Infrastructure Networks- Ad Hoc Network- IEEE 802.11 – HIPERLAN- Bluetooth – Wireless ATM: Working Group- Services- References Model- Function – Radio Access Layer – Handover- Location Management- Addressing Mobile Quality of Service- Access Point control Protocols

UNIT III -   MOBILE IP

Goals – Assumptions and Requirement –Entities- IP packet Delivery –Agent Advertisement and Discovery – Registration – Tunneling and encapsulation- Optimization –Reverse Tunneling- Ipv6- DHCP- Ad hoc Networks

UNIT IV -   TRADITIONAL TCP

Indirect TCP- Snooping TCP – Mobile TCP –Fast retransmit/ Fast Recovery-Transmission/timeout Freezing- Selective Retransmission – Transaction Oriented TCP

UNIT V - WAP ARCHITECTURE

– Datagram protocol – Transport Layer Security – Transaction protocol- Session Protocol-application Environment – Wireless Telephony Application

SUGGESTED READINGS

1. Ashok, K.Talukder,& Roopa, R. Yavagal. (2008). Mobile Computing. Tata Mc-Graw Hill Publishing Company Pvt Ltd, New Delhi.
2. Raj Kamal . (2011). Mobile Computing. Pearson Education. Tomasz Imielinski,
3. Henry F. Korth . (2014). Mobile Computing. Springer , US.
4. Mischa Schwartz. (2005). Mobile Wireless Communications. Cambridge University Press.
5. J.Schiller. (2000). Mobile Communication, Addison Wesley.
3. William Stallings. (2004). Wireless Communication and Networks, Pearson Education
4. Singhal. (2003). AP-Wireless, Application Protocol, Pearson Education.
5. Lother Merk,Martin, S.Nicklaus and Thomas Stober. (2003). Principles of Mobile Computing, Second Edition,Springer.
6. William C.Y.Lee. (1993). Mobile Communication Design Fundamentals, John Wiley.

15RCS311   Paper – III: Special Paper X: Cloud Computing   4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0   Marks: External:100 Total: 100

End Semester Exam : 3

Course Objectives

To learn about the basic things involved in cloud computing and its architecture.

- To know the basics of cloud computing and its types.
- To know about the services such as IaaS, PaaS, SaaS, IDaaS and CaaS.
- To understand the Virtualization Technologies.
- To understand the Information Security, Privacy and Compliance Risks.
- To learn commercial Google Web services – Open Nebula.
- To portray the recent trends in the field of cloud computing and providing exposures to some open source and commercial clouds.

Course Outcomes (COs)

On successful completion of the course the student should be able to:

1. Understand cloud architecture and model.
2. Identify various service models of Cloud computing.
3. Explore cloud infrastructure.
4. Learn Threat issues and Database Integrity Issues.
5. Learn Open Source and Commercial Clouds such as Microsoft Azure, Amazon EC2.
6. Provide a good understanding of the concepts, standards and protocols in Cloud computing

UNIT I - INTRODUCTION TO CLOUD COMPUTING

Characteristics of Cloud Computing -Paradigm shift - Benefits of cloud computing - Disadvantages of cloud computing- Role of Open Standards-Cloud Computing Architecture: Cloud computing stack-Public cloud -Private cloud -Hybrid cloud -Community cloud

UNIT II - INFRASTRUCTURE AS A SERVICE (IAAS)

Platform as a Service (PaaS) -Software as a Service (SaaS) -Identity as a Service (IDaaS) - Compliance as a Service (CaaS)- Cloud storage.

UNIT III - VIRTUALIZATION TECHNOLOGIES

Load Balancing and Virtualization -Advanced load balancing -The Google cloud - Hypervisors -Virtual machine types -VMware vSphere - Machine Imaging -Porting Applications -The Simple Cloud API - AppZero Virtual Application Appliance

UNIT IV - CLOUD INFORMATION SECURITY OBJECTIVES

Confidentiality, Integrity, and Availability -Cloud Security Services - Relevant Cloud Security Design Principles -Cloud Computing Risk Issues -The CIA Triad
Privacy and Compliance Risks -Threats to Infrastructure, Data, and Access Control -Cloud Access Control Issues -Database Integrity Issues -Cloud Service Provider Risks Architectural Considerations
General Issues- Trusted Cloud Computing -Identity Management and Access Control

UNIT V - CASE STUDY ON OPEN SOURCE AND COMMERCIAL CLOUDS

Microsoft Azure- Amazon EC2-Google Web services-Open Nebula.

SUGGESTED READINGS

1. Dr Kumar Saurabh.(2012). Cloud Computing, 2nd Edition, Wiley India.
2. Barrie Sosinsky .(2010). Cloud Computing Bible, Wiley- India
3. Rajkumar Buyya, James Broberg, Andrzej M Goscinski. (2011). Tata Mc-Graw Hill, New Delhi.
4. Ronald L. Krutz, Russell Dean Vines. (2010). Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley –India
5. OpenNebula 3 Cloud Computing by Giovanni Toraldo, Packt Publishing.
6. Anthony T.Velte, Toby J.Velte, Robert Elsenpeter. (2010). Cloud Computing Practical Approach, 1st Edition, Tata McGraw Hill, New Delhi.
7. Nikos Antonopoulos, Lee Gillam. (2012). Cloud Computing: Principles, Systems and Applications, Springer.

WEB SITES
1. en.wikipedia.org/wiki/Cloud_computing
2. www.ibm.com/cloud-computing/in/en/
3. www.oracle.com/CloudComputing
4. www.microsoft.com/en-us/cloud/default.aspx
5. en.wikipedia.org/wiki/OpenNebula

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION SYSTEMS

Content

S. No.	Course	Course Code	Title of the course
01	Paper – 1	15RELE101	Research Methodology and Pedagogy
02	Paper – 2	15RELE 201	Trends in Electronics
03	Paper – 3 (Special paper)	15RELE 301	Wireless Communication Systems
		15RELE 302	Embedded Systems
		15RELE 303	VLSI Design Techniques
		15RELE 304	Digital Image Processing

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M.Phil./Ph.D. – Syllabus

ELECTRONICS

Paper-I: Research Methodology and Pedagogy   [15RELE101]

(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES

➤ Understand some basic concepts of research and its methodologies
➤ Identify and discuss the issues an d concepts salient to the research
➤ process
➤ Select and define appropriate research problem and parameters
➤ Identify and discus the complex issues inherent in selecting a research problem, selecting an appropriate research design and implementing research project
➤ Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.

COURSE OUTCOMES

➤ Explain key research concepts and issues
➤ Demonstrate knowledge of research processes
➤ Perform literature reviews using print and online databases
➤ Identify, explain, compare and prepare the key elements of a research proposal
➤ Compare an contrast quantitative an qualitative research
➤ Describe sampling methods measurement scales and instruments and appropriate uses of each.

UNIT I

Research Methodology

Ethics of Research - Objectives of Research - Motivations in Research - Types of Research - Research Approaches - Significance of Research - Research Methods v/s Methodology - Research and Scientific Methods - Research Process - Criteria of Good Research - Funding agencies - Defining the Research Problem: Research Problem - Selecting the Problem - Necessity of Techniques in defining the Problem.

UNIT II
Research Design

Concepts - Features of Good Design– Types - Basic Principles of Experimental Design- Developing a Research Plan - Sample Design: Implication – Steps - Criteria for selecting a Sample procedure - Characteristics of Good sampling Procedure- Types of Sample Design - Experimental Design: Regarding observation - Types of observation - Laboratory setting sample - Data Collection - Presentation and analysis of collected data -Preparation of result reports and publication of research findings in peer reviewed journals - Impact factors.

UNIT III

Scientific Papers, Presentations and Report Writing

Organizing and Writing a rough draft – Searching and reviewing scientific literature – Publishing in Scientific Journals – Ethical and Legal Issues – Scientific Presentations – Oral presentation – Poster Presentation - Preparation of research report - Steps involved in writing a good report - Concepts of bibliography and references - Role of computer in design and planning phase- Computer and Collaborative learning- Application of computer packages - Educational and Research Resources on Internet - Data Analysis and Display using software- INFLIBNET - Use of E Journals - Use of E library - Use of EBSCO HOST online database of academic libraries.

UNIT IV

Probability Distribution

Mean-Median-Mode-Peak alue and Standard Deviation – Binomial Distribuion – Poisson istribution – Gaussian and Normal EWrroe Ditribution – Moes of Distribution – Error Analysis: Instrimental and Statistical uncertainties – Propagation of errors – Estimation of mean and errors – Method of pf least squares – Statistical Fluctuations – Chi Square test of a distribution.

UNIT V

Pedagogical Methods and Techniques of Higher Education

Historical perspective – Objectives and role of higher education – Learning and learning hierarchy – Information processing – Learning events and outcomes – Motivation. Methods and Techniques of Teaching: Large group techniques - Lecture – Modified lecture – Seminar – Symposium – Panel discussion – Team teaching – Project approach and workshop - Small group techniques - Group

discussion – Simulation – Role playing – Buzz techniques – Brain storming – Case discussion – Assignment – System approach in education.

Evaluation: A Conceptual Framework - Methods of Evaluation – Self Evaluation and Student Evaluation in Higher Education - Diagnostic Testing and Remedial Teaching.

Suggested Readings:

- Research Methodology Methods and Techniques, C. R. Kothari, New Age International Pvt. Ltd., Publishers, third edition, 2014

- Research Methodology: A Step by Step Guide for Beginners, Ranjit Kumar, Sage Publications, Second Edition, 2005.

- Research Methodology: An Introduction, Wayne Goddard and Stuart Melville, Juta Academic Publication, Second Edition, 2004

- Scientific Papers and Presentations, Martha Davis, San Diego: Academic Press, 1997.

- Teaching technology for College Teachers, E.G. Vedanayagam, Sterling Publishers (P) Ltd., 1989

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M.Phil./Ph.D. – Syllabus
ELECTRONICS
Paper II: Trends in Electronics   [15RELE201]
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES

➢ Ability to design different types of Electronic Circuits such as Amplifiers and Oscillators.
➢ To understand and implement the advanced electronic circuits such as amplifiers etc with the help of theoretical and practical problem solving.
➢ To learn the designing procedure and operation of circuits used for communication
➢ Ability to design an Embedded System, component or process to meet desired needs within realistic constraints.
➢ Analyze & compare different signal processing strategies.
➢ To get an exposure on Discrete Fourier Transforms (DFT), its applications and implementation by FFT techniques

COURSE OUTCOMES

➢ Design simple circuits and know the benefits of feedback in amplifier
➢ Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.
➢ Use of different modulation and demodulation techniques used in analog communication
➢ Explore the features of the microcontroller and provide solutions for   embedded applications
➢ Ability to compute various transform analysis of Linear Time Invariant Systems
➢ Apply design techniques for FIR type digital filters

UNIT I

Analog and Digital Electronic Circuits

Rectifiers - Voltage regulated ICs and regulated power supply - Biasing of Bipolar junction transistors and JFET - Single stage amplifiers, multistage amplifiers - Operational Amplifiers(OPAMP) -Characteristics and Applications - Computational Applications – Integrator – Differentiator - Wave shaping circuits - F to V and V to F converters - Logic families - Flip Flops – Gates - Boolean algebra and minimization techniques - Multivibrators and clock circuits - Counters – Ring – Ripple - Synchronous – Asynchronous - Up and Down shift registers - Multiplexes and Demultiplexers - A/D and D/A converters**.**

UNIT II

Digital Communication Technology

Digital communication principles - FDM, TDM and WDM systems – PCM - Delta modulation - Transmission coding - Code compression - Encryption/decryption algorithms – MODEM - Shift Keying Techniques - Spread Spectrum modulation - FDMA - TDMA and CDMA - Telephone communication - Switching networks - Analog and digital exchanges - Speech digitization and transmission - Traffic engineering - Numbering and charging plan – Facsimile - Mobile communication systems - Cellular concepts – UMTS - Frequency Reuse – Roaming – SMS – GSM – GPRS - CDMA and EDGE - GPS.

UNIT-III

Embedded System Design: Hardware and Software Interaction

Introduction - From Simple Compiler to Software Design for MPSoC - MPSoC Architecture

MPSoC Programming Steps - Hardware/Software Abstraction Levels - Concept of Mixed

Architecture/Application Model - Examples of Heterogeneous MPSoC Architectures-Examples of

Multimedia Applications - Programming Models for MPSoC - Software Stack for MPSoC -

Hardware Components - Software Layers.

UNIT IV

VLSI Design Technology

The VLSI design process – Architectural design – Logical design – Physical design –Layout styles – Full custom – Semi custom approaches - Basic electrical properties of MOS and CMOS circuits: Ids versus Vds relationships – Transconductance – Pass transistor – NMOS inverter – Determination of pull up to pull down ratio for an NMOS -inverter – CMOS inverter – MOS transistor circuit model.

UNIT V

Digital Signal and Image Processing

Methods and techniques for digital signal processing - Review of sampling theorems - Z-transform methods - Linear shift - Invariant systems - Difference equations – Correlation and convolution - Canonical forms - Design of digital filters - IIR and FIR filters - FFT techniques - Image acquisition

- Image representations - Image digitalization - Sampling - Quantization - Histograms - Image Quality - Noise in Images - Basic operations on images - Image Enhancement - Pixel intensity transformations - Histogram equalization and matching - noise removal - Edge sharpening - Image smoothing.

Suggested Readings :

- Electronic Devices and Circuits, S.Salivahanan, N.Suresh Kumar & A.Vallavaraj, ,Tata Mc Graw –Hill Publishing Company Limited, Fourth Edition,2013.

- Embedded Systems Architecture Programming and Design, Rajkamal, Tata McGraw - Hill Publishing Company Limited, Third Edition, 2014.

- Principles of Communication Engineering, Anok Singh & A K Chhabra ,S.chand Publications , Seventh Edition,2010

- Electronic Communication Systems, Kennedy and Davis,Tata McGraw Hill, fifth Edition, 2012.

- VHDL:Programming by Examples, Douglas.P.Perry, Mc Graw Hill Publications, Fourth Edition, 2014.

- Low Power CMOS VLSI circuit design, K.Roy and S.C. Prasad, Wiley Publications, 2011.

- Discrete Time Signal Processing, Oppenheim A.V and Schaffer RW, Buck .C, Prentice Hall India, Second Edition, 2013.

- Digital Image Processing, Rafael C. Gonzalez, Richard E Woods, Pearson Education, 2014

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M.Phil./Ph.D. – Syllabus
ELECTRONICS
Paper III : Special Paper I - Wireless Communication Systems [15RELE301]
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES

- ➢ To know the fundamental concept of Mobile Communication.
- ➢ To understand the concept of Protocol standards and security tasks.
- ➢ Provides the concept of Cellular Networks, GPRS, Wi-Fi, WiMax Systems
- ➢ Encompasses the various Mobile Communication Technologies and the Structure of Protocols
- ➢ To make students familier with fundamentals of mobile communication systems 2. To choose system (TDMA/FDMA/CDMA) according to the complexity, installation cost, speed of transmission, channel properties etc
- ➢ To identify the requirements of mobile communication as compared to static communication

COURSE OUTCOMES

- ➢ Understand the basics of information theory, source coding techniques and calculate Entropy of source
- ➢ To make students familiar with various generations of mobile communications
- ➢ To understand the concept of cellular communication
- ➢ To understand the basics of wireless communication
- ➢ Knowledge of GSM mobile communication standard, its architecture, logical channels, advantages and limitations.
- ➢ To under multicarrier communication systems. 8. To differentiate various Wireless LANs. Acquire knowledge about embedded processors and their applications

UNIT I

Digital Cellular Systems

GSM architecture – Layer modeling – Transmission – Data service – Multiple access scheme – Channel Coding Interleaving – Radio resource management – Mobility management – Communication management – Network management – TDMA architecture – Transmission and modulation – CDMA – Terms of CDMA systems – Call processing – Handover procedures.

UNIT – II

Intelligent Network for Wireless Communication

Intelligent cell concept – Intelligent micro cell operation – Applications – Advanced Intelligent Network (AIN): Evaluation – Architecture – ISDN for AIN – AIN for mobile – Asynchronous Transfer Mode (ATM) technology - ATM network concept – Applications – Wireless information super highway.

UNIT III

Mobile Communication

Frequency management – Channel assignment- hand off procedures - Mobile Network layer - Mobile IP – Dynamic Host Configuration Protocol – Mobile Ad-hoc networks - Mobile Transport Layer Traditional TCP - Classical TCP improvements – TCP over 2.5/3G wireless networks - 3G Networks – Introduction - Principles of WCDMA - UMTS network architecture and protocols.

UNIT IV

WiFi, WLL, WiMAx

 Architecture-WiFi-802.11b-802.11g-802.11a-802.16-WLL–overview–WLL   Configurations - Benefits – Highlights - Propagation - Considerations - Standards of IEEE 802.16 -WiMax Architecture - MAC layer-IEEE 802.16 Protocol – Channel Acquisition –IP Connectivity –Radio Link Control (RLC) –Interferences – Security in WiMax Networks-PKM Protocol.

UNIT V

Wireless Sensor Technology

Sensor node technology – Sensor Network Architecture - Sensor taxonomy – MAC protocols – Transport protocols - Routing Protocols – Routing challenges and design issues in wireless sensor networks – Network management design issues – Operating system design issues – Applications of WSN.

Suggested Readings:

- Mobile Communications, Jochen Schiller, Pearson Education, Second Edition, 2010

- Electronic Communication Systems, Kennedy and Davis, Tata McGraw Hill, Fifth Edition, 2012.

- Mobile Computing, Hasan Ahmed, Roopa Yavagal, Asoke K, McGraw Hilll Education Private India, Second Edition, 2011.

- Wireless Sensor Network Technology, Protocols and Applications, Kazem Sohraby, Daniel Minoli and Taieb Znati, John Wiley and Sons, Second Edition, 2010.

- Principles ofMobile Computing,Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thom as Stober, Springer, 2010

- Clint Smith ,P.E Daniel Collins, 3G Wireless Networks, Tata McGraw Hill International Edition, 2nd Edition, 2009.

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M.Phil./Ph.D. – Syllabus

ELECTRONICS

Paper III: Special Paper II - Embedded Systems [15RELE302]
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES

➢ Ability to design an Embedded System, component or process to meet desired needs within realistic constraints.
➢ To develop the next generation technologies, methods and tools for modeling, design, implementation and operation of hardware/software systems embedded in intelligent devices
➢ To understand the need and applications of Microcontrollers n embedded system.
➢ To understand architecture and features of typical Microcontroller.
➢ Learn interfacing of real world input and output devices
➢ To study various hardware and software tools for developing applications embedded systems

COURSE OUTCOMES

➢ Understand hardware and software design requirements of embedded systems.
➢ Acquire knowledge about embedded processors and their applications
➢ Analyze the embedded systems specification and develop software programs.
➢ Ability to design an Embedded System, component or process to meet desired needs within realistic constraint
➢ Evaluate the requirements of programming embedded systems and tool chain for embedded systems.
➢ Explore the features of the microcontroller and provide solutions for embedded applications

UNIT I

Introduction

Definition and classification – Overview of microprocessor - Microcontroller - DSP – exemplary high performance processors – CISC and RISC architecture – Hardware unit in an embedded system - Software embedded into a system – Exemplary applications – Embedded systems on a chip and in VLSI circuit – Over view of 8051 family – 8051 instruction set and registers - 8051 assembly programming - Addressing modes – Assembler directives - Programming with C - Data types –

Time delay programming – I/O programming – programming of 8051 timer - 8051 serial Communication - 8051 interrupts.

UNIT II

Architecture of Embedded System

Hardware components – SOC – Processors – CPU – Types of memory – Memory management – I/O devices and interfacing – Software components – Interpreter – Compiler – Assembler – Cross Assembler – RTOS – Languages for embedded applications – Hardware and software architecture. Examples: Cell Phone – Smartcard - Digital Thermometer.

UNIT III

Embedded System Design

Design of Embedded systems - Microcontroller architecture and microcontroller based system design - Case studies - Interfacing Memory and I/O devices - Synchronous and Asynchronous transfer – Interrupts – DMA - Serial data transfer – GPIB - RS-232C, I2C, CAN bus protocols - RFID, Smart cards - PDA's, Zip drives - Development and troubleshooting tools - Single board microcomputer kits – Simulators - In Circuit Emulators, IDE - Logic analyzer.

UNIT IV

Performance Issues of an Embedded System

CPU performance – CPU Power Consumption – Analysis and Optimization of CPU- Power Consumption program execution time – Analysis and optimization of energy and power – Analysis of program size – Hardware accelerators.

UNIT V

Introduction to Operating System

Introduction to real time theory – Operating System Services – Real time Operating System Concepts – Basic design using a RTOS – Underground tank monitoring system Process Management & Inter Process Communication – Semaphores - Conditional critical regions - Events - Queues – Deadlock - Processor management - Scheduling algorithms - Queuing system model - Memory management - File System Organization.

Suggested Readings:

- ARM Microcontroller, B.Shantha Kumar Naik, Saona Book House, First Edition, 2013.
- Programming and Customizing the PIC Microcontroller, Myke Predko Tata McGraw - Hill Education, Third Edition,2010.
- Embedded Systems Architecture, Programming and Design, Rajkamal, Tata McGraw Hill Publications, Third Edition, 2014.
- Programming and Customizing the PIC Microcontroller, Myke Predko, Tata McGraw - Hill Education, Third Edition, 2010.
- Embedded Systems Architecture Programming and Design, Rajkamal, TataMcGraw Hill Publications, Second Edition, 2008.

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M.Phil./Ph.D. – Syllabus

ELECTRONICS

Paper III: Special Paper III - VLSI Design Techniques [15RELE303]
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES

> ➢ To learn the fabrication techniques of Integrated Circuits.
> ➢ To know the fundamental rules of layout design.
> ➢ To design the fundamental blocks of a VLSI circuits, both by circuit schematic and physical layout
> ➢ Importance of CMOS and Mixed Signal VLSI design in the field of Electronics and Telecommunication
> ➢ Underlying methodologies for analysis and design of fundamental CMOS Analog and Mixed signal Circuits like Current and Voltage references, Single stage Amplifiers, Operational Amplifiers, Data Converters
> ➢ The issues associated with Mixed Signal VLSI Circuits.

COURSE OUTCOMES

> ➢ Realize logic circuits with different design styles.
> ➢ Understand working principle of operation of different types of memories.
> ➢ Familiarize with the fabrication techniques of Integrated Circuits.
> ➢ Design the fundamental blocks of a VLSI circuits, both by circuit schematic and physical layout.
> ➢ Express the layout of simple MOS Circuit using Lambda based design rules.
> ➢ Design an application using Verilog HDL

UNIT I

VLSI Design Process

Architectural design - Logical design - Physical design – CMOS Technology – Integrated Circuit Design Techniques - Transistors and Layout : Introduction – Fabrication processes –Layout design and tools – Threshold Voltage – Body Effect – Design Equations – Second Order Effects – MOS Models and Small Signal AC Characteristics.

UNIT II

Inverters and Logic Gates

NMOS and CMOS Inverters - Stick diagram, Inverter ratio - DC and Transient characteristics - Switching time - Super buffers - Driving Large Capacitance loads - MOS logic structures -

Transmission gates - Static CMOS Design - Dynamic CMOS design – Combinational logic functions – Static complementary gates – Switch logic – Low power gates – Delay through resistive interconnect - Delay through Inductive Interconnect.

UNIT III
Design Tools

Grounds rules for successful design – Design styles and philosophy – CAD tools for design & simulation: Textual entry layout language – Graphical entry layout – Design verification – Design rule checkers – Simulators – Tests & testability - PLA – Finite state machine – PLA based finite state machine design – Design of 4-bit shifter – Design of ALU subsystem: Adders – Multiplexers

UNIT IV
Sequential Machines and Subsystem Design

Introduction – Latches and flip-flops – Sequential systems and Clocking disciplines – sequential system design – Power optimization – Design validation – Sequential testing -Introduction – Subsystem design principles – Combinational shifters–High density memory – Programmable gate arrays – Programmable logic arrays.

UNIT V
VERILOG Hardware Description Language

Overview of digital design with VERILOG HDL - Hierarchical modeling concepts - Modules and port definitions - Gate level modeling - Data flow modeling - Behavioral modeling - Task and functions - Test Bench.

Suggested Readings:

- VHDL: Programming by Examples, Douglas.P.Perry, Mc Graw Hill Publications, Fourth Edition, 2014
- Principles of VLSI Design, S.Sumathi, Scitech Publications (India) Pvt., Ltd, 2012.
- A VHDL Primer, J.Bhasker , Pearson Education, Third Edition, 2010.
- HDL Programming VHDL and Verilog, Nazeih M.Botros, Wiley India Pvt.Ltd, First Edition, 2012
- Basic VLSI Design, Pucknell D.A., & Eshraghian K., PHI, Third Edition, 2009.

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ELECTRONICS

Paper III : Special Paper IV - Digital Image processing [15RELE304]
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES

- ➢ To get an exposure on Discrete Fourier Transforms (DFT), its applications and implementation by FFT techniques.
- ➢ To understand the fundamental concepts and theory of Discrete Fourier Series and Discrete Fourier Transform.
- ➢ To acquire the fundamental concepts of a digital image processing system
- ➢ To identify and exploit analogies between the mathematical tools.
- ➢ To design and implement with MATLAB algorithms for digital image process.
- ➢ Discuss techniques specific to 2D system

COURSE OUTCOMES

- ➢ Understand the need for image transforms different types of image transforms and their properties.
- ➢ Develop any image processing application.
- ➢ Learn different techniques employed for the enhancement of images.
- ➢ Learn different causes for image degradation and overview of image restoration techniques.
- ➢ Understand the need for image compression and to learn the spatial and frequency
- ➢ Apply design techniques for FIR type digital filters

UNIT I

Digital Image Fundamentals

Elements of digital image processing systems - Vidicon and Digital Camera - Working principles - Elements of visual perception – Brightness – Contrast – Hue – Saturation - Mach Band Effect - Image Sampling – Quantization – Dither – Two dimensional Mathematical preliminaries.

UNIT II

Image Transforms

Introduction to Fourier transform – DFT – Properties of two dimensional FT – Separability – Translation – Periodicity – Rotation - Average value – FFT algorithm – Walsh transform –

Hadamard transform – Discrete cosine transform - 1D DFT - 2D transforms – DFT – DCT - Discrete Sine – Walsh – Hadamard – Slant – Haar - KLT – SVD - Wavelet transform.

UNIT III

Image Enhancement and Restoration

Histogram modification - Noise distributions - Spatial averaging - Directional Smoothing – Median - Geometric mean - Harmonic mean - Contraharmonic and Yp mean filters - Image restoration – Degradation model - Unconstrained and Constrained restoration - Inverse filtering – Removal of blur caused by uniform linear motion - Wiener filtering - Geometric transformations – Spatial transformations – Gray level interpolation.

UNIT IV

Image Segmentation and Recognition

Image segmentation – Edge detection - Edge linking and boundary detection - Region growing - Region splitting and Merging - Image Recognition – Patterns and pattern classes - Matching by minimum distance classifier - Matching by correlation - Neural networks – Back propagation network and training - Neural network to recognize shapes.

UNIT V

Image Compression

Need for data compression – Huffman - Run Length Encoding - Shift codes - Arithmetic coding - Vector Quantization - Block Truncation Coding - Transform coding - JPEG standard - JPEG 2000 – SPIHT - MPEG

Suggested Readings:

- Digital Image Processing, Rafael C. Gonzalez, Richard E Woods, Pearson Education, 2014.
- Digital Image Processing, S. Sridhar, Oxford University Press, First Edition, 2011
- Fundamentals of Digital Image Processing, Anil K.Jain, Pearson Education, 2010.
- Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, Pearson Education, Inc., Second Edition, 2004
- Digital Image Processing using MATLAB, Rafael C.Gonzalez, Richard E.Woods, Steven Eddins, Pearson Education, Inc., 2004

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M.Phil./ Ph.D - ENGLISH

SYLLABUS

(Effective from the Academic year 2015 – 2016 and onwards)

DEPARTMENT OF ENGLISH

2015 – 2016

Content

S. No.	Course	Course code	Title of the course
01	Paper - 1	15RENG101	Research Methodology and Pedagogy
02	Paper – 2	15RENG 201	Modern Literary Theory and Criticism
03	Paper – 3 (Special paper)	15RENG 301	English Language Teaching
		15RENG 302	Drama
		15RENG 303	Fiction
		15RENG 304	Poetry
		15RENG 305	Linguistics

PAPER- I: RESEARCH METHODOLOGYAND PEDAGOGY

15RENG101

Course Objective:

- To understand some basic concepts of research and its methodologies.
- To identify appropriate research topics.
- To select and define appropriate research problem and parameters.
- To prepare a research proposal.
- To organize and conduct research in a more appropriate manner.
- To write a research report and thesis.

Course Outcome:

- Demonstrate the ability to choose methods appropriate to research aims and objectives.
- Understand the limitations of particular research methods.
- Develop skills in qualitative and quantitative data analysis and presentation.
- Develop advanced critical thinking skills.
- Demonstrate enhanced writing skills.
- Develop a comprehensive research methodology for a research question.

UNIT: I- Research Process

Research and writing, selecting a topic, using the library, conducting research, arriving at a thesis statement, taking notes, outlining, writing drafts and style Plagiarism.

UNIT:II- The Mechanics of Writing

Spelling, punctuation, names of persons, numbers, and titles of works in the research papers, use of questions, use of ellipsis and other alterations of sources.

UNIT: III- Documentation

Documentation sources, list of works cited and other source lists – citing print and non-print sources, citing electronic publications, compiling a bibliography or work cited, abbreviations, content notes.

UNIT: IV- Format of Thesis

Margins, heading and titles, page and chapter format, the text of the thesis, and organizing the material.

UNIT: V- Pedagogy

Objectives and Role of Higher Education – Important Characteristics of an Effective lecture –Quality Teaching and Learning – Lecture Preparation – Characteristics of Instructional

Design – Methods of Teaching Learning: Large Group– Technique – Lecture, Seminar, Symposium, Team Teaching, Project Small Group Technique – Simulation, Role Playing Demonstration, Brain Storing, Case Discussions and Assignment, Methods of Evaluation– SelfEvaluation, Student Evaluation, Diagnostic Testing and Remedial Teaching – Question Banking – Electronic Media in Education: - 'e'Learning Researches– Web Based Learning.

Reference

1. *Modern Language Association.MLA Handbook for the Writers of Research Papers.* East West PressSeventh edition, New Delhi.2012.Print.
2. Raimes, Ann. *Keys for Writers*. Houghton Mifflin, New York, 2002. Print.
3. Vedanayagam, E.G.*TeachingTechnology for College teachers*. New Delhi: Sterling Publishers (P) Ltd., 1989. Print.
4. Kumar, K.L.*Educational Technologies,* New Delhi: New age International. 1997. Print.

PAPER-II: MODERN LITERARYTHEORY AND CRITICISM

Course Objective:

- To introduce scholars to the nature, function and relevance of literary criticism and theory.
- To encourage scholars to deal with highly intellectual and radical content and thereby develop their logical thinking and analytical ability.
- To develop sensibility and competence in them for practical application of critical approach to literary texts.
- To make the scholars analyse and interpret literature.
- To enhance the critical thinking of students by introducing to them a bunch of literary andpolitical theories.
- To give the scholars a firm grounding in a major methodological aspect of literary studies known as theory.

Course Outcome:

- Widens the knowledge of literary and focuses on their importance.
- Helps to write a critical appreciation.
- Provides an insight of practical criticism.
- Sets the mind towards creative writing, appreciation, critical thinking and critical analysis.
- Highlights expression of thoughts and views for critical appreciation and judgmental reviews.
- Develop a skill in applying various literary theories in interpreting a specific text.

UNIT: I

Structuralism, Post structuralism, Deconstruction

Gerard Gennette	:	Structuralism and Literary Criticism
Colin Mac Cab	:	Language, Linguistics and the Study of Literature
Derrida	:	Structure, Sign and Play in the Discourse of Human Sciences

UNIT: II

Psychoanalysis, Hermeneutics and Phenomenology

Jacques Lacan	:	The Insistence of the Letter in the Unconscious
Wolfgang Iser	:	The Reading Process: A Phenomenological Approach
Ed.Hirsch, Jr	:	Three dimensions of Hermeneutics

UNIT: III

Feminist Criticism, New Historicism, Cultural Studies

Elaine Showalter   :   Feminist Criticism in the Wilderness
Stephan Green Blat   :   The Circulation of Social Energy
Stuart Hall   :   Cultural Identity and Diaspora

UNIT: IV

Marxism, Post Modernism, Post Colonialism

Edmund Wilson   :   Marxism and Literature
Terry Eagleton   :   Capitalism, Modernism and Post modernism
Edward Said   :   'Crisis' (Selection from *Orientalism*)

UNIT: V

Eco-criticism, The Reader Response Theory, Discourse Analysis

Cheryll Glotfelty et al.:   Landmarks in Literary Ecology:The Eco-criticism Reader
Stanley Fish   :   Is There a Text in This Class
Foucault   :   Archaeology of Knowledge   (Chapter- I)

Reference:

1. Abrams and Harpham eds,. *A Glossary of Literary Terms*, 11th ed; cencage Harning, 2015.
2. Barry, Peter. *Beginning Theory: An Introduction to Literary and Cultural Theory*,2013.
3. Dorairaj Joseph, *Interventions: Essays in Philosophy and Literary Theory*, 2006.
4. Leitch,et al.*The Norton Anthology of Theory and Criticism*. 2002.
5. Lodge and Wood, eds, *Modern Criticism and Theory*: *A Reader*, 2003.
6. Sethuraman, VS, *Contemporary to Postmodernism: An Anthology*, 1989.
7. Waugh, Patricia. ed, *Literary Theory and Criticism*: *An Oxford Guide,* 2006.

PAPER- III: SPECIAL PAPER
ENGLISH LANGUAGE TEACHING

15RENG 301

Course Objective:

- To acquaint the scholars with different theoretical and practicalaspects of English language teaching.
- To acquaint scholars with different approaches, methods and techniques of teaching English language.
- To identify the role and importance of English as a global language.
- To familiarize the different methods and approaches of English.
- To develop a basic knowledge of the English around the world.
- To apply different pedagogical strategies in teaching and learning process.

Course Outcome:

- Infer the technicalities involved in the teaching-learning process.
- Predict different methods and approaches for efficient teaching-learning.
- Design various teaching methodologies and practices.
- Illustrate a thorough knowledge of the methods in learning and teaching.
- Analyse and decide on the effectual methodologies for teaching-learning.
- Examine new techniques involved in pedagogy and English Language Teaching.

UNIT: I

English as an International, Colonial and National Language.

Language Pedagogy and the Teaching of English

UNIT: II

Methods and Approaches

Spoken English and the Teaching of Spoken English

Vocabulary enrichment and the Teaching of Vocabulary

UNIT: III

English Grammar and the Teaching of Grammar

Reading, Writing and the Teaching of Composition

The Teaching of Prose and Poetry

UNIT: IV

Instructional Aids and StudyAids

Test, Testing and Evaluation

Planning and Lesson planning

UNIT: V

Common Errors and Remedial English

Recent Trends in ELT: CALL, MALL, CLT, ICT

Reference:

1. Teaching English: Approaches, Methods, and Techniques by N.Krishnaswamy & Lalitha Krishnaswamy, Macmillan India Limited, 2003.
2. English Language Teaching: Approaches methods Techniques by Geetha Nagaraj, Orient Longman, 2003.

PAPER- III: SPECIAL PAPER
DRAMA

15RENG 302

Course Objective:

- To identify the basic structure of drama as a major genre.
- To outline the different ages of drama in literature.
- To draw an understanding of the importance of drama in theatre arts.
- To interpret the dramatic works of different ages and authors.
- To analyse the various theoretical and critical aspects of drama.
- To examine the theatrical and societal function of drama.

Course Outcome:

- Appraise a dramatic work of art technically.
- Characterize the thematic aspect of a drama.
- Demonstrate the knowledge of stylistic techniques of dramatic masterpieces and authors.
- Interpret a literary piece in terms of different socio-political milieus.
- Compare and contrast the critical approaches of different ages.
- Devise novel theoretical and critical approaches of a dramatic work of art.

UNIT-I:

Shaw -Pygmalion

UNIT-II:

Bertolt Brecht -Mother Courage

UNIT-III:

Harold Pinter - The Birthday Party

UNIT-IV:

Girish Karnad–Hayavadhana

UNIT-V:

Tennessee Williams–Cat on a Hot Tin Roof

FICTION

15RENG 303

Course Objective:

- To identify the construction of fiction as a literary genre.
- To outline the diverse ages in which fiction flourished.
- To draw an understanding of the importance of fiction in the study of literature.
- To interpret the fictional works belonging to different ages and authors.
- To analyse the diverse historical, social and political milieus in relation with a text.
- To examine the unique characteristic feature of fiction in literature.

Course Outcome:

- Classify a piece of fiction using different critical and literary theories.
- Characterize the multiple thematic functions of fiction.
- Appraise the uniqueness of stylistic techniques of novelists around the world.
- Predict the socio-political and historical milieus of a work of art.
- Compare and contrast the critical approaches of different ages.
- Devise new theoretical and critical approaches to analyse a literary piece.

UNIT:I

Henry James   :   The Golden Bowl

UNIT: II

William Faulkner   :   The Sound and the Fury

UNIT: III

Patrick White   :   Vass

UNIT: IV

Margaret Laurence   :   The Stone Angel

UNIT: V

Bharati Mukherjee   :   Jasmine

PAPER- III: SPECIAL PAPER
POETRY
15RENG 304

Course Objective:

- To identify the origin and development of poetry as a literary genre.
- To outline the diverse ages in which poetry flourished.
- To draw an understanding of the importance of poetry in the study of literature.
- To interpret the poetry of different ages and authors.
- To analyse the diverse historical, social and political milieus found in poetry.
- To examine the unique characteristic feature of poetry in literature.

Course Outcome:

- Characterize a piece of poetry using different critical and literary theories.
- Demonstrate the multiple thematic functions of poetry.
- Appraise the uniqueness in the stylistic sophistication of poets all over the world.
- Predict the socio-political and historical milieus of a work of art.
- Compare and contrast the critical approaches of poetry in different ages.
- Devise new critical approaches to interpret a piece of poetry.

UNIT: I

Chaucer	:	Prologue to the Canterbury Tales
Milton	:	Paradise Lost - Book IX
Wordsworth	:	Tintern Abbey
Philip Larkin	:	Church Going

UNIT: II

Robert Frost	:	Mending Wall
William Carlos Williams:		The Red Wheelbarrow
Leslie Marmon Silko	:	It was a long time before
Wallace Stevens	:	The Emperor of Ice Cream

UNIT: III

Dorothy Livesay	:	Green Rain
A.J.M. Smith	:	Ode on the death of W.B. Yeats

F.R.Scott	:	Lourentian Shield
Margaret Atwood	:	Tricks with Mirror

UNIT: IV

Tagore	:	Gitanjali(Part-I)
Kamala Das	:	An Introduction
Nissim Ezekiel	:	Enterprise
Keki N. Daruwallah	:	The Ghaghra in Spate

UNIT: V

Seamus Heaney	:	Digging
Derek Walcott	:	The Season of Phantasmal Peace
Claude McKay	:	If We Must Die
A.D. Hope	:	Australia

PAPER- III: SPECIAL PAPER

LINGUISTICS

15RENG 305

Course Objective:

- To identify the role and importance of Linguistics.
- To describe the study of linguistics as a science of language studies.
- To develop a basic knowledge of Linguistics.
- To demonstrate an understanding of the significance of linguistics.
- To discuss different linguistic approaches in language learning process.
- To formulate effective linguistic and phonetic analysis in language learning.

Course Outcome:

- Infer the technicalities involved in different types of linguistic approaches.
- Predict difference between a traditional approach and modern linguistic approach of language studies.
- Devise new strategies in technically analyzing different components of language.
- Illustrate a thorough knowledge of linguistics in learning English.
- Analyse and decide on the linguistic strategies in teaching-learning process.
- Examine new techniques in language studies and ability to apply it practically.

UNIT: I

Linguistics: An Introduction
Traditional Approaches to study of the English Language Merits and Inadequacies
Linguistics as an autonomous science
Linguistics and other disciplines

UNIT: II

Morphology: Free, Bound, Zero morphemes, Allomorphs
Semantics

UNIT: III

Clauses, Basic Patterns and Sentence Typologies
Transformational Generative Grammar
I.C. Analysis: features, merits and limitations
Phrase structure Grammar: features, merits and limitations

UNIT: IV

Phonetics, Phonology and Phonemics/Phonematics
Phoneme, Allophone, Free Variants

UNIT: V

IPA Symbols and other symbol systems
Word-stress,
Words in connected speech
Intonation
Assimilation
Broad Transcription

Reference

1. Jindal, D.V. *An Introduction to Linguistics*. London: Prentice Hall, 2010. Print.
2. Yule, George, *The Study of Language*. Chennai: Cambridge UP, 2014. Print.
3. Rajimwale, Sharad. *Elements of General Linguistics*.2vols. Delhi: Rama. 2012. Print.
4. Lyons, John. *An Introduction to Theoretical Linguistics*. Cambridge UP, 1968. Print.

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)

FACULTY OF ARTS, SCIENCE AND HUMANITIES

RESEARCH PROGRAMME

M. PHIL / Ph.D

(MANAGEMENT)

**Curriculum & Syllabus
(2015)**

CHOICE BASED CREDIT SYSTEM (CBCS)

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DEPARTMENT OF MANAGEMENT
FACULTY OF ARTS, SCIENCE AND HUMANITIES
M.Phil./Ph.D. in Management
(2019-2020 Batch and onwards)

Course code	Name of the course	Instruction hours/week	Credit(s)	Maximum Marks (100)
15RMGT101	**Paper-I:** Research Methodology And Pedagogy	4	4	100
15RMGT201	**Paper-II:** General Management	4	4	100
15RMGT301	**Paper III: Special Paper I** - Advanced Financial Management	4	4	100
15RMGT302	**Paper-III: Special Paper II** - Advanced Marketing Management	4	4	100
15RMGT303	**Paper-III: Special Paper III** - Corporate Human Resource Management	4	4	100
15RMGT304	**Paper-III: Special Paper IV** - System Management	4	4	100
15RMGT305	**Paper-III: Special Paper V** - Project Management	4	4	100
15RMGT306	**Paper-III: Special Paper VI** – Advanced Management Science	4	4	100
15RMGT307	**Paper-III: Special Paper VII** – Advanced Operations Management	4	4	100
15RMGT308	**Paper-III: Special Paper VIII** – Consumer Behavior	4	4	100
15RMGT309	**Paper-III: Special Paper IX** - Corporate Social Responsibility, Business Ethics and Corporate Governance	4	4	100
15RMGT310	**Paper-III: Special Paper X** - Advanced Entrepreneurship	4	4	100
PROGRAM TOTAL		12	12	300

15RMGT101   RESEARCH METHODOLOGY AND PEDAGOGY   4H – 4C

Instruction Hours / wee L:4   T: 0 P : 0   Marks: Internal: External: 100   Total: 100

End Semester Exam: 3 Hours

COURSE OBJECTIVES:
To make the Learners
- To impart knowledge in the concept of problem identification and research methodology
- To familiarize with basic of *research* and the *research* process
- To demonstrate the different types of research and its applicability
- To comprehend the knowledge of social research
- To exhibit in sampling design and sampling techniques
- To enrich the knowledge in writing a good research report.

COURSE OUTCOMES:
Learners should be able to
1. Understand the concept of research process, research design and sampling techniques
2. Assess the various research tools and techniques in order to facilitate the research work
3. Calculate and apply the measure of central tendency and dispersion in decision making
4. Understand and Exhibit the statistical tools, parametric and non-parametric in research.
5. Analyze the research problem and design the blue print to capture data and analyses the same using appropriate statistical techniques and apply the learning lifelong.
6. Design a report to communicate the findings and suggestion to make business decision

UNIT-I
Research- Scope and Significance- Types of Research- Research Process- Characteristics of Good Research- Identifying Research problem- Sampling Design- meaning- Steps in sampling-criteria for good sample design- Types of Sample Design- Probability and non-probability sampling methods. Measurement-Meaning-Types of scales.

UNIT -II
Review of Literature- Data Collection-Types of Data- Sources- Methods of Data collection- constructing questionnaire- Establishing, reliability and validity- data processing- Coding-editing and tabulation of data. Report writing- Types of Report- Steps – Precautions for writing report- Norms for using Tables, Charts and diagram. Appendix:- Index, Bibliography.

UNIT - III
Mean, Median and Mode- Parametric Test- Hypothesis testing- Z-test, t-test, F-test, Chi-square test- ANOVA- Correlation, Multiple Regression, Factor Analysis, Non- Parametric tests- Basic of Psychometric Test: Sign test, H test, U test and Run test.

UNIT -IV
Quantitative Techniques- Operations Research- Scope and Models- Linear Programming formulation- Transportation Model- Assignment Model- Mathematical formulations of problems and applications in decision making- Queuing theory- Decision Theory- Simulation model.

UNIT-V
Pedagogical methods in higher Education
Objectives and roll of higher education- Important characteristics of an effective Lecture –Quality teaching and learning- Lecture preparation-Characteristics of instructional design-Methods of teaching learning: Large group – Technique - Lecture, Seminar, Symposium, Team teaching, Project, Small group Technique –

Simulation, role playing Demonstration, brain storing, case discussions, and assignment, Methods of evaluation – Self evaluation, student evaluation, Diagnostic testing and remedial teaching – question banking – Electronic media in education: - 'e' learning researches – web based learning.

REFERENCES:
1. Donald Cooper, (2000). Business Research Methods, Tata Mc graw Hill, New Delhi
2. Gupta S.P (2001), Statistical Methods, Sultan Chand & Sons, New Delhi
3. Kothari, C.R, (2002), Research Methodology, Wishwa Prakasam, New Delhi
4. Krishnaswami, (2003), Methodology of research in social Sciences, himalaya Publishing House, New Delhi
5. Pannerselvam, R. (2004) Research Methodology, Prentice Hall of India, New Delhi
6. Sterling (2003), Research Methods for Management and Commerce, Tata MC Graw Hill, New Delhi
7. Vedanayagam, E. G(1989) Teaching Technology for college Teachers, New Delhi: Sterling Publishers (P) Ltd.
8. Rajasekar S(2005) Computer Education and Educational computing, Hyderabad, Neelkamal Publications
9. Kumar K.L (1997) Educational Technologies, New Delhi, New Age International.
10. Kanthi Swarup P.K Gupta, Man Mohan "Operations Research", Sultan Chand and sons, New Delhi

15RMGT201	**GENERAL MANAGEMENT**	**4H – 4C**

Instruction Hours / wee L:4   T: 0 P : 0   Marks: Internal: External: 100   Total: 100

End Semester Exam: 3 Hours

COURSE OBJECTIVES:

To make the learners

- To demonstrate the concepts of functions of management.
- To identify factors involved in human behaviour and human resource management
- To infer the knowledge on procuring and management of funds
- To familiarise with the concept of marketing management
- To analyse the production and operations management concept
- To compose the knowledge in the field of general management

COURSE OUTCOMES:

Learners should be able to

1. Demonstrate the concepts of management and the functions of management and organizational behaviour.
2. Understand the importance of human resource management in a variety of circumstances.
3. Assess the impact of the profitability and time value of money
4. Exhibit the marketing skills in various situations
5. Learners can assess the individual and group behaviour in organizations.
6. Understand and exhibit the communication skills to convey the thoughts and ideas to the individuals and group.

UNIT-I

Management: Role of Manager- Managerial Levels- Managerial Functions –Planning: Nature, purpose and objectives- Decision making: meaning, process- Organizing: Structure, Line/Staff functions, Staffing, manpower planning, Recruitment, selection- leadership, types of leaders, effective leadership

UNIT -II

Human resource Management: Functions-Objectives- HRM in Changing environment, Job Analysis- Performance Appraisal, Methods, uses- Training and Development, Compensation Management concepts- Foundations of Organizational Behaviour- nature, role and functions- individual behaviour- group behaviour- transactional analysis, power and conflicts- organization culture and change.

UNIT - III

Financial Management: Objectives, goals, scope- an overview of Indian Financial system, development, reforms- Financial Statement Analysis- Limitations- cost of Capital- capital Structure- Leverages- Cost Volume profit analysis-capital Budgeting.

UNIT -IV
Marketing Management: Meaning, Nature- conceptual foundation of Marketing- Modern Concepts of Marketing- New Horizons of Marketing- Marketing systems – Marketing functions- Market segmentation- Marketing mix: Product Mix, price mix and Promotion mix.

UNIT -V
Information Systems: A framework for business users- System concepts – Organization as a system – components of Information systems- IS activities, types- System development Life cycle- Comparison, concepts and knowledge representation- managing international information system- managing information technology- Security and Ethical Challenges.

REFERENCES:

1. Bharati V. Pathak (2008), The Indian Financial system, Markets, institutions, and Services, 2nd edition, Pearson Education
2. James A O'Brien, "Management Information Systems", Tata McGraw Hill, Fourth Edition, 1999
3. Philip Kotler, (2001), Marketing Management, 10th Edition, Prentice Hall Inc., USA
4. Prasanna Chandra, Financial Management Theory & Practice (6th Edition), Tate McGraw Hill Publishing Company Ltd
5. Sisodia, V & Udai Pareek, Human Resource Development, Tata Mcgraw Hill
6. Stephen Robbins and Timothy A, Judge, Organisation Behaviour, Prentice Hall of India.

M.Phil/Ph.D   **2015-2016**

15RMGT301	ADVANCED FINANCIAL MANAGEMENT	4H – 4C

Instruction Hours / wee L:4   T: 0   P : 0   Marks: Internal: External: 100   Total: 100

End Semester Exam: 3 Hours

COURSE OBJECTIVES:
 To make the learners
- To enable the learners to acquire knowledge in financial management
- To Impart the knowledge in finance functions, cost of capital, capital structure, capital budgeting and leverage.
- To access the concept of cost of capital and capital structure.
- To understand the importance of financial data in preparing report
- To Provide an in-depth view of the process in *financial management* of the firm.
- To Develop knowledge on the allocation of resources.

COURSE OUTCOMES:
 Learners should be able to
1. Understand how funds are managed and their reflections on the fundamental decisions to be taken by the corporate world.
2. Apply the basics of Finance functions and working capital management.
3. Demonstrate an understanding of the overall role and importance of the finance function.
4. Communicate effectively using standard financial terminology.
5. Demonstrate the impact of leverage and dividend policy on stockholders.
6. Observe the functions and trends in financial markets and react.

UNIT I
Financial Management: - Financial Analysis and Control; Time value of Money; Capital Budgeting Decisions - Capital Structure - Long and Short Term Sources- Cost of Capital - Leverages- Dividend Policy - Financial Modeling

UNIT II
Working Capital Management: Concept, Need and Determinants of Working Capital- Factors Determining Working capital- Sources of Working capital Finance – Management of Cash - Receivables Management - Inventory Management

UNIT III
Security and Portfolio Management: Introduction to Securities – Markets for Securities -Risk and Return- Economic analysis- Industry analysis - Company Analysis- Security Analysis- Technical Analysis- Portfolio Analysis and Management- Financial Derivatives.

UNIT IV
Financial Markets and Institutions: Development of the Financial System in India, New Developments in the Financial System - Structure of Financial Markets: Primary and Secondary Market, Money Market, Capital Market, Debt market - Financial Institutions: Banking and Non-Banking Institutions

UNIT V
International Financial Management: Introduction – Foreign Exchange Market – International Parity Relationships – Foreign Exchange Risk and Hedging – International Capital Investment analysis- Political risk of foreign investment- financing international operations- recent trends in international financial management
(Note: Theory- 60%; Problems- 40%)

REFERENCES:

1. Prasanna Chandra, Financial Management Theory & Practice , Tata McGraw Hill Publishing Company Ltd
2. Donald E. Fischer and Ronald J.Jordan.2000. "Security Analysis and Portfolio Management". Prentice Hall of India. New Delhi
3. Shashi K.Gupta, Nisha Aggarwal, Neeti Gupta, "Financial Institutions and Markets" – Kalyani Publishers
4. Dr.Jain P.K 2001. **"International Financial Management"** and others, Macmillan India. New Delhi
5. IM Pandey, "Financial Management" 10th Edition, Vikas Publishing House Pvt. Ltd, New delhi, 2010

15RMGT302	**ADVANCED MARKETING MANAGEMENT**	**4H – 4C**

Instruction Hours / wee L:4   T: 0   P : 0   **Marks: Internal: External: 100   Total: 100**
                                                                 End Semester Exam: 3 Hours

Course Objectives:
To make the students
- To understand the marketing concepts and conduct market analysis through environment scanning
- To recognize and apply market segmentation branding and New Product development concepts in real situations.
- To identify the importance of selecting the marketing channel and the pricing strategies and its applications.
- To recognize the growth of the service sector and strategic marketing management for services
- To understand the ethical issues related to marketing and the latest development in marketing.
- To analysis Global Marketing Management Control and Global Marketing Research

Course Outcomes:
Learners should be able to
1. Understand the core concepts of marketing and the role of marketing in business and society.
2. Perform market analysis and identify the best marketing mix.
3. Determine strategies for Planning merchandise needs and merchandise budgets
4. Understand the latest trends in marketing and apply the ethical norms in marketing domain.
5. Effectively communicate ideas, explain procedures and interpret results and solutions in written and oral forms to the team members.
6. Designing competitive strategies for Leaders and identify Future trends of International Marketing

UNIT – I
PRINCIPLES OF MARKETING
Marketing Concepts – Marketing Environment– Market Segmentation – New Product Decision Process – Types of new products. Marketing Mix – Product Life Cycle – Managing the product in Product Life Cycle. Physical Distribution – Importance and role of distribution in marketing –Marketing as promotion tools. Pricing - Market Evaluation and Controls

UNIT – II
SERVICES MARKETING
Introduction - growth of the service sector -marketing mix in services marketing - the seven Ps - strategic marketing management for services - delivering quality services - developing appropriate and effective communication about service quality. marketing of services with special reference to :financial services - health services - hospitality services including travel, hotels and tourism.

UNIT - III
RURAL AND INDUSTRIAL MARKETING
Economy - Rural - Rural Marketing - Concept and Scope - Selection of Markets - Pricing strategy - pricing polices - Distribution -' Logistics Management. Introduction to Industrial Markets - Strategic Industrial Marketing (S.T.P.) -

Marketing Information Systems and Marketing Research. Classification of Industrial Products and Services - Formulating Channel Strategies - Developing Marketing Strategies and Programs for Industrial Goods / Services.

UNIT – IV
RETAIL MARKETING
An overview of retailing - Types of stores - Product retailing vs. Service retailing -Retail store location and layout - Planning merchandise needs and merchandise budgets - Communicating with the retail customer - Globalisation and changing retail formats. - Virtual store - E-relating International Retailing.

UNIT – V
INTERNATIONAL MARKETING
International Marketing – Meaning – Definition-Role of Export in Economic Development -Export procedure and documentation.-India's export performance – problems in export trade – Developing consumer products for Global markets – Global Marketing Management Control –Global Marketing Research – Future trends of International Marketing.

REFERENCES:

1. Marketing Management - V.S.Ramaswamy and S.Namakumari, Macmilan India, 2007
2. Valerie Zeithaml & Mary Jo Bitner: SERVICES MARKETING, McGraw Hill. 2008
3. Peter M. Chisnall: STRATEGIC INDUSTRIAL MARKETING; Prentice-Hall International, 2008
4. CSG Krishnamacharylu & Laitha Ramakrishna - Rural Marketing Pearson Edu Asia
5. Rona Ostrow and Sweetman R. Smith: DICTIONARY OF RETAILING.
6. Lucas, Robert Bush & Larry Gresham: RETAILING (Hononghton Miffin, AIPD, India).
7. Varshney R .L . and Bhattacharya. 2007 "International Marketing Management." S.Chand and Sons. New Delhi
8. Balagopal. T.A.S 2006. "Export Management". Himalaya Publishing House New Delhi

M.Phil/Ph.D   **2015-2016**

CORPORATE HUMAN RESOURCE MANAGEMENT

15RMGT303   **4H – 4C**

Instruction Hours / week L:4   T: 0 P : 0   **Marks: Internal: External: 100   Total: 100**

                                                  End Semester Exam: 3 Hours

Course Objectives:

To make the students

- To gain knowledge of HR planning, Selection, Recruitment, job analysis and its interrelations.
- To understand the concepts and practical implications of performance management, Training methods and career planning.
- To know about Conditions for failure and success in OD and efforts of OD
- To be familiar with Employee relations and its application for the development of Human resources.
- To understand the methods to improve quality of work life and Work stress management
- To acquire knowledge in Interpersonal Interventions & Comprehensive interventions

Course Outcomes:

Learners should be able to

1. Assess the importance of HRM and effects of Workforce Diversity and Cultural Diversity
2. Evaluate the Cultural Difference and HRM
3. Understand the compensation and reward system applicable to the industry and International Recruitment Policy, Selection criteria, Training Development
4. Understand and apply the appropriate employee relations measures.
5. Understand the HR functions and latest developments in the field of HR and effectively communicate ideas, explain procedures and interpret results and solutions in written and oral forms to different audiences.
6. Make any manager to identify various activities related to Human Resources, Job involved in HR, Training, Compensation and Labour welfare practices

UNIT I

Human Resource Management: Nature-Scope- importance- strategic HRM. Recruitment & Selection – Process - Methods. Training and development-types of training - Evaluation of Training. Performance appraisal-Methods-360 feedback-Potential Appraisal-Process-Di

fference between performance and potential appraisal-career guidance-counseling-HR audit. Recent trends in HR.

UNIT -II

Organization Behavior: Personality Determinants-Types - Values - Types. Attitudes –components - formation of attitude. Emotional intelligence-components. Work stress management-nature-causes of stress-effects of stress- managing stress-managing organizational change-counseling.

UNIT III
Human Resource Development: HRD-meaning-Scope-difference between personnel management and HDR-key performance area-role analysis-transactional analysis-Executive Development-Management Development.

UNIT IV
Organization Development: OD-Concepts-Nature-Scope, Conditions for failure and success in OD efforts-OD Intervention-Team Intervention, Interpersonal Interventions & Comprehensive interventions:

UNIT V
International HRM: Cultural Difference and HRM. International Recruitment Policy-Selection criteria - Training Development – Compensation - Repatriation. Workforce Diversity. Cultural Diversity.

REFERENCES:
1. Aswathappa, Human Resource Management Prentice Hall of India.
2. Rao, V.S.P.,Human Resource Management, Excel Books.
3. Stephen Robbins and timothy,A.Judge, Organization Behavior .Prentice hall of India.
4. McShane, Organization Behavior, Prentice Hall of India.
5. Sisodia, V & Udai Pareek, Human Resource Development. Tata Mcgraw Hill of India.
6. Tripathi, P.C., Human Resource Development.Sultan Chand & Sons.
7. Cecil.H..bell & Wendell.L.French, Organizational Development. Prentice hall of India

M.Phil/Ph.D   **2015-2016**

SYSTEM MANAGEMENT

15RMGT304   **4H – 4C**

Instruction Hours / week L:4 T: 0 P : 0   **Marks: Internal: External: 100 Total: 100**

                                                          End Semester Exam: 3 Hours

Course Objectives:
To make the students
- To understand the concept of Metrics in the process and project domains and Software Project planning
- To gain the knowledge of hardware and operational design of data warehouses
- To obtain the knowledge of Project Scheduling and tracking
- To understand Electronic Commerce for Service Industries and Business-to-Business Electronic Commerce
- To comprehend on the concept of Internet , World Wide Web and Internet Protocols
- To know about Visualization techniques, Knowledge discovery process and Recent trends in Information technology

Course Outcomes:
Learners should be able to
1. Understand the basic principles, concepts and applications of data warehousing and data mining,
2. Comprehend the importance of a task set for the software project.
3. Visualize the techniques of clustering, classification, association finding, feature selection and its importance in analysing the real-world data.
4. Understand the Conceptual, Logical, and Physical design of DSS
5. Exhibit behaviour and performance that demonstrates enhanced competence in decision-making, group leadership, oral and written communication, critical thinking, analysing, planning and team work.
6. Understand Reliability models for software quality and TQM for Software Quality

UNIT- I:
Software Project Management – Concepts and 3 P's (People, problem and process) - Metrics in the process and project domains, - Software Project planning – objectives, scope - Software project estimation – Popular decomposition techniques – problem-based - process-based - Project Scheduling and tracking – relationship between people and effort – defining a task set for the software project.

UNIT-II:
Decision Support Systems – Definition – Characteristics & capabilities Classes of DSS - DSS hardware and software – Group DSS – components & typology – Constructing of DSS – Components of DSS-database, Model base, Communication subsystem & User –a DSS – development process- DSS applications – Portfolio Management – Human Resource Management, Marketing Decision Support System.

UNIT-III:
Foundations of Electronic Commerce - Electronic Commerce for Service Industries - Business-to-Business Electronic Commerce - Intranet and Extranet - Electronic Payment Systems - Overview of Enterprise Systems – Evolution – Risks and Benefits - Trends in ERP Systems.

UNIT-IV:
Internet and World Wide Web, Internet Protocols –   Marketing on Web – Advertising, e-mail Marketing, e-CRM; Business Oriented e-commerce – e-Government - E payments – Characteristics of payment of systems, protocols, E-cash, E-cheque and Micro payment systems.

UNIT – V:
PLC – concepts – models for software and process models – Reliability models for software quality - ISO 9000 for Software Quality – CMM, CMMI, PCMM - TQM for Software Quality - Overview: Definition, History, Myths, Transition to Client Server Computing, Database Architectures, Advantages and Disadvantages of Client Server Architecture – Recent trends in Information technology.

REFERENCES:
1. Pressman: Software Engineering: A Practitioner's approach (McGraw-Hill)
2. Principles of software engineering management (Addison-Wesley)
3. Electronic Commerce A Managerial Perspective by Efraim Turban, Jae Lee, David King and H. Michael Chung, Prentice Hall Inc, International Edition.
4. Efralm Turbon: Decision Support System & Expert Systems, Macmillan.
5. Alexis Leon, ERP demystified, second Edition Tata McGraw–Hill, 2006.
6. Hentry Chan & el, E–Commerce, fundamentals and Applications, Wiley India Pvt. Ltd, 2007.
7. Gary P. Schneider, Electronic commerce, 4th Edition Thomson course technology, 2007.
8. Robert Orfali, Dan Harkey and Jere Edwadrs, The Essential Client/Server Survival Guide, Galgoties Publications, 2002.
9. Robert T Futrell, Donald F Shafer, Lurda I Safer, Quality Software Project Management, Pearson Education, 2002.

M.Phil/Ph.D   **2015-2016**

15RMGT305   **PROJECT MANAGEMENT**   **4H – 4C**

Instruction Hours / week **L:4   T: 0   P : 0**   **Marks: Internal: External: 100   Total: 100**
                                                               End Semester Exam: 3 Hours

Course Objectives:
- To make students understand all aspects of Project Management covering project identification formulation, planning, scheduling & control.
- Enable students to acquire concepts, tools & techniques of project management.
- To sensitize the students to complexities of project management.
- To enhance the students of project financing and development banks
- To know the implementation of project and preparation of project report
- To evaluate the project performance and evaluation of costs.

Course Outcomes:
1. Inculcate in the students the expertise required for formulating project ideas and projecting cash flows as well as evaluation of project proposals.
2. To analyze the feasibility of project taking into consideration all parameters to successful implementation of project
3. To know the difficulties in project implementation and provide solutions
4. Analyze the learning and understand techniques for Project planning, scheduling and Execution Control.
5. Helps students to develop project models
6. Initiate students to carry out social and government projects

UNIT- I
The Nature and   Purpose of Project Management: Definition, Objectives, Characteristics, Importance, Types, Steps in identification of projects, Project Life Cycle, Project Planning Project Uncertainty, Management action, Investment returns and corporate Strategy.

UNIT - II
Project Planning and Evaluation: Scope, Problem statements, Project Goals, Success criteria, assumptions and risk factors, approval process, strategic planning, financial evaluation. Evaluation and uses of Hurdle rate, cash flow for project appraisal, investment analysis using capital budgeting, project rating index.

UNIT - III
Project implementation and Monitoring: Project Resource Requirements, Types of Resources, Project Procurement, Inventory Management, Project Logistics, Network Analysis, Pert, CPM and GERT- Resources Allocation and Resource Leveling Managing Risk in Projects, Project Audits, Project Communication, Post Project Reviews.

UNIT -IV
Financing of Projects: Raising Finance In Domestic Market And International Market, Infrastructure Financing, Tax Planning While Financing For Projects, Managing Strategic Change, Technical,

Commercial, Financial And Managerial, Appraisal, Economic And Environment Appraisal, Social Cost Benefit Analysis, Preparation Of Project Report.

UNIT –V
Closing of Project: Types of Project Termination, Strategic Implications, Project Trouble, Termination Strategies, Evaluation of Termination Possibilities, Termination Procedures, Human Factors in Project Management, Legal Aspects in Project Management

REFERENCES:
1. Project Management – David I Cleland- Mcgraw hill International, 1999.
2. Project Management- Harry, Maylor- Pearson Publications
3. Gopalakrishnan, Project Management , TMH, 2007
4. H.R. Machiraju, Introduction to Project Finance, Vikas Publications, 2005.
5. Narendra Singh, Project Management Control, 4th Revised Edition, Himalaya Publishing House, 2007.
6. Prasanna Chandra, "Project Management" , TMH, 2007
7. Chowdry, Project Management, TMH, 2007
8. Clifford F. Gray, Erik W. Larson, "Project Management the Managerial Process, 3rd Edition, McGrawhill,2007

15RMGT306   **ADVANCED MANAGEMENT SCIENCE**   **4H – 4C**

Instruction Hours / wee L:4   T: 0 P : 0   Marks: Internal: External: 100   Total: 100
                                                                                 End Semester Exam: 3 Hours

Course objectives
To make the students
- To understand the basic framework of operation research and its applications in business decision.
- To develop an understanding of Transportation model for Mathematical formulation of the Transportation problem.
- To identify strategies for to minimize the cost of service through Queuing theory.
- To have a thorough understanding on game theory
- Understand the mathematical tools and professionally allocate scarce resources to optimize and maximise profit.
- To inculcate the knowledge of geometric programming to solve the non linear programs

Course outcomes (Cos):
Learners should be able to
1. Assess the operation research and its applications in business decision.
2. Discover suitable transportation model and apply mathematical formulation of the transportation problem.
3. Apply suitable strategies to minimize the cost of service
4. Analyze the non-linear programming techniques to solve the problems in functional areas
5. Demonstrate separable programming function to design a suitable Programming based on the ethical norms of research.
6. Identify the mathematical software to solve the proposed models

UNIT – I
Introduction to Operations Research, evaluation of the field, scope, phase merits and limitations – concept of optimization, Theory of simplex methods to solve canonical and general LPP, Primal – dual problem and its properties, dual simplex method, sensitivity analysis relating to changes in tightness of constraints and co-efficient of objectives function; LINGO Package and its applications in solving LPP and sensitivity analysis. Concept of Goal Programming.

UNIT – II
Transportation problem by Vogel's approximation method with MODI optimality test; assignment problem including traveling salesman model; integer 1 linear Programming complete enumeration method and Gomory's cutting plane methods; fixed charge problem and Zero-one Programming (formulation only).

UNIT – III
Network analysis – drawing of Arrow diagram – critical path method – calculation of critical path duration, total, free and independent floats, PERT problems; Inventory Theory, Deterministic models – purchase problem without and with shortages, with price breaks, production problem without shortages, probabilistic models, single period model.

UNIT – IV

Decision under risk – expected money value criterion – decision trees – decision under uncertainty – minimax criterion; Theory of Games – pure and mixed Strategies, Principles of dominance, graphical methods, simplex methods.

UNIT – V

Introduction to Queuing Theory, Basic Waiting Line Models: $(M/M/1):(GD/\alpha/\alpha)$, $(M/M/1):(GD/N/\alpha)$, $(M/M/C):(GD/\alpha/\alpha)$, $(M/M/C):(GD/N/\alpha)$, Introduction to queuing system simulation – Introduction to Basic Replacement Analysis: Economic Life of an Asset.

REFERENCES:

1. Sharma J.K.: Operations Research Theory and Applications, Macmillan India Ltd., New Delhi
2. Agarwal, J. D. and Sagarika Ghosh: Quantitative Techniques for Financial Analysis, Indian Institute of Finance, New Delhi.
3. Billy, E. Gillett: Introduction to Operation Research A Computer Oriented Algorithmic Approach, Tata McGraw Hill Publishing Ltd., New Delhi.
4. Lucey, T: Quantitative Techniques, D.P. Publications, London.
5. Sharma, K.R. Quantitative Techniques and Operations Research: Kalyani Publication, Ludhiana.
6. Taha, Hamdy A: Operations Research An Introduction, Prentice Hall, Delhi.
7. Vazsonyi, Andrew and Herbert F.Spriner: Quantitative Analysis for Business, Prentice Hall, New Delhi.
8. Vohra, N.D.: Quantitative Techniques in Management, Tata McGraw Hill, NewDelhi.
9. Wagner , H.M: Principles of Operations Research, Prentice Hall, Delhi.]
10.Watsman, Terry J. and Parrramor Keith: Quantitative Methods in Finance, International Thompson Business Press.
Suggested Readings :
1) Operation Research – India Edition – Cengage learning fourth edition by Wayne.L. Winston.
   Email : narasimhan.r@cengage.com. www. cengage.co.in
2) Operation Research with C programs by S. Kalavathy Vikas publishing. Email
   :p.thanigaimalai@vikaspublishing.com
3) Operation Research – by Rathindra P. Sen, PHI learning India.

M.Phil/Ph.D   **2015-2016**

ADVANCED OPERATIONS MANAGEMENT

15RMGT307   **4H – 4C**

Instruction Hours / wee L:4   T: 0   P : 0   **Marks: Internal: External: 100   Total: 100**

                                                   End Semester Exam: 3 Hours

COURSE OBJECTIVES:

To make the students

- To understand the Operations management and operation strategy concepts and its application in business.
- To recognize the importance of various production systems.
- To formulate the production planning and control systems and ensure efficient scheduling for production.
- To understand and apply the technology in production.
- To understand the quality management practice and TQM tools and its application in improving the organizational performance.
- To understand the concept of organization transformation and re-engineering.

COURSE OUTCOMES:

Learners should be able to

1. Understand the core features of the operations and production management function at the operational and strategic levels.
2. Evaluate and decide the best plant and factory location and layout.
3. Forecast the requirement and make accurate production planning , inventory planning and schedule the production.
4. Obtain the knowledge of applying a quality management TQM tools to improve organizational effectiveness.
5. Effectively communicate ideas, explain procedures in oral and written forms to different audiences.
6. Creating and delivering products & services to customers and improving process & supply chain performance

UNIT -I

Concept of Operations Management - Characteristics of Manufacturing sector and service sector - Evolution of Operations Management Discipline - Concepts and Calculations of Productivity - Productivity Techniques - Productivity improvement measures. Impact of Technology on Production; Economics and Social Issues – Automation – Operation strategy and competitiveness Management.

UNIT - II

Types of production systems - Job shop industry, Process Industry, Project type of industry, Mass production Industry with product layout, process layout and cellular manufacturing system. Design of the systems and procedures: Product Decision and Process Selection.

UNIT - III

Design of Production, planning and control system – design on scheduling system – design of inventory system – design of maintenance system - Supply chain Management Logistics management- NW-1, MRP-11, ERP and use of Simulation technique for decision making.

UNIT - IV

Concept of Total Quality Management - Quality Philosophies of Deming, Cross by and Miller - Statistical Quality Control technique - Continuous' Improvement Strategies, deming -wheel - Taguichi Techniques, Seven- QC tools - TQM culture, Quality Circle Six Sigma - ISO Certification Process.

UNIT - V

Principles of organizational transformation and re-engineering - methodology -guidelines Analytical and process tools and techniques Information and communication technology - Enabling role of IT in re-engineering - synchronous manufacturing – production planning and financial planning - Human aspects of production management.

<center>(Note: Theory- 60%; Problems- 40%)</center>

REFERENCES:

1. Edward S. Buffa and Rakesh Sarin, "Modem Production and Operations Management, John Wiley & sons., 1987.
2. Lee J. Krajewski and Larry P. Ritzman, "Operations Management: Strategy and Analysis", Addison Wesley, 2000.
3. Chase, Aquilano & Jacobs ""Production and Operations Management", Tata McGraw Hill, 8th Edition, 1999.
4. Everett E Adam Jr. and Ronald J. Edbert, 'Production and Operations Management, Prentice Hall of India, 1992.
5. Edsomwan, JA., Organisational transformation and process re-engineering, British Library Cataloging in Pub.data 1996.
6. Samuel K.Ho, TQM, An Integrated approach, Kogan Page India Pvt Ltd, 2002.
7. J.D. Radford and D.B. Richardson Oriver W. Wight – The Management of Production and Inventory Management in Computer area
8. Powell Niland – Production Planning, Scheduling and Inventory control
9. Floyd C. Mann and L. Richard – Automation and the worker Heffman

M.Phil/Ph.D   **2015-2016**

15RMGT308   **CONSUMER BEHAVIOUR**   **4H – 4C**

Instruction Hours / wee L:4   T: 0 P : 0   Marks: Internal: External: 100   Total: 100
                                                                    End Semester Exam: 3 Hours

Course Objectives:
- To design and produce, evaluate a research proposal & understand the quality of research studies.
- To acquaint with the factors influencing the consumer behavior and concepts to marketing decisions
- To provide the relevance of consumer behaviour models
- To understand appropriate combinations of theories and concepts
- To learn the basic skills to conduct professional marketing research.
- To understand the applications of business research tools in Marketing decision making

Course Outcomes:
 Learners should be able to
1. The course should enable students to develop marketing strategies that are consumer   based and create and enhance customer value.
2. Identify the major influences in consumer behavior
3. Formulate the appropriate techniques to apply market solutions
4. Apply business research tools in marketing decision making.
5. To generate new models of consumer behavior
6. Evaluate the effectiveness of marketing programmes on consumption decisions

UNIT – I
Introduction to consumer Behaviour : Introduction to consumer behaviour – Diversity of Consumer behaviour – concepts and need for studying consumer behaviour and marketing management, factors influencing consumer buying behviour, consumer buying process.

UNIT – II
Consumer Behaviour Models: Industrial and Individual consumer behaviour models – The economic model – learning model – Psychoanalytic model – The Sociological model – The Harward Sheth Model of Buying behaviour – The Nicosia model – The Engel – Kollat – Black Well Model.

UNIT – III
Consumer Behaviour Internal Influences: Psychological influences on consumer behaviour – motivation – perception – Personality. Learning and attitudes – Self Image and Life styles – consumer expectation and satisfaction.

UNIT – IV
Consumer Behaviour External Influences : Influence of Social class – Definition and meaning of social stratification – socio – cultural, cross culture – Family group – Reference group – communication , consumer decision making process.

UNIT – V
Industrial / Organizational buying behaviour : Essential features of Industrial buying and consumer buying – segmenting industrial markets – buying decisions involved in Industrial buying process –

factors influencing industrial buying behvaiour – stages of Industrial buying process – Customer and Marketing of services.

REFERENCES:
1. Jay.D. Lindquist and Joseph Sirgy, Shopper , Consumer Behaviour, Biztranza 2009.
2. Paul Peter, Consumer Behaviour and Marketing Strategy, Tata McGraw Hill, 2010.
3. Leon.G. Sahiffman, Lesile Lazar kanuk, consumer Behaviour, Pearson Education, 2010.
4. David L Loudon, Albert J della Bitta, Consumer Behaviour, Tata McGraw Hill, 2010.
5. Ramanauj Majumdar, Consumer Behaviour, PHI 2010
6. Blackwell, Consumer Behaviour, Cengage, 2009.
7. Hawkins, Consumer Behaviour Building Marketing Strategy, Tata McGraw Hill 2010.
8. Raju, Dominique Xavedel, Consumer Behaviour, Concepts Applications and Cases, Vikas Publishing house, 2010.
9. Suja.R. Nair, 'Consumer Behaviour in Indian prospective" – Himalaya Publication Home, 2001.

M.Phil/Ph.D   **2015-2016**

CORPORATE SOCIAL RESPONSIBILITY, BUSINESS ETHICS AND CORPORATE GOVERNANCE

15RMGT309   **4H – 4C**

Instruction Hours / week L:4 T: 0 P : 0	Marks: Internal: External: 100 Total: 100
	End Semester Exam: 3 Hours

Course Objectives:

To make the students

- To develop knowledge and understand about the theoretical perspectives and frameworks of corporate governance, ethical, and social dimensions.
- To learn the ethics to be followed in management and various areas to protect the interests of beneficiaries
- To assess and understand social responsibility of business and its impact.
- To provide clear understanding of constitution of board and powers of directors
- To understand issues related to business and good governance necessary for long term survival of business.
- To learn new trends in corporate social responsibility

Course Outcomes:

Learners should be able to

1. Inculcate the ethical practices in personal and organizational life
2. Practice ethical and morals in business to protect the long term interest of the shareholders and create policies that adopt by laws.
3. To define the powers and responsibilities of board of directors
4. Maintain and transfer sense of social responsibility to create effective developments in organization and society
5. Analyze ethical issues related to business and good governance necessary for long term survival of business.
6. Evaluate the emerging Areas and Trends in Corporate Social Responsibility

UNIT – I CORPORATE SOCIAL RESPONSIBILITY

Introduction – System Concept of Business Society – Business and Society Relationship – Business Environment – Business in a Social World – Social Responsibility – Corporate Social Responsibility – Corporate Social Accountability – Social Responsibility Tools – Globalization and the perspectives of CSR – Corporate Legislations – Labour Legislations – Stakeholders Legislations – Environmental Legislations and Overview of Air and Water Pollution Control Acts.

UNIT – II ETHICS AND SOCIAL RESPONSIBILITY

Introduction – Approaches to Ethics – Meaning of Ethics – Major Attributes of Ethics – Business Ethics – Factors that influence Ethics – Importance of Ethics – Ethics in Management – Organisational Ethics – Ethical Aspects in Marketing – Mass Communication and Ethics – Television – Whistle blowing - Intellectual Property and Ethics – Ethical Investing – Ethics in Financial Services – Professional Ethics – Introduction – Engineering Ethics – Principles of Medical Ethics.

UNIT – III CORPORATE GOVERNANCE

Introduction – Meaning of Corporate Governance – Definitions – Significance – Importance – Nature of Corporate Governance – Features of Corporate Governance – Objectives of Corporate

Governance – Reasons for Corporate Governance Failure – Certain New Initiatives in Governance – Benefits of Corporate Governance – Consequences of Bad Governance – Requirements to Strengthen Corporate Governance – Corporate Governance Models – Global Corporate Governance Forum – Sustainability and Corporate Governance – Sustainability Reporting : Discipline, Mission, Principles and Dimensions – Corporate Governance and National Economy – Corporate Governance and Corporate Administration – Corporate Governance – Indian Experience.

UNIT – IV   SOCIAL ACCOUNTING, AUDITING AND REPORTING
Introduction - Social Accounting - Social Auditing - Corporate Social Reporting - Auditing the Social Reporting Process – Secretarial Audit – Legal Framework – Corporate Board Management – Structure and Composition of the Board – Composition of Board – Size of the Board - Powers of the Board of Directors – Responsibilities – Functions of the Board – Code of Conduct for Board Members – Effectiveness of the Board.

UNIT – V CONTRIBUTION OF NGO's TO CORPORATE SOCIAL RESPONSIBILITY
Introduction – Characteristics of an NGO – Types of NGO's – Social Welfare Schemes of the Government – United Nations Development Programme – United Nations Children's Fund. Stakeholders' perspectives of business ethics, corporate governance and CSR

REFERENCES:
1.V.Balachandran and V.Chandrasekaran, Corporate Governance, Ethics and Social Responsibility, PHI Learning Private Ltd, New Delhi , 2011
2.V.Balachandran and V.Chandrasekaran, Corporate Governance and Social Responsibility, PHI Learning Private Ltd, New Delhi , 2011
3.Parthasarathy.S, Corporate Governance: Principles, Mechanisms and Practice, Biztantra, Delhi, 2007.
4.Bajaj.P.S and Agarwal Raj, Business Ethics: An Indian Perspectives, Biztantra, Delhi, 2006.

M.Phil/Ph.D   **2015-2016**

15RMGT310	**ADVANCED ENTREPRENEURSHIP**	**4H – 4C**

Instruction Hours / week L:4   T: 0   P : 0   **Marks: Internal: External: 100   Total: 100**
                                                                   End Semester Exam: 3 Hours

Course Objectives:
- To provide theoretical foundations of entrepreneurship
- To acquaint students with the special challenges of starting new ventures and introducing new product and services ideas
- To train the students on entrepreneurial ethics and project management
- Knowledge on various sources of institutional finance
- Knowledge on project management and implementation
- To get acquaint with various categories of project and factors determining in successful completion of project

Course Outcomes:
1. To inculcate entrepreneurial skills and foster entrepreneurial development
2. Evaluate the best sources of finance suitable for financing projects
3. Categorize the financial plan considering the borrowing capacity of entrepreneurs
4. Design the project and undergo feasibility analysis to implement the project
5. Analyze the categories of project and define the role of project manager
6. Communicate effectively the promotion of entrepreneurship in building all-round industrialization

UNIT I ENTREPRENEURSHIP DEVELOPMENT: Entrepreneur – Importance – Entrepreneurship Development - its importance – Role of Entrepreneurship – Entrepreneurial Environment. Evolution of Entrepreneurs - Entrepreneurship Development and Government Assistance

UNIT II SOURCES Of FINANCE: Various sources of finance available : Long Term Sources – Equity Shares, Preference Shares and Debentures – Kinds of Private Placements – IPO – SEBI – FDI – Institutional Finance – Banks – IDBI, IFCI, IIBI, ICICI, SIDBI, SFC's in India – Short term sources – Sources of Working Capital.

UNIT III – Preparing the financing plan: General Considerations – Construction financing – Long term financing – withholding tax considerations – estimating the borrowing capacity of a project – Loan repayment parameters.

UNIT IV – Project Management : Concept of a project – Categories of a project – Project Lift Cycle – Definition of project management – Project as a conversion process – Project Environment – Complexity of Projects – Relationship between project management and line management – Current issues in project management – System approach to project management – Roles and Responsibilities of Project Manager.

UNIT V - Project Planning and Implementation : Process of Project Planning – Managing the planning process – Evaluation and project financing – Development Banking – Investment Institutions – Means of Financing – Project Financing Package – Procuring funds. Bottlenecks in

project implementation – management techniques for project management – Project Evaluation – Project Review

REFERENCES:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management" Himalaya Publishing House, New Delhi
2. Srinivasan. N. P & Gupta. G.P, "Entrepreneurial Development", Sultan Chand & Sons, New Delhi
3. Robert D. Hisrich, Michel P Peter, "Entrepreneurship Development", Tata McGraw Hill, New Delhi
4. Harvey Maylor, "Project Management", Mac Millan India Limited
5. Prasana Chandra, "Project Planning, Analysis, Selection, Implementation and Review", Tata McGraw Hill, New Delhi.

DEPARTMENT OF MATHEMATICS
FACULTY OF ARTS, SCIENCE AND HUMANITIES
RESEARCH PROGRAM – M.Phil / Ph.D Mathematics
(2015–2016 Batch and onwards)

Course code	Name of the course	Instruction hours / week	Credits	Maximum Marks (100)
Paper-I				
15RMAT101	Research Methodology and Pedagogy	4	4	100
Paper-II				
15RMAT201	Advanced Algebra and its Applications	4	4	100
15RMAT202	Differential Equations			
15RMAT203	Algebra and Mathematical Analysis			
Paper-III				
15RMAT301	Optimization Techniques	4	4	100
15RMAT302	Fuzzy Mathematics			
15RMAT303	Advanced Topics in Fluid Dynamics			
15RMAT304	Hydrodynamic and Hydromagnetic Stability			
15RMAT305	Robust Control Systems			
15RMAT306	Topology			
15RMAT307	Advanced Graph Theory			
15RMAT308	Stochastic Processes			
Program Total		**12**	**12**	**300**

M.Phil / Ph.D Mathematics   **2015-2016**

Paper-I

15RMAT101   RESEARCH METHODOLOGY AND PEDAGOGY   4H – 4C

Instruction Hours / week: L: 4   **Total Mark: 100**

End Semester Exam: 3 Hours

Course Objectives:

This course enables the students to learn
- Fundamentals of research terminology.
- The ethical principles of research, ethical challenges and approval processes.
- The quantitative, qualitative and mixed methods approaches to research.
- The components of a literature review process.
- How to critically analysed published research.
- About e-learning researches and web-based learning.

Course Outcomes (Cos):

After completing this course, the student will be able to:

1. Understand the basic framework of research process.
2. Understand the various research concepts of Implicit functions and extremum problems.
3. Know about the Oscillations of second order equation
4. Understand the basic concepts of LATEX.
5. Study about the Quality teaching and learning.
6. Acquiring the knowledge of e-learning researches and web-based learning.

UNIT – I

Research Methodology – Meaning of research, Objectives of Research, Motivation in Research – Types of Research – Research approaches – Research methods, Versus Research Methodology – Research process – Scientific method – Criteria for good research, Defining the research problem – Necessity of defining the problem – Techniques involved in defining the problem, Research Design – Meaning and need for Research Design – Features of good design – Important concepts relating to research design.

UNIT – II

Implicit functions and extremum problems: Introduction – Functions with non zeroJacobian determinant – Inverse function theorem – Implicit function theorem – Extrema of real valued functions of one variable and several variables. Rank Theorem – Determinants – Derivatives of Higher order-Differentiation of Integrals.

UNIT – III

Oscillations of second order equation-Fundamental results – Sturms comparison theorem – elementary linear oscillations – comparison theorem of Hille winter – Oscillations of $x'' + a(t)x = 0$ elementary non linear oscillations – stability of linear and non linear systems – elementary critical points – system of equations with constant co efficient – the linear equations with constant co efficient – Lyabunov stability – Stability of quasi linear systems.

UNIT– IV

LATEX: The Basics - The Document -Bibliography - Bibliographic Databases - Table of contents, Index and Glossary - Displayed Text - Rows and Columns -Typesetting Mathematics - Typesetting - Several Kinds of Boxes - The figure environment -Cross References in LATEX - Footnotes, Marginpars, and Endnotes.

UNIT– V

Objectives and roll of higher education – Important characteristics of an effective Lecture – Quality teaching and learning – Lecture preparation – Characteristics of instructional design – Method of teaching and learning: Large group – Technique – Lecture, Seminar, Symposium, Team Teaching, Project, Small group Technique – Simulation, role playing Demonstration, Brain Storing, case discussion and assignment, Methods of evaluation – Self evaluation, Student evaluation, Diagnostic testing and remedial teaching – Question banking – Electronic media in education: e-learning researches – web based learning.

REFERENCES:

- Kothari, C. R. (2004), Research Methodology, Method and Techniques, Second Edition, New age International publishers, New Delhi.

- Rudin. W, 1976 .Principles of mathematical Analysis, McGraw hill, New York.

- Earl A. Coddington, 2002, an introduction to Ordinary differential Equations, Prentice Hall of India Private limited, New Delhi. (For Unit III)

- E. Krishnan, Latex Tutorials – A primer, Indian TEX users group, Trivandrum, India, Sep 2003.

- Panneerselvam. R, (2004), Research Methodology, Prentice Hall of India, NewDelhi.

- Gupta. S. P, (2001), Statistical Methods, Sultan Chand & sons, New Delhi.

- Vedanayagam, E. G (1989), teaching Technology for college teachers, New Delhi.

- Kumar. K. L. (1997) Educational Technologies, New Delhi: New age International.

- Winkler, Anthony C. & Jo Roy McCuen (1985), writing a research paper: A Handbook, 2nd edition, Harcourt, New York.

Paper-II

15RMAT201   ADVANCED ALGEBRA AND ITS APPLICATIONS   4H – 4C

Instruction Hours / week: L: 4   **Total Mark: 100**
                                            End Semester Exam: 3 Hours

Course Objectives:

This course enables the students to learn

- The concepts of finite and algebraic extensions.
- Primitive elements and Purely inseparable extensions.
- Approximation by continuous functions
- Perturbations methods and Parametric Perturbation
- Topological preliminaries and theorems.
- The concepts of diffusion equation with sources and elementary solutions of diffusion equation.

Course Outcomes (Cos):

After completing this course, the student will be able to:

1. Understand the Field Extensions and Normal extensions.
2. Study Riesz Representation Theorem and Topological preliminaries.
3. Understand the concepts of convex functions and inequalities.
4. Know about the Asymptotic expansion and sequential convergent versus asymptotic series.
5. An understanding of the Role of co-ordinate system.
6. Know about the diffusion equation with sources, elementary solutions of diffusion equation and separation of variables.

UNIT – I
Field Extensions – Finite and algebraic extensions – Algebraic closure – Splitting fields and Normal extensions - Separable extensions – Finite fields – Primitive elements – Purely inseparable extensions.

UNIT-II
Positive Borel Measure –Riesz Representation Theorem: Topological preliminaries - Riesz Representation Theorem – Regularity properties of Borel measures – Lebesgue measure – Continuity properties of measurable functions.

UNIT-III

L^p spaces: Convex functions and inequalities – The L^p spaces – Approximation by continuous functions.

UNIT-IV

Perturbations methods – Parametric Perturbation – Algebraic equation – The Vanderpol Oscillator – Co-ordinate Perturbation – The Bessel Equation of zeroth order-simple examples – Order Symbols and Gauge function – Asymptotic expansion and sequential convergent versus asymptotic series – Non uniform expansion – Straight forwarde expansion and sources of non-uniformity – Infinite domain – Duffing equation – A model for weak nonlinear instability – A small parameter multiplying the highest derivative – A second order example – Relaxation oscillation – Type change of PDE – A simple example – The presence of singularities – Shifting Singularity – Role of co-ordinate system.

UNIT - V

Elementary solutions of one dimensional wave equation-Vibrating membranes-Applications of calculus of variations-three dimensional problems – general solutions of the wave equation – Green's function for the wave equation – Non homogeneous wave equation.The use of integral transform, the use of green's function – The diffusion equation with sources - elementary solutions of diffusion equation-Separation of variables.

REFERENCES:

- Serge Lang: Algebra (1993), Addison Wesley Publishing Company, Inc., Amsterdam.

- Walter Rudin: Real and complex analysis, 3rd edition, McGraw Hill Book Company, New York.

- Ross. S (2002): A first course in Probability, 6th edition, pearson Education, Delhi.

- Ian.N.Sneedon, Elementary partial differential equations,(1988).Tata Mcgraw Hill Ltd. (For Unit III)

Paper-II

15RMAT202   **DIFFERENTIAL EQUATIONS**   **4H – 4C**

Instruction Hours / week: L: 4   **Total Mark: 100**

End Semester Exam: 3 Hours

Course Objectives:

This course enables the students to learn
- How to solve first-order linear systems with constant coefficients.
- Create and analyze mathematical models using higher order differential equations to solve application problems.
- First order differential equations including separable, homogeneous, exact, and linear.
- The concepts of Green's Function and Sturm, Liouville problems.
- The complete solution of a differential equation with constant coefficients by variation of parameters.
- Wave equation and its applications.

Course Outcomes (Cos):

After completing this course, the student will be able to:

1. Solve first order differential equations utilizing the standard techniques for linear cases.
2. Know about the nonlinear systems.
3. Understand the concepts of Green's Function and Sturm, Liouville problems.
4. Find the complete solution of a partial differential equation.
5. Determine Green's function for Laplace's Equations.
6. Study wave equation and its applications.

UNIT – I
Linear Systems: Uncoupled Linear systems – Diagonalization – Exponentials of operators – Fundamental theorem for linear systems – Linear Systems in R2 – Complex eigen values – Multiple eigen values – Jordan forms – Stability theory – Non-homogeneous linear systems.

UNIT – II
Non Linear systems: Some preliminary concepts and definitions – The fundamental existence–uniqueness theorem – The maximal interval of existence – The flow defined by differential Equation.

UNIT – III

Green's Function and Sturm – Liouville problems: Solutions of second order linear equations – Boundary value problems and Green's function – Sturm-Liouville problems – Convergence in the mean – Integral operator with continuous symmetric kernel – Completeness of eigen functions of Sturm-Liouville problems – Non homogeneous integral equations – Properties of eigen values and eigen functions.

UNIT – IV
Partial Differential Equations : The Heat equation – Maximum Principle – Initial Value problem – Laplace Equation – Boundary value problems – Green's Identity and Uniqueness theorem - Maximum Principle – Green's function for Laplace's Equations.

UNIT – V
The Wave equation: The one-dimensional wave equation – Higher dimensions – Energy methods – Lower-order terms.

TEXT BOOKS:
- L. Perko, Differential Equations and Dynamical systems, Springer-Verlag, New-York, 1991.
- Chi Y. Lo, Boundary Value Problems, Allied-Publishers Pvt Ltd, 2003
- Robert C. McOwen, Partial Differential Equations, Pearson Education, First Indian Reprint, 2004.

REFERENCES
- Phoolan Prasad and RenukaRavindran, Partial Differential Equations, Wiley-Eastern Ltd, 1987.
- J.N. Sharma and Kehar Singh, Partial Differential Equations for Engineers and Scientists, Narosa Publishing House, New Delhi, 2001.
- W.E. Williams, Partial Differential Equations, Clarender Press, Oxford, 1980.
- Garrett Birkhoff, Gian-Carlo Rota, Ordinary Differential Equations, IV Edn.John Wiley & Sons.

M.Phil / Ph.D Mathematics	2015-2016

Paper-II

15RMAT203ALGEBRA AND MATHEMATICAL ANALYSIS   4H – 4C

Instruction Hours / week: L: 4　　　　　　　　**Total Mark: 100**
　　　　　　　　　　　　　　　　　　　　　　End Semester Exam: 3 Hours

Course Objectives:

This course enables the students to learn
- To solve systems of linear equations and application problems requiring them.
- About and work with vector spaces and subspaces.
- The basic concepts of groups and rings.
- The Structure of rings and simple and primitive rings.
- The concepts of separation theorems in the plane.
- The basic concepts of properties of the spectrum and more results on the Spectra.

Course Outcomes (Cos):

After completing this course, the student will be able to:

1. Understand the fundamental concepts of Commutative rings and Modules.
2. Know about the Structure of Rings.
3. Investigate symmetry using group theory
4. Know about the Cauchy's Integral formula.
5. Understand the concepts of Spectral results for Hilbert Space Operators.
6. Study more results on the spectra of self adjoint operators.

UNIT – I
Commutative rings and Modules : Chain Conditions – Prime and Primary Ideals – Primary Decomposition – Noetherian rings and Modules – Ring Extensions – Dedikind Domains – The Hilbert Nullstellensatz.

UNIT – II
The Structure of Rings: Simple and Primitive Rings – The Jacobson Radicals – Semi simple Rings – The Prime Radical; Prime and Semi prime Rings – Algebras – Divisions Algebras.

UNIT – III
The Fundamental Group:Homotopy of paths- The fundamental Group – Covering Spaces – The fundamental group of the circle – Retractions and fixed points – The fundamental

theorem of Algebra – The Borsuk – Ulam Theorem – Deformation   retracts and Homotopy type – The fundamental Group of S^n- Fundamental groups of some surfaces.

UNIT – IV

Separation Theorems in the plane: The Jordan Separation Theorem – Invariance of Domain- The Jordan Curve Theorem – Imbedding Graphs in the plane – The winding Number of a simple Closed curve – The Cauchy's Integral formula.

UNIT – V

Operators on Hilbert Spaces:Adjoint of an operator – Self Adjoint -Normal and unitary operator- Hilbert-Schmidi operator. Spectral results for Hilbert Space Operators - Some properties of the Spectrum- More results on the Spectra of Self Adjoint Operators.

REFERENCES:

- Thomas W.Hungerford , "Algebra", 2005 , Springer , New yark. (For Unit I & Unit II)

- James . R. Munkers , " Topology" , 2002 , Prentice Hall of India Pvt. Ltd., New Delhi.(For Unit III & Unit IV)

- Simmons. G.F. "Introduction to Topology and Modern Analysis", 1963 , Tata McGraw Hill Publishing Company, New Delhi.(For Unit – V)

		Paper-III
15RMAT301	**OPTIMIZATION TECHNIQUES**	**4H – 4C**

Instruction Hours / week: L: 4   **Total Mark: 100**
                                                             End Semester Exam: 3 Hours

Course Objectives:

This course enables the students to learn
- Fundamental concepts of optimizations methods.
- Economic interpretation of dual constraints and game theory.
- Revised Simplex Method, Parametric Linear Programming, Integer Linear Programming: Branch and Bound Method, Cutting Plane Method.
- About the Stochastic processes in Queuing and Reliability
- The concepts of Decision making.
- The Simulation Modeling and types of simulation.

Course Outcomes (Cos):
After completing this course, the student will be able to:

1. Formulate the Linear Programming Problems.
2. Study about the non linear programming.
3. Understand the concepts of Simulation Modeling.
4. Know about the Stochastic processes in Queuing and Reliability.
5. Understand the concepts of Decisions under uncertainty.
6. Study the ACO algorithm for traveling sales man problem.

UNIT-I
Linear Programming:Formulation, Simplex method,Two phase method, Simplex multipliers, Sensitivity Analysis. Duality and Post optimal Analysis: Primal and Dual relationship, Economic interpretation of duality – Additional Simplex Algorithm – Post Optimal Analysis.

UNIT -II
Non Linear Programming: Interval halving method,Fibonacci method, Pattern search method – Hooke and Jeeves method, Gradient of a function – Steepest descent method, Conjugate gradient method,Fletcher – Reeves method.

UNIT-III

Simulation Modeling: Monte Carlo Simulation – Types of Simulation – Elements of Discrete event simulation – Generation of Random numbers – Mechanics of Discrete simulation – Methods for gathering Statistical observations- Simulation languages.

UNIT-IV

Stochastic processes in Queuing and Reliability: Queuing systems general concepts - The queuing Model (M/M/1) : Steady state behavior – Transient behavior of (M/M/1) Model- Birth and death processes in Queuing Theory : Multi channel models- Non birth and death queuing processes : Bulk Queues – Network of Markovian queuing system – Non Markovian queuing Models – The model (GI / M/ 1)- The model M / G (a,b/1) – Reliability. Important properties of Laplace Transforms – Differential – difference Equations- Matrix Analysis.

UNIT-V

Decision Making: Decisions under uncertainty - under certainty and under risk - Decision trees- Expected value of perfect information and imperfect information.
Ant colony optimization: Ant's foraging behavior and optimization- Artificial ants and minimum cost paths- Traveling sales man problem - ACO algorithm for traveling sales man problem.

REFERENCES:

- Hamdy A Taha, "Operations research – An Introduction", 2002, Pearson Education, New delhi.
- Singiresu S Rao, "Engineering Optimization Theory and Practice ", 2004, New Age International.
- Kambo N S" Mathematical Programming Techniques ", 2006,East West Press,New Delhi.
- Kalyanmoy Deb, "Optimization for Engineering Design,algorithms and examples" ,2010, Prentice Hall,New Delhi.
- MarcoDorigo and Thomas Stutzle, "Ant Colony Optimization" ,2005 , Prentice Hall, New Delhi.(For Unit – V)
- J. Medhi, 'Stochastic Processes", 2004, New Age International Publishers, New Delhi.(For Unit – IV)

Paper-III

15RMAT302   **FUZZY MATHEMATICS**   **4H – 4C**

Instruction Hours / week: L: 4   **Total Mark: 100**
                                                      End Semester Exam: 3 Hours

Course Objective:

This course enables the students to learn

- The basic mathematical elements of the theory of fuzzy sets.
- Differences and similarities between fuzzy sets and classical sets theories.
- The concepts of crisp set, fuzzy logic and fuzzy graphs.
- The need of fuzzy sets, arithmetic operations on fuzzy sets,
- Fuzzy relations, Fuzzy measures, Decision making in fuzzy environments.
- How to solve problems that are appropriately solved by neural networks, fuzzy logic, and genetic algorithms.

Course Outcomes (Cos):

After completing this course, the student will be able to:

1. Understand about the concepts of fuzzy sets and fuzzy logic.
2. Acquire the knowledge on general aggregation operations.
3. Know about the fuzzy relation equation and fuzzy graphs.
4. Describe the probability measures and fuzzy measures of fuzziness.
5. Import the knowledge on the Decision making in fuzzy environments.
6. Understand decision making in fuzzy environments**.**

UNIT - I
Crisps sets and Fuzzy sets: Introduction –Crisp Sets: An overview-The notion of fuzzy sets – Basics concepts of fuzzy sets –Classical logic: An overview-Fuzzy logic.

UNIT- II
Operations on Fuzzy sets: Fuzzy complement - fuzzy union – fuzzy Intersection – combinations of operation – General Aggregation operations.

UNIT - III
Fuzzy relations and Fuzzy graphs: Crisp and fuzzy relations – Binary relations-Binary relations on a single set – Equivalence and similarity relations-Compatibility or Tolerance relations – ordering- Morphisms – Fuzzy relation equations – Fuzzy graphs.

UNIT- IV
Fuzzy Measures: Belief and Plausibility Measures – Probability Measures – Possibility and necessity measures-Relationship among classes of Fuzzy measures of Fuzziness.

UNIT- V
Decision making in fuzzy environments: Fuzzy Decisions – Fuzzy Linear programming – symmetric Fuzzy LP – Fuzzy LP with crisp objective function – Fuzzy Dynamic Programming-Fuzzy Dynamic with Crisp state Transformation Function- fuzzy multi criteria Analysis– Multi objective Decision Making(MODM) – Multi Attributive Decision making (MADM).

REFERENCES:

1. Fuzzy sets – Uncertainty and information by George J.Klir and Tina A.Folger, Prentice – Hall of India Pvt. (2006). Chapters: I, II, III & IV.

2. Fuzzy set theory and its applications – H.J.Zimmermann – Springer – Fourth Edition (2001). Chapter XIV.

Paper-III

15RMAT303   **ADVANCED TOPICS IN FLUID DYNAMICS**   **4H – 4C**

Instruction Hours / week: L: 4   **Total Mark: 100**

End Semester Exam: 3 Hours

Course Objectives:

This course enables the students to

- Understand the dynamics of fluid flows and the governing non dimensional parameters.
- Make the students to acquire the knowledge on the properties of two dimensional flow.
- Familiarize the concept of equation of motion in rotating co-ordinate system.
- Describe the main properties of the system of equations.
- Introduce the system of Magnetohydrodynamics equations and main theorems that follow from the Magnetohydrodynamics system.
- Understand the importance of fluid dynamics in diverse real life applications.

Course Outcomes (Cos):

After completing this course, the student will be able to:

1. Solve and Classify the fluids based on the physical properties of a fluid.
2. Compute correctly the kinematical properties of a fluid element.
3. Apply correctly the conservation principles of mass, linear momentum, and energy to fluid flow systems.
4. Extend the physics and mathematical properties of fluid flow by governing Navier-Stokes equations with proper boundary conditions and obtain solution.
5. Equip the student with the basic mathematical background and tools to model fluid motion.
6. Develop a physical understanding of the important aspects that govern fluid flows that can be   observed in a variety of situations in everyday life.

UNIT – I

Steady unidirectional flow – Poiseuille flow – Two dimensional flow – Paint-Brush model – unsteady unidirectional flow – Flow with circular stream lines – Flow fields in which inertia forces are negligible – Lubrication theory.

UNIT – II

Thermal boundary layer in laminar flow: Derivation of the energy equation – Temperature increase through adiabatic compression – Stagnation temperature – Theory of similarity in

heat transfer – Exact solutions for the problem of temperature distribution in a viscous flow – Boundary layer simplifications.

UNIT – III

Equation of motion in rotating co-ordinate system – Potential vorticity – vorticity equation – Ertel's theorem – Non dimensional parameters – Rossby number – Ekman number – Geostrophic flow – Taylor – Proudman theorem – Taylor coloumn.

UNIT – IV

Magnetohydrodynamics: Electrodynamics of moving media – The electromagnetic effects and the magnetic Reynolds number – Alfen's theorem – The magnetic energy – The mechanical equations – Basic equations for the incompressible MHD – Steady Laminar motion – Hartmann flow.

UNIT – V

Magnetohydrodynamic waves – waves in an infinite fluid of infinite electrical conductivity – Alfen's waves – Magnetohydrodynamic waves in a compressible fluid – Magneto acoustic waves – Slow and Fast waves – Stability – Physical concepts – Linear- Pinch – Kink – Sausage and Flute types of instability – Method of small oscillations – Jeans criterion for gravitational stability.

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Batchelor. G.K	An Introduction to Fluid Dynamics	Cambridge University Press	2000
2	Schlichting. H	Boundary – Layer Theory	Springer	2000
3	Friedlander. S	An Introduction to the Mathematical Theory of Geophysical Fluid Dynamics	Elsevier	1980
4	Ferraro .V.C.A and Plumpton. C	An Introduction to Magneto Fluid Dynamics	Oxford University	1961

Paper-III

15RMAT304   HYDRODYNAMIC AND HYDROMAGNETIC STABILITY4H – 4C

Instruction Hours / week: L: 4   **Total Mark: 100**
                                                End Semester Exam: 3 Hours

Course Objectives:
This course enables the students to
1. Learn the concept of stability of hydrodynamics systems.
2. Impart the basic knowledge of hydromagnetic systems.
3. Disseminate the importance of rotation of fluid in stability analysis.
4. Introduce the system of Magnetohydrodynamics equations and magnetohydrodynamics system.
5. Learn the Perturbation Techniques for determining the stability of superposed fluids.
6. Understand the concept of important instabilities like Rayleigh-Taylor, Kelvin-Helmholtz instability.

Course Outcomes (Cos):
After completing this course, the student will be able to:

1. Describe the fundamental principles of the motion of ideal (inviscid) and real (viscous) fluid flows.
2. Apply analytical concepts to analyze a range of two-dimensional engineering fluid flows, with appropriate choice of simplifying assumptions and boundary conditions.
3. Provide the details of the derivation of ideal and resistive Hydrodynamic equations.
4. Demonstrate the basic properties of Hydrodynamic fluids.
5. Equip to solve the fluid flow analysis electromagnetic fields.
6. Analyze the analytical technique to characterize the hydrodynamic stability.

UNIT – I
Introduction: Basic Concepts - Analysis in terms of normal modes - Non-dimensionalnumber.

UNIT – II
Benard Problem: Basic hydrodynamic equations. Boussinesq approximation.
Perturbation equations.Analysis into normal modes.Principle of exchange of stabilities.
Equations governing the marginal state. Exact solution when instability sets in as stationary convection for two free boundaries.

UNIT – III

The effect of rotation: The Perturbation equations. Analysis in terms ofnormal modes.Variational Principle for stationary convection. Solutions when instability setsin as stationary convection for two free boundaries. On the onset of convection asoverstability; the solution for the case of two free boundaries.

UNIT – IV

The effect of magnetic field: The Perturbation equations. The casewhen instability sets in as stationary convection; Avariational principle. Solutions forstationary convection and for overstability for the case of two free boundaries.

The stability of superposed fluids.

UNIT – V

(i) **Rayleigh-Taylor instability:**The Perturbation equations. Inviscidcase(the case of two uniform fluids of constant density separated by a horizontal boundary, the case of exponentially varying density). Effect of rotation.Effect of vertical magnetic field.
(ii) **The Kelvin-Helmholtz instability:** The perturbation equations, the case of two uniform fluids in relative horizontal motion separated by a horizontal boundary, the effect of rotation, the effect of horizontal magnetic field.

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Chandrasekhar. S	Hydrodynamic and Hydromagnetic Stability	Dover Publications	1981
2	Drazin. P.G and Reid. W.H	Hydrodynamic Stability	Cambridge University Press	2004

M.Phil / Ph.D Mathematics	2015-2016

		Paper-III
15RMAT305	**ROBUST CONTROL SYSTEMS**	**4H – 4C**

Instruction Hours / week: L: 4

Total Mark: 100
End Semester Exam: 3 Hours

Course Objectives:
This course enables the students to learn

- The concept of design of feedback control systems.
- The concept of robust control systems**.**
- Implementation of Digital Controllers and its applications.
- Different types of analysis in frequency domain to explain the nature of stability of the system.
- The step response analysis of second order systems.
- Time response analysis by using MATLAB.

Course Outcomes (Cos):
After completing this course, the student will be able to:

1. Understand the fundamental designs of feedback control systems.
2. Understand digital optimal control system and its applications.
3. Understand the state feedback and observer.
4. Study robust control systems and its applications.
5. Study impulse and step response analysis of second order systems.
6. Know about the Root Locus of Digital Control Systems.

UNIT I   Design of Feedback Control Systems:
Introduction- Approaches to System Design- Cascade Compensation Networks-Phase: Lead Design Using the Bode Diagram- Phase-Lead Design Using the Root Locus- System Design Using Integration Networks- Phase-Lag Design Using the Root Locus- Phase-Lag Design Using the Bode Diagram- Design on the Bode Diagram Using Analytical Methods- Systems with a Prefilter- Design for Deadbeat Response- Design Examples.

UNIT II   Design of State Variable Feedback Systems
Introduction- Controllability and Observability- Full-State Feedback Control Design- Observer Design- Integrated Full-State Feedback and Observer- Reference Inputs- Optimal Control Systems- Internal Model Design- Design Examples.

UNIT III   Robust Control Systems

Introduction- Robust Control Systems and System Sensitivity - Analysis of Robustness- Systems with Uncertain Parameters- The Design of Robust Control Systems- The Robust Internal Model Control System- Design Examples- The Pseudo- Quantitative Feedback System.

UNIT IVTIME RESPONSE ANALYSIS

Time response analysis – First Order Systems – Impulse and Step Response analysis of second order systems – Steady state errors – P, PI, PD and PID Compensation, Analysis using MATLAB

UNIT V   Digital Control Systems

Introduction- Digital Computer Control System Applications-Sampled Data Systems- The Z Transform- Closed Loop Feedback Sampled-Data Systems- Performance of a Sampled Data, Second-Order System-Closed Loop Systems with Digital Computer Compensation- The Root Locus of Digital Control Systems- Implementation of Digital Controllers-Design Examples.

REFERENCES:

* Richard C. Dorf and Robert H. Bishop, Modern Control Systems, , - Prentice Hall, July 29, 2010
* Katsuhiko Ogata , Discrete Time Control Systems., - Pearson, July 12, 1994
* Gene F. Franklin, J. David Powell and Abbas Emami, Feedback Control of Dynamic Systems Naeini, Pearson, Paperback – 1 Oct 2008
* J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007.
* M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 2nd Edition, 2002.

		Paper-III
15RMAT306	**TOPOLOGY**	**4H – 4C**

Instruction Hours / week: L: 4	**Total Mark: 100**
	End Semester Exam: 3 Hours

Course Objectives:

This course enables the students to learn

- The basics concepts and definitions of topology.
- The fundamentals of point-set topology.
- How to begin research thesis**.**
- The fundamentals of algebraic topology.
- Different types of analysis in frequency domain to explain the nature of stability of the system.
- The fundamental group and covering spaces.

Course Outcomes (Cos):

After completing this course, the student will be able to:

1. Know the definitions of standard terms in topology.
2. Understand computations in and applications of algebraic topology.
3. Work with new ideas in mathematics and separation theorem in the plane
4. Know about Fundamental Group of a Wedge of Circles.
5. Study the classification theorem and constructing compact surfaces.
6. Know about the Constructing Compact Surfaces.

UNIT-I:

The Fundamental Group: Homotopy of Paths – The Fundamental Group – Covering Spaces

UNIT-II:

The Fundamental Group: The Fundamental Theorem of Algebra – The Borsuk-Ulam Theorem – Deformation Retracts and Homotopy Type – The Fundamental Group of S_n – Fundamental Groups of Some Surfaces

UNIT-III:

Separation Theorem in the Plane : The Jordan Separation Theorem – Invariance of Domain – The Jordan Curve Theorem – Imbedding Graphs in the Plane

UNIT-IV:

The Seifert –van KampenTheorem: Direct Sums of Abelian Groups – Free Products of Groups – Free Groups – The Seifert – van Kampen Theorem – The Fundamental Group of a Wedge of Circles

UNIT-V:

Classification of Surfaces: Fundamental Groups of Surfaces – Homology of Surfaces – Cutting and Pasting – The Classification Theorem – Constructing Compact Surfaces

TEXT BOOKS:

- Topology A First Course by James R.Munkres,Prentice Hall of India PvtLtd.,New Delhi,2000
- G.F.Simmons,Introduction to topology and modern analysis,McGraw Hill Book Co.(1963)
- Chang,C.L Fuzzy topological spaces, J.Math,Anal.Appl.,(1968),182-190

REFERENCES:

- J. Dugundji,Topology,Allyn and Bacon,1966(Reprinted in India by Prentice Hall of India Private Limited)
- George F.Simmons,Introduction to Topology and Modern Analysis,McGraw Hill Book Company, 1963

M.Phil / Ph.D Mathematics   **2015-2016**

Paper-III

15RMAT307   **ADVANCED GRAPH THEORY**   **4H – 4C**

Instruction Hours / week: L: 4   **Total Mark: 100**
                                                      End Semester Exam: 3 Hours

Course Objectives:
This course enables the students to learn

- About the basic concepts and definitions of graph theory.
- The concept of an integral part of discrete mathematics and has applications in diversified areas such as Electrical Engineering, Computer science, Linguistics.
- Theoretical knowledge acquired to solve realistic problems in real life.
- The applicability of theoretical concepts to address network design problems.
- About factorizations and decompositions of graphs.
- About the Ramsey numbers.

Course Outcomes (Cos):
After completing this course, the student will be able to:

1. Express vertex and edge coloring of graphs and apply in real life situations
2. Describe embeddings, dual graphs and Kuratowski's theorem, five color theorem.
3. Illustrate decomposition and labelling of any type of graphs.
4. Calculate domination and independent domination number of a graph.
5. Explain classical Ramsey numbers and generalize the theory of Ramsey.
6. Apply the concept of domination and labeling in recent research areas.

UNIT-I:

C**oloring of Graphs** : Vertex coloring and upper bounds – Brook's Theorem – Graphs with large chromatic number – Turan's Theorem – Counting proper coloring – Edge coloring – Charecterization of line graph

UNIT-II:

Planar Graphs: Embeddings and Euler's Formula – Dual graphs – Kuratowski's Theorem – Five color theorem – Crossing number – Surface of higher genus

UNIT-III:

Decomposition and Labeling: Factorizations and Decompositions of graphs- Labeling of Graphs

UNIT-IV:

Domination: The Domination number of a graph- The Independent Domination number of a graph

UNIT-V:

Ramsey Theory: Classical Ramsey numbers- Generalized Ramsey Theory.

REFERENCES:

- G. Chartrand, L. Lesniak, Graphs and Digraphs, Chapman and Hall/CRC, New York, 1996.

- Douglas B. West, Introduction to Graph Theory, Prentice Hall of India, 2002.

- Bondy J. A. and Murty U. S. R, Graph Theory, Springer, 2008.

- Harary F, Graph Theory, Addison-Wesley Publication, 1972.

- Deo N, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India, 1974.

	Paper-III
15RMAT308 **STOCHASTIC PROCESSES**	**4H – 4C**

Instruction Hours / week: L: 4   **Total Mark: 100**

                                                          End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The mathematical theory of random variables and random processes.
- How queueing theory are used as tools and mathematical models in the study of networks.
- The theoretical concepts and techniques for solving problems that arises in practice.
- The Markovian models in reliability theory.
- Laplace transforms and its properties.
- Poisson process and related distribution.

Course Outcomes (COs)

On successful completion of the course, students will be able to:

1. Capable to expose the students to different types mathematical models with a view of random processes.
2. Understanding in the concept of Brownian motion.
3. Formulate some real-life problems into queueing models.
4. Study Poisson process, related distribution and birth and death process.
5. Understand the Poisson process and related distribution.
6. Know about Laplace transforms of a probability distribution a random variable.

UNIT-I:

Generating function – Laplace Transform **–** Laplace (stieltjes) transforms of a probability distribution a random variable – Classification of distributions.

UNIT-II

Stochastic processes – Notation – Specification – Stationery process – Markov Chains – Definition and example and higher transition probabilities.

UNIT –III

Classification of states and chains – Determination of higher transition probabilities – Stability of a Markov system - Limiting behavior.

UNIT-IV

Poisson processand related distribution – Generalization of Poisson process - Birth and Death process. Renewal processes - Renewal processes in continuous time – Renewal equation – Altering renewal processes.

UNIT- V
Reliability –Markovian models in reliability theory – Shock models and wear processes.

TEXTBOOKS

- J. Medhi, Stochastic process, New age International Private Limited publishers, 1982.

REFERENCE BOOKS

- Samuel KarlinFirst course in stochastic process, Academic press, 1975.

- Srinivasan, S. Kidambi, K. M. Mehta, Stochastic processes, 2nd edition, Tata McGraw Hill Publishing Company, New Delhi.

- SaeedGhahramani, Fundamentals of Probability with stochastic processes, 3rd edition, prentice Hall, 2005.

- Sheldon Ross, Introduction to Probability models, 9th edition, Academic press, 2007.

Paper – I: Research Methodology and Pedagogy   15RMB101

(Effective from the academic year 2015-2016 onwards)

UNIT – I (Spectroscopy and Chromatography)
Spectroscopy: Principles and instrumentation and applications of UV-Visible light spectroscopy, Spectrofluorimeter, Atomic spectroscopy, IR spectroscopy, NMR spectroscopy and MALDI-TOF. Chromatographic techniques: Principles of column chromatography. Instrumentation of Low pressure liquid chromatography (LPLC), High performance liquid chromatography (HPLC) Fast protein liquid chromatography (FPLC), Perfusion chromatography, Ion-exchange chromatography, Molecular exclusion chromatography, Affinity chromatography, Gas chromatography (GC – MS).

UNIT – II (Research design)
Research: Scope and significance – Types of Research – Research Process – Characteristics of good research – Problems in Research – Identifying research problems. Research Designs – Features of good designs. Sampling design: Meaning – Concepts – Steps in sampling – Criteria for good sample design.

UNIT – III (Sample design and analysis)
Scaling measurements – Techniques – Types of scale**.** Correlation – Meaning and definition - Scatter diagram –Karl pearson's correlation coefficient. Rank correlation. Regression: Regression in two variables – Regression coefficient problems – uses of regression. Hypothesis testing – Errors in Hypothesis testing - large sample test (Z – test) single and two tailed test, Small sample test (t – test)- Single mean-Two mean-Paired t-test, F – test, Chi–square test –Single variance-Goodness of fit, Anova – one way and two way. – CRD, RBD Designs. Thesis report writing.

UNIT – IV (Computer Applications)
Spreadsheet tool - Introduction to spreadsheet application, features and functions, using formulas and functions, data storing, features for statistical data analysis, generating charts/ graph and other features. Tools used may be Microsoft Excel, Open office or similar tool. Presentation tool - Introduction to presentation tool, features and functions, creating presentation, customizing presentation, showing presentation. Tools used may be Microsoft Power Point, Open Office or similar tool. Web Search - Introduction to internet, use of internet and WWW, using search engine like Google, Yahoo etc, using advanced search techniques.

UNIT – V (Pedagogical Methods in Higher Learning)
Historical Perspectives – Objectives and role of Higher Education – Learning and Learning Hierarchy – Information processing – Learning Events and Outcomes – Motivation. Education Evaluation: A Conceptual Framework – Methods of Evaluation – Self Evaluation and Student Evaluation in Higher Education – Question Banking – Diagnostic Testing and Remedial Teaching.

(Effective from the academic year 2015-2016 onwards)

REFERENCES:

- Boyer, R. 2006 Modern Experimental Biochemistry. 3rd Edition. Addision Wesley Longman. New Delhi.
- Wilson, K and J. Walker 2006. Principles and techniques of biochemistry and molecular
- biology, 6th Low Price Edition, Cambridge University Press, India
- David Friedfelder 2001. Physical Biochemistry. 5th Edition Oxford Publishers. New York.
- Kothari, C. R. 2005. Research Methodology-Methods and Techniques, Wiley International Ltd, UK
- S. Palanichamy and M. Manoharan 2001. Statistical methods for biologists, Palani Paramount
- Publications, Palani.
- R. Rajaram, 2008. Basic Computer Science and Communication Engineering Second Edition.
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Paper – II: Subject Paper: Recent trends in Microbiology   15RMB201
(Effective from the academic year 2015-2016 onwards)

UNIT – I (General Microbiology)

History of Microbiology, microbial groups and their taxonomic position, in relation to other living organisms. Prokaryotes and eukaryotes. Classification and nomenclature of bacteria. Structure, morphology and reproduction of bacteria, fungi, yeast, algae, protozoa, mycoplasma, rickettsiae. Viruses – structure and life cycle of bacteriophage. Microbial growth-physical conditions required for bacterial growth. Ecosystems – concepts, structure and function of major ecosystems. Types – Terrestrial, aquatic, marine. Nutrient cycles.

UNIT – II (Microbial physiology and genetics)

Structure and function of cell organelles. Fundamentals of cell organelles. Enzymes and factors affecting enzymatic reactions. Fundamentals of bioenergetics, glycolysis, Krebs cycle, oxidative phosphorylation , Anaerobic respiration, fermentation. Structure and functions of DNA and RNA. Genetic code, protein synthesis, mutations. Genetic recombination methods in bacteria-transformation transduction and conjucation. Mendelian Genetics, Basics of Molecular Genetics, Genetics Engineering and recombinant DNA technology.

UNIT – III (Medical Microbiology)

Diseases caused by microbes in humans. Collection – transportation – handling and examination of pathological specimens – methods of isolation, identification and interpretation of pathogenic organisms – Antibiotic susceptibility testing. Bacterial infections - *Staphylococcus sp., E.coli.;* Protozoan infections - *Entamoeba histolytica, Ascaris lumbricoides, Wuchereria bancrofti.;* Viral infection – *HIV, Hepatitis;* Fungal infection – *Aspergillosis.*

UNIT – IV (Environmental Microbiology)

Aquatic environment - microbiology of water - water pollution and water borne pathogens. Bacteriological examination of water, indicator organism. Microbiology of sewage - Chemical and biochemical characteristic of sewage. Methods of sewage treatment - physical screening, chemical, Biological (sludge digestion; activated sludge, aerating filters, oxidation pond)

UNIT – V (Patenting and IPR)

Patenting – fundamental requirements – multicellular organisms and its patenting. Patenting the genes, Regulating - recombinant technology, Food and food ingredients. Discrepancies in biotechnology / chemical patenting. IPR – historical perspective – recent developments – IPR in India, IPR and the rights of farmers in developing countries.

(Effective from the academic year 2015-2016 onwards)

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- Shuler, M.L. and F. Kargi 2005. Bioprocess engineering basic concepts. Pearson Education, New Delhi.

- Hugo, W.B and A.D. Russell 2007. Pharmaceutical Microbiology, 7th Edition, Publisher Blackwell Science Ltd.

- Ananthanarayanan R and C.K. Jayaram Panicker 2005. Text Book of Microbiology. 7th Edition. Orient Longman. New Delhi.

- Jawetz, E.; J.L., Melnic and E.A. Adelberg 2001. Review of Medical Microbiology. 22nd Edition Lange Medical Publishers, New York.

- Glick,B.K and Pasternak,J.J. 2003. Molecular Biotechnology: Principles and applications of recombinant DNA" 3rd Edition. ASM Press, Washington

- Jagadish Chander. 1996. A Text book of medical Mycology. Interprint, New Delhi

- Parija, S, C. 1996. Text Book of Medical Parasitology, Orient Longmans, Chennai, India.

Paper – III: Special Paper I: Industrial and Pharmaceutical Microbiology   15RMB301
(Effective from the academic year 2015-2016 onwards)

UNIT – I
History and chronological development of industrial microbiology. Industrially important strains – Isolation and preservation. Inoculum development for various fermentation processes. Strain development – mutation, recombinant DNA technology and protoplast fusion

UNIT – II
Fermentation – submerged and solid state fermentation. Types of fermentors (Tower, cylindroconical and airlift) – batch fermentation – continuous fermentation. Downstream process – intracellular and extracellular product separation. Liquid extraction, precipitation and floatation.

UNIT – III
Production of beverages: beer and wine, Vitamin: B12 and riboflavin, Antibiotics: penicillin and streptomycin, Production of enzymes: amylase and proteases. Free cell immobilization and enzyme immobilization techniques. Production of Single cell protein – bakers yeast, spirulina, red algae.

UNIT – IV
Clinical uses of antimicrobial drugs, Microbial spoilage and preservation of pharmaceutical products, Sterilization of pharmaceutical products, Applications of microorganism in the pharmaceutical sciences

UNIT – V
Role of precursors and steering agents in production of antibiotics, vitamins and enzymes. Antiseptics-disinfectants - preparation, standardization. Quality control of Pharmaceutical products – Injectables, IV fluids and pyrogen testing.

References
- Patel, A.H. 2003. Industrial microbiology, Macmillan India Ltd. New Delhi
- Prescott and Dunn's 1983. Industrial microbiology, CBS Publishers, New Delhi
- Stanbury, P.T. and A. Whitaker 2005. Principles of Fermentation Technology, Pergamon Press, NY
- Atlas R.N and R. Bartha 2007. Microbial Ecology-Fundamental and Applications. 4th Edition. Redwood City CA. Benjamin/Cumming Science Publishing Co., New Delhi
- Michael J Waites 2007. Industrial microbiology, Blackwell publishing.UK
- Mansi, E.M.T. and C.F.A. Bryce 2000. Fermentation Microbiology and Biotechnology, Taylor and Francis, New York.
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- Hugo, W.B. and A.D. Russell 2007. Pharmaceutical Microbiology, 7th Edition, Blackwell Science Ltd, Oxford

Paper – III: Special Paper II: Immunotechnology and Biotechnology 15RMB302
(Effective from the academic year 2015-2016 onwards)

UNIT – I

Cells and Organs of immune system, T / B cell – maturation, activation – receptor, Cytokines – structure and fuctions, Antigen – Structure and chemical make-up, Immunoglobulin – structure - Organization and expression of Immunoglobulin genes, Purification of antigens and immunoglobulins., MHC – structure and functions, HLA tissue typing,

UNIT – II

Antigens - Antibody reactions, *In vitro* methods – Agglutination – Passive and reverse passive agglutination, Precipitation – reactions in gels – Immuno diffusion – Counter immuno electrophoresis, Complement fixation test, Immunofluorescence, ELISA, RIA, Immuno electron microscopy, Forensic serology.

UNIT – III

Introduction to genetic engineering, Restriction enzymes – types and nomenclature - classification – and uses, Cloning Vectors – types of vectors, Prokaryotic hosts: *E. coli*, Eukaryotic hosts: Yeast cell. Gene cloning - construction of cDNA and genomic libraries - selection and screening method of recombinants - Screening of recombinants for Site directed Mutagenesis by SSCP, heteroduplex analysis.

UNIT – IV

Isolation of DNA and RNA – Handling and quantification of nucleic acids, radiolabelling and non radiolabelling of nucleic acids, Gel electrophoresis - Blotting techniques, Hybridization and heteroduplex analysis, Molecular diagnostics of genetic disease using PCR / OLA, DNA diagnostic system in forensic sciences.

UNIT – V

Genetic engineering of plants and animals: Gene transfer techniques into plant and animal cell. Plants as tool for recombinant protein production; Development and use of transgenic animals; transgenic mice – methodology and applications. Ethical issues of gene cloning.

(Effective from the academic year 2015-2016 onwards)

REFERENCES

- Richard A. Goldsby, Thomas J.Kindt. Barbara A. Osborne 2000. Kuby Immunology. 5th Edition. W.H. Freeman and Company, New York.

- Frank C. Hay and Olwyn M.R. Westwood 2002. Practical Immunology. 4th Edition, Blackwell Science Ltd. Oxford.

- Roitt, I.M. Brostaff, J.J. and D.K. Male 2000. Immunology. 6th Edition. C.V. Mosby Publishers. St. Louis.

- Winnacker, E.L. 2003. From genes to clones. Introduction to Gene Technology.1st Edition VCH. Weinhein.

- Brown, T.A. 2006. Gene Cloning and DNA analysis; An Introduction. 5th Edition. Blackwell Publishing, UK

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- Old, R.M and S.B. Primrose 2003. Principles of Gene manipulation. 6th Edition. Blackwell Scientific Publication. London.

- Watson, J.D., M. Gilman, J. Wikowski 2001. Recombinant DNA. 2nd Edition. Scientific American Books. W.H. Freeman & Co. NY.

Paper III Special Paper III: Virology   15RMB303
(Effect from the academic year 2015-2016 onwards)

UNIT -I

History of Virology, Brief outline of virology: discovery of virus, General properties of viruses, Classification of viruses, Preservation of viruses, & Cultivation of viruses.

UNIT -II

Viruses & Human diseases: DNA viruses: Pox virus, Herpes virus, adenovirus. Papova virus, Hepadna virus, Pathogenesis & Laboratory diagnosis.

UNIT -III

Viruses & Human diseases: RNA viruses: Orthomyxo viruses, Paramyxo viruses, Influenzae and other arthropod born viruses, Retroviridae.

UNIT - IV

Virus – Host interaction, immunity to viral diseases. Antiviral agents and Viral Vaccines. Immunization Schedules.

UNIT -V

Epidemiology and Laboratory diagnosis of viruses: Electron microscopy, molecular and sero diagnosis of viral infections, PCR; Sequencing & genotyping.

(Effective from the academic year 2015-2016 onwards)

REFERENCES

- Review of Medical Microbiology: Jawetz & Melnick -21st Edn. (2000) Lange Medical Publications.

- Medical Virology – Morag C, and Timby M.C. X Edition (1994) Churchill Livingstone, London.

- Introduction to Modern Virology – Dimmock N.J. Primrose SB. IV Edition (1994). Blackwell Scientific Publications, Oxford.

- Virology – Contrat H.F. Kimball PC and Levy JA. IIIrd Edition. (1994). Prentice Hall, Englewood cliff, New Jersy.

- Bacteriophages – Calender R. Vol.I, II and III. (1988). Plenum Press.

- Principles of Bacteriology, Virology and Immunology – Topley & Wilson's (1995). Edward Arnold, London.

- Diagnostic Procedures for viral and Ricketsial diseases – Lennetter EH. (1984). American Public Health Association. N.Y.

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- Clinical Virology -2nd Edition 2002, Doughlas D Richman (Edn.) ASM Press.

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- Principles of Molecular Virology, 1997. 2nd ed. A.Cann. Academic Press.

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- Jawetz E, Melnick J.L, Adelberg E.A. (1998). Review of Medical Microbiology, 19th edition. Lange Medical Publication. ELBS, London.

Paper – III: Special Paper IV: Medical Microbiology   **15RMB304**

(Effective from the academic year 2015-2016 onwards)

UNIT – I

Laboratory precaution and guidelines – collection – transportation – handling and examination of pathological specimens – methods of isolation, identification and interpretation of pathogenic organisms – Antibiotic susceptibility testing. Infections – types – methods – Infectious disease cycle. Quality control in microbiology lab and automation in medical microbiology.

UNIT – II

Gram positive organisms: Morphology, cultural characteristics, antigenic property, pathogenecity, laboratory diagnosis and Treatment. *Staphylococcus* sp., *Streptococcus* sp., *Bacillus* sp., *Corynebacterium* sp., *Clostridium* sp. and *Mycobacterium* sp.

UNIT – III

Gram negative organisms: Morphology, cultural characteristics, antigenic property, pathogenecity, laboratory diagnosis and Treatment. *E.coli, Klebsiella* sp., *Proteus* sp., *Pseudomona*s sp., *Vibrio* sp., *Salmonella* sp., *Shigella* sp., *Treponema* sp., *Neisseria* sp. and *Haemophilus* sp.

UNIT – IV

Superficial mycosis - Pityriasis versicolor, Tinea nigra, piedra. Cutaneous mycosis Dermatophytes. Systemic mycosis - Coccidiomycosis - Blastomycosis – Histoplasmosis. Opportunistic mycosis, Candidosis, Aspergillosis, Zygomycosis. Subcutaneous mycosis – Sporotrichosis, Chromoblastomycosis and Mycetoma.

UNIT – V

Protozoan infections - *Entamoeba histolytica, Plasmodium vivax, Plasmodium falciparum, Giardia intestinalis, Trichomonas vaginalis, Taenia solium*. Trematodes - *Fasciola hepatica, Schistosoma haematobium*, Nematodes - *Trichuris trichiura, Ascaris lumbricoides*, and *Wuchereria Bancrofti*.

(Effective from the academic year 2015-2016 onwards)

REFERENCES

- Ananthanarayanan, R. and C.K.J. Panicker, 2005. Text Book of Microbiology 7th Edition. Orient Longman, New Delhi.

- Brook,G.F., J. S. Butel, A. Stephen and Morse, 2003. Medical Microbiology, 22nd Edition. Mc Graw Hill.

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M.Phil. / Ph.D. Physics

SYLLABUS

(Effective from the Academic year 2015 – 2016 and onwards)

DEPARTMENT OF PHYSICS

KARPAGAM ACADEMY OF HIGHER EDUCATION

(**Deemed to be University Established Under Section 3 of UGC Act, 1956**)
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DEPARTMENT OF PHYSICS
FACULTY OF ARTS, SCIENCE & HUMANITIES
RESEARCH PROGRAM – M.Phil / Ph.D in PHYSICS
(2015–2016 Batch and onwards)

S. No.	Course	Course code	Title of the course
01	Paper - 1	15RPHY101	Research Methodology and Pedagogy
02	Paper – 2	15RPHY201	Advanced Physics
03	Paper – 3 (Special paper)	15RPHY301	Solar Energy and Utilization
		15RPHY302	Molecular Spectroscopy
		15RPHY303	Thin Film Physics
		15RPHY304	Crystal Growth
		15RPHY305	Cosmic Ray Astrophysics
		15RPHY306	Material Science
		15RPHY307	Concepts of Nanophysics and Nanotechnology

PAPER – I: Research Methodology & Pedagogy (15RPHY101)
(Effective from the academic year 2015 – 2016 onwards)

Course Objectives
- To develop a research orientation among the scholars and to acquaint them with fundamentals of research methods.
- To develop understanding of the basic framework of research process.
- To develop an understanding of various research designs and techniques.
- To identify various sources of information for literature review and data collection.
- To develop an understanding of the ethical dimensions of conducting applied research.
- Appreciate the components of scholarly writing and evaluate its quality.

Course Outcomes
Upon completing this course, each scholar will be able to:
1. demonstrate knowledge of research processes (reading, evaluating, and developing)
2. perform literature reviews using print and online databases
3. identify, explain, compare, and prepare the key elements of a research proposal/report
4. define and develop a possible higher education research interest area using specific research designs;
5. compare and contrast quantitative and qualitative research paradigms, and explain the use of each in higher education research;
6. describe sampling methods, measurement scales and instruments, and appropriate uses of each explain the rationale for research ethics, and the importance of and local processes for Institutional Review.

Unit – I
Ethics of Research – Objectives of Research – Historical Background of Physics Research – Research Works of Sir C.V. Raman, S.Chandrasekhar and Venkaraman Ramakrishnan (Nobel prize works only) (Nobel Lectures) – Experimental Research in Physics – Design of the experiment, Apparatus to be used, Results and Interpretation – Theoretical Research in Physics – Theory, Models, Methods to solve the problems, results and Interpretation – Literature Survey on Thesis Writing – Online literature survey – Science Citation Index – Impact factor of a journal – Thesis writing.

Unit – II
Probability distributions
Mean, Median peak value, and Standard Deviation – Binomial Distribution – Poisson Distribution – Gaussian or Normal Error Distribution – Modes of distributions.
Error Analysis
Instrumental and Statistical uncertainties – Propagation of errors – Estimation of means and errors – Method of least squares – Statistical fluctuations – Chi square test of a distribution

Unit–III

Numerical Integration: Trapezoidal and Simpson's 1/3 rule for single integrals - Error estimates - Trapezoidal and Simpson's rule for double integrals

Interpolation: Two points Gaussian quadrature - Three points Gaussian quadrature - Cubic spline interpolation

Eigen values: Power method - Jacobi method (Only 2 x 2 and 3 x 3 matrices)

Simulation techniques: Monte Carlo simulation – Fuzzy logic.

Unit IV

Computer Applications in Physics Research

Programming in C: Constants - Variables - Data types - Operators and Expressions - Input/Output Statements - Control statements - Functions - Arrays - One, two, multidimensional array declarations and initializations

Simple applications using C - Program: Program to integrate tabulated function using Trapezoidal rule - Program to integrate tabulated function using Simpson's 1/3 rule -Program to compute the solution of first order differential equation of the type $y' = f(x,y)$ using RK4 method - Program to compute first order differential equation $y' = f(x,y)$ using Milne's method - Program to compute the interpolation value at a specified value from a set of table points using natural cubic spline interpolation.

Unit V

Pedagogical Methods in Higher Learning

Historical perspectives: Objectives and role of higher education – Learning and learning hierarchy – Information processing – Learning and outcomes – Motivation.

Education evaluation: A conceptual framework – Methods of evaluation – Self evaluation and student evaluation in higher education – Question banking – Diagnostic testing and remedial teaching.

References

1. E.Balagurusamy - Numerical methods , Tata McGraw Hill Publishing company Limited
2. Nye, J.F. (1985). Physical Properties of Crystals: Their Representation by Tensors and Matrices. Oxford University Press, New York.
3. P.Kandasamy - Numerical methods, K.Thilgavathy and K.Gunavathi, S.Chand and company limited
4. Bevington Philip, Robinson D. Keith – Data Reduction and Error Analysis for Physical Sciences, Mc Graw Hill Higher Education.

PAPER – II: Subject Paper : Advanced Physics (15RPHY201)
(Effective from the academic year 2015 – 2016 onwards)

Course Objectives
- To convey the scholars some of the concepts of higher levels of physics
- To prepare them for research in advanced physical fields.
- To introduce the concept of advanced concepts of quantum mechanics
- To teach scholars some of the basic concepts of experimental methods of physics in research
- To prepare them for research in advanced fields of experimental physics.
- To prepare and specialize them in the relevant areas of research, development and applications.

Course Outcomes
After attending the course the scholars will understand the
1. some of the advanced concepts of Electrodynamics, quantum mechanics, condensed matter physics, Spectroscopy and mathematical physics, likely to be useful in forefront areas of research.
2. conversant with the concepts of scattering theory, relativistic quantum mechanics and the idea of quantum field theory.
3. some of the fundamental and higher level concepts of measurement and characterization techniques likely to be useful especially in forefront areas of experimental research.
4. acquainted with the basic theoretical knowledge that explains various phenomena of condensed matter such as superconductivity, fractional Hall effect etc.
5. Explain various types of magnetic phenomenon, physics behind them, their properties and applications.
6. Apply integral transform (Fourier and Laplace) to solve mathematical problems of Fourier transforms as an aid for analyzing experimental data.

Unit – I
Maxwell's equations: Magnetic field of a spherically symmetric current - A traveling field - The speed of light - Solving Maxwell's equations; the potentials and wave equation - Maxwell's equations for waves in free space, plane waves - Three dimensional waves - Spherical waves - Maxwell's equations for light and electromagnetic waves - Spherical waves from a point source - The fields of an oscillating dipole - The potentials of a moving charge - The potentials for a moving charge with constant velocity

Unit – II
Quantum behaviour
Atomic Collision and Backscattering Spectrometry: – Energy loss of Light Ions and Backscattering Depth Profiles – Sputter Depth Profile and Secondary Ion Mass Spectroscopy – Channeling: Basics and its application in Thin Film analysis - X-ray Photoelectron Spectroscopy – Electron Microprobe analysis of surface – Non-radiative Transitions and Auger Electron Spectroscopy.

Unit – III
Spectroscopic Techniques

Spectrophotometer – UV –VIS Near IR, - Basic concepts of FTIR and Raman and its applications to various materials - NMR and ESR and its applications – Thermal analysis (TG/DTA, DSC) of different Materials.

The Bragg Law – X-ray Spectroscopy – Diffraction Directions – Diffraction Methods – Powder Method – Particle size Calculation – X-ray scattering by electrons, atomic and unit cells.

Unit – IV
Crystal Physics and Physical Properties of Crystals

Representation of physical quantities by scalars, vectors and tensors – Tensors of second rank-Transformations of components of a second-rank tensor – Representation quadric – Simplification of equations referred to principal axes – Effect of crystal symmetry on crystal properties: Neumann's principle – Magnitude of a property in a given direction – Geometrical properties of the representation quadric – Equilibrium properties represented by second-rank tensor:

Properties of metallic and semiconducting Nanoparticles – various physical and chemical methods of preparation - synthesis of carbon nanostructures and their applications

Unit V
Ordinary differential equations

Runge-kutta IVth order method for first order differential equation – RK4 for simultaneous first order differential equations – RK4 method for second order differential equations – Milne's Predictor – Corrector method

Partial differential equations

Difference quotients – Graphical representation of partial quotients – Classification of PDE of the second order – Elliptic equations – Standard five point formula – Diagonal five-point formula – Solution of Laplace's equation by Liebmann's iteration.

References

1. Amnon Yariv (1975). Quantum Electronics (Chapter-14). John Wiley & Sons, Inc., New York.
2. Banwell. Fundamentals of Molecular Spectroscopy.
3. Chang Raymond. Basic Principles of Spectroscopy. McGraw Hill International book company
4. Cullity, B.D. Elements of X-Ray Diffraction (Second Edition)
5. Guozhong Cao. Nanostructures & Nanomaterials Synthesis, Properties and Applications. World Scientific Publishing.
6. Laud , B.B. (1985). Lasers and Non-Linear Optics (Chapter-13). Wiley Eastern Ltd.
7. Leonard C. Feldman and James W. Mayer. Fundamentals of surface and thin film analysis
8. Nye,J.F. (1985), Physical Properties of Crystals: Their Representation by Tensors and Matrices, Oxford University Press, New York.
9. Pool, C.P. Jr. and Owens, F.J. Introduction to Nanotechnology. John Wiley & Sons.

PAPER – III : Special Paper I : Solar Energy and its Utilization (15RPHY301)
(Effective from the academic year 2015 – 2016 onwards)

Course Objectives
- Solar energy harvesting and utilizing for day to day purposes has become order of the day. The scarcity and increasing need of the fossil fuel has made man to think about alternate sources, the easiest and best being Solar energy. Hence the course introduced to get knowledge of solar energy and its utilization.
- To introduce the students to the world of solar energy, its different uses, the different methods of harvesting solar energy.
- To understand the basic concepts of energies produced from various energy sources, advantages and disadvantages
- To learn the present energy scenario and the need for energy conservation
- To facilitate the students to achieve a clear conceptual understanding of technical and commercial aspects of Solar Power Development and Management.
- To enable the students to develop managerial skills to assess feasibility of alternative approaches and drive strategies regarding Solar Power Development and Management.

Course Outcomes (COs)
At the end of the course, Students will / can be able to
1. Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations.
2. Know the need of renewable energy resources, historical and latest developments
3. explain the principles that underlie the ability of various natural phenomena to deliver solar energy
4. outline the technologies that are used to harness the power of solar energy
5. Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc
6. Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.

UNIT - 1: Radiation Geometry
Basis earth sun angles - Determination of Solar time - Derived Solar angles - Day length - Solar Radiation measurements - selective surfaces - Heat balance energy lost by radiation, convection and conduction - Physical characteristics of selective surfaces - Anti reflection coatings - Solar reflector materials - production methods of coatings.

UNIT - II: Fundamentals of Heat Transfer
Transfer of Heat by Conduction: Study heat flow in a slab-steady heat flow in a cylindrical shell-Heat transfer through fins – Transient heat conduction. Thermal Radiation: Basic laws of radiation –

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Radiant heat transfer between two black bodies- Radiant heat transfer between grey bodies. Convention heat loss Evaluation of convective heat transfer co-efficient –Free convection from vertical planes and cylinders – Forced convection – Heat transfer for fully established flow in tubes.

UNIT-III: Solar Thermal systems

General description of plate collector – thermal losses and efficiency of FPC –Energy balance equation – Evaluation of overall loss coefficient – Thermal analysis of flat plate collector and useful heat gained by the fluid performance of solar air heaters – Heating and drying of agricultural products Types of drier in use.
Solar concentrators and Receiver geometries – General characteristics of focusing collector systems Evaluation of optical losses – Thermal performance of focusing collectors.

UNIT-IV: Photovoltaics

Description of the photovoltaic effect – Electrical characteristics calibration and efficiency measurement – silicon solar energy converters – Thermal generation of recombination centers silicon. Role of thin films in solar cells Properties of thin films for solar ells CdSe, CdTe, In P, Ga As, Cd Cu2, Cu In SnO2, Cd2SnO4 ZnO)- Transport properties of metal films – poly crystalline film silicon solar cells (Photovoltaic characteristics, junction analysis loss mechanisms) Amorphous silicon solar cells (Structural compositional optical and electrical properties)

Unit- V: Energy storage and solar applications

Types of energy storage Thermal storage Latent heat storage – Electrical storage principle of operation of solar ponds-Non convective solar ponds – Theoretical analysis of solar pond – solar distillation – solar cooking –solar pumping.

References:

1.   Charles E. Backus (1976). Solar cells. IEEE Press
2.   Garg, H.P. (1982). Treatise on solar energy volume I fundamentals of Solar Energy.
3.   Kasturi Lal Chopra and Suhit Ranjan Das (1983). Thin film solar cells.
4.   Rai, G.D. (1996). Solar energy utilization.
5.   Rai, G.D.Thermal performances testing of FPC and CPC

PAPER – III: Special Paper II. Molecular Spectroscopy (15RPHY302)
(Effective from the academic year 2015 – 2016 onwards)

Course Objectives
- This paper gives an insight into the theoretical and practical aspects of spectroscopy.
- It is used as a tool for non-destructive testing of samples.
- It is important to know the physical aspects of spectroscopy.
- The major objectives of this course are to integrate theory and practice and to bring together different branches of both Academic studies and Industrial Research through the presentation of critical aspects of modern Spectroscopy.
- To give an understanding of wide range of techniques including optical Nearfield spectroscopy, Raman, and FTIR spectroscopy.
- To introduce electronic spectroscopy methods that are widely used in physics, chemistry and biological sciences.

Course Outcomes (COs)
After completing the course the students will / can able to
1. Understand the basic physical chemistry law that govern molecular spectroscopy
2. Describe the basic concepts of crystal field theory.
3. According to crystal field theory examines simple molecules.
4. Defines the basic concepts of molecular orbital theory.
5. According to molecular orbital theory examines simple molecules.
6. Identify the types of radiation in the atomic and molecular electronics.

UNIT – I: Molecular Symmetry
Symmetry operation – symmetry elements – Different type of symmetry operations – symmetry point groups – Linear and non linear molecules – Representations of groups - Irreducible Representations and character – and character tables.

UNIT – II: Molecular Orbital theory
General principles – the LACO approximation – the Huckel approximation – Bonding character of orbitals - symmetry factoring of secular equations – Transformation properties of Atomic orbitals – Hybridization schemes of and orbitals Hybrid orbitals as linear combinations of Atomic orbitals – Valence Bond and Molecular orbital theory - Brief description of Hartree-Fock theory and Density functional theory

UNIT – III: Molecular Vibrations
The symmetry of Normal vibrations – Determining the symmetry types of the Normal mode – Internal coordinates – symmetry coordinates - Normal coordinates – potential and kinetic energies in terms of symmetry coordinates – removal of redundant coordinates – application of group theory of Raman and IR activity.

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UNIT – IV: Infrared And Raman Spectroscopy
IR spectroscopy: Practical aspects – Theory of I.R rotation vibration spectra of gaseous diatomic molecules – applications of I.R spectroscopy – Principles of F.T.I.R spectroscopy – FTIR instrumentation – Interpretation of data.

Raman spectroscopy: Classical and Quantum theory of Raman effect - Rotation vibration Raman spectra of diatomic and polyatomic molecules – Applications - Laser Raman spectroscopy – Sample handling techniques – Polarized Raman spectra of single crystals – Fundamentals of Surface Enhanced Raman Scattering (SERS)

UNIT - V:. **Electronic Spectra - Fluorescence and Phosphorescence Spectroscopy**
Electronic excitation of diatomic species - Resonance and Normal Fluorescence – Intensities of transitions - Phosphorescence population of triplet state and intensity- Experimental methods - Applications of Fluorescence and phosphorescence – UV spectrophotometry.

References
1.   Chandra, A.K. Quantum chemistry.
2.   Aruldhas, G. (2008). Molecular Structure and Spectroscopy. Pergamon Press, New Delhi.
3.   Cotton, F.A. Chemical applications of group theory. Wiley Inter science.
4.   Herzberg. Infra red Raman spectroscopy.
5.   Puranik, P.G. Group theory application to molecular vibrations.
6.   People, J.A. and Segai, G.A. (1965). Approximate self–consistent molecular orbital theory I. Calculations with complete neglect of Differential over lap. J . Che . Phy . Vol.43.
7.   People, J.A. and Segai, G.A. (1965). Approximate self–consistent molecular orbital theory II. Calculations with complete Neglect of Differential over lap. J Che. Phy .Vol. 43 No .10.
8.   People, J.A. and Segai, G.A. (1965). Approximate self–consistent molecular orbital theory III CNDD Results for AB-2 and AB,3 Systems .
9.   Santry, D.P. and Segai, G.A. (1967). Approximate self – consistent molecular orbital theory IV. Calculations on Molecules including the Elements sodium through chlorine. J. Chem. . phys . vol. 47 – 158 – 174.
10.   Segai, G.A. (1967) Calculation of Equilibrium bond lengths by the CNDO method. J.Chem.Phys . vol. 47 . 1876 – 1877.
11.   Wioson, E.B. Cross. Molecular vibrations.

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PAPER – III: Special Paper III. Thin Film Physics (15RPHY303)
(Effective from the academic year 2015 – 2016 onwards)

Course Objectives
- Introduce physical concepts and mathematical tools used to describe surfaces, interfaces and thin films.
- To develop an intuition for surface and thin film physical principles through plotting of functions using Maple
- To relate the mathematical results to practical applications and experiments in thin film techniques.
- Develop an appreciation of the mathematical basis for experimental techniques for deposition and analysis of thin films
- Understand physical phenomena that can be exploited for the deposition of thin films
- To demonstrate knowledge of different thin film deposition strategies

Course Outcomes (COs)
At the end of the course, the students can/will be able to
1. Discuss the differences and similarities between different vacuum based deposition techniques
2. Evaluate and use models for nucleating and growth of thin films
3. Examine the relation between deposition technique, film structure, and film properties, discuss typical thin film applications,
4. Select proper deposition techniques for various applications.
5. Understand the basic concepts about the thin film technology
6. The importance of use of thin films in application and research.

UNIT - I: Preparation of Thin Films
Spray pyrolytic process – characteristic feature of the spray pyrolytic process – ion plating – Vacuum evaporation – Evaporation theory – The construction and use of vapour sources – sputtering Methods of sputtering – Reactive sputtering – RF sputtering - DC planar magnetron sputtering.

UNIT - II: Thickness measurement and Nucleation and Growth in Thin Film
Thickness measurement: electrical methods – optical interference methods – multiple beam interferometry – Fizeau – FECO methods – Quartz crystal thickness monitor.
Theories of thin film nucleation – Four stages of film growth incorporation of defects during growth.

UNIT - III: Electrical properties of metallic thin films
Sources of resistivity in metallic conductors – sheet resistance - Temperature coefficient of resistance (TCR) – influence of thickness on resistivity – Hall effect and magneto resistance – Annealing – Agglomeration and oxidation.

UNIT - IV: Transport properties of semiconducting and insulating Films

Semiconducting films; Theoretical considerations - Experimental results – Photoconduction – Field effect thin films – transistors, Insulation films Dielectric properties – dielectric losses – Ohmic contracts – Metal – Insulator and Metal – metal contacts – DC and AC conduction mechanism .

UNIT - V: Optical properties of thin films and thin films solar cells

Thin films optics –Theory – Optical constants of thin films – Experimental techniques – Multilayer optical system – interference filers – Antireflection coating, thin films solar cells: Role, Progress, and production of thin solar cells – Photovoltaic parameter, thin film silicon (Poly crystalline) solar cells : current status of bulk silicon solar cells – Fabrication technology – Photo voltaic performance: Emerging solar cells: GaAs and CulnSe$_2$.

Reference:

1.   Anderson, J.C. The use of thin films in physical investigation.
2.   Berry, Koil and Harris. Thin films technology.
3.   Chopra, K.L. Thin film Phenomena.
4.   Chopra, K.L. and Das, S.R. Thin films solar cells.
5.   George Hass and others (Ed). Physics of thin films, vol. 12.
6.   Holland, L. Vacuum deposition of thin films.
7.   Maissel, L.I. and Clang, R. Hand book of Thin films Technology.
8.   Vilsan, J.L. Thin films processes.

PAPER – III: Special Paper IV: Crystal Growth (15RPHY304)
(Effective from the academic year 2015 – 2016 onwards)

Course Objectives
- To strengthen the students with crystallographic and crystal growth techniques
- To provide the general characteristics of crystals, methods of preparation etc.
- Various thin films deposition techniques and thin film characterization techniques are also covered in the course.
- To give an idea about historical importance of crystals, methods of preparation and characterization of crystals etc.
- To explore the knowledge in fundamentals of materials syntheses, crystal growth techniques, zone refining, properties etc.,
- To provide the basic knowledge on crystal structure.

Course Outcomes (COs)
After completing the course the students will / can able to
1. The student will learn about the crystal growth mechanisms and techniques.
2. Understand different crystals having a lot applications in electronics, energetics etc.
3. Acquire the theoretical concept behind electrical and thermal properties of metals
4. Understand the fundamental theories to describe the energy bands in metals
5. Gain the knowledge about Semiconductor Crystals and their properties
6. Gain the knowledge about phonons and its importance in thermal physics

Unit – I: Fundamentals of Crystal Growth
Importance of crystal growth – Classification of crystal growth methods – Basic steps: Generation, transport and adsorption of growth reactants – Nucleation: Kinds of nucleation –Classical theory of nucleation: Gibbs Thomson equations for vapour and solution – Kinetic theory of nucleation – Becker and Doring concept on nucleation rate – Energy of formation of a spherical nucleus – Statistical theory on nucleation: Equilibrium concentration of critical nuclei, Free energy of formation.

Unit – II Theories of Crystal Growth
An introductory note to Surface energy theory, Diffusion theory and Adsorption layer theory – Concepts of Volmer theory, Bravais theory, Kossel theory and Stranski's treatment – Two-dimensional nucleation theory: Free energy of formation, Possible shapes and Rate of nucleation – Mononuclear, Polynuclear and Birth and Spread models – Modified Birth and Spread model – Crystal growth by mass transfer processes: Burton, Cabrera and Frank (BCF) bulk diffusion model, Surface diffusion growth theory.

Unit – III Experimental Crystal Growth-Part-I: Melt Growth Techniques.
Basics of melt growth – Heat and mass transfer – Conservative growth processes: Bridgman-Stockbarger method – Czochralski pulling method – Kyropolous method – Nonconservative processes: Zone-refining – Vertical and horizontal float zone methods – Skull melting method – Vernueil flame fusion method.

Unit – IV Experimental Crystal Growth-Part-II: Solution Growth Techniques.
Growth from low temperature solutions: Selection of solvents and solubility – Meir's solubility diagram – Saturation and supersaturation – Metastable zone width – Growth by
restricted evaporation of solvent, slow cooling of solution and temperature gradient methods– Crystal growth in Gel media: Chemical reaction and solubility reduction methods – Growth from high temperature solutions: Flux growth Principles of flux method – Choice of flux – Growth by slow evaporation and slow cooling methods – Hydrothermal growth method.

Unit –V Experimental Crystal Growth-Part-III: Vapour Growth Techniques
Basic principles – Physical Vapour Deposition (PVD): Vapour phase crystallization in a
closed system – Gas flow crystallization – Chemical Vapour Deposition (CVD): Advantageous and disadvantageous – Growth by chemical vapour transport reaction: Transporting agents, Sealed capsule method, Open flow systems – Temperature variation
method: Stationary temperature profile, Linearly time varying temperature profile and Oscillatory temperature profile.

Books for Study and Reference
1.   Brice, J.C. (1986). Crystal Growth Processes.   John Wiley and Sons, New York.
2.   Mullin, J.W. (2004), Crystallization. Elsevier Butterworth-Heinemann, London.
3.   Pamplin, B.R. (1975). Crystal Growth. Pergamon Press, Oxford.
4.   Sunagawa Ichiro. (2005). Crystals: Growth, Morphology and Perfection. Cambridge University Press, Cambridge.
5.   Vere, A.W. (1987). Crystal Growth: Principles and Progress. Plenum Press, New York.

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PAPER – III: Special Paper V: Cosmic Ray Astrophysics (15RPHY305)
(Effective from the academic year 2015 – 2016 onwards)

Course Objectives

- A survey of the Universe at all scales and wave lengths/energies.
- Studies of the interstellar medium and magnetic fields.
- Cosmic ray acceleration and propagation; pulsars, gamma-ray astrophysics; radio and x-ray astronomy.
- Formulate and tackle problems, both open and more defined, identifying the most relevant principles and using approaches where necessary to reach a solution, which should be presented with an explanation of the suppositions and approaches.
- Understand the bases of advanced topics selected at the frontier of high energy physics, astrophysics and cosmology and apply them consistently.
- Understand of the close relationship between scientific research and the development of new knowledge in a global context.

Course Outcomes

After this course the scholars are expected to be able to:

1. demonstrate a detailed physical and mathematical understanding of a variety of systems and processes in a range of advanced topics in physics;
2. apply the concepts and theories of a range of advanced topics in physics;
3. demonstrate specialised analytical skills and techniques necessary to carry out advanced calculations in a range of advanced topics in physics;
4. approach and solve new problems in a range of advanced topics in physics;
5. Analyze the different sources of cosmic radiation.
6. Distinguish and analyze the different classs of cosmic radiation detectors.
7. Understand the physical processes responsible for the emission, propagation and absorption of cosmic radiation

Unit I

Introduction to Cosmic Rays – The nature of the radiation – the latitude effect and effect of earth's magnetic fields – The primary cosmic ray energy spectrum – components in the primary radiation – Observation of knee and ankle in the energy spectrum – origin of cosmic rays – Possibility of electromagnetic acceleration – Fermi's acceleration mechanism – Supernovae as sources – Other sources – Motion and storage of cosmic rays.

Unit II

Extensive Air Shower (EAS) – Phenomenology – The cascade process – Bhabha's cascade theory – Electromagnetic cascade – Interaction of photons with matter – Interaction of electrons with matter – Lateral spread of EAS particles – EAS cascade – Monte Carlo simulation – Numerical methods – EAS initiated by primary nuclei.

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Unit III

General features of EAS – Electromagnetic component – Lateral studies – Hadron component – Temporal structure of Hadrons – Charged to neutral (C/N) ratio – Muon component – Cherenkov light from EAS – Fluorescence light – Radio emission from EAS

Unit IV

Detection of EAS – Electron detectors – Scintillation detectors – Yes/No type detectors – Proportional counters – Fast timing – Muon detectors – Importance of muon detectors in EAS detector arrays – Hadron detectors – Underground detectors – Recording systems – Calibration of the detectors and electrons.

Unit V

Analysis of EAS data – Determination of shower parameters – NKG function – Search for sources – Significance of size spectrum – Relation to the energy spectrum – Knee and Ankle of the energy spectrum – Possible explanations – Models of origin of cosmic rays.

REFEENCES
1. Rao M.V.S and B.V. Sreekantan, Extensive Air Shower, Pergamon Press.
2. Hillas A.M., Cosmic Rays, Pergamon Press, New York

PAPER – III: Special Paper VI : Material Science (15RPHY306)
(Effective from the academic year 2015 – 2016 onwards)

Course Objectives

- To provide an introduction to the concepts underlying solid state Ionics
- To illustrate the wide range of materials and physical properties that currently available for ionic conductors
- To introduce the superionic conductors and their applications
- To establish the ionic conductors for energy applications
- To introduce the different mechanism of electrochemical energy storage materials and their applications
- To understand the ion transport mechanism via gas, liquid and solid phase materials.

Course Outcomes

Students will be able to:

1. calculate point defect concentrations using formation energies, develop Brouwer diagrams, describe several means of tailoring point defect concentrations through independent variables, and apply equilibrium thermodynamics to the case of defective solids
2. write point defect reactions in Kroger-Vink notation to describe defect processes, and apply a non-equilibrium thermodynamics and chemical kinetics framework to describe defect reactions and kinetic behavior
3. describe operation of various solid state ionics applications (including open circuit cells, cells using current, and cells generating current)
4. select measurement techniques appropriate for investigating solid state electrochemical material/device behavior and select materials appropriate for different functions within the devices.
5. use appropriate resources for finding up-to-date information on solid state ionics for continued learning.
6. Learn the superionic conductors and their real life applications.

Unit I

Crystalline solids – space lattice – the basis and crystal structure; crystal translational vectors, symmetry operation primitive lattice cell and unit cell symmetry elements, Fundamental type of lattice, atomic packing, atomic radius, lattice constants and density, crystal structure other cubic structure – type of bonding – Ionic bonding – Energy of formation of NACL molecules, Madelung constants – potential energy of diagram of ionic molecules – calculation of repulsive exponent – Born Haber cycle characteristics of ionic bond.

Unit II

Ionic conductivity – Normal and super ionic conductors – Mass transport in crystals – Diffusion – Atomic diffusion theory – Experimental determination of the diffusion constant – Ionic conduction –

Experimental results – for ionic conduction – The Einstein relation – Dielectric loss in ionic crystals – Electronic conduction in ionic crystals – Excess conductors – Deficit conductors – Amphoteric semiconductor.

Unit III

Phenomenological Models – Huberman's Theory – Ries Strassler Toom's Theory – Weleh and Diene Theory – Lattice Gas theory – Free ion model – Domain Model – Riea and Roth Theory – The Path Probability Method – The static variables – the Path variables – The path Probability – Stationary state condition – Classification of Superionic solids – Crystalline and Amorphous – Glasses – Dispersed solid Electrolytes – polymers – Ion exchange resins – biological basis resins – Classification over conducting ion species – mode and mechanism of conduction in each case and their corresponding criteria to be superionic conductors.

Unit IV

Structural characterization – XRD surface Analysis, EXAFS, IPS and Quasi neutron scattering – Thermo dynamical characterization – Differential scanning calorimetry, Differential Thermal Analysis, Thermo Gravimetric Analysis and Thermo electric power – Ion transport properties – Electrical conductivity – Two probe method – four probe method – Immitance spectroscopy – Dynamical conductivity – state conductivity – polarisation characteristic – determination of small electronic transport numbers – The permeation Technique (Static) – The polarization cell (Static) – the polarized cell technique (Dynamic) – The permeation technique (Dynamic).

Unit V

Application of superionic solid – Battery and Non-Battery application – conventional cells – fuel cells – Supercapacitors-sensors and partial pressure – gauges – Oxygen and non Oxygen sensors – coulometers – timers – Diffusion coefficient measurement in solids and liquids – Electro chemic displays.

Books of Reference

1.   Superionic solid – Principles and applications (Ed. S.Chandra) North Holland 1981
2.   Solid state ionics (Eds. T Kudo and Fueki) VCH Publishers, Kodansha 1990
3.   Lectures on solid state physics (Eds. G Bush and H Schade), international series on Natural Philosophy Vol. 79 Pergamon, press 1976
4.   "Solid Electrolytes" (Eds. S Geller) Springer Verlag New York 1977
5.   'Importance Spectroscopy' (Eds. Joscher) Springer Verlag
6.   'Physics of Electrolytes – Transport Processes solid Electrolytes and in Electrodes (Eds. J Hladik) Academic press, New York 1972.

PAPER – III: Special Paper VII : Concepts of Nanophysics and Nanotechnology (15RPHY307)

(Effective from the academic year 2015 – 2016 onwards)

Course Objectives
- To foundational knowledge of the Nanoscience and related fields.
- To make the students acquire an understanding the Nanoscience and Applications
- To help them understand in broad outline of Nanoscience and Nanotechnology.
- To familiarize with the on-going merge of the top-down approach of microelectronics and micromechanics with the bottom-up approach of chemistry/biochemistry.
- To demonstrate the potential of nanoscience and industrial applications of nanotechnology.
- To give you an insight into complete systems where nanotechnology can be used to improve our everyday life.

Course Outcomes
Scholars will be able to:
1. understand the fundamental physical principles, which govern properties of the condense matter and in particular the role of dimensionality on the mechanical, thermal, optical, electricaland magnetic properties of materials
2. understand the physical basis of new phenomena that appear when the linear dimension of an object or device shrinks below a micrometer
3. be familiar with the methods for fabrications of nanostructures
4. understand and be able to explain the principles of newly characterization techniques for imaging and analysis of nanostructures and nanomaterials
5. understand and be able to explain the principles of operation of nanoelectronic and nanophotonic devices
6. became familiar with the whole concept of nanoscale science and technology and be able to apply their knowledge for understanding further developments in this rapidly emerging area.

Unit I: Introduction to Nanotechnology
Defining nanotechnology, Historical development – Beyond Moore's law, Comparison of bulk and nano materials – change in band gap and large surface to volume ratio, Classification of nanostructured materials – one, two and three-dimensional confinement, quantum dots, quantum wires and quantum wells, scope of applications.

Unit II Synthesis and characterization
Classification of fabrication methods – Top to bottom approach – Ball milling, etching etc bottom to top approach – Physical and chemical methods – Molecular Beam Epitaxy, optical and electron beam lithography, Ion implantation, sputtering, thermal evaporation, pulsed laser deposition, chemical vapor deposition, controlled precipitation, sol gel methods. Grain size determination – XRD (Debye Scherer equation), TEM, AFM, STM and Light scattering techniques. Composition analysis – ICP – AES, EDAX, SIMS.

Unit III Optical and vibrational properties of nanoparticles

Basic concepts – Band structure of solids, excitons, effective mass, reciprocal lattice, Brillouin zone, phonons etc. Size and dimensionality effects – Bulk to nano transition –Density of states, potential well - quantum confinement effect – weak and strong confinement regime. Blue shift of band gap - Effective mass approximation (Rigorous mathematical treatment not necessary). Phonon confinement effect and presence of surface modes. Characterization tools - UV – Visible absorption and Photoluminescence techniques, Raman and IR spectroscopy

Unit IV Carbon Nanostructures

Carbon nanostructures – carbon molecules – carbon clusters. Fullerene - structure of C_{60} and its crystal – larger and smaller fullerenes – other bucky balls. Carbon nanotubes – fabrication – structure – electrical properties – vibrational properties – mechanical properties. Applications of carbon nanotubes – Field emission and Shielding – computers – Fuel cells – Chemical sensors – Catalysis – Mechanical reinforcement.

Unit V Nanomachines and Nanodevices

Extension of conventional devices by nanotechniques – Bipolar and MOS transisitors – structure and technology, electrical characteristics, limitations, low temperature behavior. Microelectromechanical systems (MEMSs), Nanoelectromechanical systems (NEMSs), Resonant Tunneling Diode, Quantum Cascade lasers, Single Electron Transistors – Operating principles and applications.

Books for reference

1.   Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse "Nanotechnology", Overseas Press New Delhi 2005
2.   W. R. Fahrner (Ed.) "Nanotechnology and Nanoelectronics", Springer 2006.
3.   Charles P Poole Jr and Frank J Owens "Introduction to Nanotechnology", Wiley student edition 2003.

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)
Coimbatore – 641 021.
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DEPARTMENT OF TAMIL

M.Phil & Ph.D CURRICULUM (2015-2016)

S.No	Subject Code	Name of the Course	Credits	Exam duration (Hrs)	Max Marks
1	15RTAM101	**Paper-I:** Research Methodology and Pedagogy	4	3	100
2	15RTAM201	**Paper-II:**History of Tamil Literature	4	3	100
		Paper III: Special Paper			
3	15RTAM301	Sanga Ilakkiyam			
4	15RTAM302	Ara Ilakkiyam			
5	15RTAM303	Bhakthi Ilakkiyam	4	3	100
6	15RTAM304	Ikkaala Ilakkiyam			
7	15RTAM305	Naattuppuraviyal			
		Total	12		300

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established Under Section 3 of UGC Act, 1956)

DEPARTMENT OF TAMIL
SYLLABUS
M.Phil, / Ph.D., Programs (2015-2016)

தாள்:1   ஆய்வியல் நெறிமுறைகள் மற்றும் கற்பித்தல்

தாள்:2   ஆய்வுசார் வெளியீடுகளுக்கான நெறிமுறைகள்

தாள்:3 ஆய்வுக்களம் சார்ந்த சிறப்புப் பாடம்

 3.1 சங்க இலக்கியம்

 3. 2. அற இலக்கியம்

 3. 3.பக்தி இலக்கியம்

 3. 4. இக்கால இலக்கியம்

 3. 5. நாட்டுப்புறவியல்

தாள்:1   ஆய்வியல் நெறிமுறைகள் மற்றும் கற்பித்தல்

பாடத்திட்டப் பொதுநோக்கம்

- ஆய்விற்கான அடிப்படைக் கருத்துக்களையும்,அதற்கான உத்திகளையும் ஆய்வாளர் புரிந்து கொள்ளுதல்

- கருதுகோளை உருவாக்குதல்

- பொருத்தமான தலைப்பைத் தேர்வு செய்தல்

- ஆய்வுச்சிக்கலைத் தேர்வுசெய்து உரியகாலத்தில் அதற்கான தீர்வு காலத்தை வரையறுத்தல்.

- ஆய்வு முன்மொழிவைத் தயாரித்தல்.

- தேர்வு செய்த தலைப்பின் அடிப்படையில் ஆய்வறிக்கை எழுதத் தயாராதல்.

அலகு– 1 ஆய்வும் ஆய்வுப் பொருளும் தேர்வும்

ஆய்வு என்பதன் விளக்கம் - ஆய்வாளனுக்குரிய தகுதிகளும் உளப்பாங்கும் - ஆய்வுக்குரிய களம் - ஆய்வு நோக்கினைச் சுட்டல் - ஆய்வுச்சிக்கல் - ஆராயும் பொருள் பற்றித் தெளிதல் - ஆய்வுப் பொருள் பற்றி அதுவரை செய்யப்பட்ட ஆய்வுகள் பற்றிய தொகுப்புரையும் மதிப்பீடும்.

அலகு – 2 ஆய்வுப் பகுப்பும் தொகுப்பும் - களஆய்வும்

முதன்மைக்கூறுகள் (சேஅயசஉநள ஞழரசஉ நள) துணை நிலைக்கூறுகள் (ஞநஉ ழநஒனெயசல ஞழரசசஉ நள)இவ்வறைத் தொகுத்தலும் பகுத்தலும் - பல்வேறு தொகுப்பு முறைகள் - நேர்காணல் - வினாத்தொகுதி(ஞுரநளவழைறெ) மாதிரிகள் (ஞயஅடெநள) முதலியவை பற்றிய விளக்கம். கள ஆய்வு வகைகள் - மக்கள் இன,பண்பாட்டு ஆய்வு – கள ஆய்வுக்குத் தேவையானபொருட்கள் - களஆய்வில் ஈடுபடுவோர் தகுதிகள் - களக் குறிப்புகள் - உள இயலும் கள ஆய்வும் -நேர்காணல், வினா நிரல் ஆகியவற்றின் விளக்கம் - நேர்காணலின் வகைகள் - உற்று நோக்கல் உற்றுநோக்குவோரின் அணுகு முறைகள் - எழுத்து, படஆதாரம் - புகைப்படம், திரைப்படம், நாடா ஒலிப்பதிவு,ஓவியம், அரும்பொருள்கள் ஆகியவற்றைப் பணன்படுத்தும் முறைகள்.

அலகு – 3 ஆய்வு நெறிமுறைகள்

ஆய்வு நெறிமுறைகளின் வகைகள் -அளவையியல் முறை (டுழபஉைஊட ஆநவாழன), அறிவியல் முறை (ஞஉநைவெகைஉ ஆநவாழன),அமைப்பு முறை (ஞளௌஉரவெரசஉ ஆநவாழன), வரலாற்று முறை (ஈளௌௌரசஇஊட ஆநவாழன),

ஒவ்வொரு குறிப்பிட்ட துறை, பொருளுக்கேற்ப ஆய்வு முறையை அமைத்தல்.

அலகு – 4 ஆய்வேட்டின் உருவாக்கம்

ஆய்வேட்டை உருவாக்கும் பல்வகை நிலைகள், மாதிரி வரைவு – பொறியாளர், அறிஞர்களின் கருத்தறிதல் - கலந்துரையாடல், மாதிரி வரைவு மறுபார்வை செய்தல் - திருத்தல் - செம்மையாக்கல் - ஆய்வேட்டின் அமைப்பு – பகுதிகள் - இயல் பிரிப்பு – சுருக்கக் குறியீடு, அடிக்குறிப்புகள், அட்டவணை, விளக்கப் படங்கள், பின்னிணைப்பு முதலியன – ஆய்வேட்டின் கட்டமைப்பும் புறத் தோற்றமும்.

3

அலகு – 5 தற்காலத் தமிழாய்வுப் போக்குகள்

உருவவியல் - அமைப்பியல் - குறியியல் - தொல் படிமவியல் - இலக்கிய வகை நிலையியல் - தத்துவவியல் - நவீனத்துவம் - மார்க்சியம் - பெண்ணியம் - தலித்தியம் முதலான தற்காலத் தமிழாய்வுப் போக்குகள்.

பாட நூல்கள்:
1.ஆய்வியல் அறிமுகம் -டாக்டர்.தமிழண்ணல், டாக்டர்.எம்.எஸ்.இலக்குமணன்.
2.இலக்கிய ஆராய்ச்சி முறைகள் - டாக்டர். முத்துச் சண்முகம், டாக்டர்.சு.வேங்கடராமன்

பார்வை நூல்கள்:
1.ஆய்வுக் கட்டுரை எழுதும் முறை - டாக்டர். முத்துச் சண்முகம், டாக்டர்.சு.வேங்கடராமன்
2.நாட்டார் வழக்காற்றியல் களஆய்வு – தே.லூர்து
3.கள ஆய்வில் சில அனுபவங்கள் - டாக்டர். சரசுவதி வேணுகோபால்
4.ஆய்வு நெறிமுறைகள் - டாக்டர்.ஈ.சு.விசுவநாதன்
5.ஆராய்ச்சி நெறிமுறைகள் - டாக்டர். ச.வே.சுப்பிரமணியம்
6.திறனாய்வுக்கலை – தி.சு.நடராஜன் (என்.சி.பி.எச் வெளியீடு)
7.ஆராய்ச்சி முறைமைகள் - முனைவர்.எச்.சித்திரபுத்திரன்,முனைவர் ஆ.சண்முகம்
8..ஆய்வியல் நெறிமுறைகள் - கு.வெ.பாலசுப்பிரமணியன்
9.நாட்டுப்புறவியல் - களஆய்வு – முனைவர்.இரா.சந்திர சேகரன்

தாள் - 2 தமிழ் இலக்கிய**வரலாறு**

தாள்:2 ஆய்வுசார் வெளியீடுகளுக்கான நெறிமுறைகள்

பாடத்திட்டப் பொதுநோக்கம்

- அகப் புறக் கொள்கைகளின் அடிப்படையில் எட்டுத்தொகை பத்துப்பாட்டின் கருத்தாக்கங்களை ஆராய்ச்சிக்கு உட்படுத்துதல்.

- சங்கம் மருவிய கால இலக்கியங்களின் வழி ஆதிக்கப் பண்பாட்டு மாற்றங்களைக் கட்டமைத்தலும், எடுத்துரைத்தலும்.

- சமண,பௌத்த மதங்களின் வளர்ச்சியும் ,மதங்களால் தமிழுக்கு ஏற்பட்ட வளர்ச்சி நிலைகளை ஆவணப்படுத்தலும், ஆராய்ச்சிக்குட்படுத்தலும்.

- ஐம்பெரும், ஐஞ்சிறுகாப்பியங்களின் வரவால் ஏற்பட்ட சமூகமாற்றங்களையும், பண்பாட்டு வளர் நிலைகளையும் ஆராய்ச்சிக்குட்படுத்தல்.

- தமிழ்ச் சிற்றிலக்கியங்களின் வகைகள், பாடுபொருள்,அதன் இலக்கணம் போன்றவற்றைக் கண்டறிலும், வகைப்படுத்தலும்.

- 15-16 ஆம் நூற்றாண்டில் சிற்றிலக்கியங்களின் வளர்ச்சியால் ஏற்பட்ட பண்பாட்டு மரபுகளையும், மாற்றங்களையும் ஆராய்தல்.

அலகு – 1 சங்க இலக்கியங்கள்
சங்க இலக்கியங்கள் - பத்துப்பாட்டு – எட்டுத்தொகை நூல்கள் - அக, புறக் கொள்கைகள் - சான்றோர் செய்யுள் - தன்னுணர்ச்சிப்பாடல்கள் - குறிக்கோள் சமூகம்.

அலகு – 2 நீதி இலக்கியங்கள்
சங்கம் மருவிய காலம் - களப்பிரர் - பல்லவர் ஆட்சி – சமண நூல்களின் ஆதிக்கம்- பண்பாட்டு மாற்றம், பாடு பொருள் மாற்றம் , வடிவ மாற்றம், வெண்பாவை ஒட்டிப் பதினெண்கீழ்கணக்கு – திருக்குறள் மனித குலத்தை மையப்படுத்திய நீதி இலக்கியம் - விழுமியங்களின் களஞ்சியம் - நீதி இலக்கியங்களில் காலந்தோறும் ஏற்பட்ட மாற்றம்.

அலகு – 3 பக்தி இலக்கியங்கள்
பக்தி இலக்கியத் தோற்றம் - சமண பௌத்த பண்பாட்டுத் தாக்கத்தின் அடிப்படையில் மொழி, வரலாறு, சமய வாழ்வு, மாறுதல் - இசை, நாடகம் பற்றிச் சமணர் பௌத்தர் கோட்பாடுகள் - ஆழ்வார்கள்,நாயன்மார்கள் பக்திக் கோட்பாடுகள்.

அலகு – 4 காப்பியங்கள்
காப்பியம் - இதிகாசம் - புராணம் - இவற்றின் தொன்மையும் தன்மைகளும் - காப்பியம் பற்றிய வடமொழி – தமிழ் மொழி இலக்கணங்கள் - ஐம்பெரும் காப்பியங்கள் - ஐஞ்சிறு காப்பியங்கள் - காப்பியங்கள் -வழிப்பெரும் சமுதாய விழுமியங்கள் - அறம்,பொருள்,இன்பம் வீடு – தமிழ்க் காப்பிய மரபு– சிலம்பும் மேகலையும் - பெரியபுராணம் காப்பியம் என்ற கொள்கை – மேல் நாட்டுக் காப்பியக் கொள்கைகள் - தமிழில் உள்ள பிற காப்பியங்கள்.

அலகு – 5 சிற்றிலக்கியங்கள் மற்றும் முக்கிய இலக்கியங்கள்

தமிழ்ச் சிற்றிலக்கியங்களின் வகைகள் - பாடுபொருள் - யாப்பு – ஒரு சிறு துறை பிரபந்தமாதல் - பரணி , உலா,பிள்ளைத்தமிழ், அந்தாதி – குறவஞ்சி, பள்ளு, கலம்பகம் ஆகியவற்றின்இலக்கணம் - நாவல், சிறுகதைகளின் வரையறை – கதைக்கரு, கதைக் கோப்பு, பாத்திரங்கள் பற்றியஅறிமுகம்.

பார்வை நூல்கள்

1.சங்க இலக்கதி ஒப்பீடு (இரண்டு பாகங்கள்) – தமிழண்ணல்

2. தமிழ்க்காதல் - வ.சு.ப. மாணிக்கம்

3.திருக்குறள் நீதி இலக்கியம் - டாக்டர்.க.த. திருநாவுக்கரசு

4.பதிணென்கீழ்கணக்குச் சொற்பொழிவுகள் - சைவ சித்தாந்த நூற்பதிப்புக்கழக வெளியீடு

5.காவியகாலம் - எஸ்.வையாபுரிப்பிள்ளை

6.தமிழில் காப்பியக் கொள்கை – டாக்டர் துரை.சீனிச்சாமி

7.தமிழும் தத்துவமும் - டாக்டர்.சோ.ந.கந்தசாமி

8. சிற்றிலக்கியச் சொற்பொழிகள   - டாக்டர் ப. அருணாச்சலம்

9.பெரியபுராணம்:ஓர் ஆய்வு – அ.ச ஞானசம்பந்தம்

தாள்:3 ஆய்வுக்களம் சார்ந்த சிறப்புப் பாடம் - சங்க இலக்கியம்

பாடத்திட்டப் பொதுநோக்கம்

- எட்டுத்தொகை, பத்துப்பாட்டு நூல்களின் வழி பழந்தமிழரின் பண்பாடு சார்ந்த வாழ்க்கை முறைகளை ஆசாய்ச்சிக்குட்படுத்துதல்.

- சங்கம் இருந்தது என்பதற்கான சான்றுகள்,முற்சங்க வரலாறு, முச்சங்கங்களால் இயற்றப்பட்ட முத்தமிழ் நூல்கள் பற்றிய ஆராய்ச்சி செய்தல்.

- எட்டுத்தொகை, பத்துப்பாட்டு தொகுப்பு முறைகள், திணைத்,துறை அமைப்பு பற்றிய ஆவணங்களைத் தொகுத்தல்.

- முதல் கரு,உரிப்பொருள் அமைப்பு யாப்புவகைகள், உள்ளுறை, இறைச்சி பொருள் அமைப்பு முறைகளைக்கொண்டு மேலாய்வு செய்தல்.

- சங்ககாலத்து மக்கள் வாழ்வியல் முறைகள், பண்பாடு, தொழில்,வாணிபம், உணவு,உடை ஒழுக்கம் , இல்லறமுறை போன்றவற்றை ஆய்வுக்குட்படுத்தல்.

- சங்க இலக்கியங்களின் மெய்ப்பொருளியல், நிலையாமை உணர்வு, அறக்கோட்பாடுகள், ஒரேபொருள் பல கடவுள்கள் என்ற அமைப்புமுறைகளைக் கண்டறிதல்.

அலகு– 1சங்கமும் சங்க நூல்களும்

சங்கம் - சொற்பொருள், துணையான சொற்கள் - சங்கம் இருந்தது என்பதற்குச் சான்றுகள் - கடல் கோள் - முற்சங்கம். முதல், இடை, கடைச் சங்கங்களின் காலவரையறை – சங்கம் பற்றிய பழமை உரையாசிரியர்களின் கருத்து, இக்காலத்து ஆய்வாளர்களின் கருத்துக்கள் - சங்கம் பற்றிய புராணக் கதைகள் செவிவழிச் செய்திகள் - பிற்காலத்துச் சமண சங்கம் - சமண சங்கத்துச் செய்திகளைப் பழந்தமிழ்ச் சங்கத்திற்கு ஏற்றிச் சொல்லுதல் - மூன்று சங்கங்களிலும் தோன்றிய இயல், இசை, நாடகத் தமிழ் நூல்களைப் பற்றிய பொதுக்குறிப்பு.

அலகு– 2 கடைச்சங்க நூல்களின் யாப்பு மரபும் பொருள் மரபும்

எட்டுத்தொகை – பத்துப்பாட்டு – தொகுப்புமுறை – புறப்பாடல்கள் - திணை, துறை அமைப்பு – அகப்பாடல்கள் - முதல், கரு, உரிப்பொருள் அமைப்பு – யாப்பு வகைகள் 0 அறநெறிக் கோட்பாடுகள் - குறிப்புப் பொருள் - உள்ளுறை, இறைச்சி.

அலகு– 3 சங்க காலத்து மக்கள் வாழ்வியல்

நிலப்பாகுபாடு – மக்கட் பாகுபாடு, நிலவழிப் பகுப்பு, தொழில் வழிப் பகுப்பு, தகுதி வழிப் பகுப்பு, மேலோர், கீழோர் - வருணப் பகுப்பு - இல்வாழ்க்கை குடும்பம், குழு உறுப்பினர். துலைவன், தலைவி, ஏவலர் - இல்லறத்தார் கடமை – களவு, கற்பு ஒழுக்கங்கள், திருமணம் - பின்முறை வதுவையர், காமக்கிழத்தி, பரத்தை போன்றோரின் நிலைகள் - கைத்தொழில், உழவு– உணவு, உடை, அணிகலன் - கல்வி, கலை, இசை, நாகம்,ஓவியம், சிற்பம், கட்டடங்கள், குடியிருப்பு, வீடு, அரண்மனை, கோவில்கள் - பொழுது போக்குகள், பயணங்கள் - சமூக வாழ்வு– அறநெறிக் கொள்கைகள், தனிமனித அறம், சமூக அறம்,ஈகை, ஒப்புரவு – நம்பிக்கைகள்.

அலகு– 4 சங்க காலத்து அரசியல்

முடியாட்சி – தந்தை வழி மகன் அரசுரிமை - இளவரசன் - குறுநில மன்னர்கள், அரசாங்கம், அரசவை, அரசியலாயம், ஐம்பெருங்குO> எண்பேராயம், புலவர், கலைஞர் - அமைச்சு, நாடு, நாட்டுப் பிரிவுகள், பெருநகரம், நகரமைப்பு, சிற்றூர்கள், ஊரமைப்பு, ஆட்சியமைப்பு – நாட்டாச்சி, நகராட்சி, சிற்றூராட்சிகளின் தொடர்பு – ஆட்சிக் குழுக்கள் தேர்தல்கள் - நிதி, பொருளாதாரம், வரிப்பொருள், சுங்கம், பிறபொருள்கள், நாணயம், நிதி, அறங்கூறவையம் - வணிகம் - தரைவழி, கடல்வழி வாணிகங்கள் - நெடுஞ்சாலை சாலைப்

பாதுகாப்பு, வேளாண்மை — பாசன வசதிகள் - படை, நால்வகைப்படை, படைத் தலைவன், போர் வீரன், போர் அறம், போர் முறைகள் - அரண், மதில், அகழி, காடு, வெளிநாட்டுத் தொடர்பு, வல்லாண்மை, புலவர், புரவலர் தொடர்புக்கல்வி — சுகாதாரம்.

அலகு— 5 சங்க காலத்து மெய்ப்பொருளியல்

தத்துவ ஆராய்ச்சி — மண்முதல் மூலப்பகுதி ஈறாக உள்ள பொருள்கள், நிலையாமை உணர்வு, அறக்கோட்பாடுகள், கடவுள் கொள்கைகள், ஒரே பொருள் பல கடவுளர்கள் - உயிர்கொள்கை, உயிர் வகைகள், பல பிறப்புக் கோட்பாடுகள் - இம்மை, மறுமை, எழுமை — fd;kf; Nfhl;ghLfs; - Co;tpid — சமயச் சடங்குகள், பிறப்பு, இறப்ப, திருமணம், தெய்வ வழிபாடு, திருக்கோவில்கள், தெய்வத்திரு உருவங்கள்,சிறுதெய்வ வழிபாடுகள் - திருவிழாக்கள் - துறவுக் கொள்கை — அறவோர், அறிவர், துறவி, தாபதர் ஒழுக்க நெறிகள்- சங்க காலத்திலும் சங்கம் சார்ந்த காலத்திலும் சமண — பௌத்த, வைதீக மெய்பபொருளியல் கொள்கையின் வளர்ச்சி.

பார்வை நூல்கள்

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3. தொல்காப்பியரின் இலக்கியக் கொள்கைகள் : நோக்கு, இறைச்சி, மெய்ப்பாடு, உள்ளுறை — டாக்டர் தமிழண்ணல்
4. சங்க இலக்கிய ஒப்பீடு பாகம் :1 — டாக்டர் தமிழண்ணல்
5. சங்க இலக்கிய ஒப்பீடு பாகம் :2 — டாக்டர் தமிழண்ணல்
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9. அகப்பொருட் பாடல்களில் தலைவி — டாக்டர் கோ. பாசுகரதாஸ்
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14. சங்ககாலச் சமூக அமைப்புகள் - கு.வெ. பாலசுப்பிரமணியம்
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16. தமிழ் நூல்களில் குறிப்புப் பொருள் - முனைவர் மா.ரா.போ. குருசாமி.

குறிப்பு : பாடத்திட்டம் ஐந்து அலகுகளாகத் தரப்பட்டுள்ளது. ஒவ்வொரு அலகிலிருந்தும் இரண்டு வினாக்கள் அளிக்கப்பட்டு ஏதேனும் ஒன்றிற்கு விடை எழுதக் கோரும் வகையில் வினாத்தாள் அமையும். ஆக ஐந்து அலகுகளிலிருந்தும் ஐந்து வினாக்களுக்கு விடைகள் எழுதப்படவேண்டும்.மொத்தமதிப்பெண்கள்-100.

தாள்:3 ஆய்வுக்களம் சார்ந்த சிறப்புப் பாடம் – அற இலக்கியம்

பாடத்திட்டப் பொதுநோக்கம்

- சங்கம் மருவியகதல நூற்களான பதினெண் மேற்கணக்கு நூற்கள் தமிழ்ச் சமூகத்திற்கு அளித்த அறச்சிந்தனைகளைப், பட்டியலிடுதல், ஆராய்ச்சிக்குட்படுத்துதல்.

- திருக்குறள் –நாலடியார் உட்பட்ட அறஇலக்கியங்களின் பாடுபொருள்களின் பகுப்முறைகள், மக்கள் வாழ்வில் அவ்விலக்கியங்களினால் ஏற்பட்ட மாற்றங்களைக் கண்டறிதல்.

- அறஇலக்கியங்கள் தோன்றிய காலச்சூழல், சமண பௌத்தர்களின் வருகை,களப்பிரர் ஆட்சி, ஒழுக்க நெறிகளுக்கு முக்கியத்துவம் தந்த சூழல்.

- திருக்குறள்,நாலடியார் பொன்ற அறஇலக்கியங்களின் தனித்தன்மைகள், பாடுபொருள் பகுப்புமுறைகள் , காலம் ஆகியவற்றைக் கண்டறிதல்.

- சிறுபஞ்சமூலம், ஏலாதி, திரிகடும், ஆசாரக்கோவை போன்ற அற இலக்கியங்களின் அமைப்புமுறை,இவ்விலக்கியங்களால் ஏற்பட்ட மாற்றங்களை ஆய்வு செய்தல்.

- பிற்கால அறஇலக்கியங்களான ஆத்திச்சூடி,நல்வழி, மூதுரை,கொன்றைவேந்தன், நீதிநெறிவிளக்கம் ஆகிய நூல்களின் அமைப்புமுறைகளைக் கண்டறிதல்.

அலகு - 1
அறம் (நீதி) - விளக்கம் : பொது அறம், சமயச்சார்பு அறம்- விளக்கம் - நீதி இலக்கியங்கள் ∴ அற நூல்கள் மற்றும் சமயச் சார்பு அற இலக்கியங்கள்- விளக்கம் - அற இலக்கியங்களுக்கும் ஏனைய இலக்கியங்களுக்கும் உள்ள பொதுவியல்புகளும்- சிறப்பியல்புகளும் அற நூல்களின் வடிவம் (யாப்பு)

அலகு - 2
அற இலக்கியங்கள் தோன்றிய காலச்சூழல் - சமண பௌத்தர்களின்வருகை - களப்பிரர் ஆட்சி - அற இலக்கியங்களின் தோற்றம் - அற இலக்கியங்களின் முக்கியத்துவம் -அற இலக்கியக் கோட்பாடுகள் - வாழ்வியல் / ஒழுக்க நெறிகளுக்கு முக்கியத்துவம் தந்தவை.

அலகு - 3
திருக்குறள் - நாலடியார் தனித்தன்மைகள் பாடுபொருள்களிலும் பகுப்புமுறையிலும் சங்க இலக்கியத்தினின்றும் வேறுபட்டுள்ள திறம் - வேறுபாட்டிற்கான காரணங்கள் -திருக்குறளின் நோக்கம் - வாழ்வியல் நெறிமுறைகள்.

அலகு - 4
சிறுபஞ்சமூலம் - ஏலாதி - முதுமொழிக்காஞ்சி - நான்மணிக்கடிகை - திரிகடுகம் - ஆசாரக்கோவை- இன்னா நாற்பது - இனியவை நாற்பது - பழமொழி - இவற்றின் அமைப்புமுறை - அறம் புகட்டும் உத்திகள் - சமயக் கோட்பாடுகள் - வாழ்வியல் நெறிமுறைகள் -இவ்விலக்கியங்களின் தனித்தன்மைகள் - பா வடிவம் ஒற்றுமை - வேற்றுமைகள்.

அலகு - 5
பிற்கால அற இலக்கியங்கள் - ஒளவையாரின் ஆத்திசூடி நல்வழி - மூதுரை - கொன்றை வேந்தன் - நீதி நெறி விளக்கம் அமைப்பு முறை - அறம் புகட்டும் உத்திகள் - காலத்தின் வெளிப்பாடு சங்க மருவிய அற இலக்கியங்களுக்கும் இக்கால அற இலக்கியங்களுக்குமுள்ள ஒற்றுமை -வேற்றுமை - பாரதியின் ஆத்திசூடி முதல் டாக்டர் சொ. பரமசிவத்தின் அறநூல் வரையிலான இருபதாம்நூற்றாண்டு அற நூல்களின் அமைப்பு முறை - உத்திகள் - வெளிப்பாட்டுத்திறன் - தனித்தன்மைகள்.

ஒவ்வொரு அலகிலிருந்தும் பொதுவான வினாக்களே அமைதல் வேண்டும்.

பார்வை நூல்கள் :

1) திருக்குறள் : பதின்மர் உரை தொடங்கி, தற்கால உரை மற்றும் திறனாய்வு விளக்க நூல்கள் அனைத்தும்.

2) "நாலடியார் : உரைவளம்" பாகம் 1 ரூ 2 - தஞ்சை சரசுவதிமகால் நூல்நிலைய வெளியீடு, தஞ்சை.

3) ஏனைய பதினெண்கீழ்க்கணக்கு அறநூல்களும், அவற்றின் உரை மற்றும் திறனாய்வு விளக்க நூல்களும்.

4) பதினென்கீழ்க்கணக்குச் சொற்பொழிவுகள், கழக வெளியிடு, சென்னை.

5) நீதி நெறி விளக்கம் - குமரகுருபரர்

6) நீதி நூல் - முனிசீப் வேதநாயகம் பிள்ளை, கழகம், சென்னை.

7) விவேக சிந்தாமணி, கழக வெளியீடு, சென்னை.

8) நீதிக் களஞ்சியம், நியூ செஞ்சுரி புத்தக நிலையம்

9) அறநூல் - டாக்டர். சொ. பரமசிவம், பட்டுப்பதிப்பகம், 1269, 32 ஆவது தெரு, 'ஐ' பிரிவு, அண்ணாநகர், சென்னை - 40.

10) தமிழின் பழமொழி இலக்கியம் - எஸ். சவுந்திரபாண்டியன், ஸ்டார் பிரசுரம், சென்னை.

11) பாரதியார் ஆத்திசூடி : உரையுடன் - பூம்புகார் பதிப்பகம், சென்னை.

12) திரு. வி. க. வின் திருக்குறள் பாயிரம் - பூம்புகார் பதிப்பகம், சென்னை.

13) திரு. வி. க. வின் திருக்குறள் பாயிரம் : 2 - பூம்புகார் பதிப்பகம், சென்னை.

14) நீதி நூல்கள் - முல்லை முத்தையா : பாகம் 1 - பூம்புகார் பதிப்பகம், சென்னை.

15) ஒளவை அமுதம் (ஆத்திசூடி விளக்க உரை) - பூம்புகார் பதிப்பகம், சென்னை.

16) வெற்றிவேற்கை - அதிவீரராமபாண்டியன்

17) ஆத்திசூடி - பாரதிதாசன்.

தாள்:3   ஆய்வுக்களம் சார்ந்த சிறப்புப் பாடம் –பக்தி இலக்கியம்

பாடத்திட்டப் பொதுநோக்கம்

- பக்திக் காலத்திற்கு முன்பிருந்த தமிழக நிலை. பன்னிரு ஆழ்வார்களின் பக்தி நெறி,

- வைணவத் தத்துவங்கள்,பிற்கால சைவ – வைணவ சமய வளர்ச்சியை ஆய்வுக்படுத்துதல்.

- இயற்கைவழிபாடு, ஆவிவழிபாடு, இறைநம்பிக்கை,அறுவகைச் சமயங்கள் பற்றிய ஆய்விற்கு உட்படுத்தல்.

- நாலாயிரத்திவ்ய பிரபந்தம், பன்னிரு ஆழ்வார்களின் பக்திநெறி, வைணவத்தத்துவங்கள் போன்றவற்றை மேலாய்வுக்களங்களில் உட்படுத்துதல்.

- கிறித்துவ, இசுலாமிய இலக்கியங்கள் போன்றவற்றின் சமயக்கோட்பாடுகளின் சிறப்புக்கள்.

- பிற்கால சைவ வைணவ இலக்கியங்களின் வளர்ச்சி,கோயில் அமைப்பு, வழிபாட்டு முறைகளைக் கண்டறிதல்.

அலகு : 1
பக்தி விளக்கம் - அச்சம், நம்பிக்கையால் பக்தி பிறந்த முறை - பக்தியின் பிரிவுகள் -இயற்கை வழிபாடு - ஆவி வழிபாடு - நடுகல் வழிபாடு - இறை நம்பிக்கை - இறைவழிபாடு - அறிவாராய்ச்சியில் எழுந்த கடவுள் நம்பிக்கை - அன்பு நெறியில் எழுந்த வழிபாட்டுநிலை - அறுவகைச் சமயங்கள்.

அலகு : 2
பக்திக் காலத்திற்கு முன்பிருந்த தமிழக நிலை - பக்தி இயக்கம் தோற்றமும்வளர்ச்சியும் - பன்னிரு திருமுறைகள் - சைவத் தத்துவம் - சமயக் குரவர்களின் பக்தித் திறன் -பன்னிரு திருமுறைகள் காட்டும் சமுதாயம் - பண்பாடு - சிவனின் அருளிச்செயல்கள் - புராணக் கதைகள்.

அலகு : 3
நாலாயிர திவ்யப் பிரபந்தம் - பன்னிரு ஆழ்வார்கள் ஆழ்வார்களின் பக்தி நெறி - வைணவத்தத்துவங்கள் - நாயக, நாயகி பாவம் - சரணாகதித் தத்துவம் - பரபத்தி, பரமஞானம், பிற பக்தித்திறன்கள் - திருமாலின் அருளிச் செயல்கள், புராணக் கூறுகள்.

அலகு : 4
கிறித்துவ இலக்கியங்கள் - இசுலாமிய இலக்கியங்கள் - கிறித்துவ சமயக் கோட்பாடுகள் -இசுலாமிய சமயக் கோட்பாடுகள் - பிற்கால சைவ - வைணவ சமய வளர்ச்சி.

அலகு : 5
இந்துத் திருக்கோயில் அமைப்பு - வழிபாட்டு நெறிமுறைகள் - கோயில் கலைகள் -ஏனைய ஆலய அமைப்பும் - வழிபாட்டு நெறிமுறைகளும், கலைகளும்.

பார்வை நூல்கள் :
1) பக்தி இலக்கியம் - ப. அருணாச்சலம்,பாரி புத்தக நிலையம், 1970, சென்னை.
2) மதமும் பண்பாடும் - எஸ். இராதாகிருஷ்ணன் (மொழிபெயர்ப்பாளர் - வி. எஸ். வி. ராகவன்), வள்ளுவர் பண்னை, 1977, சென்னை.
3) பெரிய புராணம் : ஓர் ஆய்வு - அ. ச. ஞானசம்பந்தம், தமிழ்ப் பல்கலைக்கழகத் தத்துவ மையம், 1987, காஞ்சிபுரம்.
4) பக்தி இலக்கிய உருவாக்கம் - வ. ஜெயா, முத்துப் பதிப்பகம், 1994, விழுப்புரம்

5) சைவ இலக்கியச் சேவை - மு. சாய்பு மரைக்காயர், வானதி பதிப்பகம், 1986, சென்னை

6) இந்திய சமுதாய வரலாறு - ந. க. மங்கல முருகேசன், தமிழ்நாட்டுப் பாட நூல் நிறுவனம், 1975, சென்னை.

7) தமிழர் சமய வரலாறு - அ. வேலுப்பிள்ளை, பாரி புத்தகப் பண்ணை, 1985, சென்னை

8) தமிழும் தத்துவமும் - சோ. ந. கந்தசாமி, மணிவாசகர் பதிப்பகம், 1980, சிதம்பரம்.

9) தம்பிரான் தோழர் - ந. சுப்புரெட்டியார், பாரி நிலையம், 1985, சென்னை

10) வைணவ உரைவளம் - ந. சுப்புரெட்டியார், பாரி நிலையம், 1985, சென்னை

11) வைணவச் செல்வம் - ந. சுப்புரெட்டியார், தமிழ்ப் பல்கலைக்கழகம், 1995, தஞ்சாவூர்.

12) ஆழ்வார்களின் ஆரா அமுது - ந. சுப்புரெட்டியார், ஐந்திணைப் பதிப்பகம், 1987, சென்னை.

13) விட்டுசித்தன் விரித்த அமுது - ந. சுப்புரெட்டியார், ஐந்திணைப் பதிப்பகம், 1987, சென்னை.

14) தமிழர் சமுதாய வரலாறு - க. ப. அறவாணன், மொழிக்கோட்டம், 1992, பாண்டிச்சேரி.

15) நாலாயிர திவ்ய பிரபந்தம் - மதி. ஸ்ரீநிவாசன், ஆழ்வார்கள் அமுத நிலையம், 1987, சென்னை.

16) சைவ சமய வளர்ச்சி வரலாறு - மா. இராச மாணிக்கனார்

17) கிறித்துவமும் தமிழும் - மயிலை சீனி. வேங்கடசாமி

18) இசுலாம் வளர்த்த தமிழ் - மு. மு. உவைசு, உலகத்தமிழாராய்ச்சி நிறுவனம், சென்னை.

19) தமிழகக் கோயிற்கலைகள் - இரா. நாகசாமி, ம. சத்திய மூர்த்தி தமிழ்நாடு அரசு தொல்பொருள் ஆய்வுத்துறை, 1976, சென்னை.

20) தமிழர் வளர்த்த அழகுக் கலைகள் - மயிலை சீனி. வேங்கடசாமி.

குறிப்பு : பாடத்திட்டம் ஐந்து அலகுகளாகத் தரப்பட்டுள்ளது. ஒவ்வொரு அலகிலிருந்தும் இரண்டு வினாக்கள் அளிக்கப்பட்டு ஏதேனும் ஒன்றிற்கு விடை எழுதக் கோரும் வகையில் வினாத்தாள் அமையும். ஆக ஐந்து அலகுகளிலிருந்தும் ஐந்து வினாக்களுக்கு விடைகள் எழுதப்பட வேண்டும். மொத்த மதிப்பெண்கள் - 100.

தாள்:3 ஆய்வுக்களம் சார்ந்த சிறப்புப் பாடம் –இக்கால இலக்கியம்

பாடத்திட்டப் பொதுநோக்கம்

- உரைநடை தோற்றத்திற்கான சூழல், புதுக்கவிதையின் வளர்ச்சி,

- தமிழில் நாடக ,சிறுகதை, நாவல் இலக்கியங்களின் வளர்நிலை போன்றவற்றை ஆய்வுக்குட்படுத்துதல்.

- திரு.வி.க,மறைமலை அடிகள், உ.வேஇசா, சி.என் அண்ணாதுரை போன்றோர் உரைநடைக்கு அளித்த பங்கு.

- புதுக்கவிதை தோற்றம் வளர்ச்சி, விடுதலைகுப்பின் மரபுக்கவிதையின் போக்கு, இருபதுகளில் தமிழ்க்கவிதையின் நிலைபற்றி ஆராய்தல்.

- தமிழ் நாடக இலக்கியங்களின் தனித்தன்மைகள்,நாடகமறுமலர்ச்சி, நாடகத்தில் கதைக்கரு,நாடகத்தில் பாத்திர அமைப்பு.

- சிறுகதை தோற்றம் வளர்ச்சி,சிறுகதையின் அமைப்புமுறைகள், மணிக்கொடியின் காலம். கல்கிமுதல் செயகாந்தன் வரையிலான படைப்புக்களை ஆய்வு செய்தல்.

அலகு : 1 - தமிழில் உரைநடை இலக்கியம் :
உரைநடையின் தோற்றத்திற்கான சூழல் - உரைநடையின் தோற்றமும் வளர்ச்சியும் -உரைநடையின் வகைகள் - தமிழில் மொழிபெயர்ப்பு, பயண இலக்கியம், அறிவியல்கட்டுரைகள் ஆகியவற்றில் உரைநடையின் பங்கு - உரைநடைக்கு திரு.வி.க., மறைமலை அடிகளார்,உ.வே.சா., சி. என். அண்ணாதுரை, மு.வ. ஆகியோரின் பணிகள் - பாரதிக்குப்பின் தமிழ்உரைநடை - குறிப்பாகக் கல்கி, வ.சுப. மாணிக்கனார் ஆகியோர்தம் பங்களிப்புப் பற்றிய செய்திகள்.

அலகு : 2 - தமிழில் கவிதை இலக்கியம் :
கவிதையின் விளக்கம் - கூறுகள் - கவிதை வரலாற்றில் பாரதி, பாரதிதாசன்பெறுமிடம் - விடுதலைக்குப்பின் மரபுக் கவிதையின் நோக்கும் போக்கும் - புதுக்கவிதையின்தோற்றமும் வளர்ச்சியும் - இருபதுகளில் தமிழ்க் கவிதை - எழுத்து, கசடதபற, வானம்பாடிக் காலம்- தற்கால புதுக்கவிதை வளர்ச்சி- நாமக்கல் கவிஞர், கவிமணி, பாவேந்தர், கண்ணதாசன், ந.பிச்சமூர்த்தி, மு. மேத்தா, நா. காமராசன், அப்துல் ரகுமான், சிற்பி ஆகியோர் தம் கவிதைகள்தமிழில் ஏற்படுத்திய மாற்றம் - வசன கவிதை பற்றிய செய்திகள்.

அலகு : 3 - தமிழில் நாடக இலக்கியம் :
நாடகத்தோற்றம் - நாடகக்கூறுகள் - தமிழ் நாடக வரலாற்றில் பரிதிமாற் கலைஞர், பம்மல்சம்பந்த முதலியார் - செய்யுள் நாடகங்கள் - நாடக மறுமலர்ச்சிக் காலம் - சுதந்திரப் போராட்டக்காலத்தில் தமிழ் நாடகங்கள், சமூக நாடகங்கள் மற்றும் வரலாற்று நாடகங்கள் பற்றிய பார்வைகள் -நாடகக் கதைத்திட்டம் - நாடகத்தில் பாத்திரம், உரையாடல், தனிமொழி, பின்புலம் பற்றிய செய்திகள்- நாடக அமைப்பு, தொடக்கம், வளர்ச்சி, உச்சநிலை, வீழ்ச்சி பற்றிய கருத்துக்கள் - இணைக்கதை,எதிர்க்கதை, நாடக்கதை, நாடக முரண் பற்றிய செய்திகள் - தமிழ் நாடகங்களில் மேலைநாட்டு நாடகங்களின் தாக்கம் - ஓரங்க நாடகம் - வானொலி நாடகம் பற்றிய கருத்துக்கள்.

அலகு : 4 - தமிழில் சிறுகதை இலக்கியம் :
சிறுகதையின் விளக்கம் - சிறுகதையின் இலக்கணம் - அமைப்பு - சிறுகதையின்தோற்றமும் வளர்ச்சியும் - சிறுகதை வரலாற்றில் வ. வே. சு. ஐயர் மற்றும் பாரதி பெறுமிடம் -தமிழ்ச் சிறுகதைகளில் மணிக்கொடியின் காலம் - கல்கி, புதுமைப்பித்தன், கு. ப.ரா., விந்தன், ஜெயகாந்தன் ஆகியோர் சிறுகதைகள் பற்றிய மதிப்பீடு - தமிழ்ச் சிறுகதையின்உருவம், உள்ளடக்கம், பாடு பொருள், உத்தி - இருபதாம் நூற்றாண்டின் சிறுகதைப் போக்குகள் -இன்றைய சிறுகதைகள்.

அலகு : 5 - தமிழில் புதின இலக்கியம்

புதின இலக்கியத்தின் தோற்றமும் வளர்ச்சியும் - தமிழில் முன்னோடி நாவல்கள் -நாவலின் வகைகளும் கூறுகளும் - நாவலின் கதைத்திட்டம், பாத்திரம், உரையாடல்ஆகியவை பெறுமிடம் - விடுதலைக்கு முன்னும் பின்னும் எழுந்த தமிழ் நாவல்கள்.

பார்வை நூல்கள் :

1) தமிழ் இலக்கிய வரலாறு - டாக்டர். மு. வரதராசன்
2) தமிழ் இலக்கிய வரலாறு - டாக்டர். சி. பாலசுப்பிரமணியம்
3) பாரதிக்குப்பின் தமிழ் உரைநடை - வல்லிக்கண்ணன்
4) புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு - தமிழண்ணல்
5) திறனாய்வும் தமிழ் இலக்கியக் கொள்கைகளும் - டாக்டர். ந. பிச்சமுத்து
6) புதுக் கவிதையின் தோற்றமும் வளர்ச்சியும் - வல்லிக்கண்ணன்
7) இருபதாம் நூற்றாண்டுத் தமிழ் இலக்கியம் - மா. இராமலிங்கம் (என்ற) எழில் முதல்வன்
8) தமிழ் நாடகத்தின் தோற்றமும் வளர்ச்சியும் - சக்தி பெருமாள்
9) சிறுகதையின் தோற்றமும் வளர்ச்சியும் - கா. சிவத்தம்பி
10) உரைநடையின் தோற்றமும் வளர்ச்சியும் - அ. மு. பரம சிவானந்தம்.
11) தமிழ் நாடக வரலாறு - ஏ. என். பெருமாள்
12) தமிழ் நாவல் இலக்கியம் - க. கைலாசபதி

குறிப்பு : பாடத்திட்டம் ஐந்து அலகுகளாகத் தரப்பட்டுள்ளது. ஒவ்வொரு அலகிலிருந்தும் இரண்டு வினாக்கள் அளிக்கப்பட்டு ஏதேனும் ஒன்றிற்கு விடை எழுதக் கோரும் வகையில் வினாத்தாள் அமையும். ஆக ஐந்து அலகுகளிலிருந்தும் ஐந்து வினாக்களுக்கு விடைகள் எழுதப்பட வேண்டும். மொத்த மதிப்பெண்கள் - 100.

தாள்:3   ஆய்வுக்களம் சார்ந்த சிறப்புப் பாடம் – நாட்டுப்புறவியல்

பாடத்திட்டப் பொதுநோக்கம்

- தமிழ் நாட்டுப்புறவியல் வரலாறு,நாட்டப்புற வழக்காறுகளைச் சேகரித்தல், நாட்டுப்பறக் கள ஆய்வில் அறிவியல் அணுகுமுறைகளை உட்படுத்தி ஆய்வை மேற்கொள்ளுதல்.

- தமிழ் நாட்டுப்புற வழக்காறுகளைச் சேகரித்தலும்,பட்டியலிடுதலும்.

- நாட்டுப்புறவியல் களஆய்வில் மேற்கொள்ளும் அணுகுமுறைகள்.

- வரலாற்று நிலவியல்கோட்பாடு, வரலாற்று மீட்டுருவாக்க கோட்பாடு,செயல்திறன் கோட்பாடுகளின் அடிப்படையில் ஆய்வை மேற்கொள்ளுதல்.

- நாட்டுப்புற இலக்கியவகைகளான தாலாட்டு, காதல்பாடல்கள்,,விளையாட்டுப் பாடல்கள் போன்றவற்றை ஆவணம் செய்தல்.

- நாட்டுப்புறக் கலைகளான தெருக்கூத்து, பொம்மலாட்டம், கரகம், சிறுதெய்வ வழிபாடு விழாக்கள் ஆகியவற்றை ஆராய்ச்சிக்குட்படுத்துதல்.

அலகு : 1 - நாட்டுப்புறவியலின் விளக்கம் :
நாட்டுப்புறவியலின் விளக்கம் - பல்வேறு அறிஞர்களின் கருத்துக்கள் - நாட்டுப்புறவியல்மற்றும் வழக்காறுகளை வரையறுப்பதில் சிக்கல்கள் - சூழல், பாடம், இழைவு அடிப்படையில்(Text, Context, Texture) வழக்காறுகள் நிர்ணயம் செய்வதின் தேவை - தமிழ் நாட்டுப்புறவியல் வரலாறு- இந்தியாவில் குறிப்பாகத் தென்னிந்தியாவில் நாட்டுப்புறவியல் வளர்ச்சி.

அலகு : 2 - கள ஆய்வும் வழக்காறுகளும் :
தமிழ் நாட்டில் நாட்டுப்புற வழக்காற்றுச் சேகரிப்பும் மதிப்பீடும் - நாட்டுப்புறவியல் கள ஆய்வில்அறிவியல் அணுகுமுறையின் இன்றியமையாமை - அறிவியல் அணுகுமுறையில் சில படிநிலைகள் - ஆய்வுச் சிக்கலைத் தீர்மானித்தல் - பொதுவான கள ஆய்வின்பயனின்மை - கருதுகோளை உருவாக்குதல் - ஆய்வுச் சிக்கலைப் பகுத்தாய்தல் -சேகரித்தலும் சேகரிப்பு முறையும் - கள ஆய்வாளன் தகுதிகள்.

அலகு : 3 - கோட்பாடுகள் :
1) வரலாற்று நிலவியல் கோட்பாடு (Historical Geographical Theory)
2) வரலாற்று மீட்டுருவாக்கக் கோட்பாடு (Historical Reconstruction Theory)
3) செயல்திறன் கோட்பாடு (Functional Theory)
4) உளவியல் ஆய்வுக் கோட்பாடு (ʻsycho – Analytical Theory)
5) சூழ்நிலைக் கோட்பாடு (Contextual Theory)
6) அமைப்பியல் கோட்பாடு (Structural Theory)

அலகு : 4 - நாட்டுப்புற இலக்கியங்கள் :
நாட்டுப்புற இலக்கிய வகைகள் - நாட்டுப்புறப் பாடல்கள் - தாலாட்டு - காதல் பாடல்கள் -விளையாட்டுப் பாடல்கள் - ஒப்பாரிப் பாடல்கள் - கதைப் பாடல்கள் - கதைகள் - விடுகதைகள் -பழமொழிகள் முதலியன.

அலகு : 5 - நாட்டுப்புறக் கலைகள் :
நாட்டுப்புறக் கலைகள் - தெருக்கூத்து, பொம்மலாட்டம், கரகம், காவடி போன்றன - சிறு தெய்வவழிபாடும் விழாக்களும் - விளையாட்டுக்கள் - கைவினைப் பொருட்கள்

பார்வை நூல்கள்
1) நாட்டுப்புறப்பாடல்கள் சமூக ஒப்பாய்வு - வி. சரசுவதி, பதிப்புத்துறை, மதுரை
காமராசர் பல்கலைக்கழகம், 1982, மதுரை.
2) கள ஆய்வில் சில அனுபவங்கள் - வி. சரசுவதி, மு. இராமசாமி, வெற்றிவேல் பிரசுரம்,

1976, மதுரை.

3) நாட்டார் வழக்காற்றியல் கள ஆய்வு - தே. லூர்து, பாரிவேல் பதிப்கம், 1986, பெருமாள்புரம், திருநெல்வேலி.

4) நாட்டுப்புறவியல் ஆய்வு - சு. சக்திவேல், மணிவாசகர் பதிப்பகம், 1983, சிதம்பரம்.

5) நாட்டுப்புற இலக்கிய வரலாறு - சு. சண்முகசுந்தரம், மணிவாசகர் பதிப்பகம், 1980, சிதம்பரம்.

6) நாட்டுப்புற இயல் ஆய்வுகள் - ஆறு. இராமநாதன், 1978, சென்னை.

7) தமிழர் நாட்டுப்பாடல்கள் - நா. வானமாமலை, நியூ செஞ்சுரி புக் ஹவுஸ், 1977, சென்னை.

8) நாட்டார் வழக்காற்றியல் : சில அடிப்படைகள் - தே. லூர்து, நாட்டார் வழக்காற்றியல் ஆய்வு மையம், 1977, பாளையங்கோட்டை.

9) நாட்டுப்புறக் கலைகள் - ஆறு. இராமநாதன், மணிவாசகர் நூலகம், சென்னை.

10) கள ஆய்வு, பாரதியார் பல்கலைக்கழகம், கோவை.

குறிப்பு : பாடத்திட்டம் ஐந்து அலகுகளாகத் தரப்பட்டுள்ளது. ஒவ்வொரு அலகிலிருந்தும் இரண்டு வினாக்கள் அளிக்கப்பட்டு ஏதேனும் ஒன்றிற்கு விடை எழுதக் கோரும் வகையில் வினாத்தாள் அமையும். ஆக ஐந்து அலகுகளிலிருந்தும் ஐந்து வினாக்களுக்கு விடைகள் எழுதப்பட வேண்டும். மொத்த மதிப்பெண்கள் - 100.

FACULTY OF ENGINEERING

Part I –Ph.D – Syllabus
CIVIL ENGINEERING
(Effective from the academic year 2015-2016 onwards)

Scheme:

The candidate has to write the following three papers: (4 x 3 = 12 credits)

Paper I   : Research Methodology and Pedagogy and Communication skills (Compulsory)

Papers II & III: Any two papers to be selected from the special papers.

Paper – I : Research Methodology and Pedagogy and Communication skills

COURSE OBJECTIVES
1. To impart knowledge in the concept of problem identification and research methodology
2. To familiarize with basic of research and the research process
3. To demonstrate the different types of research and its applicability
4. To comprehend the knowledge of social research
5. To exhibit in sampling design and sampling techniques
6. To enrich the knowledge in writing a good research report.

COURSE OUTCOMES
1. Read, interpret, and critically evaluate social research.
2. Identify, explain, and apply the basic concepts of research, such as variables, operationalization, sampling, reliability, and validity.
3. Recognize the ethical issues involved in research, and practice ethical research standards.
4. Identify and explain the difference between quantitative, qualitative, and mixed methods research and what types of research questions can be answered with each method.
5. Use theory and previous research to create research questions and hypotheses and to identify and analyze the appropriate method and variables needed for research questions.
6. Use a variety of research methods through hands-on experience.

UNIT I
HIGHER EDUCATION AN INTRODUCTION
Historical perspectives, the objectives of higher education, role of higher education-social focus, curricular focus, administrative focus, drivers of change in higher education-globalization, changing demographics, structuring of employment, technological change, demand of accountability, consumerism. Expectations by employers, rate of knowledge growth, campus demographics, concern for community. Restructuring and new patterns of decision making.

UNIT II
RESEARCH PROCESSES AND METHODOLOGY
Introduction to Research – Research strategies – Ethics – Code of conduct for Research – Health and Safety – IPR – Research Events – Networks – Outreach Activities – Best Research practices – Quality assurance for Research – Career Management for Researchers – Research seminars – Journal critiques -.

UNIT III
EFFECTIVE RESEARCH SKILLS

Data collection – Modeling – Simulation – Analysis – Prototyping – Presentation Skills – Data Presentation Skills – Research Writing skills (For Articles, Reports, Journals and Thesis) – Creative Skills – Effective Interview Skills – Team Building Skills – Communication and Interpersonal Skills – knowledge Transfer skills – Vivo voce – Teaching and Information Skills – Effective use of Library – Survey Skills – Planning and Control Methods – Statistical Tools – Patents and Copyrights – Advanced Research Techniques and Tools.

UNIT IV
TECHNIQUES OF TEACHING AND EVALUATION
Large group techniques – lecture, seminar, symposium, panel discussion-project approaches and workshop. Small Group techniques-group discussion simulation, role playing-Buzz techniques, brain storming, case discussion and assignment…system approach in education. Individualized techniques-CAI Keller plan – PSI and programmed learning-methods of evaluation-self evaluation and student evaluation in higher education, question banking, diagnostic testing and remedial teaching.

UNIT V
ESSENTIALS FOR EFFECTIVE COMMUNICATION IN ENGLISH
Improving Vocabulary stock-general and technical vocabulary-British and American vocabulary-homophones & homonyms, idioms and phrases-Different grammatical functions of the same word-Grammar-Tenses, Voice, reported speech, Modals, spoken English structures, formal and informal-letters, project reports, descriptions, circulars, synopsis and summary writing. Listening skills for competitive exams-Reading skills-skimming and scanning – Reading journals, magazines and newspapers for comprehension. Practical use of English – conversation, seminars, individual speeches and group discussions. Reference skills-Using dictionary, thesaurus and encyclopedia effectively. Error shooting for better use of English.

TEXT BOOKS

- Alley, Michael,(1996), 'The Craft of Scientific Writing', 3rd Edition, Springer.
- Alley, Michael, (2003), 'The Craft of Scientific Presentations", Springer.

REFERENCE

- Hubbuch, Susan M.,(2005), Writing Research Papers Across the Curriculum, 5th Edition, Thompson.
- Vedanayagam.E.G (1989),Teaching technology for college teachers New Delhi - Sterling publishers (Pvt) Ltd.
- Kumar.K.H.(1997), Educational technology, New Delhi- New age international (Pvt) Ltd.
- Tony Bates.A.N,(2005) Technology, e-learning and distance education, New York, Rout ledge.   .
- Aggarwal. J.C. (1995), Essential of educational technology; Teaching Learning innovations in education-New Delhi- Vikas publishing house (p) Ltd.,.
- Crow & Crow. (1998),Educational Psychology", Erusia Publishing House New Delhi.
- M. Ashraf Rizvi.(2005),Effective technical communication, TataMcGraw Hill Co.Ltd.

Websites:

- www.english4engineer.com
- www.learn4good.com/language/engineer

15RCE201 - ADVANCE STRUCTURAL ENGINEERING
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES:

1. To understand the concepts of advanced concrete materials and their techniques.
2. To know about the analysis of structure by Finite element method.
3. To study about the design of yield line theory of slab and grid floors
4. To study about structural action of shell
5. To know about the model material and their testing
6. To design the large-scale structure

COURSE OUTCOMES

On completion of the course, the students will be able to:

1. Understand the concepts of advanced concrete materials and their techniques.
2. Analysis the structure by Finite element method
3. Design the yield line theory of slab and grid floors
4. Design the structural action of shell
5. Understand about the model materials and testing.
6. Will gain the knowledge about the design the large-scale structure

UNIT – I

MATERIAL SCIENCE FOR CIVIL ENGINEERING

Modern concrete and concreting techniques, advanced concrete materials, composites, laminates and its applications. Reinforced Concrete and Pre-stressed concretes, Concepts and design, Codal provisions system, optical networking, satellite communication system.

UNIT - II

FINITE ELEMENT METHOD

Finite Element Method, 2D and 3D applications in plane and three dimensional elasticity problems. Analysis of plate and shell structures. Applications using proper software. Nonlinear analysis of structural elements. Material and geometric nonlinearity. Applications for beam, plates and shells.

UNIT - III

DESIGN OF FLAT SLAB AND GRID FLOORS :

Yield line theory of slabs – Hillerberg's method of design of slab – Design of Flat- Slab Equivalent frame method of design - Approximate analysis and Design of grid floors.

UNIT - IV

MEMBRANE THRORY OF SHELLS

Classification of shells - Types of shells - Structural action - Membrane theory – Shells of revolution and shells of translation - Examples - Limitations of membrane theory.

UNIT V

MODEL ANALYSIS

Laws of similitude - model materials – model testing – testing large scale structures – holographic techniques

REFERENCE:

- Timoshenko and Goodier – Theory of Elasticity, McGraw – Hill Publications
- S. Crandall, N. Dahl and T. Lardner – Mechanics of Solids, McGraw Hill Publications
- Anil K Chopra – Dynamics of Structures Theory and Applications to Earthquake Engineering, Prentice – Hall Publications
- R.W. Clough and J Penzin – Dynamics of Structures , McGraw Hill Publications
- R.C. Roy – Structural Dynamics an Introduction to computer methods, John wiley & Sons Publications
- S. Timoshenko and W. Krieger, Theory of plates and shells, McGraw Hill
- Ansel C. Ugural, Stresses in plates and shells, McGraw Hill
- Chadrashekhara K. Analysis of Plates , New Age International Edition
- J.N. Reddy – An Introduction to the finite element method – Tata McGraw Hill Publishing Co. Ltd

15RCE202- ADVANCED SOIL MECHANICS
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES:

1. Understand the engineering properties of soil and identify the problematic soils
2. "Evaluate the soil shear strength for different types of soil and in different conditions
3. of weather"
4. Describe the basic concepts on the design of pile foundations and group of piles
5. Design the rigid pavement using IRC method
6. Apply the knowledge on finite element method in geotechnical engineering
7. Applications of finite element method to evaluate the geotechnical engineering structures

COURSE OUTCOMES

1. Describe the physio – chemical behaviour of soils.

2. Demonstrate the dynamic soil properties and engineering behavior of soils.

3. Design of pile foundations and pile group.

4. Design the rigid pavement using IRC method.

5. Understand the basic concepts and analysis of finite element method in geotechnical engineering.

6. Applications of geotechnical engineering structures using finite element method.

UNIT I
PHYSICAL AND PHYSIO-CHEMICAL BEHAVIOUR OF SOILS
Physical and physio – chemical behaviour of soils – diffused double layer theory – computation of double layer distance – effect of ion concentration, ionic valency, dielectric constant, temperature on double layer – stern layer – attractive and repulsive forces in clays – soil structure – soil water – mechanism of soil – water interactions.

UNIT II
DYNAMIC SOIL PROPERTIES AND BEHAVIOUR
Dynamic stress – strain characteristics – principles of measuring dynamic properties Laboratory Techniques – Field tests – Factors affecting dynamic properties - Typical values. Mechanism of Liquefaction–Influencing factors--Evaluation of Liquefaction potential – Analysis from SPT test – Dynamic bearing capacity – Dynamic earth pressure.

UNIT III
STRUCTURAL DESIGN OF PILE AND PILE GROUPS
Pile foundation – structural design – pile cap analysis, pile – raft system basic interactive analysis – pile and pile groups subjected to vibrations – fundamental solutions.

UNIT IV
RIGID PAVEMENT DESIGN

Design of cement concrete pavement for highways and runways; Design of joints, reinforcements, tie bars, dowel bars. IRC method of design; Design of continuously reinforced concrete pavements. Highway alignment study, controls for selection of Alignment, Engineering Surveys, Geometric design of highways: cross sectional elements, horizontal and vertical alignments, Geometric Design of Intersections – rotaries,

UNIT V
FINITE ELEMENT METHODS IN GEOTECHNICAL ENGINEERING
Stress deformation analysis: One-, Two,Three-dimensional formulations; Discretization; Analysis of foundations, dams, underground structures and earth retaining structures.

REFERENCE:

- Aki K and Richards P G (2002), Quantitative Seismology, University Science Books

- Bowles J E (1996), Foundation Analysis and Design, McGraw Hill.

- Das B M (1997), Advanced Soil Mechanics, Taylor and Francis.

- Das B M (1993), Principles of Soil Dynamics, Brooks/Cole

- Coduto D P (2001), Foundation Design: Principles and Practices, Prentice –Hall

- Kaniraj S R (1988), Design Aids in Soil Mechanics and Foundation Engineering, Tata McGraw Hill

- Poulos H G and Davis E H (1980), Pile Foundation Analysis and Design, John Wiley and Sons

- Koerner R M (1997), Designing with Geosynthetics, Prentice Hall

- Karl Terzaghi (1954), Theoretical Soil Mechanics, Chapman and Hall,.

- Rock Mechanics in Engineering Practice: Stag and Zienkiewez, John Willey & Sons

- J.C. Jagger and N.G.W. Cook(1971), Fundamentals of Rock Mechanics, Methuen and Co.,London.

- Sarsby R (2000), Environmental Geotechnics, Thomas Telford

- Hsai-Yang Fang, Introduction to Environmental Geotechnology, CRC Press.

- Kramer S L (1996), Geotechnical Earthquake Engineering, Prentice Hall

- Prakash Shamsher and Puri V K (1988), Foundations for Machines; Analysis and Design, John Wiley and Sons.

15RCE203- ADVANCED ENVIRONMENTAL ENGINEERING
(Effective from the academic year 2015-2016 onwards)

Course Objectives:
1. To provide the engineering graduates with technical expertise in Environmental Engineering which will enable them to have a career and professional accomplishment in the public or private sector.
2. To address the complexities of real-life environmental engineering problems related to water supply, sewerage, sewage treatment, waste management industrial pollution prevention and control.
3. To Identify and develop processes and technologies to meet desired environmental protection needs of society
4. To formulate solutions that are technically sound, economically feasible, and socially acceptable.
5. To design systems, processes, and equipment for control and remediation of water, air, and soil quality environment within realistic constraints of economic affordability and social acceptability
6. Have a knowledge of contemporary environmental issues and an ability to engage in life-long learning

Course Outcomes:

1. The students are expected to be able to identify, formulate, and solve environmental engineering problems using the techniques, skills, and modern engineering tools necessary for environmental engineering practice.
2. Assess the potential environmental impacts of development projects and design mitigation measures**.**
3. Have basic knowledge about environment protection and operation of pollution control devices.
4. Design and conduct experiments, as well as interpret data and communicate effectively.
5. Function in multi-disciplinary teams and understand the ethical and professional responsibility.
6. Find professional level employment as Environmental Engineers or pursue higher studies

UNIT I
SOLID WASTE TREATMENT AND DISPOSAL
Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes - Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – closure of landfills – landfill remediation.

UNIT II
INDUSTRIAL WASTEWATER TREATMENT

Equalization - Neutralization – Oil separation – Flotation – Precipitation – Heavy metal Removal– Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation – Ozonation – carbon adsorption – Photo-catalysis – Wet Air Oxidation – Evaporation – Ion Exchange – Membrane Technologies – Nutrient removal.- Treatability studies.

UNIT III
AIR QUALITY MONITORING AND CONTROL TECHNIQUES:

Air pollutants: Sources, classification, Combustion Processes, pollutant emission, Effects on Health, vegetation, materials, atmosphere, Reactions of pollutants Scales of AP studies, effects as per scales, Air sampling, pollution measurement methods, Ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations, Removal of gaseous pollutants. Particulate emission control; bioscrubers, biofilters, Indoor air quality.

UNIT IV
SURFACE WATER HYDROLOGY
HYDROLOGIC PROCESSES

Rainfall – Rain gauges – Adequacy of network – Spatial and temporal distribution – frequency and intensity / duration analysis – Consistency – missing data – Abstractions – Infiltration – Evaporation – Interception – Process, estimation and measurement – Depression and detention storages.

RUNOFF ESTIMATION

Components – Factors affecting runoff – Catchment characteristics – Flow measurements – Stream gauging – Floats, current meters – Venturi, Cut-throat and Parshall flumes – Rating curves – Aquastic Doppler velocity meter – Estimation – SCS and strange table methods – Empirical equations – Rainfall – Runoff models – TANK model – Tank clustered catchments.

UNIT V

Remote Sensing, GIS and GPS Techniques and their applications in Environmental Studies. Softwares in Environmental Engineering.Pollutant Transport Mechanisms and Modelling, Hazardous Waste Management, Waste Minimisation Techniques, Environmental Risk Management

REFERENCE:

- Manual on water supply and Treatment ",(1999) CPHEEO, Ministry of Urban Development, GOI, New Delhi.
- Manual on Sewerage and Sewage Development ",(1993), CPHEEO, Ministry of Urban Development, GOI, New Delhi.
- B.A. Hauser,(1991) " Practical Hydraulics Hand Book ", Lewis Publishers, New York,
- M.J. Hammer, " Water and Wastewater Technology ", Regents/Prentice Hall, New Jersey.
- Franzini, J., Freyberg, D., Linsley, R., and G. Tchobanoglous, WaterResources Engineering. McGraw Hill, 1991. ISBN: 0070380104 14

- Reed, S.C. and Crites, R.W.,(1996) Natural Systems for Waste Management and Treatment.McGraw Hill, ISBN: 0071346627
- Guyer, H.H.,(1998) Industrial Processes and Waste Stream Management.Wiley Interscience, ISBN: 0471299847.
- Bishop, P.,(2000) Pollution Prevention: Fundamentals and Practice. McGraw Hill, ISBN: 0073661473
- American Water Works Association, (1997) Water Treatment Plant Design, (3rd Ed.).McGraw-Hill,. ISBN: 0070016437.
- Kawamura, S., (2000) Integrated Design and Operation of Water Treatment Facilities.Wiley and Sons,. ISBN: 0471350931

15RCE301 - Advanced Concrete Technology
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES:
1. To know about the constituent materials of concrete and mix design principles.
2. To understand the concept of special concrete.
3. To study about the tests for durability of concrete
4. To study about recommendations of IS 456-2000 for quality control of concrete
5. To know about the concreting under special circumstances
6. To know about the tests for hardened concrete.

COURSE OUTCOMES

On completion of the course, the students will be able to:

1. Identify the constituent materials of concrete and mix design principles.
2. Describe the concept of special concrete.
3. Demonstrate the tests for durability of concrete
4. Categorize the quality control of concrete as per IS 456-2000 code
5. Develop the concreting under special circumstances
6. Will gain the knowledge of tests for hardened concrete.

UNIT I
INTRODUCTION
Concrete: Past, Present and Future- Constituent Materials --Strength of Concrete -Dimensional Stability of Concrete- Chemical and Mineral Admixtures-Properties of Fresh and hardened Concrete - Principles of Concrete Mix Design-Methods of Concrete mix design.

UNIT II
SPECIAL CONCRETES
Lightweight and Heavy Weight Concrete-High Strength Concrete-High Performance
Concrete-Polymers in Concrete-Steel fiber Reinforced Concrete-Ferrocement Concrete-Vaccum
Concrete-Shotcrete-Ready Mixed Concrete-SIFCON.

UNIT III
DURABILITY OF CONCRETE
Permeability-chemical attack-sulphate attack-Quality of water-marine conditions-
Thermal properties of concrete-fire resistance-methods of making durable concrete **-**
Mass Concrete-Formwork-Structural Concrete Block Masonry -Quality Control of Concrete
Construction.

UNIT IV
FORMWORK AND QUALITY CONTROL
Formwork Materials and Systems-Specifications-Design-Recommendations of IS 456-2000 on
Quality- Statistical Parameters and Variability-Errors in Concrete Constructions-Quality
Management.

UNIT V

CONCRETING UNDER SPECIAL CIRCUMSTANCES

Underground Construction-Concreting in Marine Environment-Under eater Construction-Hot weather and Cold weather concreting.

Tests on Concrete : Evaluation of Strength of existing structures-investigation Techniques-Tests on Hardened Concrete-Non Destructive Testing-Semi destructive testing techniques-Tests on fresh Concrete-Load Test on Structural Components.

REFERENCES:

- Neville, A.M., Properties of Concrete, Pitman Publishing Limited, London.
- Shetty M.S.(2003),Concrete Technology,S.Chand and Company Ltd,.New Delhi.
- Gambir,M.L.(2004) "Concrete Technology", Tata McGraw Hill, Publishing Co,Ltd, New Delhi.
- Krishnaraju.N, "Design of Concrete mixes", Sehgal Educational Consultants
- Pvt.Ltd.,Faridabad.
- IS:456-2000,Indian Standards Code of Practice for Pa\lain and Reinforced Concrete
- IS: 10262, "Recommended Guidelines for Concrete Mix Design",1982.
- Santhakumar,A.R., Concrete Technology, Oxford University Press, New Delhi.

15RCE302 - Prefabricated Structures
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES:
1. To know about the modular coordination and production process of prefabricates
2. To understand the concept of Long wall and cross-wall large panel buildings.
3. To study about the design of large panels and stair cases
4. To study about the design of shear walls
5. To know about the design of industrial sheds and roof trusses.
6. To know about the hand book-based design of prefabricates.

COURSE OUTCOMES
On completion of the course, the students will be able to:

1. Identify the modular coordination and production process of prefabricates
2. Describe the long wall and cross-wall large panel buildings.
3. Design the large panels and stair cases
4. Design the shear walls
5. Design the industrial sheds and roof trusses.
6. Will gain the knowledge of hand book-based design of prefabricates.

UNIT I
DESIGN PRINCIPLES
General Civil Engineering requirements, specific requirements for planning and layout of prefabricates plant. IS Code specifications. Modular co-ordination, standardization, Disuniting of Prefabricates, production, transportation, erection, stages of loading and codal provisions, safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls.

UNIT II
REINFORCED CONCRETE
Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls, -Connections – Beam to column and column to column.

UNIT III
FLOORS , STAIRS AND ROOFS
Types of floor slabs, analysis and design example of cored and panel types and two-way systems, staircase slab design, types of roof slabs and insulation requirements, Description of joints, their behaviour and reinforcement requirements, Deflection control for short term and long term loads, Ultimate strength calculations in shear and flexure.

UNIT IV
WALLS

Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, load transfer from floor to wall panels, vertical loads, Eccentricity and stability of wall panels, Design Curves, types of wall joints, their behaviour and design, Leak prevention, joint sealants, sandwich wall panels, approximate design of shear walls.

UNIT V
INDUSTRIAL BUILDINGS AND SHELL ROOFS
Components of single-storey industrial sheds with crane gantry systems, R.C. Roof Trusses, Roof Panels, corbels and columns, wind bracing design. Cylindrical, Folded plate and hyper-prefabricated shells, Erection and jointing, joint design, hand book based design.

REFERENCES:

- B.Lewicki, (2011) Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam, London,New York.

- Koncz.T., (1971)Manual of Precast Concrete Construction, Vol.I II and III, Bauverlag, GMBH.

- Structural Design Manual, (1978) Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag,.

- Lasslo Mokk, Prefabricated Concrete for Industrial and Public Sectors,(1964) Akademiai Kiado, Budapest.

- Murashev.V., Sigalov.E., and Bailov.V.,(2003) Design of Reinforced Concrete Structures, CBS publishers and distributors, New Delhi.

- Gerostiza. C.Z., Hendrikson, C. and Rehat D.R.,(1994) Knowledge Based Process Planning for Construction and Manufacturing, Academic Press, Inc.

- Warszawski, A.,(1990) Industrialization and Robotics in Building - A managerial approach, Harper and Row.

15RCE303- High Performance Concrete
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES:
1. To know about the characteristics of concrete
2. To know about the design of concrete mixtures
3. To understand the concept micro & macroscopic behavior and theories of HPC
4. To study about the design of Fibre reinforced concrete as per ACI 318-99
5. To study about the design of shear walls
6. To know about the hand book-based design of prefabricates.

COURSE OUTCOMES
On completion of the course, the students will be able to:

1. Identify the modular coordination and production process of prefabricates
2. Show competency in design of advanced reinforced concrete structures.
3. Develop competence for applying of structures. Design the shear walls
4. Design the industrial sheds and roof trusses.
5. Will gain the knowledge of hand book-based design of prefabricates.

UNIT I – PERFORMANCE CHARACTERISTICS OF CONCRETE
General performance characteristics – cement effect on concrete strength – Portland cement and other hydraulic cement characteristics and content – performance comparison of various cements in concrete – water/cement ratio, aggregate and admixtures – permeability effects on performance of concrete – air voids and permeability – diffusion, sorptivity – freezing, thawing effect – concrete in cold weather –air entraining agents- ACI recommendations –hot weather concreting

UNIT II – ADMIXTURES AND DESIGN MIXTURES OF HPC
Mineral admixtures – chemical admixtures – strength requirements – selection of materials and proportions – flow chat for mixtures – mixture design – high performance light weight aggregates production, properties and proportioning – mixing and placement – creep, shrinkage and durability – thermal expansion ,conductivity and carbonation – offshore arctic environment – design of concrete mixtures – long term effects

UNIT III- CHARACTERISTICS, MICRO & MACRO MECHANICS
Concrete properties – mature elastic strength expressions – workability and cohesiveness, permeability, volumetric stability – ductility and energy absorption, constructability- bond to parent concrete – abrasion and fire resistance – micro & macroscopic behavior and theories – classical failure, crack propagation and failure mechanics theory – shear friction theory – confinement

UNIT IV – FRC & FRPC AND CODE OVER VIEW
FRC historical development, general characters and mixture proportioning – mechanical properties and mechanics of fiber reinforcement – plastic composites – GFRP & CFRP sheets – fire resistance – structural element designs as per ACI 318-99 – performance control for long

term durability – constituent materials , corrosion inhibiters – water, mixture proportioning – constructability, serviceability, quality control and quality assurance

UNIT V – ECONOMICS OF HPC & HPC in 21st CENTURY

Construction needs – design and rehabilitation considerations – monitoring and cost evaluation – expectations and conclusions - principal factors affecting cost –advantages using HPC- cost studies and comparisons

REFERENCES :

- Edward G. Nawy (   )Fundamentals of high performance concrete ,2nd edition John Wily & Sons, Australia.
- Pierrie- Claude Aitcin E.& F.N Spon   High performance concrete Technology and Engineering ,London.
- Yves Malier –E & FN Spon   High performance concrete from material to structure, London.
- V.M.Malhotra (2002) High performance concrete performance and quality of concrete structures ,Proceedings of the 3rd international conference .

15RCE304 - GROUND IMPROVEMENT TECHNIQUES
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVE:

1. At the end of the course student is expected to identify the problematic soil and suitable suggest remedial measures

2. To understand the different problematic soils and effect of ground improvement techniques.

3. To describe the seepage analysis and suitable dewatering systems for the particular soil conditions.

4. To express the concept of compaction efforts on ground improvement and their installation and working principles.

5. Describe the load transfer mechanism and effect of geo textiles reinforcements in ground improvement.

6. Describe the various stabilization methods for the different types of problematic soils.

COURSE OUTCOMES

1. Student will be in a position to identify and evaluate the deficiencies if any in the deposits of a project area.
2. Capable of providing alternate methods to improve its character suitable to the project, so that the structures built will be stable and serve.
3. Describe the dewatering systems for different soil conditions and their effect.
4. Express the working principles of different compaction methods on improving weak deposits.
5. Express the design of geo textiles reinforcements for ground improvement.
6. Express the soil stabilization methods for the problematic soils.

UNIT I
DEWATERING
Introduction - Scope and necessity of ground improvement in Geotechnical engineering basic concepts and philosophy. Drainage - Ground Water lowering by well points, deep wells, vacuum and electro-osmotic methods. Stabilization by thermal and freezing techniques.

UNIT II
COMPACTION AND SAND DRAINS
Insitu compaction of granular and cohesive soils, Shallow and Deep compaction methods - sand piles – concept, design, factors influencing compaction. Blasting and dynamic consolidation – Preloading with sand drains, fabric drains, wick drains etc. – Theories of sand drain – design and relative merits of above methods.

UNIT III
STONE COLUMN, LIME PILES AND SOIL NAILING

Stone column, lime piles – Functions – Methods of installation – design, estimation of load carrying capacity and settlement. Root piles and soil nailing - methods of installation – Design and Applications – case studies.

UNIT IV
EARTH REINFORCEMENT
Earth reinforcement – Principles and basic mechanism of reinforced earth, simple design, Synthetic and natural fibre based Geotextiles and their applications. Filtration, drainage, separation, erosion control – case studies.

UNIT V
GROUTING
Grouting – Types of grout – Suspension and solution grouts – Basic requirements of grout. Grouting equipment – injection methods - jet grouting – grout monitoring – Electro – chemical stabilization – Stabilization with cement, lime etc. – Stabilization of expansive clays.

REFERENCES:

- Ramanatha Ayyar, T.S., Ramachandran Nair, C.L. and Balakrishnan Nair, N., (2002.) Comprehensive Reference book on Coir Geotextiles, Centre for development of Coir Technology.

- Koerner, R.M.,(1997) Designing with Geosynthetics, Third Edition, Prentice Hall.

- Jewell, R.A.,(1996) Soil Reinforcement with Geotextiles, CIRIA, London.

- Jones, J.E.P.,(1985) Earth Reinforcement and Soil Structure, Butterworths,.

- Rowe, R.K.,(2001) Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers.

- Moseley, M.D., (1998) Ground Treatment, Blackie Academic and Professional.

- Das, B.M(1999), Principles of Foundation Engineering, Fourth Edition, PWS Publishing.

- Koerner, R.M. and Welsh, J.P(1990), Construction and Geotechnical Engineering using Synthetic   Fabrics, John Wiley.

- Hehn, R.W(1996.), Practical Guide to Grouting of Underground Structures, ASCE.

- Shroff, A.V(1999), Grouting Technology in Tunneling and Dam, Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi.

- Lee. C.F., Lau, L.K.., Ng., C.W.W., Kwong A.K., Pang., P.L.R., Yin, J.K., and Yue, Z.Q., Soft soil engineering, Proceedings, Third international conference on soft soil engineering

15RCE305 - Geopolymer Cement and Concrete
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES:

1. To familiarize with the basic chemistry, structure, and reactions of geopolymer formation and its reaction products
2. To understand the fundamentals of Geopolymer composites (resins, pastes, mortars, concretes) and their characterization using different advanced analytical tools
3. To study the characteristic properties of Geopolymer composites such as strength, durability, waste utilization, safe disposal of hazardous effluents and heavy metal encapsulations
4. To identify and evaluate various geopolymer systems for commercially viable practical applications in various fields such as infrastructure, nuclear, constructions, buildings, precast systems, strengthening/retrofitting operations, and thermal/fire resistances
5. To analyse the Geopolymer composites with reference to ecology, economy, sustainability and environmental friendliness

COURSE OUTCOMES

On completion of the course, the students will be able to:

1. Understand the concepts of basic chemistry, structure, and reactions of geopolymer formation and its reaction products
2. Understand the fundamentals of Geopolymer composites and their characterization
3. characteristic properties of Geopolymer composites such as strength, durability, waste utilization, safe disposal of hazardous effluents and heavy metal encapsulations
4. Identify and evaluate various geopolymer systems for commercially viable practical applications.
5. Analyse the Geopolymer composites with reference to ecology, economy, sustainability and environmental friendliness
6. Will gain the knowledge about toxic waste management

UNIT I
POLYMERS AND GEOPOLYMERS
Introduction - The mineral polymer concept: silicones and geopolymers - Macromolecular structure of natural silicates and alumino silicates - Scientific Tools, X-rays, FTIR, NMR – Poly (siloxonate) and polysilicate, soluble silicate,Si:Al=1:0 - Chemistry of (Na,K)–oligo-sialates: hydrous alumino-silicate gels and zeolites - Kaolinite / Hydrosodalite based geopolymer, poly(sialate) with Si:Al=1:1 - MetakaolinMK-750 based geopolymer, poly(sialate-siloxo) with Si:Al=2:1- Chemical mechanism: formation of ortho-sialate (OH)3-Si-O-Al- (OH)3 –

UNIT II
GEOPOLYMERS AND TOXIC WASTE MANAGEMENT

Calcium based geopolymer, (Ca, K, Na)-sialate, Si:Al=1, 2, 3 - Silica-based geopolymer, sialate link and siloxo link in poly(siloxonate) Si:Al>5 - Fly ash-based geopolymer - Phosphate-based geopolymers - Organic-mineral geopolymer - Containment with barriers - Waste encapsulation requires MK-750-based geopolymers - Heavy metals in mine tailings - The use of geopolymers for paint sludge disposal - Treatment of arsenic-bearing wastes - Uranium mining waste treatment - Geopolymers in other toxic-radioactive waste management applications

UNIT III
PROPERTIES AND APPLICATIONS

Physical properties of condensed geopolymers - Chemical Properties of condensed geopolymers - Long-term durability, archaeological analogues, geological analogues - Quality control - Development of user-friendly systems - Castable geopolymer, industrial and decorative applications - Geopolymer – fiber composites - Foamed geopolymer - Geopolymers in ceramic processing

UNIT IV
GEOPOLYMER CEMENT

The manufacture of geopolymer cements - Greenhouse CO_2 mitigation fosters the development of geopolymer cements - Additional Raw-Materials from industrial wastes - Additional Raw-Materials from industrial wastes - Replacement of (Na,K) soluble silicates with synthetic lavas

UNIT V
GEOPOLYMER CONCRETE

Geopolymer concrete - Mixture proportions of fly ash-based geopolymer concrete - Mixing, casting, and compaction of fly ash-based geopolymer concrete - Curing of fly ash-based geopolymer concrete - Design of fly ash-based geopolymer concrete mixtures - Short-term properties of fly ash-based geopolymer concrete - Long-term properties of fly ash-based geopolymer concrete - Reinforced geopolymer concrete beams and columns - Better than Portland cement concrete

REFERENCES :

- Geopolymer Chemistry and Applications ,3rd edition July 2011 ,Joseph Davidovits , Institute Géopolymère , 16 rue Galilée , F-02100 Saint-Quentin , France

- Advanced concrete technology by Zongjin li , John – Wily & sons , New Jersey

- Innovative Material for concrete construction – ACES workshop by Michael N.Fardis, Springer Publications, London, New York

- Ground Improvement Techniques by Dr. P. Purushothama Raj, Raj

- Purushothama , Laxmi Publications , New delhi.

15RCE306 - PAVEMENT ENGINEERING

(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES:

7. To understand the importance of transportation and characteristics of road transport
8. To know about the history of highway development, surveys and classification of roads
9. To study about the geometric design of highways
10. To study about traffic characteristics and design of intersections
11. To know about the pavement materials and design
12. To design flexible and rigid pavements as per IRC.

COURSE OUTCOMES

On completion of the course, the students will be able to:

1. Carry out surveys involved in planning and highway alignment.
2. Design cross section elements, sight distance, horizontal and vertical alignment.
3. Implement traffic studies, traffic regulations and control, and intersection design.
4. Determine the characteristics of pavement materials.
5. Design flexible and rigid pavements as per IRC.
6. Will gain the knowledge of horizontal and vertical curves

UNIT I

BASIC CONCEPTS

Pavements types – Historical developments - Approaches to pavement design –vehicle and traffic considerations – behaviour of road materials under repeatedloading – Stresses and deflections in layered systems.

UNIT II

FLEXIBLE PAVEMENT

Factors affecting flexible pavements – material characterization for analyticalpavement design – CBR and stabilometer tests – Resilient modulus – Fatiguesubsystem – failure criteria for bituminous pavements – IRC design guidelines.

UNIT III

RIGID PAVEMENT

Factors affecting rigid pavements - Design procedures for rigid pavement – IRC guidelines – Airfield pavements. Highway pavements – CRC pavements.

UNIT IV

PAVEMENT EVALUATION AND REHABILITATION

Pavement evaluation and rehabilitation, condition and evaluation surveys causes and types of distress – in flexible and rigid pavements – PSI models – Serviceability indexof rural roads – Overlay design, pavements maintenance management and construction.

UNIT V

STABILIZATION OF SOILS FOR ROAD CONSTRUCTIONS

The need for a stabilized soil – Design criteria and choice of stabilizers – Testing and field control – Stabilisation in India for rural roads – Use of Geosynthetics in road construction - Case studies.

REFERENCES:

- Wright, P.H(1996), Highway Engineers, John Wiley & Sons, Inc., New York.
- Khanna S.K and Justo C.E.G(2001), Highway Engineering, Eighth Edition, New Chand and Brothers, Roorkee.
- Yoder R.J and Witchak M.W(2000)., Principles of Pavement Design, John Wiley.
- Croney, D(1979), Design and Performance of Road Pavements, HMO Stationary Office.
- Design and Specification of Rural Roads (Manual),(2001), Ministry of rural roads, Government of India, New Delhi.
- Guidelines for the Design of Flexible Pavements, IRC:37 - 2001, The Indian roads Congress, New Delhi.
- Guideline for the Design of Rigid Pavements for Highways, IRC:58-1998, The Indian Roads Congress, New Delhi.
- O' Flaherty, C.A (1978), Highway Engineering (Vol. 2), Edward Arnold Cp.
- Bell. P.S(1978), Developments in Highway Engineering, Applied Sciences publishers.

15RCE307 - TRAFFIC ENGINEERING AND MANAGEMENT
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVE:
1. To learn the fundamentals of traffic engineering
2. To learn the methods of intersection design
3. To learn the skills of traffic control
4. To be introduced to the different theories of traffic flow
5. To be aware of the importance of traffic safety
6. To be aware of traffic flow theory

COURSE OUTCOMES

Upon completing of this course, the students should be able to:
1. Carry out traffic studies
2. Design intersections
3. Implement traffic system management
4. Be aware of traffic flow theory
5. Enhance safety in all design aspects
6. The skills of traffic control

UNIT I
INTRODUCTION
Significance and scope, Characteristics of Vehicles and Road Users, Skid Resistance and Braking Efficiency (Problems), Components of Traffic Engineering- Road, Traffic and Land Use Characteristics

UNIT II
TRAFFIC SURVEYS AND ANALYSIS
Surveys and Analysis - Volume, Capacity, Speed and Delays, Origin and Destination, Parking, Pedestrian Studies, Accident Studies and Safety Level of Services- Problems

UNIT III
TRAFFIC CONTROL
Traffic signs, Road markings, Design of Traffic signals and Signal co-ordination (Problems), Traffic control aids and Street furniture, Street Lighting, Computer applications in Signal design

UNIT IV

GEOMETRIC DESIGN OF INTERSECTIONS

Conflicts at Intersections, Classification of Intersections at Grade, - Chanallised and Unchanallised Intersection - Grade Separators (Concepts only), Principles of Intersection Design, Elements of Intersection Design, Chanallisation and Rotary design (Problems), Grade Separators

UNIT V

TRAFFIC MANAGEMENT

Traffic Management- Traffic System Management (TSM) and Travel Demand Management (TDM), Traffic Forecasting techniques, Restrictions on turning movements, One-way Streets, Traffic Segregation, Traffic Calming, Tidal flow operations, Exclusive Bus Lanes - Introduction to Intelligence Transport System (ITS)

REFERENCES:

- Indian Roads Congress (IRC) specifications: Guidelines and special publications on Traffic Planning and Management.
- Guidelines of Ministry of Road Transport and Highways, Government of India.
- Subhash C.Saxena,(2009), A Course in Traffic Planning and Design, Dhanpat Rai Publications, New Delhi.
- Khanna K and Justo C E G(2001), Highway Engineering, Khanna Publishers, Roorkee.
- Kadiyali L(2000), Traffic Engineering and Transport Planning. Khanna Technical Publications, Delhi.

15RCE308 - Solid and hazardous waste management
(Effective from the academic year 2015-2016 onwards)

Course Objectives:
1. To gain a brief knowledge on different hazardous waste and its disposal methods.
2. To provide students with the necessary background and knowledge about the various sources.
3. To know the on-site/off-site processing of the Solid waste management and the disposal methods.
4. To characterize the waste and its sources with various test available for checking the quality.
5. To impart knowledge and skills in various components of Municipal Solid Waste Management.
6. To gain the knowledge of processing and conversion technologies.

Course Outcomes:
1. Brief knowledge on different hazardous waste and its disposal methods.
2. The necessary background and knowledge about the various sources.
3. The on-site/off-site processing of the Solid waste management and the disposal methods.
4. Understand the fundamental principles of existing and emerging technologies for the treatment of waste and recovery of materials and energy from waste.
5. Have an overview of the Indian and international waste management regulations and guidelines for the design, construction, operation and management of waste treatment facilities.
6. Ways of operation of collection, transfer, treatment, management and disposal of wastes as per Solid Waste Management Rules, 2016.

UNIT I
INTRODUCTION
Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management – Elements of integrated waste management and roles of stakeholders - Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, lead acid batteries, plastics and fly ash.

UNIT II
WASTE CHARACTERISATION AND SOURCE REDUCTION
Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes – Recycling and reuse – Waste exchange.

UNIT III
STORAGE, COLLECTION AND TRANSPORT OF WASTES
Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport

UNIT IV
WASTE PROCESSING TECHNOLOGIES
Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes

UNIT V
WASTE DISPOSAL
Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – closure of landfills – landfill remediation.

REFERENCE BOOKS:

- George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, 1993, "Integrated Solid Waste Management, McGraw- Hill International edition, New York.

- CPHEEO "Manual on Municipal Solid waste management, 2000, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi.

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15RCE309 –Remote Sensing and GIS Applications in Environmental Engineering
(Effective From the academic year 2015-2016 onwards)

COURSE OBJECTIVE:
1. To gain a sound fundamental understanding of the GIS and remote sensing technologies
2. To understand the basic principles underlying the GIS/model-based management of water resources and environment.
3. To become familiar with the GIS-based analytical and problem-solving techniques for sustainable planning and management of water resources and environmental problems.
4. Different types of remotely sensed images and data available for water resource applications.
5. To apply the GIS-based analytical and problem-solving techniques for sustainable planning and management of water resources and environmental problems.
6. To develop a project report and can develop Water Resource Information Systems (WRIS) for regional and basin scale.

COURSE OUTCOMES

By the end of this course the students will be able to

1. Develop fundamental understanding of the GIS and remote sensing technologies
2. Understand the basic principles underlying the GIS based management of water resources and environment.
3. Apply the GIS-based analytical and problem-solving techniques for sustainable planning and management of water resources and environmental problems.
4. Understand the types of remotely sensed images and data available for water resource applications.
5. Develop a project report and can develop Water Resource Information Systems (WRIS) for regional and basin scale.
6. Understand the basic principles underlying the GIS/model-based management of water resources and environment.

UNIT I
FUNDAMENTALS OF REMOTE SENSING
Introduction to remote sensing – Principles of Electro – Magnetic Radiation – Energy / Matter interaction with Atmosphere and land surface – spectral reflectance of earth Materials and vegetation – Data products

UNIT II
AERIAL PHOTOGRAPHY AND SATELLITE REMOTE SENSING
Aerial Photography – photogrammetry And Visual Image Interpretation –Various Satellites in orbit and their sensors – Resolutions - Multispectral Remote Sensing System (MSS) and design – VISIBLE – NIR remote sensing – Thermal IR Radiation Properties, systems and application – Microwave and LIDAR remote sensing – Principles and applications

UNIT II
DATA ANALYSIS AND GIS

Data Analysis – Visual interpretation and digital image processing – Classification -Introduction to GIS, concepts and base structure , various GIS software.

UNIT IV
REMOTE SENSING AND GIS APPLICATIONS

Application of Remote sensing and GIS – Management and Monitoring of Land, air ,Water and pollution studies – conservation of resources – coastal zone management –
Limitations

UNIT V
LABORATORY PRACTIES

Data sources - Visual interpretation - digital image processing –Introduction to ENVI image processing software – GIS / Data Analysis in ARC GIS.

REFERENCES :

- Anji Reddy ,(2001) "Remote Sensing and Geographical Information system ", B S Publications.
- M.G. Srinivas (2001) "Remote sensing applications", Narosa publishing House .
- A M. Chandra and S.k .Ghosh, (2006) "Remote Sensing and   Geographical Information System", Narosa Publishing House, .
- Lintz, J. and Simonet,(1994.) Remote Sensing of Environment, Addison Wesle Publishing Company,
- Burro ughs (1998) P.A, Principles of Geographical Information system , Oxford University Press .
- Thomas   M Lille sand , Rupiah W.Kiefer & Jonathan W. Chip man (2004) "Remote sensingAnd Image   Interpretation " John Wiley Sons, .

15RCE310 - GROUNDWATER MODELING AND MANAGEMENT
(Effective From the academic year 2015-2016 onwards)

Course Objectives:
1. These courses are introduced to the students to understand the basic concept of mathematical modelling
2. To know about the process simulation techniques of environmental disturbances
3. To know about modeling concept and transport phenomena.
4. To understand ground water prospecting.
5. To understand the contaminant transport model in environment.
6. To gain the knowledge about the ground water flow model.

Course Outcomes:

At the end of this course students can

1. Understand the basic concept of mathematical modelling
2. Know about the process simulation techniques of environmental disturbances with groundwater domains.
3. Concept of modeling concept and transport phenomena.
4. Understand ground water flow model.
5. Understand the ground water prospecting understand the contaminant transport model in environment.
6. Know the importance of Subsurface mass transport through the vadose zone.

UNIT I
GROUNDWATER PROSPECTING
Investigation and evaluation – Geophysical methods- Electrical Resistivity methods – Interpretation of data – Seismic method – Subsurface investigation – Test drilling – Resistivity logging – Application of remote sensing techniques.

UNIT II
GROUNDWATER FLOW MODEL
Physical models – Analog models – Mathematical modeling – Unsaturated flow models Numerical modeling of groundwater flow – Finite Differential equations - Finite difference solution – Successive over Relaxation, Alternating direction implicit procedure – Crank Nicolson equation – Iterative methods -Direct methods - Inverse problem – Finite element method

UNIT III
CONTAMINANT TRANSPORT MODEL
Contaminant transport theory – Advection, dispersion equation – Longitudinal and transverse dispersivity – Hydrodynamic dispersion – Analytical models – Numerical simulation of solute transport – Solution methods - Sorption model – Subsurface mass transport through the vadose zone - Density driven flow - Heat transport.

UNIT IV

MODEL DEVELOPMENT

Data requirements – Conceptual model design : Conceptualization of aquifer system – Parameters, Input-output stresses, Initial and Boundary conditions - Model design and execution : Grid design, Setting boundaries, Time discretization and Transient simulation – Model calibration : steady state and unsteady state – sensitivity analysis – Model validation and prediction – Uncertainty in the model prediction

UNIT V
GROUNDWATER MANAGEMENT MODEL

Optimal groundwater development – Indian GEC norms – Conjunctive use models Modeling multilayer groundwater flow system -Modeling contaminant migration – Modeling fracture flow system – Artificial recharge feasibility through modeling – Simulation of movements of solutes in unsaturated zone – Stochastic modeling of groundwater flow - Groundwater contamination, restoration and management

REFERENCES:

- Anderson M.P., and Woessner W.W (2000), Applied Groundwater Modelling : Simulation of flow and advective transport, Academic Press, Inc.
- Fetter C.W (2008) Contaminant Hydrogeology, Prentice Hall.
- Rushton K.R (2003), Groundwater Hydrology : Conceptual and Computational Models, Wiley.
- Elango L. and Jayakumar, R. (2001), Modelling in Hydrology, Allied Publishers Ltd.
- Remson I., Hornberger G.M. and Moltz F.J(2007), Numerical Methods in Subsurface Hydrology, Wiley, New York.
- Robert Willis and William W.G.Yenth (1987), Groundwater System Planning and Management, Prentice Hall, Englewood Cliffs.
- Randall J.Charbeneau (2000) , Groundwater Hydraulics and Pollutant Transport, Printice Hall.

15RCE311 - INDUSTRIAL WASTEWATER POLLUTION – PREVENTION AND CONTROL

(Effective From the academic year 2015-2016 onwards)

Course Objectives:
1. To learn various process engineering, unit operations of Mining, Metallurgical, Thermal Power, Cement and Petroleum Industries.
2. Provides a fundamental understanding of the design, operational principles and practical applications of modern instrumental methods employed in chemical analysis of environmental samples.
3. To have a basic knowledge about Source reduction techniques.
4. To understand the concept of wastewater reuse and residual management
5. To understand detailly about Disposal on water and land
6. To gain the knowledge about the pollution prevention of assessment.

Course Outcomes:

At the end of this course students can
1. Understanding the environmental aspects and impacts of each unit operations of the polluting industries.
2. The students will be able to understand and orient themselves with the industry before they undergo summer training, internship, interview or job.
3. The students will be able to conceive and prepare Environmental Management Plan of these industries.
4. Develop critical thinking skills in the areas of instrument selection, method development and data interpretation.
5. Knowledge in various case studies about various industries.
6. Able to get a detailed Regulatory requirement for treatment of industrial wastewater.

UNIT I
INTRODUCTION
Industrial scenario in India– Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling - generation rates, characterization and variables –Toxicity of industrial effluents and Bioassay tests – Major issues on water quality management

UNIT II
INDUSTRIAL POLLUTION PREVENTION
Prevention and Control of Industrial Pollution – Benefits and Barriers – Waste management Hierarchy - Source reduction techniques – Pollution Prevention of Assessment - Material balance

- Evaluation of Pollution prevention options –Cost benefit analysis – pay back period - Waste minimization Circles

UNIT III
INDUSTRIAL WASTEWATER TREATMENT

Equalization - Neutralization – Oil separation – Flotation – Precipitation – Heavy metal Removal– Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation – Ozonation – carbon adsorption – Photo-catalysis – Wet Air Oxidation – Evaporation – Ion Exchange – Membrane Technologies – Nutrient removal.- Treatability studies.

UNIT IV
WASTEWATER REUSE AND RESIDUAL MANAGEMENT

Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse – Industrial reuse, Present status and issues - Disposal on water and land – Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge – Thickening, digestion, conditioning, dewatering and disposal of sludge – Management of RO rejects.

UNIT V
CASE STUDIES

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Oil Refining – Pharmaceuticals – Sugar and Distilleries.

REFERENCES

- Eckenfelder, W.W (2000) Industrial Water Pollution Control, Mc-Graw Hill.

- Nelson Leonard Nemerow (2007), Industrial waste treatment contemporary practice and vision for the future, Elsevier, Singapore.

- Frank Woodard (2001), Industrial waste treatment Handbook, Butterworth Heinemann, New Delhi.

- World Bank and UNEP (1998), Pollution Prevention and Abatement Handbook – Towards Cleaner Production, Washington D.C.

- Paul L. Bishop (2000) Pollution Prevention: - Fundamentals and Practice, Mc-Graw Hill International, Boston.

15RCE312 - ENVIRONMENTAL POLICIES AND LEGISLATIONS
(Effective from the academic year 2015-2016 onwards)

Course Objectives:

1. Understating the environmental laws, acts, standard for environmental compliance.
2. Understating the EIA and its methodologies for Industries and Regulators.
3. To learn methodologies of Environmental Management System through Appellate Authority – Penalties for violation of consent conditions
4. To learn the implementation of Environmental Management System through Environmental Audits.
5. Insight of regulatory framework related to hazardous waste management.
6. To have a knowledge about the air act, water act and environmental act.

Course Outcomes:

At the end of this course students can learn the

1. Concepts and applications of Environmental Laws and EIA in real world situations
2. Environmental management system and various auditing processes.
3. Prepare the statutory Environmental Statement for various industries.
4. Serve and guide the industrial sector as good corporate citizens.
5. Understanding the principles of regulatory framework for the treatment and disposal of hazardous wastes.
6. Knowledge about the Concept of absolute liability.

UNIT I
INTRODUCTION
Indian Constitution and Environmental Protection – National Environmental policies – Precautionary Principle and Polluter Pays Principle – Concept of absolute liability – multilateral environmental agreements and Protocols – Montreal Protocol, Kyoto agreement, Rio declaration – Environmental Protection Act, Water (P&CP) Act, Air (P&CP) Act – Institutional framework (SPCB/CPCB/MoEF)

UNIT II
WATER (P&CP) ACT, 1974
Power & functions of regulatory agencies - responsibilities of Occupier Provision relating to prevention and control Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Water Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.

UNIT III
AIR (P&CP) ACT, 1981
Power & functions of regulatory agencies - responsibilities of Occupier Provision relating to prevention and control Scheme of Consent to establish, Consent to operate – Conditions of the

consents – Outlet – Legal sampling procedures, State Air Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.

UNIT IV
ENVIRONMENT (PROTECTION) ACT 1986
Genesis of the Act – delegation of powers – Role of Central Government - EIA Notification – Sitting of Industries – Coastal Zone Regulation - Responsibilities of local bodies mitigation scheme etc., for Municipal Solid Waste Management - Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier, authorisation – Biomedical waste rules – responsibilities of generators and role of Pollution Control Boards

UNIT V
OTHER TOPICS
Relevant Provisions of Indian Forest Act, Public Liability Insurance Act, CrPC, IPC -Public Interest Litigation - Writ petitions - Supreme Court Judgments in Landmark cases.

REFERENCES:
- CPCB,(1997)"Pollution Control acts, Rules and Notifications issued there under "Pollution Control Series – PCL/2/1992, Central Pollution Control Board, Delhi.
- Shyam Divan and Armin Roseneranz (2001) "Environmental law and policy in India "Oxford University Press, New Delhi.
- Pollution control Legislations volume I &II issued by Tamil Nadu Pollution Control Board

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers I: 15RCSE101-Research Methodology and pedagogy
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

- To introduce the research methodology concepts
- To discuss various steps for experimental design
- To categorize various testing methods used for research
- To discuss about various multivariate statistical techniques applied for research
- To explain about pedagogical methods in higher learning
- To discuss methods to implement research using research methodology and pedagogy

COURSE OUTCOMES:

Upon completion of this course the students will be able to:

- Identify and understand the research methodology concepts
- Develop various steps for experimental design
- Categorize various testing methods used for research
- Implement various multivariate statistical techniques applied for research
- Understand about pedagogical methods in higher learning
- Explain various methods to implement research using research methodology and pedagogy

UNIT I   **INTRODUCTION TO RESEARCH**

Research methodology – definition, mathematical tools for analysis, Types of research,exploratory research, conclusive research, modeling research, algorithmic research, Research process- steps.Data collection methods- Primary data – observation method, personal interview, telephonicinterview, mail survey, questionnaire design.Secondary data- internal sources of data, external sources of data.

UNIT II   **EXPERIMENTAL DESIGN**

Laboratory and the Field Experiment – Internal and External Validity – Factors affectingInternal validity. Measurement of variables – Scales –Types of scale – Thurstone's Case V scale model, Osgood'sSemantic Differential scale, Likert scale, Q- sort scale-Sampling methods- Probability sampling methods – simple random sampling with replacement,simple random sampling without replacement, stratified sampling, cluster sampling. Non- probability sampling method – convenience sampling, judgment sampling, quota sampling.

UNIT III   **TESTING METHODS**

Hypotheses testing – Testing of hypotheses concerning means (one mean anddifference between two means -one tailed and two tailed tests), Concerning variance – onetailed Chi-square test-Nonparametric tests- One sample tests – one sample sign test, Kolmogorov-Smirnovtest, run test for randomness, Two sample tests – Two sample sign test, Mann-Whitney U test,K-sample test – Kruskal Wallis test (H-Test)

UNIT IV   MULTIVARIATE STATISTICAL TECHNIQUES

Data Analysis – Factor Analysis – Cluster Analysis – Discriminant Analysis – MultipleRegression and Correlation – Canonical Correlation – Application of Statistical (SPSS)Software Package in Research.

UNIT-V PEDAGOGICAL METHODS IN HIGHER LEARNING

Objectives and roll of higher education- important characteristics of an effective lecture- Quality teaching and learning- Lecture preparation- Characteristics of instructional design- Methods of teaching and learning: Large group –Technique- Lecture, Seminar, Symposium, Team Teaching, Project, small group technique-Simulation, role playing demonstration, Brain storming, Case studies and assignment, methods of evaluation-self evaluation, student evaluation, diagnostics testing and remedial teaching –question banking-electronic media in education:-'e' learning researches-web based learning.

REFERENCES:

1. Donald R. Cooper and Ramela S. Schindler, Business Research Methods, Tata

McGraw- Hill Publishing Company Limited, New Delhi, 2000

2. Uma Sekaran, Research Methods for Business, John Wiley and Sons Inc., NewYork, 2000.

3. C.R.Kothari, Research Methodology, WishvaPrakashan, New Delhi, 2001.

4. Donald H.McBurney, Research Methods, Thomson Asia Pvt. Ltd. Singapore, 2002.

5. G.W.Ticehurst and A.J.Veal, Business Research Methods, Longman, 1999.

6. Ranjit Kumar, Research Methodology, Sage Publications, London, New Delhi, 1999.

7. Raymond-Alain Thie'tart, et.al., Doing Management Research, Sage Publications,London, 1999.

8. Panneerselvam, R., Research Methodology, Prentice-Hall of India, New Delhi, 2004

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers II: 15RCSE201. Soft Computing
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

- To introduce neurofuzzy and soft computing concepts
- To discuss various categories of optimization
- To compare supervised and unsupervised learning neural networks
- To discuss various neuro fuzzy modeling algorithms
- To discuss different applications of computational intelligence
- To explain various applications of soft computing to implement in research

COURSE OUTCOMES:

Upon completion of this course the students will be able to:

- Understand neurofuzzy and soft computing concepts
- Differentiate various categories of optimization
- Understand and compare supervised and unsupervised learning neural networks
- Implement various neuro fuzzy modeling algorithms
- Develop different applications of computational intelligence
- Implement various applications of soft computing to implement in research

UNIT – I FUZZY SET THEORY

Introduction to Neuro – Fuzzy and soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic operations – Member Function Formulation and parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT – II OPTIMIZATION

Derivative-based Optimization – Descent Methods – The Method of steepest Descent – Classical Newton's Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

UNIT – III NEURAL NETWORKS

Supervised Learning Neural Networks – Perceptrons-Adaline – Backpropagation Multilayer perceptrons – Radial Basis Function Networks – Unsupervised Learning and Other Neural

Networks – Competitive Learning Networks – Kohonen Self – Organizing Networks – Learning Vector Quantization – Hebbian Learning.

UNIT – IV NEURO FUZZY MODELING

Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro-Fuzzy Modeling – Framework – Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT – V APPLICATION OF COMPUTATIONAL INTELLIGENCE

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency prediction – Soft Computing for Color Recipe Prediction.

REFERENCES:

1. Soft Computing: Neural Networks, Fuzzy Logic and Genetic Algorithms, Sushil Kumar Singh, Galgotia, 2012
2. Soft Computing & Intelligent System: Theory, Tools and Applications, Fakhreddine O. Karray, Pearson Education; First edition , 2009.
3. Davis E.Goldberg, 2004,"Genetic Algorithms Search, Optimization and Machine Learning", 4th Edition, Addison Wesley, New York.
4. Rajasekaran S. and G.A.V.Pai, 2006,"Neural Networks, Fuzzy Logic and Genetic Algorithms", 5th Edition, PHI, New Delhi.
5. Eberhart R. P.simpson and R.Dobbins, 2003,"Computional Intelligence PC Tools", 3rd Edition, AP Professional, Boston.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers II: 15RCSE202. Advanced Digital Image Processing
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

- To introduce various fundamentals of Digital Image Processing
- To discuss various concepts based on segmentation
- To explain different feature extraction techniques present for digital image processing
- To discuss about registration and image fusion for digital image processing
- To discuss various concepts of 3D image visualization
- To discuss about various research-oriented applications using advanced digital image processing

COURSE OUTCOMES:

Upon completion of this course the students will be able to:

- Understand various fundamentals of Digital Image Processing
- Explain various concepts based on segmentation
- Compare different feature extraction techniques present for digital image processing
- Explain about registration and image fusion for digital image processing
- Explain various concepts of 3D image visualization
- Develop various research-oriented applications using advanced digital image processing

UNIT I FUNDAMENTALS OF DIGITAL IMAGE PROCESSING

Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, 2D image transforms-DFT, DCT, KLT, and SVD. Image enhancement in spatial and frequency domain, Review of morphological image processing

UNIT II SEGMENTATION

Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour methods, Texture feature based segmentation, Model based segmentation, Atlas based segmentation, Wavelet based Segmentation methods

UNIT III FEATURE EXTRACTION

First and second order edge detection operators, Phase congruency, Localized feature extraction-detecting image curvature, shape features Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors- Autocorrelation, Co-occurrence features, Runlength features, Fractal model based features, Gabor filter, wavelet features.

UNIT IV REGISTRATION AND IMAGE FUSION

Registration- Preprocessing, Feature selection-points, lines, regions and templates Feature correspondence-Point pattern matching, Line matching, region matching Template matching. Transformation functions-Similarity transformationand Affine Transformation. Resampling-Nearest Neighbour and Cubic Splines Image Fusion-Overview of image fusion, pixel fusion, Multiresolution based fusiondiscrete wavelet transform, Curvelet transform. Region based fusion.

UNIT V 3D IMAGE VISUALIZATION

Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on 3D images

REFERENCES:

1. John C.Russ, "The Image Processing Handbook", CRC Press,2011.

2. Mark Nixon, Alberto Aguado, "Feature Extraction and Image Processing", Academic Press, 3rd edition, 2012.

3. ArdeshirGoshtasby, " 2D and 3D Image registration for Medical, Remote Sensing and Industrial Applications",John Wiley and Sons,2005.

4. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing', Pearson,Education, Inc., 3rd Edition, 2007.

5. Anil K. Jain, Fundamentals of Digital Image Processing', Pearson Education,Inc., 2002.

6. Rick S.Blum, Zheng Liu,"Multisensor image fusion and its Applications",Taylor& Francis,2006.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE203. CRYPTOGRAPHY ANDNETWORK SECURITY
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

- To introduce various concepts of cryptography and network security
- To explain public key encryption
- To discuss message authentication
- To discuss about network security practices
- To illustrate various concepts of system security
- To explain various cryptography and network security applications for research and engineering

COURSE OUTCOMES:

Upon completion of this course the students will be able to:

- Analyse various concepts of cryptography and network security
- Explain public key encryption
- Understand message authentication
- Discuss about network security practices
- Illustrate various concepts of system security
- Develop various cryptography and network security applications for research and engineering

UNIT I -INTRODUCTION

Attacks - Services - Mechanisms - Conventional Encryption - Classical And Modern

Techniques – Encryption Algorithms - Confidentiality.

UNIT II- PUBLIC KEY ENCRYPTION

RSA - Elliptic Curve Cryptography - Number Theory Concepts

UNIT III- MESSAGE AUTHENTICATION

Hash Functions - Digest Functions - Digital Signatures - Authentication Protocols.

UNIT IV-NETWORK SECURITY PRACTICE

Authentication, Applications - Electronic Mail Security - IP Security - Web Security.

UNIT V-SYSTEM SECURITY

Intruders – Viruses – Worms – Firewalls Design Principles – Trusted Systems.

REFERENCES:

1. Stallings, Cryptography & Network Security - Principles & Practice, Prentice Hall, 6th Edition 2012.

2. Bruce, Schneier, Applied Cryptography, 2nd Edition, Toha Wiley & Sons, 1996.

3. Man Young Rhee, "Internet Security", Wiley, 2003.

4. Pfleeger&Pfleeger, "Security in Computing", Pearson Education, 4th Edition, 2006.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE204. DATA WAREHOUSING AND DATA MINING
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

- To Introduce the concepts of data warehousing and data mining
- To illustrate various data preprocessing and association rules
- To explain in detail about predictive modeling
- To discuss the concepts of data warehousing in detail
- To explain various applications for research
- To explain the concepts of various data warehousing and data mining functionalities for real life scenarios

COURSE OUTCOMES:

Upon completion of this course the students will be able to:

- Understandthe concepts of data warehousing and data mining
- Analyze various data preprocessing and association rules
- Understand in detail about predictive modeling
- Interpret the concepts of data warehousing in detail
- Explain various applications for research
- Understand the concepts of various data warehousing and data mining functionalities for real life scenarios

UNIT I - INTRODUCTION

Relation To Statistics, Databases- Data Mining Functionalities-Steps In Data MiningProcess- Architecture Of A Typical Data Mining Systems- Classification Of Data MiningSystems - Overview Of Data Mining Techniques.

UNIT II- DATA PREPROCESSING AND ASSOCIATION RULES

Data Preprocessing-Data Cleaning, Integration, Transformation, Reduction,Discretization Concept Hierarchies-Concept Description: Data Generalization AndSummarization Based Characterization- Mining Association Rules In Large Databases.

UNIT III- PREDICTIVE MODELING

Classification And Prediction: Issues Regarding Classification And Prediction-Classification By Decision Tree Induction-Bayesian Classification-Other ClassificationMethods-Prediction- Clusters Analysis: Types Of Data In Cluster Analysis-Categorization Of Major Clustering Methods: Partitioning Methods –HierarchicalMethods

UNIT IV- DATA WAREHOUSING

Data Warehousing Components -Multi Dimensional Data Model- Data WarehouseArchitecture-Data Warehouse Implementation- -Mapping The Data Warehouse ToMultiprocessor Architecture- OLAP.-Need- Categorization Of OLAP Tools.

UNIT V- APPLICATIONS

Applications of Data Mining-Social Impacts Of Data Mining-Tools-An Introduction ToDB Miner-Case Studies-Mining WWW-Mining Text Database-Mining SpatialDatabases.

REFERENCES:

1. Jiawei Han, MichelineKamber, "Data Mining: Concepts and Techniques",Morgan Kaufmann Publishers, 2011.
2. Alex Berson,Stephen J. Smith, "Data Warehousing, Data Mining,& OLAP", TataMcgraw-Hill, 2004.
3. UsamaM.Fayyad, Gregory Piatetsky - Shapiro, Padhrai Smyth AndRamasamy, 1996.
4. Uthurusamy, "Advances In Knowledge Discovery And Data Mining", The M.I.TPress, 1996.
5. Ralph Kimball, "The Data Warehouse Life Cycle Toolkit", John Wiley &SonsInc., 1998.
6. Sean Kelly, "Data Warehousing In Action", John Wiley & Sons Inc., 1997.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE205. AGENT BASED INTELLIGENT SYSTEMS

(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

- To introduce various concepts of agent based intelligent systems in detail
- To discuss concepts on knowledge representation and reasoning
- To explain about various planning agents
- To understand about agents and uncertainty in detail
- To explain about various higher level agents
- To illustrate various applications of agent based intelligent systems in detail

COURSE OUTCOMES:

Upon completion of this course the students will be able to:

- Understand various concepts of agent based intelligent systems in detail
- Interpret various concepts on knowledge representation and reasoning
- Understand about various planning agents
- Explain about agents and uncertainty in detail
- Explain about various higher level agents
- Develop various applications of agent based intelligent systems in detail

UNIT I- INTRODUCTION

Definitions - Foundations - History - Intelligent Agents-Problem Solving-Searching -Heuristics - Constraint Satisfaction Problems - Game playing.

UNIT II- KNOWLEDGE REPRESENTATION AND REASONING

Logical Agents-First order logic-First Order Inference-Unification-Chaining-ResolutionStrategies-Knowledge Representation-Objects-Actions-Events

UNIT III- PLANNING AGENTS

Planning Problem-State Space Search-Partial Order Planning-Graphs-NondeterministicDomains-Conditional Planning-Continuous Planning-MultiAgent Planning.

UNIT IV -AGENTS AND UNCERTAINITY

Acting under uncertainty – Probability Notation-Bayes Rule and use –BayesianNetworks-Other Approaches-Time and Uncertainty-Temporal Models- Utility Theory -Decision Network – Complex Decisions.

UNIT V-HIGHER LEVEL AGENTS

Knowledge in Learning-Relevance Information-Statistical Learning Methods-Reinforcement Learning-Communication-Formal Grammar-Augmented Grammars-Future of AI.

REFERENCES:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence - A Modern Approach",2nd Edition, Prentice Hall, 2009.

2. Michael Wooldridge, "An Introduction to Multi Agent System", John Wiley, 2009.

3. Patrick Henry Winston, Artificial Intelligence, III Edition, AW, 1999.

4. Nils.J.Nilsson, Principles of Artificial Intelligence, Narosa Publishing House, 2014.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE206. NETWORK ROUTING ALGORITHMS
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:
- To expose the students to the layered architecture for communication networks
- To explain about Internet Routingprotocols
- To discuss specific functionality of the network layer.
- To enable the student to understand the basic principles of routing and implementation in conventional networks and the evolving routing algorithms based on Internetworking requirements, optical backbone and the wireless access part of the network.
- Explain about mobile ad –hoc networks
- To enable the student to understand the different routing algorithms existing and their performance characteristics.

COURSE OUTCOMES:
Upon completion of the course, the students will be able to:
- Understand layered architecture and its significance.
- Learn network layer and various routing techniques available.
- Apply knowledge for identifying a suitable routing algorithm ,implementing it and analysing its performance for any given network and user requirements and the type of channel over which the network has to operate,
- Design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications.
- Compare Routing techniques and protocols.
- Acquire the knowledge of how data transfer happen in conventional networks.

UNIT I INTRODUCTION
ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing.

UNIT II INTERNET ROUTING
Interior protocol : Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.

UNIT III ROUTING IN OPTICAL WDM NETWORKS

Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control,Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting- Benefits and Issues, Lightpath Migration, Rerouting Schemes, Algorithms- AG, MWPG.

UNIT IV MOBILE - IP NETWORKS

Macro-mobility Protocols, Micro-mobility protocol:Tunnel based : Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII).

UNIT V MOBILE AD –HOC NETWORKS

Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV), Reactive routing: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector Routing (AODV), Hybrid Routing: Zone Based Routing (ZRP).

REFERENCES

1. William Stallings, ' High speed networks and Internets Performance and Quality of Service', IIndEdition, Pearson Education Asia. Reprint India 2009
2. M. Steen Strub, ' Routing in Communication network, Prentice –Hall International, Newyork,1995.
3. S. Keshav, 'An engineering approach to computer networking' Addison Wesley 1999.
4. William Stallings, 'High speed Networks TCP/IP and ATM Design Principles, Prentice- Hall, New York, 1995
5. C.E Perkins, 'Ad Hoc Networking', Addison – Wesley, 2001
6. Ian F. Akyildiz, Jiang Xie and ShantidevMohanty, " A Survey of mobilityManagement in Next generation All IP- Based Wireless Systems", IEEE
Wireless Communications Aug.2004, pp 16-27.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers II: 15RCSE301. Ad hoc Networks
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:
- To learn Ad-Hoc Wireless Networks, Issues, and Classification of MAC Protocols.
- To understand the different types of AdHoc Routing Protocols and TCP overAdHoc Protocol.
- To understand about Sensor Network Architecture, its Applications and MAC Protocols for sensor networks.
- To learn the Different Issues in Wireless Sensor Routing
- To discuss the Indoor and outdoor Localization and Quality of Service in WSN.
- To learn Mesh Networks , IEEE 802.11s Architecture and different types of Mesh Networks. □□□

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
- Gain the knowledge of Ad-Hoc Network and its issues.
- Identify the basic problems, limitations, strengths and current trends of mobile computing □□
- Analyze the current wireless networking mechanisms for mobile computing □□
- Analyzeand critique the performance of different networks and algorithms for mobile □ Computing □□
- Develop an attitude to propose solutions with comparisons for problems related to mobile computing
- Investigation of different protocols and mobile/wireless networks □□□

UNIT I -INTRODUCTION

Introduction-Fundamentals of Wireless Communication Technology –TheElectromagnetic Spectrum - Radio Propagation Mechanisms - Characteristics of theWireless Channel - IEEE 802.11a,b Standard – Origin Of Ad hoc: Packet RadioNetworks - Technical Challenges - Architecture of PRNETs - Components of PacketRadios – Ad hoc Wireless Networks -What Is an Ad Hoc Network? Heterogeneity inMobile Devices - Wireless Sensor Networks - Traffic Profiles - Types of Ad hoc MobileCommunications - Types of Mobile Host Movements - Challenges Facing Ad HocMobile Networks-Ad hoc wireless Internet

UNIT II- AD HOC ROUTING PROTOCOLS

Introduction - Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks - Classifications of Routing Protocols -Table-Driven Routing Protocols –DestinationSequenced Distance Vector (DSDV) - Wireless Routing Protocol (WRP) - Cluster SwitchGateway Routing (CSGR) - Source-Initiated On-Demand Approaches - Ad Hoc On-Demand Distance Vector Routing (AODV) - Dynamic Source Routing (DSR) -Temporally Ordered Routing Algorithm

(TORA) - Signal Stability Routing (SSR) -Location-Aided Routing (LAR) - Power-Aware Routing (PAR) - Zone Routing Protocol(ZRP)

UNIT III- MULTICASTROUTING IN AD HOC NETWORKS

Introduction - Issues in Designing a Multicast Routing Protocol - Operation of MulticastRouting Protocols - An Architecture Reference Model for Multicast Routing Protocols -Classifications of Multicast Routing Protocols - Tree-Based Multicast Routing Protocols-Mesh-Based Multicast Routing Protocols - Summary of Tree-and Mesh-Based Protocols- Energy-Efficient Multicasting - Multicasting with Quality of Service Guarantees -Application-Dependent Multicast Routing - Comparisons of Multicast Routing Protocols

UNIT IV- TRANSPORT LAYER, SECURITY PROTOCOLS

Introduction - Issues in Designing a Transport Layer Protocol for Ad Hoc WirelessNetworks - Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks -Classification of Transport Layer Solutions - TCP Over Ad Hoc Wireless Networks -Other Transport Layer Protocols for Ad Hoc Wireless Networks - Security in Ad HocWireless Networks - Network Security Requirements - Issues and Challenges in SecurityProvisioning - Network Security Attacks - Key Management - Secure Routing in Ad HocWireless Networks

UNIT V-QoS AND ENERGY MANAGEMENT

Introduction - Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions - MAC Layer Solutions - Network Layer Solutions -QoS Frameworks for Ad Hoc Wireless Networks Energy Management in Ad HocWireless Networks –Introduction - Need for Energy Management in Ad Hoc WirelessNetworks - Classification of Energy Management Schemes - Battery ManagementSchemes - Transmission Power Management Schemes - System Power ManagementSchemes

REFERENCES:

1. Siva Ram MurthyC. and B.S. Manoj "Ad Hoc Wireless Networks: Architectures andProtocols", Prentice Hall PTR,2004

2. TohC.K., Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice HallPTR ,2001

3. Charles E. Perkins, Ad Hoc Networking, Addison Wesley, 2000

4. Mobile Ad Hoc Networking, Stefano Basagni, Marco Conti, Wiley India Private Limited , 26 August 2010.

5. Mobile Ad Hoc Networks: Current Status and Future TrendsHardcover, Jonathan Loo, Jaime LloretMauri, CRC Press, 16 December 2011.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers II: 15RCSE302. BIGDATA

(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:
- To explore the fundamental concepts of big data analytics □□
- □ To learn and analyze big data like Hadoop, NoSqlMapReduce. □□□
- □ To understand the various search methods and visualization techniques. □□□
- □ To learn the techniques and principles in achieving big data analytics with scalability and streaming capability
- □ To learn Hive and Pig scripts in the Hadoop environment.
- □ To explain various challenges and Solutions in Big Data.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- Gain knowledge of Big Data and Hadoop ecosystem
- Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
- Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
- Design and implement MapReduce programs and implementing HBase
- Implement Hive and Pig scripts in the Hadoop Environment.
- Discuss the Challenges and Solutions in Big Data.

UNIT I – UNDERSTANDING BIG DATA

What is bigdata–why big data–convergence of key trends–unstructured data–industry examples of big data–web analytics–big data and marketing–fraud and big data–risk and big data–credit risk management –big data and algorithmic trading–big data and healthcare –big data in medicine –advertising and big data –big data technologies – introduction to Hadoop– open source technologies– cloud and big data–mobile business intelligence–Crowd sourcing analytics–inter and transfirewallanalytics

UNIT II –NO SQL DATA MANAGEMENT

Introduction to NoSQL–aggregate data models–aggregates –key-value and document data models –relationships –graph databases –schema less databases –materialized views– distribution models–sharding–master-slave replication–peer-peer replication – shardingand replication –consistency –relaxing consistency –version stamps –map- reduce–partitioning and combining–composing map-reduce calculations

UNIT III – BASICS OF HADOOP

Data format –analyzing data with Hadoop –scaling out–Hadoopstreaming –Hadooppipes–design of Hadoop distributed file system (HDFS)–HDFS concepts–Java interface –data flow–HadoopI/O–data integrity–compression –serialization–Avro–file-based data structures

UNIT IV –MAP REDUCE APPLICATIONS

Map Reduce workflows –unit tests with MR Unit–test data and local tests–anatomy of Map Reduce job run–classic Map-reduce –YARN –failures in classic Map-reduce and YARN –job scheduling –shuffle and sort–task execution –Map Reduce types–input formats–output formats

UNIT V   HADOOP RELATED TOOLS

Hbase– data model and implementations– Hbaseclients– Hbase examples– praxis.Cass and ra–cassand radata model –cassand ra examples –cassand raclients – Hadoopintegration. Pig–Grunt–pig data model–Pig Latin– developing and testing Pig Latin scripts.Hive–data types and file formats–Hive QL data definition –Hive QL data manipulation – Hive QL queries.

SUGGESTED READINGS

1.MichaelMinelli, Michelle Chambers, and AmbigaDhiraj,(2013),"Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.

2. P. J. Sadalage and M. Fowler, (2012),"No SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional,

3.TomWhite, (2012),"Hadoop: The Definitive Guide", ThirdEdition, O'Reilley,

4.EricSammer,(2012), "HadoopOperations", O'Reilley,

5.E.Capriolo, D.Wampler, and J. Rutherglen, (2012),"ProgrammingHive",O'Reilley,

6.LarsGeorge, (2011), "HBase: The Definitive Guide", O'Reilley,

7. EbenHewitt,(2010), "Cassandra: The Definitive Guide",O'Reilley,

8.AlanGates,(2011), "Programming Pig",O'Reilley,

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE303. PERFORMANCE EVALUATION OF COMPUTER SYSTEMS ANDNETWORKS

(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

- To introduce basic concepts of performance evaluation of computer systems and networks
- To explain probability and stochastic processes
- To discuss about queuing theory
- To discuss about petri nets and system performance
- To discuss the process of analysis
- To explore various methods to perform evaluation of computer systems and networks

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:
- Explain basic concepts of performance evaluation of computer systems and networks
- Understand probability and stochastic processes
- Learn about queuing theory
- Understand about petri nets and system performance
- Understand the process of analysis
- Apply various methods to perform evaluation of computer systems and networks

UNIT I- INTRODUCTION

Need for performance evaluation – Role of performance evaluation –performanceevaluation Methods – Performance Metrics and Evaluation Criteria – CPU and I/OArchitectures – Distributed and Network Architectures– Secondary Storage – Topologies– Computer Architecture - Fundamental Concepts and Performance Measures.

UNIT II- PROBABILITY AND STOCHASTIC PROCESSES

Scheduling Algorithms – Workloads – Random Variables – Probability Distributions –Densities – Expectation – Stochastic Processes – Poisson Process – Birth-Death Process –Markov Process.

UNIT III- QUEUING THEORY

Queuing Systems – Networks of Queues - Estimating Parameters and Distributions – Computational Methods – Simulation Process – Time Control – Systems and Modeling.

UNIT IV-PETRI NETS AND SYSTEM PERFORMANCE

Petri Nets – Classical Petri Nets – Timed Petri Nets – Priority-based Petri Nets – ColoredPetri Nets – Generalized Petri Nets – Tool Selection – Validation of Results –Performance Metrics – Evaluation – Multiple Server Computer System Analysis.

UNIT V- ANALYSIS

OS Components – System Architecture – Workloads – Design – Simulation – Analysis - Database System Performance – Computer Networks Components – SimulationModelling of LAN.

REFERENCES:

1. Paul J. Fortier, Howard E. Michael, "Computer Systems PerformanceEvaluation and Prediction", Elsvier Science (USA), 2003.
2. Thomas G. Robertazzi, "Computer Networks and Systems: Queing theory andPerformance Evaluation", 3rd Edition, Springer, 2000.
3. Domenico Ferrari , Giuseppe Serazzi ,AlexandroZeijher, Measurement &Tuningof Computer Systems –Prentice Hall Inc, 1983.
4. Michael F.Mories and Paul F.Roth,.Tools and techniques, Computer PerformanceEvaluation, Van Nostrand, New York, 1982.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE304. DISTRIBUTED COMPUTING

(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:
- To understand the fundamentals and acquire knowledge of the architectures of distributed systems.
- To gain knowledge of various remote procedure call models.
- To understand concepts of distributed shared memory systems.
- To make students aware about synchronization and management mechanism for distributedenvironment.
- To learn features of distributed file systems.
- To explain various security aspect of distributed systems.

COURSE OUTCOMES:
Upon completion of the course, the students will be able to:
- Understand the principles and desired properties of distributed systems based on different application areas.
- Understand and apply the basic theoretical concepts and algorithms of distributed systems in problem solving.
- Learn the concepts of distributed shared memory systems.
- Analyse various synchronization and management techniques for distributed environment.
- Identify the features of distributed file systems.
- Understand the security aspect of distributed systems.

UNIT I- INTRODUCTION

Characterization of Distributed Systems - Examples - Resource Sharing and the Web - Challenges - System Models - Architectural and Fundamental Models - Networking andInternetworking - Types of Networks - Network Principles - Internet Protocols - CaseStudies.

UNIT II- PROCESSES AND DISTRIBUTED OBJECTS

Interprocess Communication - The API for the Internet Protocols - External DataRepresentation and Marshalling - Client-Server Communication - Group Communication- Case Study - Distributed Objects and Remote Invocation - Communication BetweenDistributed Objects - Remote Procedure Call - Events and Notifications - Java RMI -Case Study.

UNIT III- OPERATING SYSTEM ISSUES – I

The OS Layer - Protection - Processes and Threads - Communication and Invocation –OS Architecture - Security - Overview - Cryptographic Algorithms - Digital Signatures -

Cryptography Pragmatics - Case Studies - Distributed File Systems - File ServiceArchitecture - Sun Network File System - The Andrew File System

UNIT IV- OPERATING SYSTEM ISSUES – II

Name Services -Domain Name System - Directory and Discovery Services –GlobalName Service - X.500 Directory Service - Clocks, Events and Process States -Synchronizing Physical Clocks - Logical Time And Logical Clocks - Global States -Distributed Debugging - Distributed Mutual Exclusion – Elections – MulticastCommunication Related Problems.

UNIT V- DISTRIBUTED TRANSACTION PROCESSING

Transactions - Nested Transactions - Locks - Optimistic Concurrency Control -Timestamp Ordering - Comparison - Flat and Nested Distributed Transactions –AtomicCommit Protocols - Concurrency Control in Distributed Transactions –DistributedDeadlocks - Transaction Recovery - Overview of Replication And DistributedMultimedia Systems

REFERENCES:

1. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Conceptsand Design, Pearson Education, 5th Edition, 2011.

2. SapeMullender, Distributed Systems, Addison Wesley, 2nd Edition, 1993.

3. Albert Fleishman, Distributes Systems- Software Design and Implementation,Springer-Verlag, 1994

4. LiuM.L., Distributed Computing Principles and Applications, Pearson Education,2004.

4. Andrew S Tanenbaum ,MaartenvanSteen,Distibuted Systems –Principles andPardigms,Pearson Education, 2006.

5. MugeshSinghal,Niranjan G Shivaratri,Advanced Concepts in OperatingSystems,Tata McGraw Hill Edition, 21st reprint, 2008

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE305. COMPONENT BASED TECHNOLOGY

(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

- Introduce Component based technology
- Explain about java component technologies
- Discuss about various Corba technologies
- Discuss various aspects of .com and .Net technologies
- Discuss about component frameworks and development
- Discuss application of Component based technology

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:
- UnderstandComponent based technology
- Interpret about java component technologies
- Learn about various Corba technologies
- Understand various aspects of .com and .Net technologies
- Understand about component frameworks and development
- Interpret application of Component based technology

UNIT I- INTRODUCTION

Software Components – objects – fundamental properties of Component technology –modules – interfaces – callbacks – directory services – component architecture –components and middleware.

UNIT II- JAVA COMPONENT TECHNOLOGIES

Threads – Java Beans – Events and connections – properties – introspection – JAR files – reflection – object serialization – Enterprise Java Beans – Distributed Object models –RMI and RMI-IIOP.

UNIT III- CORBA TECHNOLOGIES

Java and CORBA – Interface Definition language – Object Request Broker – systemobject model – portable object adapter – CORBA services – CORBA component model –containers – Application server – model driven architecture.

UNIT IV -COM AND .NET TECHNOLOGIES

COM – Distributed COM – object reuse – interfaces and versioning – dispatch interfaces–connectable objects – OLE containers and servers – Active X controls – .NETcomponents - assemblies – appdomains – contexts – reflection – remoting.

UNIT V- COMPONENT FRAMEWORKS AND DEVELOPMENT

Connectors – contexts – EJB containers – CLR contexts and channels – Black Boxcomponent framework – directory objects – cross-development environment –component-oriented programming – Component design and implementation tools –testing tools - assembly tools.

REFERENCES:

1. Clemens Szyperski, "Component Software: Beyond Object-Oriented Programming",Addison Wesley, 2nd Edition 2011.

2. Ed Roman, "Enterprise Java Beans",3rd Edition, Wiley, 2004.

3. Andreas Vogel, Keith Duddy, "Java Programming with CORBA", John Wiley &Sons 1998

4. Corry, Mayfield, Cadman, "COM/DCOM Primer Plus", Tec media, 1st Edition, 1999

(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:
- To introduce the fundamentals of XML and web services
- To gain knowledge of XML technology
- To understand concepts of SOAP
- To make students aware about various web services available
- To learn features of XML security system available
- To explain various applications and research based on XML and web services

COURSE OUTCOMES:
Upon completion of the course, the students will be able to:
- Understand the fundamentals of XML and web services
- Interpret knowledge of XML technology
- Illustrate concepts of SOAP
- Be aware about various web services available
- Explain features of XML security system available
- Develop various applications and research oriented concepts based on XML and web services

UNIT I - INTRODUCTION

Role Of XML – XML and The Web – XML Language Basics – SOAP – Web Services – Revolutions Of XML – Service Oriented Architecture (SOA).

UNIT II- XML TECHNOLOGY

XML – Name Spaces – Structuring With Schemas and DTD – Presentation Techniques – Transformation – XML Infrastructure.

UNIT III- SOAP

Overview Of SOAP – HTTP – XML-RPC – SOAP: Protocol – Message Structure – Intermediaries – Actors – Design Patterns And Faults – SOAP With Attachments.

UNIT IV- WEB SERVICES

Overview – Architecture – Key Technologies - UDDI – WSDL – ebXML – SOAP And

Web Services In E-Com – Overview Of .NET And J2EE.

UNIT V- XML SECURITY

Security Overview – Canonicalization – XML Security Framework – XML Encryption –

XML Digital Signature – XKMS Structure – Guidelines For Signing XML Documents –

XML In Practice.

REFERENCES:

1. Web Technologies HTML, CSS, JavaScript, ASP.NET, Servlets, JSP, PHP, ADO.NET, JDBC, and XML Black Book, Kogent Learning Solutions Inc.Dreamtech Press, 2013.
2. XML and Web Services Unleashed Ron Schmelzer, Pearson Education; First edition,2008

3. Frank. P. Coyle, XML, Web Services And The Data Revolution, Pearson Education,2002.

4. Ramesh Nagappan , Robert Skoczylas and Rima Patel Sriganesh, " Developing JavaWeb Services", Wiley Publishing Inc., 2004.

5. SandeepChatterjee, James Webber, "Developing Enterprise Web Services", PearsonEducation, 2004.

6. McGovern, et al., "Java Web Services Architecture", Morgan KaufmannPublishers, 2005.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021

PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE307. FUZZY LOGIC, NEURAL NETWORKS AND APPLICATIONS

(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES
- To introduce the basic concepts of Fuzzy logic and its applications in various domain
- To educate how to use Fuzzy computation to solve real-world problems
- To have a solid understanding of Basic fuzzy models.
- Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
- To learn about applications on Fuzzy based systems
- To familiarize with fuzzy fiction and de fuzzy fiction procedures

COURSE OUTCOMES
At the end of the course the students will be able to
- Understand the basic concepts of Fuzzy logic and its applications invarious domain
- Gain knowledge on theory of Reasoning
- Develop fuzzy controllers
- Understand concepts of adaptive fuzzy control
- Ability to develop how to use Fuzzy computation to solve real- world problems
- Design fuzzy based model for any application

UNIT I   INTRODUCTION TO NEURAL NETWORKS
Biological neural - Neural processing - Supervised and unsupervised learning - Neural network learning rules. Single layer perception - discrete and continuous perception - multi layer feed forward network – Back propagation Networks - feed back networks - Training Algorithms.

UNIT II   UNSUPERVISED NETWORKS
Unsupervised Learning – Competitive Learning Networks – Kohonenself organising networks – Learning Vector Quantization – Hebbian Learning – Hopfield Network –Content Addressable Nature – Binary Hopfield Network – Continuous Hopfield Network

UNIT III   ASSOCIATIVE MEMORIES AND SOM
Bidirectional Associative Memory – Principle Component Analysis.Auto associative memories - Bidirectional Associative memory (BAM) - Self Organization Maps (SOM) and ART1.

UNIT IV   FUZZY LOGIC
Fuzzy sets - Fuzzy Rules: Extension Principle, fuzzy measures - fuzzy relations - fuzzy functions-Fuzzy Reasoning.

UNIT V   FUZZY SYSTEMS AND APPLICATIONS

Representation of fuzzy knowledge - fuzzy inference systems- Mamdani Model – Sugeno Model – Tsukamoto Model– Fuzzy decision making – Multi Objective Decision Making – Fuzzy Classification– Fuzzy Control Methods – Application.

REFERENCES:

1. Jang J S R Sun C T and Mizutani E, "Neuro Fuzzy and Soft computing", PearsonEducation, (Singapore), 2004.
2. S Rajasekaran and G AVijayalakshmiPai, "Neural networks Fuzzy logics and Genetic algorithms", Prentice Hall of India, 2004
3. DerongLiu , "Advances in Neural Networks--ISNN 2007 ", Springer, 8th edition, 2011
4. Timothy J Ross, "Fuzzy Logic Engineering Applications", John Wiley and Sons, 2004James A. Anderson, "An Introduction to Neural Networks", Prentice Hall, 3rd edition, 2010.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE308. ONTOLOGY AND SEMANTIC NETWORKS
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

- To understand the basic concepts and layers of semantic web.
- To learn RDF data models and querying the semantic web using SPARQL
- To learn Ontology Engineering, construction and reusing.
- To understand the description logics and monotonic rules.
- To learn Social Network Analysis and semantic web
- To explain various applications of Semantic web technologies to real world.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
- Describe the rationale behind Semantic Web.
- Model ontologies using Resource Description Framework (RDF).
- Design RDF Schemas for ontologies.
- Model and design ontologies using Web Ontology Language (OWL).
- Query ontologies using SPARQL.
- Apply Semantic web technologies to real world applications.

UNIT I INTRODUCTION
Components – Types – Ontological Commitments – Ontological Categories – Philosophical
Background -Sample - Knowledge Representation Ontologies – Top Level Ontologies –
Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation – Layers –
Architecture.
UNIT II LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES

Web Documents in XML – RDF - Schema – Web Resource Description using RDF- RDF
Properties – Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics -
Traditional Ontology Languages – LOOM- OKBC – OCML - Flogic Ontology Markup
Languages – SHOE – OIL - DAML + OIL - OWL
UNIT III ONTOLOGY LEARNING FOR SEMANTIC WEB
Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning –
Importing and Processing Ontologies and Documents – Ontology Learning Algorithms -
Evaluation
UNIT IV ONTOLOGY MANAGEMENT AND TOOLS

Overview – need for management – development process – target ontology – ontology mapping – skills management system – ontological class – constraints – issues. volution – Development of Tools and Tool Suites – Ontology Merge Tools – Ontology based Annotation Tools.

UNIT V APPLICATIONS

Web Services – Semantic Web Services - Case Study for specific domain – Security issues – current trends.

REFERENCES:
1. Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Dean Allemang, James Hendler, Morgan Kaufmann; 2 edition, 5 July 2011.
2. Semantic Web: Concepts, Technologies and Applications,   Karin Breitman, Marco Antonio CasanovaSpringer (sie), 2009.
3 . Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez "Ontological Engineering: with examples from the areas of Knowledge Management, e-Commerce and the Semantic Web" Springer, 2004
4. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", The MIT Press, 2004
5. Alexander Maedche, "Ontology Learning for the Semantic Web", Springer; 1 edition, 2002
4. John Davies, Dieter Fensel, Frank Van Harmelen, "Towards the Semantic Web: Ontology – Driven Knowledge Management", John Wiley& Sons Ltd., 2003.
6. John Davies (Editor), Rudi Studer (Co-Editor), Paul Warren (Co-Editor) "Semantic Web Technologies: Trends and Research in Ontology-based Systems"WileyPublications,Jul 2006.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE309. VISUALIZATION TECHNIQUES

(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

- To introduce the basic concepts of visualization techniques.
- To learn popular techniques in visualization techniques.
- To learn advanced techniques on visualization.
- To understand the description of visualization systems.
- To learn software visualization.
- To explain various applications ofvisualization to real world.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
- Interpret the basic concepts of visualization techniques.
- Learnpopular techniques in visualization techniques.
- Analyze variousadvanced techniques on visualization.
- Describe various visualization systems.
- Learn varioussoftware visualization techniques.
- Develop various applications ofvisualization to real world.

UNIT I- INTRODUCTION

Introduction to Visualisation - Principles of 2D & 3D Computer Graphics - Models andSimulation strategies.

UNIT II- POPULAR TECHNIQUES

Surface Plots - City scopes - Fish eye views - Benediktine Space - Perspective walls -Cone trees and Cam trees - Sphere Visualisation - Rooms - Emotical icons.

UNIT III-ADVANCED TECHNIQUES

Self-Organising graphs - Spatial Data arrangements - Benediktine Cyberspace -Statistical Clustering and Proximity measures - Hyper Structures - Human CenteredApproaches - Information Cube.

UNIT IV- VISUALIZATION SYSTEMS

Database Visualisation - Populated Information Terrains - Legibility enhancement -Hyper structure Visualisation - Information Visualisation.

UNIT V-SOFTWARE VISUALIZATION

Rapid Prototyping - Models for user interaction - Formal Specification of Software -DFD – Software Architecture.

REFERENCES:

1.Chaomei Chan**,** Information Visualisation and Virtual Environment **,** Springer –Verlag, New York**,** 2002

2.Benedikt.M**,** Cyberspace First Steps **,** MIT Press, New Delhi**,** 2004

3.Pauline Wills, Visualisation A Beginner's Guide , Hodder& Stoughton, New Delhi., 2002

4.Sheryl A Sorbyexal, 3D Visualisation for Engineering Graphics , Prentice Hall, New Delhi, 2002

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE310. VIRTUALIZATION TECHNIQUES

(Effective from the academic year 2015-2016 and onwards)
COURSE OBJECTIVES:

- To discuss the basic overviewof virtualization techniques.
- To explain popular techniques in server consolidation.
- To explain concepts of network virtualization.
- To discuss various virtualization storage systems.
- To discuss variousvirtual machines products.
- To develop various applications ofvirtualization to real world.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
- Introduce the basic overviewof virtualization techniques.
- Understandpopular techniques in server consolidation.
- Describe concepts of network virtualization.
- Describe various virtualization storage systems.
- Learn variousvirtual machines products.
- Develop various applications ofvirtualization to real world.

UNIT I OVERVIEW OF VIRTUALIZATION
Basics of Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – System-level or Operating Virtualization – Application Virtualization-Virtualization Advantages - Virtual Machine Basics – Taxonomy of Virtual machines - Process Virtual Machines - System Virtual Machines – Hypervisor - Key Concepts

UNIT II SERVER CONSOLIDATION
Hardware Virtualization – Virtual Hardware Overview- Sever Virtualization – Physical and Logical Partitioning - Types of Server Virtualization – Business cases for Sever Virtualization – Uses of Virtual server Consolidation – Planning for Development – Selecting server Virtualization Platform

UNIT III NETWORK VIRTUALIZATION
Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design - WAN Architecture - WAN Virtualization - Virtual Enterprise Transport Virtualization–VLANs and Scalability - Theory Network Device Virtualization Layer 2 - VLANs Layer 3 VRF Instances Layer 2 - VFIs Virtual Firewall Contexts Network Device Virtualization - Data-Path Virtualization Layer 2: 802.1q - Trunking Generic Routing Encapsulation - IPsec L2TPv3 Label Switched Paths - Control-Plane Virtualization–Routing Protocols- VRF - Aware Routing Multi-Topology Routing.

UNIT IV VIRTUALIZING STORAGE

SCSI- Speaking SCSI- Using SCSI buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture– Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – SNIA Shared Storage Model – Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing
Backups – Virtual tape libraries.

UNIT V VIRTUAL MACHINES PRODUCTS

Xen Virtual machine monitors- Xen API – VMware – VMware products - Vmware Features – Microsoft Virtual Server – Features of Microsoft Virtual Server

REFERENCES:

1. William von Hagen, Professional Xen Virtualization, Wrox Publications, January, 2008.

2. Chris Wolf , Erick M. Halter, Virtualization: From the Desktop to the Enterprise, APress 2005.

3. Kumar Reddy, Victor Moreno, Network virtualization, Cisco Press, July, 2006.

4. James E. Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.

5. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE311. GRID COMPUTING

(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

* To discuss the basic overviewof grid computing
* To explain popular grid computing initiatives
* To explain various grid computing applications.
* To discuss various technologies in grid computing.
* To discuss variousgrid computing tool kits available.
* To develop various applications ofgrid computing to real world.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
* Understand the basic overviewof grid computing
* Discuss popular grid computing initiatives
* Discuss various grid computing applications.
* Enumerate various technologies in grid computing.
* Learn variousgrid computing tool kits available.
* Develop various applications ofgrid computing to real world.

UNIT I- GRID COMPUTING

Introduction - Definition - Scope of grid computing

UNIT II- GRID COMPUTING INITIATIVES

Grid Computing Organizations and their roles – Grid Computing analog – GridComputing road map.

UNIT III- GRID COMPUTING APPLICATIONS

Merging the Grid sources – Architecture with the Web Devices Architecture.

UNIT IV- TECHNOLOGIES

OGSA – Sample use cases – OGSA platform components – OGSI – OGSA BasicServices.

UNIT V- GRID COMPUTING TOOL KITS

Globus Toolkit – Architecture, Programming model, High level services – OGSI .Netmiddleware Solutions.

REFERENCES:

1. Joshy Joseph & Craig Fellenstein, "Grid Computing", PHI, PTR-2003.

2. Ahmar Abbas, "Grid Computing: A Practical Guide to technology and Applications",Charles River media – 2003.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE312. ADVANCED DATABASES

(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:

- To introduce and describe current and emerging database models and technologies.
- To design and implement relational database solutions for general applications.
- To explain the query processing and techniques involved in query optimization
- To explain common database administration tasks, such as database monitoring, performance tuning, data transfer, and security.
- □□□explain tools required for current issues in databases
- To understand the concepts, current practices and issues of data warehouses and databases.

COURSE OUTCOMES:
Upon Completion of this course the student will be able to
- Know recent developments and current trend in database models.
- Develop applications for various relational databases
- Learn and optimize query processing techniques
- Evaluate designs and architectures for databases and data warehouses
- Analyse and develop tools for current issues in databases
- Organize strategic data in an enterprise and build a data Warehouse

UNIT I- DATABASE MANAGEMENT

Relational Data Model – SQL - Database Design - Entity-Relationship Model –Relational Normalization – Embedded SQL – Dynamic SQL – JDBC – ODBC.

UNIT II- ADVANCED DATABASES

Object Databases - Conceptual Object Data Model – XML and Web Data – XMLSchema – Distributed Data bases – OLAP and Data Mining – ROLAP and MOLAP

UNIT III- QUERY AND TRANSACTION PROCESSING

Query Processing Basics – Heuristic Optimization – Cost, Size Estimation - Models ofTransactions – Architecture – Transaction Processing in a Centralized and DistributedSystem – TP Monitor.

UNIT IV- IMPLEMENTING AND ISOLATION

Schedules – Concurrency Control – Objects and Semantic Commutativity – Locking –Crash, Abort and Media Failure – Recovery – Atomic Termination – DistributedDeadlock – Global Serialization – Replicated Databases – Distributed Transactions inReal World.

UNIT V- DATABASE DESIGN ISSUES

Security – Encryption – Digital Signatures – Authorization – Authenticated RPC -Integrity - Consistency - Database Tuning - Optimization and Research Issues.

REFERENCES:

1. Philip M. Lewis, Arthur Bernstein, Michael Kifer, "Databases and Transaction, 2001.

2. Processing: An Application-Oriented Approach", Addison-Wesley, 2002

3. Elmasri R. and S.B. Navathe, Fundamentals of Database Systems, 6thEdition,Addison Wesley, 2011

4. Abraham Silberschatz, Henry. F. Korth, S.Sudharsan, Database System Concepts, 6thEdition., Tata McGraw Hill, 2013

5. Raghu Ramakrishnan& Johannes Gehrke, "Database Management Systems", 3rdEdition, TMH, 2003

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE313. WIRELESS SENSOR NETWORKS

(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:
- To understand the concepts of wireless sensor networks.
- To learn how to program sensor nodes
- To understand the medium access protocol and address the physical layer issues.
- To learn network and transport layer protocols for sensor networks and design requirements.
- To understand the middleware and security issues of wireless sensor networks.
- Discuss applications of wireless sensor networks

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
- Apply knowledge of wireless sensor networks to various application areas.
- Design, implement and maintain wireless sensor networks.
- Define medium access layer issues.
- Address the transport protocol design issues.
- Design the efficient routing algorithm
- Analyse the security issues in wireless sensor networks

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS

Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless SensorNetworks.
UNIT II ARCHITECTURES

Single-Node Architecture - Hardware Components, Energy Consumption of SensorNodes , Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, GatewayConcepts.

UNIT III NETWORKING SENSORS

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless, Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , TheMediation Device Protocol, Wakeup Radio Concepts, Address and Name Management,Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing,Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT

Topology Control , Clustering, Time Synchronization, Localization and Positioning,Sensor Tasking   and   Control.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-levelsoftware platforms, Node-level Simulators, State-centric programming.

REFERENCES:
1. Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless SensorNetworks" , John Wiley,2011.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information, Processing Approach", Elsevier,2007.
3. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks-Technology, Protocols, AndApplications",JohnWiley,2007.
4. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

KARPAGAM ACADEMY OF HIGHER EDUCATION-COIMBATORE-641 021
PART-I-Ph.D
COMPUTER SCIENCE AND ENGINEERING
Papers III: 15RCSE314. CLOUD COMPUTING
(Effective from the academic year 2015-2016 and onwards)

COURSE OBJECTIVES:
- To learn the basic concepts of cloud computing
- To learn types of cloud services and its applications
- To understand the key components of Amazon Web Services
- To collaborate with real time cloud services
- To understand the security risk and application of cloud computing
- To discuss various applications of cloud computing

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- Define basic concepts of cloud computing
- Use and Examine different cloud computing services.
- Understand and appreciate the technological impact of service and cloud computing for future enterprises, and the technologies underpinning it
- Describe importance of virtualization along with their technologies
- Analyse the key components of Amazon web Service
- Review and assess the risks, opportunities, costs and steps towards migrating existing systems to service and cloud computing

UNIT I UNDERSTANDING CLOUD COMPUTING
Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

UNIT II DEVELOPING CLOUD SERVICES
Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service –Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools Amazon Ec2 – Google App Engine – IBM Clouds

UNIT III CLOUD COMPUTING FOR EVERYONE

Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation

UNIT IV USING CLOUD SERVICES
Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event

Management – Collaborating on Contact Management – Collaborating on Project Management – Collaboratingon Word Processing - Collaborating on Databases – Storing and Sharing Files

UNIT V OTHER WAYS TO COLLABORATE ONLINE

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis

REFERENCES:
1.Antonopoulos , Cloud Computing: Principles, Systems And Applications,Springer India Private Limited, 2012.
2. Dimitris N. Chorafas, Cloud Computing StrategiesHardcover, CRC Press , 2 August 2010.
3. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.
4.. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008

FACULTY OF ENGINEERING

DEGREE OF DOCTOR OF PHILOSOPHY IN ELECTRONICS AND COMMUNICATION ENGINEERING

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(REGULAR PROGRAMME)

CURRICULUM & SYLLABI
(2015 -2016)

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Established Under Section 3 of UGC Act 1956)
COIMBATORE 641 021 INDIA

FACULTY OF ENGINEERING

DOCTORATE IN PHILOSOPHY (Ph.D.)

REGULATIONS 2015

These regulations are effective from the academic year 2015-2016 and applicable to the candidates admitted to Ph.D. during 2015-2016 and onwards.

I.   ELIGIBILITY CRITERIA

First class or 55% marks (50% marks for SC/ST), in M. Tech degree in Electonics and communication engineering or in related disciplines.

II.   MODE OF SELECTION

The guidelines as given in the Regulations for M.Phil.,/ Ph.D., of Karpagam Academy of Higher Education are applicable.

III.   PROGRAMME STRUCTURE AND RESEARCH WORK

Upon successful completion of the degree, the candidate will be conferred with the degree of Doctorate of Philosophy (Ph.D.) in Electonics and Communication engineering under the Faculty of Engineering.

PART – I COURSE WORK SYLLABUS FOR Ph.D COURSE IN ELECTRONICS AND COMMUNICATION ENGINEERING

SL.NO	Course code	TITLE OF THE COURSE	C	EXAM. HRS	MARKS
1	15RECE101	PAPER I-Research Methodology and Pedagogy	4	3	100
2	15RECE201	PAPER II Trends in Electronics	4	3	100
3	15RECE202	PAPER II Mobile communication	4	3	100
4	15RECE203	PAPER II Microcontroller System Design and Applications	4	3	100
5	15RECE204	PAPER II Soft Computing	4	3	100
6	15RECE205	PAPER II Basics of Nanotechnology	4	3	100
7	15RECE206	PAPER II Wireless Sensor Networks	4	3	100
8	15RECE301	Special Paper I: Solid State Device Modeling and Simulation	4	3	100
9	15RECE302	Special Paper II: Low Power VLSI Design	4	3	100
10	15RECE303	Special Paper III: Testing of VLSI Circuits	4	3	100

11	15RECE304	Special Paper IV: Optical Fiber Communication	4	3	100
12	15RECE305	Special Paper V: Mobile Ad-Hoc Networks	4	3	100
13	15RECE306	Special Paper VI: Advanced Digital Image Processing	4	3	100
14	15RECE307	Special Paper VII: Network Routing Algorithms	4	3	100
15	15RECE308	Special PaperVIII: : Cryptography and Network Security	4	3	100
16	15RECE309	Special Paper IX: Bio-Medical Signal Processing	4	3	100
17	15RECE310	Special Paper X: Embedded Networking	4	3	100
		TOTAL	68	51	1700

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established Under Section 3 of UGC Act 1956)

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

Paper I: Research Methodology and Pedagogy **15RECE101**

(Effective from the academic year 2015-2016 onwards)

Course Objectives
The goal of this course for research scholars is :

- To highlights the various postulates of research problems, research design, writing a thesis and modern statistical methods.
- To enable the researchers to carry out research problem individually in a perfect scientific method.
- To study on various sampling techniques
- To understand the fundamentals of hypothesis testing
- To know the pedagogical methods in higher learning objectives and roll of higher education
- To gain know methods of teaching and learning

Course Outcomes
At the end of the course the research scholars will be able to :

- Understand the various postulates of research problems, research design, writing a thesis and modern statistical methods.
- Enable the researchers to carry out research problem individually in a perfect scientific method.
- Gain knowledge on various sampling techniques
- Gain knowledge on the fundamentals of hypothesis testing
- Understand the pedagogical methods in higher learning objectives and roll of higher education
- Gain knowledge on methods of teaching and learning

UNIT I

Research – Definition – Importance and Meaning of research – Characteristics of research – Types of Research – Steps in research – Identification, Selection and formulation of research problem – Research questions – Research design – Formulation of Hypothesis – Review of Literature.

UNIT II

Sampling techniques: Sampling theory – types of sampling – Steps in sampling – Sampling and Non-sampling error – Sample size – Advantages and limitations of sampling. Collection of Data : Primary Data – Meaning – Data Collection methods – Secondary data – Meaning – Relevances, limitations and cautions.

UNIT III

Statistics in Research – Measure of Central tendency – Dispersion – Skewness and Kurtosis in research. Hypothesis – Fundamentals of Hypothesis testing – Standard Error – Point and Interval estimates – Important Non-Parametric tests : Sign, Run, Kruskal – Wallis tests and Mann-Whitney test.

UNIT IV

Para metric tests : Testing of significance – mean, Proportion, Variance and Correlation – testing for Significance of difference between means, proportions, variances and correlation co-efficient. Chi-square tests – ANOVA – One-way and Two-way. Research Report : Types of reports – contents – styles of reporting – Steps in drafting reports – Editing the final draft – Evaluating the final draft.

UNIT V

Pedagogical Methods in Higher Learning Objectives and roll of higher education – Important characteristics of an effective Lecture – Quality teaching and learning – Lecture preparation – Characteristics of instructional design – Methods of teaching and learning : Large group – Technique – Lecture, Seminar, Symposium, Team Teaching, Project, Small group Technique – Simulation, role playing Demonstration, Brain storing, case discussion, and assignment, Methods of evaluation – Self evaluation, student evaluation, Diagnostic testing and remedial teaching – Question banking – Electronic media in education: - 'e' learning researches – web based learning

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

(Effective from the academic year 2015-2016 onwards)

REFERENCES:

- Gupta S.P. Statistical Methods

- Kothari C.R. Research Methodology Methods and Techniques

- Gupta B.N. Statistics (Theory and Practice)

- Santosh Gupta, Research Methodology Methods and Statistical Techniques

- Vedanayagam, E.G (1989) Teaching Technology for college teachers. New Delhi: Sterling Publishers (P) Ltd.,

- Rajasekar.S (2005) Computer Education and educational computing. Hyderabad: Neelkamal Publications.

- Kumar K.L. (1997) Educational Technologies, New Delhi: New age International.

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

Paper II: Trends in Electronics 15RECE201

(Effective from the academic year 2015-2016 onwards)

Course Objectives

The goal of this course for research scholars is:

- To obtain in depth knowledge in various pentium processors.
- To understand the VLSI design process in detail
- To understand spectrum of electromagnetic waves and OFDM based access techniques
- To design antenna in wireless communication
- To know about various wireless networks
- To gain knowledge on real time operating systems

Course Outcomes

At the end of the course the research scholars will be able to :

- Gain in depth knowledge in various pentium processors.
- Understand the VLSI design process in detail
- Understand spectrum of electromagnetic waves and OFDM based access techniques
- Design antenna in wireless communication
- Know about various wireless networks
- Gain knowledge on real time operating systems

UNIT I   Embedded Computing and Multiprocessors

The Embedded system design process – Formalization for system design – System design techniques – Formalization of system design - Multiprocessors – Multiprocessor performance analysis – Consumer electronics architecture – Design example of cell phone , Audio players – Digital cameras – design methodologies and flows – requirement analysis – Quality assurance - The Intel 8086 Family Architecture – 80186, i286, i386 and i486 family Architecture – Pentium I, Pentium II, Pentium III, Pentium 4, and core 2 processors – PIC processor.

UNIT II   VLSI Design Technology

The VLSI design process – Architectural design – Logical design – physical design –Layout styles – Full custom – Semi custom approaches -   VLSI Design flow – NMOS & CMOS Inverters – Analysis and design of Inverters - Data path subsystems – Design – Shifters – Adders – ALUs – Multipliers – parity generators – comparators- Zero/one detectors – Counters – Array subsystems.

UNIT III Wireless Communication Systems

Spectrum of Electromagnetic waves – Radio transceivers architecture – Generation evoluation of cellular communication systems – Multiple access techniques – Channel Estimation and Equalization – Modulation techniques – OFDM – OFDM based access techniques – Fundamentals of Antenna design in wireless communication –Source coding I –Source coding II.

UNIT IV   Wireless Networks

Wireless Network Architecture -   Wireless LAN Implementation and its Standards - Wireless PAN Implementation and its standards - Wireless MAN Implementation and its standards – Future scope of wireless networking technology – Gigabit Lans – Mesh network Routing – Cognitive Radio – Network independent roaming.

UNIT   V   Real Time Operating Systems

Operating system services –I/O subsystems – Network operating systems –Interrupt routines in RTOS Environment – RTOS Task scheduling models, Interrupt –Performance Metric in Scheduling Models – IEEE standard POSIX functions for standardization of RTOS and inter-task communication functions – List of Basic functions in a Preemptive scheduler – Fifteen point strategy for synchronization between processors, ISRs, OS Functions and Tasks – OS security issues- Mobile OS

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established Under Section 3 of UGC Act 1956)

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

(Effective from the academic year 2015-2016 onwards)

REFERENCE:

- Raj Kamal , (2003), Embedded Systems Architecture, Programming and Design, Tata McGraw-Hill, New Delhi,
- Wayne Wolf, (2001), Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers,.

- Ramesh S. Gaonkar, (1999) "Microprocessor Architecture, Programming and its Applications With 8085", Mumbai: Penram International Publishing,.

- Ram. B., (2000) Fundamentals of Microprocessor and Microcontroller", Mumbai: Dhanpat rai Publication,

- Ajay V Deshmukh, (2007) Microcontroller Theory and Applications, Tata McGraw Hill,

- Daniel Tabak Advanced Microprocessor .E. Eshranghian, D.A. Pucknell and S. Eshraghian, (2005) "Essentials of VLSI circuit and systems", PHI.

- Neil H.E. Weste, David Harris and Ayan Banerjee, (2006). "CMOS VLSI Design, A circuits and Systems Perspective", (3/e), Pearson,

- W. Wolf, (2002) "Modern VLSI Design", (3/e), Pearson.S.M. Sze, (1988), "VLSI Technology",(2/e), McGraw Hill.

- Ke lin Du & M.N.S. Swamy (2010), Wireless Communication Systems: From RF Subsystems to 4G Enabling Technologies" Cambridge University press.

- Steve Rackley, (2007), Wireless Networking Technology: From Principles to Successful Implementation, Elsevier Publications

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Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

Paper II: Mobile Communication 15RECE202

(Effective from the academic year 2015-2016 onwards)

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Course Objectives
The goal of this course for research scholars is:

- To understand history of wireless communication
- To study about propagation issues
- To understand about antenna systems and its design
- To understand evolution of personal communication systems
- To understand Universal Personal Telecommunication (UPT)
- To study about UPT Digital Cellular Mobile Systems

Course Outcomes
At the end of the course the research scholars will be able to :

- Understand history of wireless communication
- Study about propagation issues
- Understand about antenna systems and its design
- Understand evolution of personal communication systems
- Understand universal personal telecommunication
- Study about UPT Digital Cellular Mobile Systems

UNIT I   INTRODUCTION TO MOBILE AND PERSONAL COMMUNICATION

History of wireless communications, Mobile and Personal communications: Cell phone generations, cellular networks, The mobile radio environment, Cellular concept and frequency reuse, Multiple access technologies for cellular systems, Channel assignment and hand off, Mobile radio interference.

UNIT II   PROPAGATION ISSUES

Prediction of propagation loss-Prediction over flat terrain, Point-point prediction, Calculation of fading and methods of reducing fading- Amplitude fading, Selective fading, Diversity schemes, combining techniques.

UNIT III   ANTENNA SYSTEMS

Design parameters at the Base station- Antenna locations, spacing, heights, configurations, Design parameters at the Mobile unit- Directional antennas and diversity schemes, Antenna connections and locations.

UNIT IV PERSONAL COMMUNICATION SYSTEMS (PCS)

The concept of PCS/PCN, Function , Evolution of personal Communications, Requirements of PCS,PCS environment, Differences between PCS and Cellular systems, IS-136(TDMA)PCS, IS-95 CDMA PCS, Data Communication with PCS, PCS standards, PCS economics

UNIT V   UNIVERSAL PERSONAL TELECOMMUNICATION (UPT)

UPT: Concept and service aspects, Functional Architecture, Numbering, Routing and Billing aspects, Access security requirements for UPT Digital Cellular Mobile Systems- GSM, IS-136, PDC, IS-95, IMT-2000: Third generation Mobile Communication Systems, W-CDMA, CDMA-2000, EDGE

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

(Effective from the academic year 2015-2016 onwards)

REFERENCES

- Lee.W.C.Y, 1993,"Mobile Communications Design Fundamentals", 2nd edition, John Wiley & sons, New York.

- RajPandya,2003, "Mobile and Personal Communication systems and services", PHI, New Delhi.

- Blake,2001, "Wireless Communication Technology", Thomson Asia Pte, Ltd, Singapore.

- Bud Bates,1995,"Wireless networked telecommunications"- Concepts, Technology and Implementation" , McGraw-Hill International Editions, New Delhi.

- Holtzman.J.M, David J. Goodman (Er.s),1996, " Wireless and Mobile Communications", Allied Publishers Limited, New Delhi.

- Andy Dorman,2001, "The Essential Guide to Wireless Communications applications", Pearson Education Asia, New Delhi.

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Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

Paper II: Microcontroller System Design and Applications 15RECE203

(Effective from the academic year 2015-2016 onwards)

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Course Objectives

The goal of this course for research scholars is:

- To understand 8051 architecture
- To write simple 8051 programs
- To know about memory organization and timing characteristics
- To understand 8096 architecture
- To understand peripheral interfacing
- To write case study on generation of gating signals for converters and inverters

Course Outcomes

At the end of the course the research scholars will be able to :

- Understand 8051 architecture
- Write simple 8051 programs
- Know about memory organization and timing characteristics
- Understand 8096 architecture
- Understand peripheral interfacing
- Write case study on generation of gating signals for converters and inverters

UNIT I   8051 ARCHITECTURE

Basic organization – 8051 CPU structure – Register file – Interrupts – Timers – Port circuits – Instruction set – Timing diagram – Addressing modes – Simple Program and Applications.

UNIT II   PERIPHERALS AND INTERFACING

Typical Bus structure – Bus – memory organization – Timing characteristics – Extended Model and Memory Interfacing – Polling – Interfacing Basic I/O devices – Analog and Digital interfacing – PWM mode operation – Serial port application.

UNIT III   8096 ARCHITECTURE

operation – Interrupt structure – Timers – High Speed Input / Output Ports – I/O control and Status registers – Instruction Set – Addressing Modes – Simple Programming – Queues – Tables and Strings – Stack Memories – Key Switch – Parsing.

UNIT IV PERIPHERALS AND INTERFACING

Analog Interface – Serial Ports – Watch dog timers – Real Time Clock – Multitasking – Bus Control – Memory Timing – External ROM and RAM expansion – PWM control – A/D interfacing.

UNIT V   CASE STUDY FOR 8051 AND 8096

Real Time clock – DC Motor Speed Control – Generation of Gating Signals for Converters and Inverters – Frequency Measurement – Temperature Control.

REFERENCES

- John B.Peatman, 1989, "Design with Micro controllers", McGraw Hill international Limited, Singapore.
- Michael Slater, 2001, "Microprocessor based design A comprehensive guide to effective Hardware design" Prentice Hall, New Jersey.
- Ayala, Kenneth, 2000, "The 8051 Microcontroller" Upper Saddle River, Prentice Hall, New Jersey
- Muhammad Ali Mazidi, Janice Gillispie mazidi, 2009,"The 8051 Microcontroller and Embedded systems", Person Education, New Delhi.

Part I –Ph.D-Syllabus
ELECTRONICS AND COMMUNICATION ENGINEERING
Paper II: Soft Computing 15RECE204
(Effective from the academic year 2015-2016 onwards)

Course Objectives
The goal of this course for research scholars is:

- To understand machine learning basics
- To gain in depth knowledge of genetic algorithms
- To understand supervised learning neural networks and unsupervised learning neural networks
- To gain knowledge on fuzzy logic concepts
- To gain knowledge advances in neural networks
- To understand neuro-fuzzy modeling

Course Outcomes
At the end of the course the research scholars will be able to :
- Understand machine learning basics
- Gain in depth knowledge of genetic algorithms
- Understand supervised learning neural networks and unsupervised learning neural networks
- Gain knowledge on fuzzy logic concepts
- Gain knowledge advances in neural networks
- Understand neuro-fuzzy modeling

UNIT I   INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS

Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics

UNIT II GENETIC ALGORITHMS

Introduction to Genetic Algorithms (GA) – Applications of GA in Machine Learning - Machine Learning Approach to Knowledge Acquisition.

UNIT III NEURAL NETWORKS

Machine Learning Using Neural Network, Adaptive Networks – Feed forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance architectures – Advances in Neural networks.

UNIT IV FUZZY LOGIC

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

UNIT V NEURO-FUZZY MODELING

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rulebase Structure Identification – Neuro-Fuzzy Control – Case studies.

TEXT BOOKS

- Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003.
- George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications",   Prentice Hall, 1995.
- James A. Freeman and David M. Skapura, "Neural Networks Algorithms,   Applications, and Programming Techniques", Pearson Edn., 2003.

REFERENCES

- Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
- David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 1997.

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

Paper II: Basics of Nanotechnology   15RECE205

(Effective from the academic year 2015-2016 onwards)

Course Objectives
The goal of this course for research scholars is:

- To understand basics of nano scale
- To study about classification of nanostructures
- To understand synthesis of nano material
- To learn about nano material properties
- To understand physical properties of nano structured materials
- To study about chemistry of tailored monolayer

Course Outcomes
At the end of the course the research scholars will be able to :

- Understand basics of nano scale
- Study about classification of nanostructures
- Understand synthesis of nano material
- Learn about nano material properties
- Understand physical properties of nano structured materials
- Study about chemistry of tailored monolayer

UNIT - I INTRODUCTION
Introduction to nanoscale materials-atomic & molecular size. Scientific revolutions-nanotechnology applicationarea. Scope of nanoscience and technology.

UNIT - II   NANOSTRUCTURES AND DIMENSIONS
Classification of nanostructures-zero, one, two and three dimensional nanostructures.Size Dependency inNanostructures-quantum size effects in nanostructures.Chemistry of tailored nano shapes.

UNIT - III NANOMATERIAL SYNTHESIS
Synthesis of nanomaterials-top down and bottom up approach. Method of nanomaterials preparation–wetchemical synthesis-mechanical grinding-gas phase synthesis.

UNIT - IV NANOMATERIAL PROPERTIES

Surface to volume ratio. Surface properties of nanoparticles. Mechanical, optical, electronic, magnetic, thermaland chemical properties of nanomaterials. Size dependent properties-size dependent absorption spectra.Shape impact.

UNIT - V PHYSICAL PROPERTIES OF NANOSTRUCTUREDMATERIALS

Quantum dots-optical properties and applications. Carbon nano tubes-physical properties and applications.Magnetic behavior of nanomaterials. Electronic transport in quantum wires. Surface chemistry of tailoredmonolayer

REFERENCE:

- Mick Wilson,Kamali Kannargare., Geoff Smith, "Nano technology: Basic Science and Emergingtechnologies", Overseas Press, 2005.

- Charles P. Poole, Frank J. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2003.

- Mark A. Ratner, Daniel Ratner, "Nanotechnology: A gentle introduction to the next Big Idea", Prentice HallP7R:1stEdition, 2002.
- T. Pradeep, " Nano the Essential Nanoscience and Nanotechnology", Tata McGraw hill, 2007.

- J. Dutta, H. Hoffmann, "Nanomaterials", Topnano-21, 2003.

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

Paper II: Wireless Sensor Networks   15RECE206

(Effective from the academic year 2015-2016 onwards)

Course Objectives
The goal of this course for research scholars is:

- To understand network architecture
- To study about communication fundamentals
- To understand data link layer
- To understand network layer
- To write case study of target detection tracking etc
- To understand IEEE 802.15.4 low rate WPAN

Course Outcomes
At the end of the course the research scholars will be able to :

- Understand network architecture
- Study about communication fundamentals
- Understand data link layer
- Understand network layer
- Write case study of target detection tracking etc
- Understand IEEE 802.15.4 low rate WPAN

UNIT I   INTRODUCTION

Challenges for wireless sensor networks, Comparison of sensor network with ad hoc network, Single node architecture –Hardware components, energy consumption of sensor nodes, Network architecture – Sensor network scenarios, types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, design principles, Development of wireless sensor networks– WINS ,µAMPS Underwater Acoustic and Deep space networks.

UNIT II   PHYSICAL LAYER

Introduction wireless channel and communication fundamentals – frequency allocation, modulation and demodulation, wave propagation effects and noise, channels models, spread spectrum communication , packet transmission and synchronization, quality of wireless channels and measures for improvement, physical layer and transceiver design consideration in wireless sensor networks, Energy usage profile, choice of modulation, Power Management

UNIT III   DATA LINK LAYER

MAC protocols –fundamentals of wireless MAC protocols, low duty cycle protocols and wakeup concepts, contention-based protocols, Schedule-based protocols, Link Layer protocols –fundamentals task and requirements, error control, framing, link management

UNIT IV   NETWORK LAYER

Gossiping and agent-based uni cast forwarding , Energy-efficient unicast, Broadcast and multicast, geographic routing , mobile nodes, Data –centric and content-based networking –Data –centric routing, Data aggregation, Data-centric storage, Higher layer design issues

UNIT V CASE STUDY

Target detection tracking, Habitat monitoring, Environmental disaster monitoring, Practical implementation issues, IEEE 802.15.4 low rate WPAN, Sensor Network Platforms and tools-Sensor node hardware, Node-level software platforms, node – level simulators.

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

(Effective from the academic year 2015-2016 onwards)

REFERENCES:

- Wireless Sensor Networks: an information processing approach – Feng zhao, Leonidas guibas, Elsivier publication, 2004.

- Wireless Sensor Networks –C.S.Raghavendra Krishna, M.Sivalingam and Tarib znati, Springer publication, 2004.

- Wireless Sensor Networks: Architecture and protocol –Edgar H .Callaway, CRC press.
- Protocol and Architecture for Wireless Sensor Networks –Holger Karl, Andrea's willig, John wiley publication, Jan 2006.
- Wireless Sensor Networks: First European workshop, EWSN 2004, Berlion, germany, January 2004 proceedings –Holger Karl, Andreas willig,Adam holisz,Springer

  publication.

- I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, "Wireless sensor networks: a survey", computer networks, Elsevier, 2002, 394 - 422.

- Jamal N. Al-karaki, Ahmed E. Kamal," Routing Techniques in Wireless sensor networks: A survey", IEEE wireless communication, December 2004, 6 – 28.

Part I –Ph.D-Syllabus
ELECTRONICS AND COMMUNICATION ENGINEERING
Special Paper I: Solid State Device Modelling and Simulation 15RECE301
(Effective from the academic year 2015-2016 onwards)

Course Objectives

The goal of this course for research scholars is:

- To know about quantum mechanical concepts
- To understand transient and AC conditions
- To study SPICE model for a Diode
- To understand bipolar device modeling
- To understand MOSFET modeling
- To know optoelectronic device modeling

Course Outcomes

At the end of the course the research scholars will be able to :

- Know about quantum mechanical concepts
- Understand transient and AC conditions
- Study SPICE model for a Diode
- Understand bipolar device modeling
- Understand MOSFET modeling
- Know optoelectronic device modeling

UNIT I BASIC SEMICONDUCTOR PHYSICS

Quantum Mechanical Concepts, Carrier Concentration, Transport Equation, Band gap, Mobility and Resistivity, Carrier Generation and Recombination, Avalanche Process, Noise Sources. Diodes: Forward and Reverse biased junctions – Reverse bias breakdown – Transient and AC conditions -– Static and Dynamic behavior- Small and Large signal models – SPICE model for a Diode – Temperature and Area effects on Diode Model Parameters.

UNIT II   BIPOLAR DEVICE MODELING

Transistor Models: BJT – Transistor Action – Minority carrier distribution and Terminal currents - Switching- Eber - Molls and Gummel Poon Model, SPICE modeling - temperature and area effects.

UNIT III   MOSFET MODELING

MOS Transistor – NMOS, PMOS – MOS Device equations - Threshold Voltage – Second order effects - Temperature Short Channel and Narrow Width Effect, Models for Enhancement, Depletion Type MOSFET, CMOS Models in SPICE.

UNIT IV   PARAMETER MEASUREMENT

Bipolar Junction Transistor Parameter – Static Parameter Measurement Techniques – Large signal parameter Measurement Techniques, Gummel Plots, MOSFET: Long and Short Channel Parameters, Measurement of Capacitance.

UNIT V   OPTOELECTRONIC DEVICE MODELING

Static and Dynamic Models, Rate Equations, Numerical Technique, Equivalent Circuits, Modeling of LEDs, Laser Diode and Photo detectors.

REFERENCES

- Ben.G.Streetman, 1997, "Solid State Devices", 3rd Edition,Prentice Hall.
- Giuseppe Massobrio and Paolo Antogentti, 1993, "Semiconductor Device Modeling with SPICE", 2nd Edition, McGraw-Hill Inc, New York.
- Tyagi.M.S, 1981, "Introduction to Semiconductor Devices",2nd Edition, Mc Graw Hill, New York.
- Sze.S.M, 1985,"Semiconductor Devices - Physics and Technology",2nd Edition,John Wiley and sons.

- Mohammed Ismail & Terri Fiez, 2001, "Analog VLSI-Signal & Information Processing", 1st Edition,Tata McGraw Hill Publishing company Ltd, New Delhi.

Part I –Ph.D-Syllabus
ELECTRONICS AND COMMUNICATION ENGINEERING
Special Paper II: Low Power VLSI Design   15RECE302
(Effective from the academic year 2015-2016 onwards)

Course Objectives
The goal of this course for research scholars is:

1. To give an experience in the implementation of power dissipation in CMOS.
2. To study different methods of construction to successfully achieve the power optimization with recommended specifications.
3. To involve the application of design of low power CMOS circuits**.**
4. To study and construction equipment of power estimation and analysis.
5. To provide a synthesis and software design for low power.
6. To present the new technology of low power VLSI design concepts and Advanced construction technology.

Course Outcomes
At the end of the course the research scholars will be able to :

1. Implementation of power dissipation in CMOS
2. Different methods of construction to successfully achieve the power optimization with recommended specifications.
3. Application of design of low power CMOS circuits**.**
4. Will gain the Knowledge of power estimation and analysis.
5. Development to the students for the courses in synthesis and software design for low power.
6. The new technology of low power VLSI design concepts and Advanced construction technology.

UNIT I   POWER DISSIPATION IN CMOS
Sources of power dissipation – Physics of power dissipation in CMOS FET devices- Basic principle of low power design.

UNIT II   POWER OPTIMIZATION
Logical level power optimization – Circuit level low power design: logic styles, transistor sizing and ordering – Circuit techniques for reducing power consumption in adders and multipliers.

UNIT III   DESIGN OF LOW POWER CMOS CIRCUITS
Computer Arithmetic techniques for low power systems – Reducing power consumption in memories – Advanced techniques: Adiabatic Computation, Asynchronous Circuits – Special techniques

UNIT IV   POWER ESTIMATION AND ANALYSIS
Logic level power estimation – Simulation power analysis – Probabilistic power analysis

UNIT V   SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER
Synthesis for low power –Behavioral level transforms- Software design for low power – Software Power Estimation – Software Power Optimization

REFERENCES

- Roy.K and Prasad.S.C, Low Power CMOS VLSI circuit design, Wiley, New Jersey,2000.

- Dimitrios Soudris, Chirstian Pignet, Costas Goutis, Designing CMOS Circuits For Low Power, Kluwer academic publishers, Boston, 2002.

- Kuo.J.B and Lou.J.H, Low voltage CMOS VLSI Circuits, Wiley, New Jersey, 2009.

- Chandrakasan.A.P and Broadersen.R.W, Low power digital CMOS design, Kluwer academic publishers, Boston , 1995

- Gary Yeap Practical low power digital VLSI design, Kluwer academic publishers, Boston, 1998.

Part I –Ph.D-Syllabus
ELECTRONICS AND COMMUNICATION ENGINEERING
Special Paper III: Testing of VLSI Circuits 15RECE303
(Effective from the academic year 2015-2016 onwards)

Course Objectives

The goal of this course for research scholars is:

- To impart the basic knowledge about the testing and fault modelling of VLSI circuit.
- To understand the concept of test generation for combinational and sequential circuits.
- To understand the working ofdesign of testable sequential circuits.
- To impart the basic knowledge of design for testability.
- To understand the fundamentals of self-test and test algorithms.
- To imparts a good knowledge about fault diagnosis.

Course Outcomes

At the end of the course the research scholars will be able to :

- Attributing the testing and fault modelling of VLSI circuit.
- Attributing thetest generation for combinational and sequential circuits.
- Reproduce the design of testable sequential circuits.
- Evaluate the various design for testability applications.
- Analysis various self-test and test algorithmsin real time applications.
- Reproduce the fault diagnosis.

UNIT I   BASICS OF TESTING AND FAULT MODELLING

Introduction to Testing - Faults in digital circuits - Modeling of faults - Logical Fault Models - Fault detection - Fault location - Fault dominance - Logic Simulation – Types of simulation - Delay models - Gate level Event-driven simulation.

UNIT II   TEST GENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS

Test generation for combinational logic circuits - Testable combinational logic circuit design - Test generation for sequential circuits - design of testable sequential circuits.

UNIT III   DESIGN FOR TESTABILITY

Design for Testability - Ad-hoc design - Generic scan based design - lassical scan based design - System level DFT approaches.

UNIT IV   SELF-TEST AND TEST ALGORITHMS

Built-In Self Test - Test pattern generation for BIST - Circular BIST - BIST Architectures - Testable Memory Design - Test algorithms - Test generation for Embedded RAMs.

UNIT V   FAULT DIAGNOSIS

Logic Level Diagnosis - Diagnosis by UUT reduction - Fault Diagnosis for Combinational Circuits - Self-checking design - System Level Diagnosis.

REFERENCES:

- M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design", Jaico Publishing House, 2002.
- P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.
- M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002.
- A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice Hall International, 2002.

Part I –Ph.D-Syllabus
ELECTRONICS AND COMMUNICATION ENGINEERING
Special Paper IV: Optical Fiber Communication 15RECE304
(Effective from the academic year 2015-2016 onwards)

Course Objectives

The goal of this course for research scholars is:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To understand the different kind of losses, signal distortion in optical wave guides and other
- signal degradation factors.Designoptimization of SM fibers, R I profile and cut-off wave length.
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes and different fiber amplifiers.
- To learn the fiber optical receivers such as P IN AP D diodes, noise performance in photo detector, receiver operation and configuration.
- To learn fiber slicing and connectors, noise effects on system performance, operational principles WDM and solutions.

Course Outcomes

At the end of the course the research scholars will be able to :

- Gain knowledge in basic elements of optical fiber transmission link, fiber modes configurations and structures.
- Gain knowledge in different kind of losses, signal distortion in optical wave guides and other signal degradation factors. Design optimization of SM fibers, R I profile and cut-off wave length.
- Gain knowledge in the various optical source materials, LED structures, quantum efficiency, Laser diodes and different fiber amplifiers.
- Gain knowledge in the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration.
- Gain knowledge in fiber slicing and connectors, noise effects on system performance, operational principles WDM and solutions.
- Gain knowledge on optical amplifiers and networks.

UNIT - I : INTRODUCTION TO OPTICAL FIBERS

Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes -Single Mode Fibers-Graded Index fiber structure.

UNIT - II : SIGNAL DEGRADATION OPTICAL FIBERS

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling -Design Optimization of SM fibers-RI profile and cut-off wavelength

.UNIT - III : FIBER OPTICAL SOURCES AND COUPLING

Direct and indirect Band gap materials-LED structures -Light source materials -Quantum efficiency and LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies -Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers- Power Launching and coupling, Lencing schemes, Fibre -to- Fibre joints, Fibre splicing.

UNIT - IV : FIBER OPTICAL RECEIVERS

PIN and APD diodes -Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise - Comparison of Photo detectors -Fundamental Receiver Operation - preamplifiers, Error Sources -Receiver Configuration -Probability of Error - Quantum Limit.

UNIT - V : DIGITAL TRANSMISSION SYSTEM

Point-to-Point links System considerations -Link Power budget -Rise - time budget -Noise Effects on System Performance-Operational Principles of WDM, Solitons-Erbium-doped Amplifiers. Basic on concepts of SONET/SDH Network.

TEXT BOOKS

- Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, Singapore, 3rd ed., 2000

REFERENCES

- J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994.
- J.Gower, "Optical Communication System", Prentice Hall of India, 2001.

Part I –Ph.D-Syllabus
ELECTRONICS AND COMMUNICATION ENGINEERING
Special Paper V: Mobile Ad-Hoc Networks 15RECE305
(Effective from the academic year 2015-2016 onwards)

Course Objectives

The goal of this course for research scholars is:

- To study about adhoc networks, characteristics features, applicationsof Wireless channel.
- To study about fundamentals of medium access protocolsand applications.
- To study about the network protocols and applications.
- To study the fundamentals ofend-end delivery and security.
- To introduce the concept of cross layer design and integration of adhoc for 4G
- To learn the main factors affecting performance of networks.

Course Outcomes

At the end of the course the research scholars will be able to :

- Conversant with the latest adhoc networks, characteristics features, applicationsof Wireless channel.
- Design and implement of medium access protocols and applications.
- Apply the concept of the network protocols and applications.
- Identify the importance of end-end delivery and security.
- Understand the concept of cross layer design and integration of adhoc for 4G
- Implement different type of factors affecting performance of networks.

UNIT I INTRODUCTION

Introduction to adhoc networks – definition, characteristics features, applications. Charectristics of Wireless channel, Adhoc Mobility Models:- Indoor and out door models.

UNIT II MEDIUM ACCESS PROTOCOLS

MAC Protocols: design issues, goals and classification. Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

UNIT III NETWORK PROTOCOLS

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

UNIT IV END-END DELIVERY AND SECURITY

Transport layer : Issues in desiging- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

UNIT V CROSS LAYER DESIGN AND INTEGRATION OF ADHOC FOR 4G

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary prespective. Intergration of adhoc with Mobile IP networks.

TEXTBOOKS

- C.Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures and protocols, 2nd edition, Pearson Education. 2007

- Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

(Effective from the academic year 2015-2016 onwards)

REFERENCES:

- Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobiladhoc networking, Wiley-IEEE press, 2004.

- Mohammad Ilyas, The handbook of adhoc wireless networks, CRC press, 2002.

- T. Camp, J. Boleng, and V. Davies "A Survey of Mobility Models for Ad Hoc Network Research," Wireless Commun. and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.

- A survey of integrating IP mobility protocols and Mobile Ad hoc networks, Fekri M. Abduljalil and Shrikant K. Bodhe, IEEE communication Survey and tutorials, v 9.no.1 2007

- V.T.Raisinhani and S.Iyer "Cross layer design optimization in wireless protocol stacks"Comp. communication, vol 27 no. 8, 2004.

- V.T.Raisinhani and S.Iyer,"ÉCLAIR; An Efficient Cross-Layer Architecture for wireless protocol stacks",World Wireless cong., San francisco,CA,May 2004.

- V.Kawadia and P.P.Kumar,"A cautionary perspective on Cross-Layer design,"IEEE Wireless commn., vol 12, no 1,2005.

Part I –Ph.D-Syllabus
ELECTRONICS AND COMMUNICATION ENGINEERING
Special Paper VI: Advanced Digital Image Processing 15RECE306
(Effective from the academic year 2015-2016 onwards)

Course Objectives

The goal of this course for research scholars is:

- To understand the Fundamentals of image processing.
- To learn Various transforms used in image processing.
- To learn the Image   processing   techniques   like   image   enhancement, reconstruction, compression and segmentation.
- To familiarize the students with the the images for enhancement of certain properties or for optimized use of the resources.
- To inculate colour transformations.
- To study smoothing and sharpening of images

Course Outcomes

At the end of the course the research scholars will be able to :

- Understand the Fundamentals of image processing.
- Knowledge about various transforms used in image processing.
- Knowledge about the Image   processing   techniques   like image enhancement, reconstruct ion, compression and segmentation.
- Gain knowledge on Multi resolution analysis.
- Understand about video coding and compression techniques.
- Develop algorithms for image compression and coding.

UNIT I FUNDAMENTALS OF DIGITAL IMAGE PROCESSING

Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, 2D imagetransforms-DFT, DCT, KLT, and SVD. Image enhancement in spatial and frequency domain,Review of morphological image processing

UNIT II SEGMENTATION

Edge detection, Thresholding, Region growing, Fuzzyclustering, Watershed algorithm, Activecontour methods, Texture feature based segmentation, Model based segmentation, Atlas basedsegmentation, Wavelet based Segmentation methods

UNIT III FEATURE EXTRACTION

First and second order edge detection operators, Phase congruency, Localized feature extraction-detecting image curvature, shape features Hough transform, shape skeletonization, Boundarydescriptors, Moments, Texture descriptors-Autocorrelation, Co-occurrence features, Runlengthfeatures, Fractal model based features, Gabor filter, wavelet features.

UNIT IV   REGISTRATION AND IMAGE FUSION

Registration-Preprocessing, Feature selection-points, lines, regions and templates Featurecorrespondence-Point pattern matching, Line matching, region matching Template matching.Transformation functions-Similarity transformationand Affine Transformation. Resampling-NearestNeighbour and Cubic SplinesImage Fusion-Overview of image fusion, pixel fusion, Multiresolution based fusiondiscrete wavelettransform, Curvelet transform. Region based fusion.

UNIT V 3D IMAGE VISUALIZATION

Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color,Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connectedsurfaces, Image processing in 3D, Measurements on 3D images.TOTAL:

TEXT BOOKS:

- John C.Russ, "The Image Processing Handbook", CRC Press,2007.
- Mark Nixon, Alberto Aguado, "Feature Extraction and Image Processing", Academic Press,2008.
- Ardeshir Goshtasby, " 2D and 3D Image registration for Medical, Remote Sensing andIndustrial Applications",John Wiley and Sons,2005

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

(Effective from the academic year 2015-2016 onwards)

REFERENCES:

- Rafael C. Gonzalez, Richard E. Woods, , Digital Image Processing', Pearson,Education, Inc.,Second Edition, 2004.

- Anil K. Jain, , Fundamentals of Digital Image Processing', Pearson Education,Inc., 2002.

- Rick S.Blum, Zheng Liu," Multisensor image fusion and its Applications",Taylor& Francis,2006.

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

Special Paper VII: Network Routing Algorithms 15RECE307

(Effective from the academic year 2015-2016 onwards)

Course Objectives
The goal of this course for research scholars is:
- To introduce the concept of circuit switching networks.
- To introduce the concept of packet switching networks.
- To introduce the concepts of high-speed networks.
- To introduce the need for mobile networks.
- To study the mobile ad-hoc networks.
- To introduce the Ad-hoc On- demand Distance Vector.

Course Outcomes
At the end of the course the research scholars will be able to :

- Knowledge about the circuit switching networks.
- Knowledge about concept of packet switching networks.
- Knowledge about the concepts of high-speed networks.
- Knowledgeabout the need for mobile networks
- Knowledge about the mobile ad-hoc networks.
- Distributions for Ad-hoc On- demand Distance Vector.

UNIT I   CIRCUIT SWITCHING NETWORKS

AT & T's Dynamic Routing Network, Routing in Telephone Network-Dynamic Non Hierarchical Routing-Trunk Status Map Routing-Real Time Network Routing, Dynamic Alternative Routing-Distributed Adaptive Dynamic Routing-Optimized Dynamic Routing

UNIT II   PACKET SWITCHING NETWORKS

Distance vector Routing, Link State Routing, Inter domain Routing-Classless Interdomain routing (CIDR), Interior Gateway routing protocols (IGRP) - Routing Information Protocol (RIP), Open Shortest

Path First (OSPF), Exterior Gateway Routing Protocol (EGRP) - Border Gateway Protocol (BGP), Apple Talk Routing and SNA Routing

UNIT III HIGH SPEED NETWORKS

Routing in optical networks-The optical layer, Node Designs, Network design and operation, Optical layer cost tradeoffs, Routing and wavelength assignment, Architectural variations, Routing in ATM networks-ATM address structure, ATM Routing, PNNI protocol, PNNI signaling protocol, Routing in the PLANET network and Deflection Routing.

UNIT IV MOBILE NETWORKS

Routing in Cellular Mobile Radio Communication networks-Mobile Network Architecture, Mobility management in cellular systems, Connectionless Data service for cellular systems, Mobility and Routing in Cellular Digital Packet Data (CDPD) network, Packet Radio Routing-DARPA packet radio network, Routing algorithms for small, medium and large sized packet,radio networks.

UNIT V MOBILE AD-HOC NETWORKS (Manet)

Internet based mobile ad-hoc networking, communication strategies, routing algorithms – Table-driven routing - Destination Sequenced Distance Vector (DSDV), Source initiated on demand routing- Dynamic Source Routing (DSR), Ad-hoc On- demand Distance Vector (AODV), Hierarchical based routing-Cluster head Gateway Switch Routing (CGSR) and Temporally-Ordered Routing Algorithm (TORA), Quality of Service.

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

(Effective from the academic year 2015-2016 onwards)

REFERENCES

- Steen strub.M,1995, "Routing in Communication networks", PH International, New York.

- William Stallings,2004, "ISDN & Broadband ISDN with Frame Relay & ATM", PHI, New Delhi.

- Behrouz A Forouzan,2004, "Data Communications and Networking (3/e), TMH, New Delhi.

- William Stallings,1998, "High Speed Networks TCP/IP and ATM Design Principles", Prentice Hall International, New York.

- Mohammad Ilyas,2002, "The Handbook of Ad hoc Wireless Networks", CRC Press, USA.

Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

Special Paper VIII: Cryptography and Network Security 15RECE308

(Effective from the academic year 2015-2016 onwards)

Course Objectives
The goal of this course for research scholars is:

*
*   To introduce the students the functions of symmetric ciphers.
*   To introduce the public-key encryption and hash functions.
*   To make students to get familiarized with different network security practice.
*   To familiarize the students with system security concepts.
*   To imparts a good knowledge in wireless security.
*   To learn about Wireless LAN Security Factors and Issues.

Course Outcomes
At the end of the course the research scholars will be able to :

*   Adequate knowledge about the functions of symmetric ciphers.
*   Adequate knowledge about the public-key encryption and hash functions.
*   Familiarize with different network security practice.
*   Trace the flow of information from system security concepts.
*   Gain knowledge to wireless security.
*   Analyze the performance of the Wireless LAN Security Factors and Issues.

UNIT I SYMMETRIC CIPHERS

Overview – classical Encryption Techniques – Block Ciphers and the Data Encryption standard – Introduction to Finite Fields – Advanced Encryption standard – Contemporary Symmetric Ciphers – Confidentiality using Symmetric Encryption.

UNIT II PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS

Introduction to Number Theory – Public-Key Cryptography and RSA – Key Management – Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Message Authentication and Hash Functions – Hash Algorithms – Digital Signatures and Authentication Protocols.

UNIT III NETWORK SECURITY PRACTICE

Authentication Applications – Kerbors – X.509 Authentication Service – Electronic mail Security – Pretty Good Privacy – S/MIME – IP Security architecture – Authentication Header – Encapsulating Security Payload – Key Management.

UNIT IV SYSTEM SECURITY

Intruders – Intrusion Detection – Password Management – Malicious Software – Firewalls – Firewall Design Principles – Trusted Systems.

UNIT V WIRELESS SECURITY

Introduction to Wireless LAN Security Standards – Wireless LAN Security Factors and Issues.

REFERENCES

- William Stallings, 2003, "Cryptography And Network Security – Principles and Practices", Pearson Education, 3rd Edition.
- Atul Kahate, 2003, "Cryptography and Network Security", Tata McGraw Hill.
- Bruce Schneier, 2001, "Applied Cryptography", John Wiley and Sons Inc,.
- Stewart S. Miller, 2003, "Wi-Fi Security", McGraw Hill.
- Charles B. Pfleeger, Shari Lawrence Pfleeger, 2003, "Security In Computing", 3rd Edition, Pearson Education.
- Mai, 2003, "Modern Cryptography: Theory and Practice", First Edition

ELECTRONICS AND COMMUNICATION ENGINEERING

Special Paper IX: Bio-Medical Signal Processing 15RECE309

(Effective from the academic year 2015-2016 onwards)

Course Objectives
The goal of this course for research scholars is:

- To know about wavelet transforms
- To understand neurological signal processing
- To understand cardiological signal processing
- To know 60- Hz adaptive canceling using a sine wave model
- To understand applications of adaptive filtering
- To gain knowledge on VLSI signal processing

Course Outcomes
At the end of the course the research scholars will be able to :

- Know about wavelet transforms
- Understand neurological signal processing
- Understand cardiological signal processing
- Know 60- Hz adaptive canceling using a sine wave model
- Understand applications of adaptive filtering
- Gain knowledge on VLSI signal processing

UNIT I   INTRODUCTION TO WAVELET TRANSFORMS

Basics of FT,FFT, DTFT, DFT, DIT-FFT, DIF-FFT algorithms, Introduction to wavelet transforms, Advantages, Applications, Limitations, Different types of wavelet transforms & their characteristics, The Discrete Wavelet Series, The Discrete Wavelet Transform, Multi Resolution Analysis

UNIT II NEUROLOGICAL SIGNAL PROCESSING

The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis, Linear prediction theory, The autoregressive (AR) method, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination

UNIT III   CARDIOLOGICAL SIGNAL PROCESSING

Basic electrocardiography, ECG data acquisition, ECG lead system, ECG parameters and their estimation, the use of multiscale analysis for parameters estimation of ECG waveforms, Arrhythmia analysis monitoring, Long-term continuous ECG is recording

UNIT IV ADAPTIVE FILTERS & ECG DATA REDUCTION TECHNIQUES

Principal noise canceller model, 60- Hz adaptive canceling using a sine wave model, applications of adaptive filtering, Direct data compression techniques, Direct ECG data compression techniques, Transformation compression technique

UNIT V VLSI IN DSP

Digital signal processors. High performance VLSI signal processing, VLSI applications in medicine, VLSI sensors for biomedical signals, VLSI tools, choice of custom, ASIC, or off- the- shelf components

REFERENCES :

- Biomedical Signal Processing, Principles and Techniques by D.C. Reddy, Tata McGraw Hill, 2005.
- Wills J. Tompkins, "Biomedical digital signal processing", Prentice Hall of India Pvt. Ltd.

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established Under Section 3 of UGC Act 1956)

KARPAGAM
ACADEMY OF HIGHER EDUCATION
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Part I –Ph.D-Syllabus

ELECTRONICS AND COMMUNICATION ENGINEERING

Special Paper X: Embedded Networking 15RECE310

(Effective from the academic year 2015-2016 onwards)

Course Objectives
The goal of this course for research scholars is:

- To understand embedded networking
- To study about basics of Controller Area Network (CAN)
- To understand CAN Networking Configuration
- To study CAN development tools.
- To know the comparison of various implementation methods
- To know about communication objects

Course Outcomes
At the end of the course the research scholars will be able to :

- Understand embedded networking
- Study about basics of Controller Area Network (CAN)
- Understand CAN Networking Configuration
- Study CAN development tools.
- Gain the knowledge on the comparison of various implementation methods
- Understand about communication objects

UNIT I INTRODUCTION

Embedded networking – code requirements – Communication requirements – Introduction to Controller Area Network (CAN) open – CAN open standard – Object directory – Electronic Data Sheets & Device –

Configuration files – Service Data Objectives – Network management CAN open messages – Device profile encoder.

UNIT II NETWORKING CONFIGURATION

CAN open configuration – Evaluating system requirements choosing devices and tools – Configuring single devices – Overall network configuration – Network simulation – Network Commissioning – Advanced features and testing.

UNIT III CONTROLLER AREA NETWORK

Controller Area Network – Underlying Technology CAN Overview – Selecting a CAN Controller – CAN development tools.

UNIT IV IMPLEMENTATION

Implementing CAN open Communication layout and requirements – Comparison of

implementation methods – Micro CAN open – CAN open source code – Conformance test – Entire design life cycle.

UNIT V COMMUNICATION OBJECTS

Implementation issues – Physical layer – Data types – Object dictionary – Communication object identifiers – Emerging objects – Node states.

REFERENCE

- Glaf P.Feiffer, Andrew Ayre and Christian Keyold, 2005, "Embedded Networking with CAN and CAN open". Embedded System Academy.

PhD Course Work Subjects

(Effective from the academic year 2015-2016 onwards)

Paper No.		Subject Code	Subject	Credit	ESE	total
Paper 1		15REEE101	Research Methodology and Pedagogy	3	100	100
Paper II		15REEE201	Renewable Energy Sources	3	100	100
		15REEE202	Advances in Power Electronics	3	100	100
		15REEE203	Advances in Power Systems	3	100	100
		15REEE204	Distributed Generation	3	100	100
		15REEE205	Smart Grids	3	100	100
		15REEE206	Advanced Control Systems	3	100	100
Paper III	Special Paper I	15REEE301	Analysis of Inverter Circuits	3	100	100
	Special Paper II	15REEE302	Analysis of Converter Circuits	3	100	100
	Special Paper III	15REEE303	Power Quality Assessment and Mitigation	3	100	100
	Special Paper IV	15REEE304	Computer Aided Design of Electrical Apparatus	3	100	100
	Special Paper V	15REEE305	Energy Auditing, Energy Efficiency and Energy Conversion	3	100	100
	Special Paper VI	15REEE306	Power Electronics Applications to Power Systems	3	100	100
	Special Paper VII	15REEE307	Special Electrical Machines	3	100	100
	Special Paper VIII	15REEE308	Advanced Bio-Medical Digital Signal Processing	3	100	100
	Special Paper IX	15REEE309	Power Sector Economics, Management and Restructuring	3	100	100
	Special Paper X	15REEE310	Wind Energy Conversion Systems	3	100	100
	Special Paper XI	15REEE311	Theory and Design of Neuro-Fuzzy Controllers	3	100	100
	Special Paper XII	15REEE312	Soft Computing Techniques	3	100	100
	Special Paper XIII	15REEE313	Flexible AC Transmission Systems	3	100	100

Special Paper XIV	15REEE314	HVDC Systems	3		100	100
Special Paper XV	15REEE315	Digital Power System Protection	3		100	100
Special Paper XVI	15REEE316	Optimization Techniques	3		100	100

Part I - Ph.D - Syllabus
Paper I: 15REEE101   RESEARCH METHODOLOGY AND PEDAGOGY
(Effective from the academic year 2015-2016 onwards)

Course Objectives:
At the end of this course, students will be able to
1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand various test
5. Understand Patent Rights
6. New Developments in pedagogy

Course Outcomes:
1. Understanding of the basic framework of research process
2. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
3. Understand the tests provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.
4. Effective technical writing
5. Nature of Intellectual Property
6. Patent Rights

UNIT I INTRODUCTION TO RESEARCH METHODOLOGY
Research – Definition – Importance and Meaning of research – Characteristics of research – Types of Research – Steps in research – Identification, Selection and formulation of research problem – Research questions – Research design – Formulation of Hypothesis – Review of Literature.

UNIT II SAMPLING TECHNIQUES
Sampling theory – types of sampling – Steps in sampling – Sampling and Non-sampling error – Sample size – Advantages and limitations of sampling. Collection of Data: Primary Data – Meaning – Data Collection methods – Secondary data – Meaning – Relevances, limitations and cautions.

UNIT III HYPOTHESES TESTS
Statistics in Research – Measure of Central tendency – Dispersion – Skewness and Kurtosis in research. Hypothesis – Fundamentals of Hypothesis testing – Standard Error – Point and Interval estimates – Important Non-Parametric tests : Sign, Run, Kruskal – Wallis tests and Mann-Whitney test.

UNIT IV PARAMETRIC TESTS AND REPORT WRITING
Para metric tests : Testing of significance – mean, Proportion, Variance and Correlation – testing for Significance of difference between means, proportions, variances and correlation co-efficient. Chi-square tests – ANOVA – One-way and Two-way. Research Report : Types of reports – contents – styles of reporting – Steps in drafting reports – Editing the final draft – Evaluating the final draft.

UNIT VPEDAGOGICAL METHODS IN HIGHER LEARNING
Objectives and roll of higher education – Important characteristics of an effective Lecture – Quality teaching and learning – Lecture preparation – Characteristics of instructional design – Methods of

teaching and learning : Large group – Technique – Lecture, Seminar, Symposium, Team Teaching, Project, Small group Technique – Simulation, role playing Demonstration, Brain storing, case discussion, and assignment, Methods of evaluation – Self evaluation, student evaluation, Diagnostic testing and remedial teaching – Question banking – Electronic media in education: - 'e' learning researches – web based learning

TEXT BOOKS:
- Rajasekar.S (2005) Computer Education and educational computing. Hyderabad: Neelkamal Publications.
- Kumar K.L. (1997) Educational Technologies, New Delhi: New age International.
- Vedanayagam, E.G (1989) Teaching Technology for college teachers. New Delhi: Sterling Publishers (P) Ltd.,

REFERENCES:
- Kothari C.R. Research Methodology Methods and Techniques, New Age Publications,Second edition,2009
- Panneerselvam R., Research Methodology, Prentice-Hall of India, New Delhi,2004

Paper II: 15REEE201 RENEWABLE ENERGY SOURCES
(Effective from the academic year 2015-2016 onwards)

Course Objectives
1. To gain the knowledge about environmental aspects of energy utilization.
2. To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion.
3. To study about solar energy collectors and its storages
4. To study about the inter connected system in wind power
5. To understand the basic principles fuel cell, Geo thermal power plants.
6. To gain the knowledge about hydro energy.

Course Outcomes
At the end of this course, students will demonstrate the ability to
1. Analyze the different energy sources
2. Able to perform an initial design of a renewable energy system.
3. Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
4. Understand the basic physics of wind and solar power generation.
5. Understand the basics of chemical ,ocean and geothermal energy.
6. Understand the power electronic interfaces for wind and solar generation.

UNIT – I   SOLAR ENERGY
Introduction to solar energy: solar radiation, availability, measurement and estimation– Solar thermal conversion devices and storage – solar cells and photovoltaic conversion – PV systems – MPPT. Applications of PV Systems – solar energy collectors and storages.

UNIT – II   WIND ENERGY
Introduction – Basic principles of wind energy conversion – wind data and energy estimation – site selection consideration – basic components of wind energy conversion system –Types of wind machines – basic components of wind electric conversion systems. Schemes for electric generations – generator control, load control, energy storage – applications of wind energy – Inter connected systems.

UNIT – III   CHEMICAL ENERGY SOURCES
Introduction – fuel cells – design and principles of operation of a fuel cell –
Classification of fuel cells. Types of fuel cells – conversion efficiency of fuel cells. Types of electrodes, work output and emf of fuel cell, Applications of fuel cells. Hydrogen energy: Introduction – hydrogen production – electrolysis, thermo chemical methods, Westing House Electro-chemical thermal sulphur cycle. Fossil fuel methods. Hydrogen storage, Utilization of hydrogen gas.

UNIT – IV   ENERGY FROM OCEANS
Introduction, ocean thermal electric conversion (OTEC), methods of ocean thermal electric power generation, open cycle OTEC system, closed OTEC cycle. Energy from tides: Basic principles of tidal power, component of tidal power plants, operation methods of utilization of tidal energy, site requirements, storage, advantages and limitations of tidal power generation. Ocean waves, energy and power from the waves, wave energy conversion devices.

UNIT – V   GEOTHERMAL ENERGY

Introduction, estimation of geothermal power, nature of geothermal fields, Geothermal sources, inter connection of geothermal fossil systems, prime movers for geo thermal energy conversion. Application of geothermal energy. Energy from biomass: Introduction, Biomass conversion technologies, photosynthesis, classification of biogas plants. Biomass Energy conversion, Energy from waste.

TEXT BOOKS:
- Goswami, D.Y., Kreith, F., and Kreider, J.F., 2000, Principles of Solar Engineering, Taylor and Francis, Philadelphia.
- Duffie, J.A., and Beckman, W.A., 1991, Solar Engineering of Thermal Processes, 2nd Edition, John Wiley, New York.

REFERENCES
- Rai, G.D., Non Conventional Energy Sources. Khanna publishers ,Fourth edition,2010
- Twidell, J., and Weir, T., 2006 , Renewable Energy Resources, E&FN Spon Ltd., London.
- Sukatme, S.P., 1991, Solar Energy – Principles of thermal collection and storage, 2nd Edition, Tata Mc Graw Hill, New Delhi.

Paper II: 15REEE202ADVANCES IN POWER ELECTRONICS
(Effective from the academic year 2015-2016 onwards)

Course Objectives

1. To review basic concepts of power electronics in the field of power control and drives
2. To address the underlying concepts and methods behind Advanced Power Electronics
3. To impart knowledge of power semiconductor technologies and their advancement in the field of power conversion.
4. To study the real time application of it.
5. To study the safe operating area of the power devices
6. MOS controlled thyristors

Course Outcomes

At the end of the course the student will be able to

1. Understand the concepts of Advanced Power Electronics
2. Understand the different characteristics of Advanced Power Electronics devices
3. Analysis the real time application of it.
4. To learn deep knowledge of FACT technologies
5. To study about real time applications of inverters and rectifiers
6. To learn about protection of device circuits

UNIT-I RESONANT CONVERTERS

Zero voltage and zero current switching-Classification of resonant converters-Basic resonant circuit concepts-Load resonant converters-Resonant switch converters-Zero voltage switching, clamped voltage topologies-Resonant DC link inverters and zero voltage switching- High frequency link integral half cycle converters – Applications in SMPS and lighting.

UNIT-II IMPROVED UTILITY INTERFACE

Generation of current harmonics – Current harmonics and power factor-Harmonic standards and recommended practices-Need for improved utility interface-Improved single phase utility interface-Improved three phase utility interface – Electromagnetic interference

UNIT-III FACTS

Introduction – Principles of reactive power control in load and transmission line compensation-Series and shunt reactive power compensation – Concepts of flexible AC Transmission system(FACTS) – Static var compensators(SVC)-Thyristor controlled reactor-Thyristor switched capacitor –Solid state power control-Static condensers-Controllable series compensation-Thyristor controlled phase angle regulator and unified power flow control.

UNIT-IV MODELING AND ANALYSIS

Modeling and methods of analysis of SVC and FACTS controllers – System control and protection – Harmonics and Filters –Simulation and study of SVC and FACTS under dynamic conditions.

UNIT-V EMERGING DEVICES AND CIRCUITS

Power Junction Field Effect Transistors-Field Controlled Thyristors-JFET based devices Vs other power devices-MOS controlled thyristors-Power integrated circuits-New semiconductor materials for power devices.

TEXT BOOKS:

- Bimal k Bose, "Modern Power Electronics-Evolution, Technology and application", Jaico Publishing House, Mumbai, 2006
- Ned Mohan., Undeland and Robbins,"Power Electronics: Convertors, Applications and Design", John Wiley and Sons(Asia) Pte Ltd, Singapore, 2003.

REFERENCES

- Rashid, M.H., "Power Electronics-Circuits, Devices and Applications", Pearson Education(Singapore)Pte. Ltd, New Delhi, 2004./Prentice Hall of India, New Delhi.
- Mohan Mathur P, Rajiv K Varma, "Thyristor- Based Facts Controllers for Electrical Transmission Systems", John Wiley and Sons Inc., IEEE Press, UAS, 2002.
- Roger C Durgan, Maric F Mcgranaghan, "Electrical Power System Quality", Mc-Graw Hill Inc, New York ,1996.
- Joseph Vithayathil., "Power Electronics", Mc-Graw Hill series in Electrical and Computer Engineering, USA, 1995.

Paper II: 15REEE203ADVANCES IN POWER SYSTEMS
(Effective from the academic year 2015-2016 onwards)

Course Objectives

1. To become familiar with different aspects of modeling of components and system
2. To study different methods of analysis of power system for power system planning andoperation.
3. To model steady-state operation of large sized power system
4. To understand the power flow problem using efficient numerical methods suitable for computer application.
5. To model and analyze power systems under abnormal(fault) conditions.
6. Tomodelandanalyzethedynamicsofpowersystemforsmallsignaland large signal disturbances and to design the system for enhancing stability.

Course Outcomes

At the end of this course, students will demonstrate the ability to
1. Understand the concepts of power systems.
2. Understand the various power system components.
3. Evaluate fault currents for different types of faults.
4. Understand the generation of over-voltages and insulation coordination.
5. Understand basic protection schemes.
6. Understand concepts of EMTP.

UNIT-I   ECONOMIC DISPATCH

Planning and operational problems of power systems - review of economic dispatch and calculation using B matrix loss formula - Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method-Base point and participation factors in on line economic dispatch. Economic dispatch controller added to LFC control.

UNIT-II   REAL POWER AND REACTIVE POWER

Fundamentals of speed governing mechanism and modeling- Speed-load characteristics – Load sharing between two synchronous machines in parallel - Plant and system level control problem - ALFC of single area system - modelling-static and transient response - ALFC of multi area system-modelling - static and transient response of two area system - development of state variable model - Two area system- AGC system design Kalmans method. Modeling of AVR loop -components - dynamic and static analysis - stability compensation - system level voltage control using OLTC, capacitor and generator voltages -expert system application for system voltage control.

UNIT-III   VOLTAGE STABILITY ANALYSIS-I

Transmission and generation and load aspects. Instability mechanisms and analysis methods: mathematical background -differential equations, bifurcations, multiple time scales.

UNIT-IV   VOLTAGE STABILITY ANALYSIS-II

Modeling for voltage stability analysis: time scale decomposition Equilibrium equations for voltage stability analysis. Loadability, sensitivity and bifurcation analysis-eigenvector and singular vector properties-loadability or bifurcation surface-case studies short term and long term voltage instability and counter measures.

UNIT-V SOLUTIONS METHODS AND MODELS FOR ANALYSIS OFELECTROMAGNETIC TRANSIENTS

Steady state and time step solutions in EMTP and their uses-models of synchronous, and induction machines EMTP; Selected case studies.

TEXT BOOKS:
- Allen J Wood and Bruce F Wollenberg, 2013, Power generation and control, John Wiley and sons, New York.
- Kundur, P., 2008 , Power system stability and control, EPRI publications, California.

REFERENCES
- Cutsem,T.V., Vournas, C., 1998,Voltage stability of power systems, Kluwer Academic Publishers.
- Dommel, H.W., August 1986, Electromagnetic Transients Program, Reference Mannual prepared for Bonnerville Power Administration, U.S.A..

Paper II: 15REEE204 DISTRIBUTED GENERATION
(Effective from the academic year 2015-2016 onwards)

Course Objectives

1. To study about the distributed generation system.
2. To study about the relaying and protections in the distributed system.
3. To get the knowledge of distributed generation, boiler turbine monitoring system.
4. To get the knowledge in Planning of distributed system
5. To know the control of DG inverter
6. To gather knowledge of protection of distributed systems

Course Outcomes

At the end of the course the students will

1. Understand the distributed generation system , boiler turbine monitoring system.
2. Understand the Planning of distributed system
3. Analysis the control of DG inverters
4. Analysis the protection of distributed systems
5. Understand the real time system
6. Analysis the norms and standards used in it

UNIT I   INTRODUCTION TO DISTRIBUTED GENERATION
Introduction to the concept of distributed generation - Distributed generation advantages and needs - Radial distribution system protection: Fuse, circuit breakers, reclosers- Per-unit analysis, fault analysis, sequence component analysis, sequence models of distribution system components. Implications of DG on distribution system protection coordination.

UNIT II   DISTRIBUTION SYSTEM LOADING
Introduction – Distribution system loading, line drop model, series voltage regulators and on line tap changers- Power quality requirements and source switching using SCR based static switches- Loop and secondary network distribution grids and impact of DG operation.

UNIT III   RELAYING AND PROTECTION
Relaying and protection, distributed generation interconnection relaying, sensing using CTs and PTs- Intentional and unintentional islanding of distribution systems. Passive and active detection of unintentional islands, non detection zones - EMI considerations in DG applications.

UNIT IV   DISTRIBUTED GENERATION PLANNING
DG planning and forecasting techniques - Load characteristics: Definitions - tariffs and metering of energy, cost implications of power quality, cost of energy and net present value calculations and implications on power converter design- Distribution Transformers: Types. Distribution sub-stations and primary systems: Voltage drop and power loss calculations: Distribution feeder costs.

UNIT V   DG INVERTERS CONTROL

Control of DG inverters, phase locked loops, current control and DC voltage control for stand alone and grid parallel operations. Protection of the converter.

TEXT BOOKS
- A Textbook of Electric Power Distribution Automation by Dr. M.K. Khedkar, Dr. G.M. Dhole Laxmi Publications, Ltd 2010.

REFERENCES
- Power Electronics: Converters, Applications, and Design by Ned Mohan, Tore M. Undeland, William P. Robbins Wiley,2002
- Electric Power Distribution Systems by TuranGonen, CRC Press, 2006
- Electric Power Distribution by Pabla, A. S 6th Edition, Tata McGraw-Hill Education 2011

Paper II: 15REEE205   SMART GRIDS
(Effective from the academic year 2015-2016 onwards)

Course Objectives:
1. Understand concept of smart grid and its advantages over conventional grid
2. Know smart metering techniques
3. Learn wide area measurement techniques
4. Understanding the problems associated with integration of distributed generation & its solution through smart grid.
5. Learn Web based Power Quality monitoring

Course Outcomes
Students will be able to:
1. Appreciate the difference between smart grid & conventional grid
2. Apply smart metering concepts to industrial installations
3. Apply smart metering concepts to commercial installations
4. Formulate solutions in the areas of smart substations,distributed generation and wide area measurements
5. Come up with smart grid solutions using modern communication technologies
6. Understand the concept of Power Quality & SCADA in Smart Grid

UNIT I   INTRODUCTION : SMART GRID AND EMERGING TECHNOLOGIES
Defining a smart grid – Characteristics of smart grid - Values of a smart grid – The economic Case – The environmental Case – Benefits to utilities – Benefits to consumers – Power system components – Power system protection: Traditional Vs Smart – Case study – Generation fundamentals – Traditional Generations – Distributed Generations – micro grid generation – Generator Protection – Challenges and Opportunities – Cost of smart grid – Government Regulations – Emerging Technologies - FACTS – optimizing integration systems – Multi generation buildings – Case study.

UNIT II   SMART GRID: MODELS AND OPERATING PRINCIPLES
Solar Photovoltaic models and grid Integration – Design of a 2 MVA PV station – DG system as part of utility power system – The smart grid PV - UPS DG system – Split DC Bus UPS – PV DG system – Island mode of operation – Parallel operation of Inverters – Power Quality. Wind turbine model and grid Integration – Micro turbine model & Grid Integration. Electric Vehicle model and Grid Integration.

UNIT III   SMART GRID: DISTRIBUTED GENERATION SYSTEMS
Power Converter System – Control System Development – Current limit and Saturation Control, Simulation using simulate and MATLAB. Inverter Parallel operation – Load sharing control Algorithm – Distributed Generation System and Newton Raphson method in power flow – Plant modeling and 3 phase 4 wire DG unit topology – Single distributed generation System –MIMO Linear system Stability robustness – PWM rectifier control – 3 Phase AC – DC – AC topology.

UNIT IV   ENERGY STORAGE AND COMMUNICATION
State–of–the art storage devices – Battery types – Ultra capacitors based Energy Storage System – Flywheel – Wide Area Network – Substation Information System – Wireless Networks – Distribution Automation – AMI Networks – Utility monitoring and Control – Inter-system Coordination – Industrial systems – Consumer Residential Systems – Network Protection – Channel model Fundamental – Low, medium, High voltage, main Topologies – Residential and Business Indoor wiring Topologies – The Power line Channel model – Digital Transmission Techniques - Threats – IEC61850 Considerations.

UNIT V SMART GRID: RELIABILITY, STABILITY AND COMPONENT INTEGRATION

Smart Grid Programming – Virtual Power Producer – Intelligent reconfiguration using SCADA – Problems in distributed grids – Solutions. Integration of Mini – Micro generation in distribution Grids – Power supply Quality generic standards – Renewable Energies specific standards – Smart Grid stability analysis schemes – Supply guarantee and Power quality – Integration in power systems – Distributed Generation advantages and needs.

REFERENCES

- Smart Power: Climate Change, the Smart Grid, and the Future of ElectricUtilities by Fox-Penner Island Press, Washington DC 2010

- Smart Grid: Modernizing Electric Power Transmission and Distribution; Energy Independence, Storage and Security; Energy Independence and Security Act and Resiliency by StanMark Kaplan, Fred SissineThe Capitol.Net, Washington DC,2009

- Integration of Green and Renewable Energy in Electric Power Systems by Ali Keyhani Mohammad N. Marwali , Min Dai Wiley, USA ,2009

- Power Electronics in Smart Electrical Energy Networks by Ryszard Michal Strzelecki , Grzegorz Pawel Benysek Springer, USA 2008

- Power Line Communications: Theory and Applications for Narrowband and Broadband Communications over Power Lines by Hendrik C. Ferreira ,Lutz Lampe , John Newbury,Theo G Swart Wiley, New York 2010

Paper II: 15REEE206 ADVANCED CONTROL SYSTEMS
(Effective from the academic year 2015-2016 onwards)
ADVANCED CONTROL SYSTEMS

Course Objectives

1. To study the state variableanalysis
2. To provide adequate knowledge in the phase plane analysis andalso describing functionanalysis.
3. To study the analysis discrete time systems using conventionaltechniques.
4. To analyze the stability of the systems using differenttechniques.
5. To study the design of optimalcontroller.
6. To study the types of compensators

Course Outcomes

At the end of the course the student will be able to

1. understand the state variable analysis, Z- transform and stateequation
2. Construct the frequency response of the system using various plots
3. Correlate the time and frequency domain specifications and effect of compensation
4. Design the different types of compensators using frequency response plots to stabilize the control system
5. Analysis the state variable representation of physical systems with the effects of state feedback its assessment for linear-time invariant systems.

UNIT 1 STATE VARIABLE ANALYSIS

Concept of state – State Variable and State Model – State models for linear and continuous time systems – Solution of state and output equation – controllability and observability - Pole Placement – State observer Design of Control Systems with observers

UNIT II PHASE PLANE AND DESCRIBING FUNCTION ANALYSIS

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearising non-linear systems - Construction of phase portraits – Singular points – Limit cycles Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations.

UNIT III Z-TRANSFORM AND DIGITAL CONTROL SYSTEM

Z transfer function – Block diagram – Signal flow graph – Discrete root locus – Bode plot.

UNIT 1V STATE-SPACE DESIGN OF DIGITAL CONTROL SYSTEM

State equation – Solutions – Realization – Controllability – Observability – Stability – Jury's test.

UNIT V OPTIMAL CONTROL

Introduction -Decoupling - Time varying optimal control – LQR steady state optimal control Optimal estimation – Multivariable control design.

TEXT BOOKS

- Control Systems Engineering By I.J. Nagrath and M. Gopal New Age International Publishers – 4th edition 2006
- Modern control Design with Matlab and Simulink by Ashish Tewari John Wiley, New Delhi 2002
- Digital Control Systems by Benjamin C. Kuo Oxford University Press – 2nd edition,2012.

REFERENCES

- Modern control system theory by M.Gopal New Age International Publishers,2002
- Feedback Control of Dynamic Systems by Gene F. Franklin, J. David Powell and Abbasemami-NaeiniPrentice Hall, 7th edition,2014
- Design of feedback Control systems by Raymond T. Stefani & Co Oxford University Press,2002

Special Paper I: 15REEE301 ANALYSIS OF INVERTER CIRCUITS
(Effective from the academic year 2015-2016 onwards)

Course Objectives

To impart knowledge on the following topics
1. Operation and performance of single phase inverters
2. Operation of different types of three phase inverters
3. Operation and performance of current source inverters
4. Operation and performance of resonant inverters
5. Operation and performance of multilevel inverters

Course Outcomes

At the end of the course, the student will able to
1. Analysis the application of single phase inverters
2. Analysis the application of three phase inverters
3. Analysis the application of current source inverters
4. Analysis the application of resonant inverters
5. Analysis the application of multilevel inverters
6. Analysis the real time application of it

UNIT- I SINGLE PHASE INVERTERS

Principle of operation of half and full bridge inverters – Performance parameters – Voltage and wave form control of single phase inverters using various PWM techniques – SVM Technique.

UNIT- II THREE PHASE VOLTAGE SOURCE INVERTERS

180 degree and 120 degree conduction mode inverters with star and delta connected loads – voltage and wave form control of three phase inverters –SVM Technique.

UNIT- III CURRENT SOURCE INVERTERS

Operation of six-step thyristors inverter – inverter operation modes – load – commutated inverters – Auto sequential current source inverter (ASCI) – current pulsations – comparison of current source inverter and voltage source inverters.

UNIT- IV MULTILEVEL INVERTERS

Multilevel concept – diode clamped – flying capacitor – cascade type multilevel inverters - comparison of multilevel inverters - application of multilevel inverters.

UNIT- V RESONANT INVERTERS

Series and parallel resonant inverters - voltage control of resonant inverters – Class E resonant inverter – resonant DC – link inverters.

TEXT BOOKS
- Rashid, M.H., 2004, Power Electronics Circuits, Devices and Applications, 3rd Edition, Prentice Hall of India, New Delhi.

- Jai P Agrawal, 2002, Power Electronics Systems, Pearson Education, 2nd Edition.

- Ned Mohan, Undeland and Robins, 1995, Power Electronics: converters, Application and design, John Wiley and sons Inc, Newyork.

REFERENCES
- Sen, P.C. 1998, Modern Power Electronics, 1st Edition, Wheeler Publishing Co, NewDelhi.

- Bimbra, P.S., 2003, Power Electronics, 11th Edition, Khanna Publishers.

- Bimal K Bose, 2003, Modern Power Electronics and AC Drives, 2nd Edition, Pearson Education.

- Singh, M.D., Khanchandan, K.B., 2002, Power Electronics, Tata McGraw Hill Publishing Limited, New Delhi.

Special Paper II: 15REEE302 ANALYSIS OF CONVERTER CIRCUITS
(Effective from the academic year 2015-2016 onwards)

Course Objectives
To impart knowledge on the following topics
1. Operation and performance of single-phase converters
2. Operation of different types of three phase converters
3. Operation and performance of DC-DC converters
4. Operation and performance of AC voltage controller
5. Operation and performance of cyclo-converters
6. dual Converters

Course Outcomes
At the end of the course, the student will able to
1. Analysis the application of single-phaseconverters
2. Analysis the application of three phase converters
3. Analysis the application of DC-DC converters
4. Analysis the application of AC voltage controller
5. Analysis the application of cyclo-converters
6. Analysis the real time application of it

UNIT- I   SINGLE PHASE AC-DC CONVERTER
Uncontrolled, half controlled and fully controlled converters with R-L, R-L-E loads and freewheeling diodes – continuous and discontinuous modes of operation - inverter operation – Dual converter - Sequence control of converters – performance parameters: harmonics, ripple, distortion, power factor – effect of source impedance and overlap.

UNIT -II   THREE PHASE AC-DC CONVERTER
Uncontrolled and fully controlled – converter with R, R-L, R-L-E - loads and freewheeling diodes – inverter operation and its limit – dual Converter – performance parameters – effect of source impedance and overlap.

UNIT- III   DC-DC CONVERTERS
Principles of step-down and step-up converters – Analysis of buck, boost, buck-boost and Cuk converters – time ratio and current limit control – Full bridge converter – Resonant and quasi – resonant converters.

UNIT- IV   AC VOLTAGE CONTROLLERS
Principle of phase control: single phase and three phase controllers – various configurations – analysis with R and R-L loads.

UNIT- V   CYCLOCONVERTERS
 Principle of operation – Single phase and three phase cycloconverters – power circuits – Output Voltage control – Control Schemes.

TEXT BOOKS

- Ned Mohan, Undeland and RoMEPEin, 2007, Power Electronics: converters, Application and design, John Wiley and sons.Inc, Newyork.

- Rashid M.H., Power Electronics Circuits, Devices and Applications, Prentice Hall of India, New Delhi, 1995.

REFERENCES
- Bimbra, P.S., 2003, Power Electronics, 11th Edition, Khanna Publishers.

- Dubey, G.K.,Doradla, S R., Joshi, A., Sinha, R.M K., 2004, Thyristorised PowerControllers, 1st Edition, New Age International Private Ltd.

Special Paper III: 15REEE303 POWER QUALITY ASSESSMENT AND MITIGATION
(Effective from the academic year 2015-2016 onwards)

Course Objectives

1. To study the production of voltages sags, over voltages and harmonics and methods ofcontrol.
2. To study various methods of power qualitymonitoring.
3. To understand the concept of power and powerfactor in single phase and three phasesystems supplying non linear loads
4. To understand the conventional compensation techniques used forpower factor correction and load voltageregulation.
5. To understand the activecompensation techniquesused forpower factor correction.
6. To understand the activecompensation techniquesused forload voltage regulation.

Course Outcomes

At the end of the course the student will be able to

1.Evaluate the characteristics of ac transmission
2.Reproduce the effect of shunt and series reactive compensation.
3.Justify the working principles of power quality measuring instruments and their operating characteristics.
4.Reproduce the basic concepts of power quality.
5.Rewrite the concept of Harmonics
6.Reproduce and justify the working principles of devices to improve power quality.

UNIT- I INTRODUCTION
Importance of power quality, terms and definitions of power quality as per IEEE std. 1159. such as transients, short and long duration voltage variations, interruptions, short and long voltage fluctuations, imbalance, flickers and transients. Symptoms of poor power quality. Definitions and terminology of grounding. Purpose of groundings. Good grounding practices and problems due to poor grounding.

UNIT- II FLICKERS AND TRANSIENT VOLTAGES
RMS voltage variations in power system and voltage regulation per unit system, complex power. Principles of voltage regulation. Basic power flow and voltage drop. Various devices used for voltage regulation and impact of reactive power management. Various causes of voltage flicker and their effects. Short term and long term flickers. Various means to reduce flickers. Transient over voltages, sources, impulsive transients, switching transients, Effect of surge impedance and line termination, control of transient voltages.

UNIT- III VOLTAGE SAG, SWELLS AND INTERRUPTIONS
Definitions of voltage sag and interruptions. Voltage sags versus interruptions. Economic impact of voltage sag. Major causes and consequences of voltage sags. Voltage sag characteristics. Voltage sag assessment. Influence of fault location and fault level on voltage sag. Areas of vulnerability. Assessment of equipment sensitivity to voltage sags. Voltage sag *limits for computer equipment, CBEMA, ITIC, SEMI F 42 curves. Representation of the results of voltage sags analysis. Voltage sag indices. Mitigation measures for voltage sags, such as UPS, DVR, SMEs, CVT etc., utility solutions and end user solutions.

UNIT- IV WAVEFORM DISTORTION

Definition of harmonics, inter-harmonics, sub-harmonics. Causes and effect of harmonics. Voltage versus current distortion. Overview of fourier analysis. Harmonic indices. A.C. quantities under non-sinusoidal conditions. Triplen harmonics, characteristics and non characteristics harmonics. Harmonics series and parallel resonances. Consequences of harmonic resonance. Principles for controlling harmonics. Reducing harmonic currents in loads. K-rated transformer. Harmonic study procedure. Computer tools for harmonic analysis. Locating sources of harmonics. Harmonic filtering, passive and active filters. Modifying the system frequency response. IEEE Harmonic standard 519-1992.

UNIT -V POWER QUALITY MONITORING, ASSESSMENT AND MITIGATION

Need of power quality monitoring and approaches followed in power quality monitoring. Power quality monitoring objectives and requirements. Initial site survey. Power quality Instrumentation. Selection of power quality monitors, selection of monitoring location and period. System wide and discrete power quality monitoring. Setting thresholds on monitors,

data collection and analysis. Selection of transducers. Harmonic monitoring, transient monitoring, event recording and flicker monitoring.

Power Quality assessment, Power quality indices and standards for assessment disturbances, waveform distortion, voltage and current unbalances. Power assessment under waveform distortion conditions. Power quality state estimation, State variable model, observability analysis, capabilities of harmonic state estimation. Test systems. Mitigation techniques at different environments.

TEXT BOOKS

- M. H. J. Bollen IEEE press, 2000, Understanding power quality problems, voltage sag and interruptions - series on power engineering.

- Roger C. Dugan, Mark F. McGranghan, Surya santoso, H. Wayne Beaty 2002 ,Electrical   power system quality ,second edition, McGraw Hill Pub.

Special Paper IV: 15REEE304   COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS
(Effective from the academic year 2015-2016 onwards)

Course Objectives

1. To study the structure and behaviour of processors, memories and input and output units and to study theirinteractions.
2. To get basic knowledge on geometric modeling
3. To study the graphic transformation needs
4. To study about the basics of parametric design and object representation
5. To get basic knowledge in product design and development.
6. To study about 3D design introduction

Course Outcomes

At the end of the course the student will be able to

1. Draw electrical drawings usingCAD.

2. Acquire basic knowledge on geometric modeling

3. Acquire knowledge on graphic transformation needs

4. Gaining CAD software application in engineering

5. Gaining basics of parametric design and object representation

6. Analysis the real time application of it

UNIT- I   INTRODUCTION

Conventional design procedures – Limitations – Need for field analysis based design.

UNIT- II   MATHEMATICAL FORMULATION OF FIELD PROBLEMS

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector /Scalar potential – Stored energy in field problems – Inductance- Development of torque/force- Lap lace and Poisson's Equations – Energy functional - Principle of energy conversion.

UNIT - III   PHILOSOPHY OF FEM

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variational method- 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques.

UNIT - IV   CAD PACKAGES

Elements of a CAD System –Pre-processing – Modelling – Meshing – Material properties- Boundary Conditions – Setting up solution – Post processing.

UNIT- V   DESIGN APPLICATIONS

Design of Solenoid Actuator – Induction Motor – Insulators – Power transformer.

TEXT BOOKS

- Salon, S.J., 1995, Finite Element Analysis of Electrical Machines, Kluwer Academic Publishers, London.

- Hoole, S.R.H., 1989, Computer – Aided, Analysis and Design of Electromagnetic Devices, Elsevier, New York, Amsterdam, London.

REFERENCES

- Silvester and Ferrari, P.P., 1983, Finite Elements for Electrical Engineers, CambridgeUniversity press.

- Lowther, D.A., and Silvester, P.P., 1986, Computer Aided Design in Magnetics, Springer verlag, New York.

Special Paper V: 15REEE305 ENERGY AUDITING, ENERGY EFFICIENCY AND ENERGY CONVERSION
(Effective from the academic year 2015-2016 onwards)

Course Objectives:
1. To gain the knowledge about energy management.
2. To understand the basic concepts in economic analysis in energy management.
3. To understand the basic principles of energy audit.
4. To gain the knowledge about the basic concept of types of Energy Audit
5. To gain and Evaluate the different energy efficient motors
6. Understand the concept of Energy conservation.
7. To study about the behavior changes of PF requirement in motor currents

Course Outcomes:
At the end of this course, students will demonstrate the ability to
1. Understand the concept of Energy Management.
2. Analyze the different methods for economic analysis
3. Knowledge about the basic concept of Energy Audit and types.
4. Evaluate the different energy efficient motors
5. Understand the concept of Energy conservation.
6. Investigate the different methods to improve power factor.

UNIT-I   INTRODUCTION
Scope of energy management, necessary steps in energy management programme, general principles of energy management, qualities of energy manager, functions of energy manager, language of energy manager.

UNIT-II ENERGY AUDIT AND ENERGY CONSERVATION
Energy surveying and auditing, objectives, uses of energy, energy conservation schemes, energy index, cost index, pie charts, Sankey diagrams, load profiles(histrograms), types of energy audits preliminary energy audit-detailed energy audit, questionnaire, energy audit instruments, energy audit report writing.
Indian energy conservation act-2001, second law of thermodynamics, rules for efficient energy conservation of energy and materials, technologies for energy conservation(reducing demand using alternative supplies, load factor, balancing and energy storage), supply side options, demand side options, maximum demand controller, transmission and distribution side options.

UNIT-III ENERGY EFFICIENT MOTORS AND BOILERS
Constructional details, factors affecting efficiency, losses distribution, soft starters, variable speed drives.
Power Factor: Causes and disadvantages of low power factor, methods to improve power factor.
Energy Efficient lighting: Terminology, cosine law of luminance, types of lamps, characteristics, design of illumination systems, good lighting practice, lighting control, steps for lighting energy conservation.
Boilers: Fuels and combustion, type of boilers, performance evaluation, factors affecting boiler performance, data collection format for boiler performance assessment, case studies.
Steam Distribution System: Steam pipe sizing, proper selection of steam traps, optimum insulation, steam utilization, steam balance-energy saving opportunities.

Furnaces: Types and classification of furnaces, performance evaluation of a typical furnace, general fuel economy measures in furnaces, case studies.

UNIT-IV HEAT RECOVERY SYSTEMS AND COMPRESSED AIR NETWORK

Sources of waste heat, guidelines to identify waste heat, grading of waste heat, feasibility study of waste heat recovery, gas to gas heat recovery, rotary generators, heat pipes, gas to liquid heat recovery, waste heat boilers

Cogeneration: Definition and need, basics of thermodynamic cycles, classification of cogeneration systems, steam turbine, typical heat to power ratio in various industries, operating strategies for cogeneration plant, typical cogeneration performance parameters relative merits of cogeneration systems.

Compressed Air Network: Types of compressors, compressor selection, monitoring performance, specific power consumption, FAD test, capacity control and power consumption, compressed air distribution system, moisture separation.

UNIT-V HVAC (HEATING VENTILATION AND AIR CONDITIONING)

Vapour compression system, vapour absorption system, measurements/field testing, performance evaluation, heat pump, energy efficiency ratios, energy conservation opportunities, case studies.

Cooling Towers: Classification of pumps, centrifugal pump, system characteristics, pump operating point, factors affecting pump performance, pump efficiency, effect of over-sizing the pump, effect of speed variation/impeller diameter change, energy performance and evaluation of pumping system at sites, flow control strategies, meeting the fixed flow reduction, meeting the variable flow reduction.

Fans and Blowers: Types of fans and blowers, fan performance evaluation and efficient system operation, fan performance curves, fan selection, variable loads, flow control methods, energy.

TEXT BOOKS

- LC Witte, PS Schmidt and DR Brown: Industrial Energy Management and Utilization (Hemisphere Publishing corporation, Wasington, 1998).

- W Trinks, MH Mawhinney, RA Shannon, RJ Reed, JR Garvey: Industrial Furnaces, Sixth Edition, (John Wiley &Sons, 2003).

REFERENCES

- JL Threlkeld: Thermal Environmental Engineering, Second Edition (Prentice Hall, 1970).

- YP Abbi and Shashank Jain: Handbook on energy Audit and Environment Management, (TERI Press, 2006).

- WC Turner: Energy Management Handbook, Seventh Edition, (Fairmont Press Inc., 2007).

- George Polimeros:Enrgy Cogeneration Handbook,(Industrial Press,Inc.,New York,1981)

Special Paper VI: 15REEE306   POWER ELECTRONICS APPLICATIONS TO POWER SYSTEMS
(Effective from the academic year 2015-2016 onwards)

To expose the students to the concepts of
1. High power devices for power system controllers
2. Properties of Single and Three Phase Converters
3. Converter control
4. Stability of Control
5. Application of converters
6. Energy conversion system

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Analyze and design of power system controllers.
2. Acquire the knowledge on csingle and 3 phase converters
3. Understand the concept of ractive power control
4. Acquire the knowledge on Concept of Flexible AC Transmission system
5. Acquire the knowledge on Harmonics and Power factor improvement
6. DC and AC power conditioners

UNIT-1 INTRODUCTION
High power devices for power system controllers-Characteristics-Converters Configurations for large power control.

UNIT-II SINGLE AND THREE PHASE CONVERTERS
Properties-Current and Voltage harmonics-Effects of source and load impedance-Choice of best circuit for power systems.

UNIT III CONVERTER CONTROL
Gate control-Basic means of control-Control characteristics- Stability of Control –Reactive power control.

UNIT IV HVDC SYSTEMS AND FACTS
Application of converters in HVDC systems-Static VAR control-Sources of reactive power-Harmonics and Filters-Concept of Flexible AC Transmission system-Static VAR compensators-Thyristors controlled reactor – Thyristors switched capacitor- Static condenser-Controllable series compensation-UPFC-Static Voltage and Phase angle Regulators-Transient Stabilty Analysis.

UNIT-V ENERGY CONVERSION SYSTEM
Basic components-Generator control-Harmonics –Power factor improvement-PV Conversion Systems: Different schemes-DC and AC power conditioners- Synchronised operation with grid supply –Harmonic problems.

TEXT BOOKS
* Arrillaga and Watson, "Computer Modelling of Electrical Power Systems,: John Wiley, London, 2001.

* NarainG.Hingorani, "Understanding FACTS," IEEE Press, New York, 2000.

REFERENCES

- E.Acha and VG Agilidis, "Power Electronic Control in Electrical Systems", Elsevier,2002

- Mukund R. Ptel., Wind and Solar Power Systems, CRC Press, London, 1999.

- Rai, G.D., "Solar Energy Utilization", Khanna Publishers, New Delhi, 1991.

Special Paper VII: 15REEE307   SPECIAL ELECTRICAL MACHINES
(Effective from the academic year 2015-2016 onwards)

Course Objectives

To expose the students to the

1. concepts of special electrical machinesand analyze their performance and to impart knowledgeon
2. Construction and performance of synchronous reluctancemotors.
3. Principle of operation and performance of stepping motors.
4. To study the knowledge on construction and operation of permanent magnet brushless D.C. motors.
5. To study the real time need of special machines
6. Construction, principle of operation and performance of switched reluctance motors, permanent magnet synchronousmotors.

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Analyze and design controllers for special Electrical Machines.
2. Acquire the knowledge on construction and operation of stepper motor.
3. Understand the concept of construction and operation of stepper switched reluctance motors.
4. Acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.
5. Acquire the knowledge on construction and operation of permanent magnet synchronous motors.
6. Determine a special Machine for a particular application.

UNIT- I   SYNCHRONOUS RELUCTANCE MOTORS
Constructional features: axial and radial air gap Motors. Operating principle, reluctance torque – phasor diagram, motor characteristics.

UNIT- II   SWITCHED RELUCTANCE MOTORS
Constructional features, principle of operation. Torque equation, Power controllers, Characteristics and control Microprocessor based controller.

UNIT- III   PERMANENT MAGNET SYNCHRONOUS MOTORS
Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power controllers, Torque speed characteristics, Self control, Vector control, Current control schemes.

UNIT- IV   PERMANENT MAGNET BRUSHLESS DC MOTORS
Commutation in DC motors, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motor, Square wave permanent magnet brushless motor drives, Torque and emf equation, Torque-speed characteristics, Controllers-Microprocessor based controller.

UNIT- V   STEPPING MOTORS

Constructional features, principle of operation, modes of excitation torque production in Variable Reluctance (VR) stepping motor, dynamic characteristics, Drive systems and circuit for open loop control, closed loop control of stepping motor.

TEXT BOOKS

- Miller, T.J.E., 1989, Brushless permanent magnet and reluctance motor drives, Clarendon Press, Oxford.

- Kenjo, T., 1989, Stepping motors and their microprocessor control,Clarendon Press, Oxford.

REFERENCES

- Kenjo, T and Naganori, S., 1989, Permanent Magnet and brushless DC motors, Clarendon Press, Oxford.

- Kenjo, T., 1989, Power Electronics for the microprocessor Age.

- Bose, B.K., 1997, Modern Power Electronics & AC drives, Prentice Hall, New Jersey.

Special Paper VIII: 15REEE308 ADVANCED BIO-MEDICAL DIGITAL SIGNAL PROCESSING
(Effective from the academic year 2015-2016 onwards)

Course Objectives

To expose the students to the

1. Concepts of wavelet transforms
2. Concepts of Neurological Signal Processing
3. Principle of operation Cardiological Signal Processing
4. To study the knowledge on Adaptive Filters
5. To study the real time need of Adaptive Filters
6. VLSI IN DSP **Course**

Outcomes
At the end of this course students will demonstrate the ability to

1. Analyze and design of various wavelet transforms
2. Acquire the knowledge on NSP
3. Understand the concept of CSP
4. Acquire the knowledge on noise canceller model
5. Acquire the knowledge on Direct data compression techniques
6. High performance VLSI signal processing

UNIT- I: INTRODUCTION TO WAVELET TRANSFORMS
Basics of FT,FFT, DTFT, OFT, DIT-FFT, DIF-FFT algorithms, Introduction to wavelet transforms, Advantages, Applications, Limitations, Different types of wavelet transforms & their characteristics, The Discrete Wavelet Series, The Discrete Wavelet Transform, Multi Resolution Analysis

UNIT- II: NEUROLOGICAL SIGNAL PROCESSING (NSP)
The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis, Linear prediction theory, The autoregressive (AR)· method, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination

UNIT- III: CARDIOLOGICAL SIGNAL PROCESSING (CSP)
Basic electrocardiography, ECG data acquisition, ECG lead system, ECG parameters and their estimation, the use of multistate analysis for parameters estimation of ECG waveforms, Arrhythmia analysis monitoring, Long-term continuous ECG is recording.

UNIT- IV: ADAPTIVE FILTERS &ECG DATA REDUCTION TECHNIQUES
Principal noise canceller model, 60- Hz adaptive canceling using a sine wave model, applications of adaptive filtering, Direct data compression techniques, Direct ECG data compression techniques, Transformation compression technique,

UNIT- V: VLSI IN DSP:
Digital signal processors. High performance VLSI signal processing, VLSI applications in medicine, VLSI sensors for biomedical signals, VLSI tools, choice of custom, ASIC, or off-

the- shelf components

TEXT BOOKS

- Biomedical Signal Processing: Principles and Techniques ,Tata McGraw-Hill Education, 2005 - Biomedical engineering.

- James D. Broesch, Dag Stranneby and William Walker. Digital Signal Processing: Instant access. Butterworth-Heinemann, 2004

REFERENCES

- VLSI digital signal processing systems Keshab K. Parhi, 1999

- Digital signal processing in VLSI Richard J. Higgins Prentice Hall, 1990.

Special Paper IX: 15REEE309 POWER SECTOR ECONOMICS, MANAGEMENT AND RESTRUCTURING
(Effective from the academic year 2015-2016 onwards)

Course Objectives
To expose the students to the
1. Concepts of Power Sector In India, Economics And Regulation
2. Calculation of Power Tariff
3. Knowledge of Power Sector Restructuring and Market Reform
4. Concepts of Electricity Markets Pricing and Non-Price Issues
5. Design idea of Transmission Planning and Pricing
6. Concepts of power purchase

Outcomes
   At the end of this course students will demonstrate the ability to
1. UnderstandPlanning Commissions
2. Acquire Different tariff principles
3. Analyze Competition in the electricity sector
4. Understand Spot prices for real and reactive power
5. Understand Price based Unit commitment
6. Analyze Power purchase agreements

UNIT-I   POWER SECTOR IN INDIA, ECONOMICS AND REGULATION
Introduction to various institutions in Indian Power sector such as CEA, Planning Commissions, PGCIL, PFC, Ministry of Power, state and central governments, REC, utilities and their roles. Critical issues / challenges before the Indian power sector, Salient features of Electricity act 2003, Various national policies and guidelines under this act. Typical cost components and cost structure of the power sector, Different methods of comparing investment options, Concept of life cycle cost , annual rate of return , methods of calculations of Internal Rate of Return(IRR) and Net Present Value(NPV) of project, Short term and long term marginal costs, Different financing options for the power sector . Different stakeholders in the power sector, Role of regulation and evolution of regulatory commission in India, types and methods of economic regulation, regulatory process in India.

UNIT-II   POWER TARIFF
Different tariff principles (marginal cost, cost to serve, average cost), Consumer tariff structures and considerations, different consumer categories, telescopic tariff, fixed and variable charges, time of day, interruptible tariff, different tariff based penalties and incentives etc., Subsidy and cross subsidy, life line tariff, Comparison of different tariff structures for different load patterns. Government policies in force from time to time. Effect of renewable energy and captive power generation on tariff. Determination of tariff for renewable energy.

UNIT-III   POWER SECTOR RESTRUCTURING AND MARKET REFORM
Different industry structures and ownership and management models for generation, transmission and distribution. Competition in the electricity sector- conditions, barriers, different types, benefits and challenges Latest reforms and amendments.   Different market and trading models / arrangements, open access, key market entities- ISO, Genco, Transco, Disco, Retailco, Power market types, Energy market, Ancillary service market, transmission market, Forward and real time markets, market power.

UNIT-IV   ELECTRICITY MARKETS PRICING AND NON-PRICE ISSUES

Electricity price basics, Market Clearing price (MCP), Zonal and locational MCPs. Dynamic, spot pricing and real time pricing, Dispatch based pricing, Power flows and prices. Optimal power flow Spot prices for real and reactive power. Unconstrained real spot prices, constrains and real spot prices. Non price issues in electricity restructuring (quality of supply and service, standards of performance by utility, environmental and social considerations) Global experience with electricity reforms in different countries.

UNIT -V   TRANSMISSION PLANNING AND PRICING

Transmission planning, Different methods of transmission pricing, Different transmission services, Congestion issues and management, Transmission cost allocation methods, Locational marginal price, firm transmission right. Transmission ownership and control, Transco and ISO, Transmission pricing Model in India, Availability based tariff, role of load dispatch centers (LDCs) Salient features of Electricity act 2003, Price based Unit commitment, concept of arbitrage in Electricity markets, game theory methods in Power System, security constrained unit commitment. Ancillary services for restructuring, Forward ancillary service auction. Power purchase agreements.

TEXT BOOKS

- Sally Hunt, Making Competition Work in Electricity, 2002, John Wiley Inc.

- Electric Utility   Planning and Regulation, Edward Kahn, American Council for Energy Efficient Economy. 1988

REFERENCES

- Regulation in infrastructure Services: Progress and the way forward - TERI, 2001.

- Maharashtra Electricity Regulatory Commission Regulations and Orders -   Various publications, reports and presentations by Prayas, Energy Group, Pune ,2011

- Central Electricity Regulatory Commission, Regulations and Orders -   Electricity Act 2003 and National Policies – Market Operations in Electric Power Systems Forecasting, Scheduling and Risk

Special Paper X: 15REEE310 WIND ENERGY CONVERSION SYSTEMS
(Effective from the academic year 2015-2016 onwards)

Course Objectives

To expose the students to the
1. Wind machine types
2. Aerodynamics Theory and Wind Turbine Types
3. Horizontal Axis Wind Turbine
4. Modern Wind Turbine Control
5. Wind Energy Conversion System
6. Integration of Wind Energy Converters

Outcomes

At the end of this course students will demonstrate the ability to
1. Understand Wind machine types, classification
2. Acquire the knowledge Wind turbine aerodynamics, momentum theories
3. Able to HAWT rotor design considerations
4. Understand the Wind turbine loads
5. Applying WECS control system
6. Understand Testing of WECS

UNIT I INTRODUCTION

Wind machine types, classification, parameters. Wind, its structure, statistics, measurements, data presentation, power in the wind.

UNIT II AERODYNAMICS THEORY AND WIND TURBINE TYPES

Wind turbine aerodynamics, momentum theories, basic aerodynamics, airfoils and their characteristics, Horizontal Axis Wind Turbine (HA WT) - Blade Element Theory, wake analysis, Vertical Axis Wind Turbine (VA WT) aerodynamics.

UNIT III HORIZONTAL AXIS WIND TURBINE

HAWT rotor design considerations, number of blades, blade profile, 2/3 blades and teetering, coning, power regulation, yaw system, tower.

UNIT IV MODERN WIND TURBINE CONTROL

Wind turbine loads, aerodynamic loads in steady operation, wind turbulence, static - dynamic - fatigue analysis, yawed operation and tower shadow, WECS control system, requirements and strategies.

UNIT V WIND ENERGY CONVERSION SYSTEM

Wind Energy Conversion System (WECS) siting, rotor selection, Annual Energy Output (AEO). Synchronous and asynchronous generators and loads, integration of wind energy converters to electrical networks, inverters. Testing of WECS- Noise- Miscellaneous topics.

TEXT BOOKS:

- Kaldellis., Stand-alone and hybrid wind energy systems,CRS Press,2010

- John D Sorensen and Jens N Sorensen,Wind energy systems,Woodhead publishi8ng Ltd,2011

REFERENCES

- Mario Garcia Sanz,Wind Energy Systems,CRC Press,2012

- Spera D.A., Wind Turbine Technology: Fundamental Concepts of Wind Turbine Engineering, ASME Press, NY 1994.

Special Paper XI: 15REEE311 THEORY AND DESIGN OF NEURO-FUZZY CONTROLLERS
(Effective from the academic year 2015-2016 onwards)

Course Objectives
To expose the students to the
1. Neural Network
2. Neural Networks In Control
3. Fuzzy Logic
4. Fuzzy Logic In Control
5. Non-Linear Fuzzy Control
6. Fuzzy Control Applications

Outcomes
At the end of this course students will demonstrate the ability to
1. Understand the concepts of back propagation learning and training
2. Acquire the knowledge of Neural network for non-linear systems
3. Design Fuzzy sets
4. Understand the Structure of fuzzy logic controller
5. Understand Non-linear fuzzy control
6. Design - fuzzy control applications-case studies.

UNIT-I   NEURAL NETWORK
Introduction-biological neurons and their artificial models-learning, adaptation and neural network's learning rules types of neural networks-single layer, multilayer-feed forward, feedback networks; back propagation learning and training-Hop field network.

UNIT-II   NEURAL NETWORKS IN CONTROL
Neural network for non-linear systems-schemes of neuro control-system identification forward model and inverse model-indirect learning neural network control applications-case studies.

UNIT-III   FUZZY LOGIC
Fuzzy sets-fuzzy operation-fuzzy arithmetic-fuzzy relations-fuzzy relational equations-fuzzy measure-fuzzy functions-approximate reasoning-fuzzy propositions-fuzzy quantifiers-if-then rules.

UNIT-IV   FUZZY LOGIC IN CONTROL
Structure of fuzzy logic controller-fuzzification models-data base-rule base-inference engine defuzzification module.

UNIT-V   NON-LINEAR FUZZY CONTROL
Introduction of Non-linear fuzzy control-PID like FLC-Sliding mode FLC - Sugeno FLC-adaptive fuzzy control-fuzzy control applications-case studies.

TEXT BOOKS

- Farin Wah, S.S., Filev, D., Langari, R., 2000, Fuzzy control synthesis and analysis, John Wiley and Sons.

- Jacek M Zurada, 1999, Introduction to Artificial Neural Systems, Jaico Publishing House.

REFERENCES

- Kosko, B., 1994, Neural Networks And Fuzzy Sstems, Prentice-Hall of India Pvt.Ltd.

- Klir, G.J. and Folger, T.A., 1993, Fuzzy sets, uncertainty and Information, Prentice-Hall of India Private Ltd.

- Zimmerman, H.J., 1994, Fuzzy set theory-and its Applications, Kluwer Academic Publishers.

Special Paper XII: 15REEE312 SOFT COMPUTING TECHNIQUES

(Effective from the academic year 2015-2016 onwards)

Course Objectives

To expose the students to the

  At the end of this course students will demonstrate the ability to

1. Architecture For Intelligent Control
2. Artificial Neural Networks
3. Fuzzy Logic System
4. Genetic Algorithm
5. Ga Application To Power System
6. Stability Analysis Of Fuzzy Control Systems

Outcomes

  At the end of this course students will demonstrate the ability to

1. Understand the Approaches to intelligent control
2. Design Concepts of Artificial Neural Networks
3. Understand the Learning and Training the neural network
4. Design concepts of Fuzzification
5. Solution of typical control problems using genetic algorithm
6. GA application to power system optimization problem

UNIT I   INTRODUCTION

Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation. Expert systems.

UNIT II   ARTIFICIAL NEURAL NETWORKS

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations. Hopfield network, Self-organizing network and Recurrent network. Neural Network based controller.

UNIT III FUZZY LOGIC SYSTEM:

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. Fuzzy logic control for nonlinear time-delay system.

UNIT IV GENETIC ALGORITHM

Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other search techniques like tabu search and and-colony search techniques for solving optimization problems.

UNIT-VAPPLICATIONS

GA application to power system optimization problem, Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab- eural Network toolbox. Stability analysis of   eural-Network   interconnection   systems.   Implementation   of   fuzzy   logic

controller using Matlab fuzzy-logic toolbox. Stability analysis of fuzzy control systems.

REFERENCES

- Oscar Castillo,PatriciaMelin, Soft Computing For Hybrid Intelligent Systems,Wiltold Pedrycz,2008
- .MadanM.Gupta, Naresh K Sinha, " Soft computing and intelligent systems: Theory and applications,2000.
- 3. J.Jacek.M.Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 199

Special Paper XIII: 15REEE313   FLEXIBLE AC TRANSMISSION SYSTEMS
(Effective from the academic year 2015-2016 onwards)

Course Objectives

To Expose the Students To
1. Concepts of Facts
2. Sub-Synchronous Resonance
3. Implementation Of Power Flow Control Using Conventional Thyristors
4. Multi-Model Decomposition
5. Static Var Compensation
6. Thyristor Controlled Reactor

Outcomes

At the end of this course students will demonstrate the ability to
1. Understand the Basic Concepts of Static Var Compensator
2. Acquire the knowledge of Series Compensation Schemes
3. Understand Unified Power Flow Control
4. Design of Facts Controllers
5. Understand Static Var Compensation
6. Acquire the knowledge of Thyristors Switched Reactor

UNIT-I   INTRODUCTION

FACTS-a toolkit, Basic concepts of Static VAR compensator, Resonance damper, Thyristor controlled series capacitor, Static condenser, Phase angle regulator, and other controllers.

UNIT-II   SERIES COMPENSATION SCHEMES

Sub-Synchronous resonance, Torsional interaction, torsional torque, Compensation of conventional, ASC, NGH damping schemes, Modelling and control of thyristor controlled series compensators.

UNIT-III   UNIFIED POWER FLOW CONTROL

Introduction, Implementation of power flow control using conventional thyristors, Unified power flow concept, Implementation of unified power flow controller.

UNIT-IV   DESIGN OF FACTS CONTROLLERS

Approximate multi-model decomposition, Variable structure FACTS controllers for Power system transient stability, Non-linear variable-structure control, variable structure series capacitor control, and variable structure resistor control.

UNIT-V   STATIC VAR COMPENSATION

Basic concepts, Thyristor controlled reactor (TCR), Thyristors switched reactor (TSR), Thyristor switched capacitor (TSC), saturated reactor (SR), Fixed Capacitor (FC).

TEXT BOOKS

- Mohan Mathur. R., Rajiv.K.Varma, Thyristor–Based Facts Controllers for Electrical Transmission Systems , IEEE press and John Wiley & Sons, Inc, New York ,2002.

- Narin G Hingorani, Understanding FACTS : Concepts and Technology of Flexible AC Transmission Systems , Standards publishers, New Delhi ,2001Flexible AC Transmission, IEEE Spectrum, pp 40-45.

REFERENCES

- Narin G Hingorani, High Power Electronics and Flexible AC Transmission Systems, IEEE High Power Engineering Review volume 8: issue 7,2002

- Einar V Larsen, Juan J Sanchez-Gasca, Joe H Chow, May 1995, Concepts for design of FACTS Controllers to damp power swings, IEEE Trans On Power Systems, Vol.10, No.2.

- Gyugyi.L, July 1992, Unified power flow control concept for flexible AC transmission, IEEE Proc-C Vol.139, No.4.

Special Paper XIV: 15REEE314   HVDC SYSTEMS
(Effective from the academic year 2015-2016 onwards)

Course Objectives
To Expose the Students To
1. Comparison of Ac - Dc Transmission
2. Analysis of Hvdc Converters
3. Hvdc System Control
4. Transient Stability Analysis
5. Dynamic Stability and Power Modulation
6. Power Modulation Controls

Outcomes
   At the end of this course students will demonstrate the ability to
1. Understand the concepts of HVDC transmission
2. Design of converter configuration
3. Understand the Principles of DC link control
4. Design and Modelling of converter
5. AC network and synchronous generator
6. Power modulation controls

UNIT-I   INTRODUCTION
Comparison of AC - DC transmission - Description and application of HVDC transmission - DC system components and their functions.

UNIT-II   ANALYSIS OF HVDC CONVERTERS
Pulse number - converter configuration, analysis greatz circuit - bridge characteristics - 12-pulse converter.

UNIT-III   HVDC SYSTEM CONTROL
Principles of DC link control - converter control characteristics - system control, firing angle control – current and excitation angle control, DC link power control - higher level controllers - reactive power control and VAR sources - Multi terminal DC system - types - control and protection.

UNIT-IV   TRANSIENT STABILITY ANALYSIS
Modelling of converter - DC network - AC network and synchronous generator -solution methodology - transient stability improvement using DC link control.

UNIT-V   DYNAMIC STABILITY AND POWER MODULATION
Power modulation controls, reactive power modulation, voltage stability in AC -DC systems control.

TEXT BOOKS:
- Naidu, M. S. and Kamaraju, V ,High Voltage Engineering, Tata McGraw Hill,   New Delhi ,2004
- Padiyar K.R., " HVDC power transmission system ", Wiley Eastern Pvt. Ltd., 1990.

REFERENCES

- Arrillaga J. and Arnald C.P., & Parker B.J., " Computer modeling of Electric power systems ", John wiley& sons, 2001.

- Arrillaga J., " High voltage direct current transmission ", Peter Peregrinus, London, 1983.

Special Paper XV: 15REEE315 DIGITAL POWER SYSTEM PROTECTION
(Effective from the academic year 2015-2016 onwards)

Course Objectives
To Expose the Students To
1. Numerical Protection
2. Digital Protection of Transmission Line
3. Digital Protection of Synchronous Generator
4. Digital Protection of Power Transformer
5. Directional Instantaneous Idmt Over Current Relay

Outcomes
   At the end of this course students will able to understand the concepts of
1. sampling theorem
2. distance relays, traveling wave relays
3. faults in synchronous generator
4. digital protection of synchronous generator
5. faults in a transformer
6. protection of transformer

UNIT- I NUMERICAL PROTECTION
Introduction, block diagram of numerical relay, sampling theorem, correlation with a reference wave, least error squared (LES) technique, digital filtering, numerical over- current protection.

UNIT- II DIGITAL PROTECTION OF TRANSMISSION LINE
Introduction, Protection scheme of transmission line, distance relays, traveling wave relays, digital protection scheme based upon fundamental signal, hardware design, software design, digital protection of EHV/UHV transmission line based upon traveling wave phenomenon, new relaying scheme using amplitude comparison.

UNIT- III DIGITAL PROTECTION OF SYNCHRONOUS GENERATOR
Introduction, faults in synchronous generator, protection schemes for synchronous generator, digital protection of synchronous generator.

UNIT- IV DIGITAL PROTECTION OF POWER TRANSFORMER
Introduction, faults in a transformer, schemes used for transformer protection, digital protection of transformer

UNIT-V DISTANCE AND OVERCURRENT RELAY SETTING AND CO-ORDINATION PC APPLICATIONS IN SHORT CIRCUIT STUDIES FOR DESIGNING RELAYING SCHEME
Directional instantaneous IDMT over current relay, directional multi zone distance realy, distance relay setting, co-ordination of distance relays, co-ordination of over current relays, computer graphics display, man-machine interface subsystem, integrated operation of national power system, application of computer graphics.

Types of faults, assumptions, development of algorithm for S.C. studies, PC based integrated software for S.C. studies, transformation to component quantities, S.C. studies of multiphase systems. Ultra high speed protective relays for high voltage long transmission line.

TEXT BOOKS
- L. P. Singh , Digital Protection, New Age International Private Ltd. Publishers, New Delhi, 2nd Edition,1997
- Paithankar, Marcel and Dekker, Transmission Network Protection, New York,1997

REFERENCE

- Paithankar&Bhide ,Fundamentals of Power System Protection ,Prentice Hall of India Pvt Ltd., New Delhi,2010
- Stanley Horowitz, Protective Relaying for Power System II   IEEE press , New York,1992

Special Paper XVI: 15REEE316   OPTIMIZATION TECHNIQUES
(Effective from the academic year 2015-2016 onwards)

Course Objectives
To Expose the Students To
1. Engineering application of Optimization
2. Linear Programming
3. Non-Linear Programming
4. Dynamic Programming
5. Advanced Techniques of Optimization
6. Optimization and Search

Outcomes
 At the end of this course students will able to understand the concepts of
1. Formulation of design
2. mathematical programming problems
3. Simplex method
4. Direct search methods
5. Direct and indirect methods
6. computational procedure

UNIT I INTRODUCTION:
Historical Development, Engineering application of Optimization, Formulation of design problems as mathematical programming problems, classification of optimization problems.

UNIT II LINEAR PROGRAMMING:
Graphical method, Simplex method, Revised simplex method, Duality in linear programming (LP), Sensitivity analysis, other algorithms for solving LP problems, Transportation, assignment
and other applications.

UNIT III NON LINEAR PROGRAMMING:
Unconstrained optimization techniques, Direct search methods, Descent methods, Constrained optimization, Direct and indirect methods, Optimization with calculus, Khun-Tucker conditions.

UNIT IV DYNAMIC PROGRAMMING:
Introduction, Sequential optimization, computational procedure, curse of dimensionality.

UNIT V ADVANCED TECHNIQUES OF OPTIMIZATION:
Introduction, Genetic algorithms for optimization and search.

TEXT BOOKS:
- S.S. Rao, "Engineering Optimization: Theory and Practice", New Age International (P) Ltd., New Delhi, 2000.

- K. Deb, "Optimization for Engineering Design - Algorithms and Examples", Prentice-Hall oflndia Pvt. Ltd., New Delhi, 1995.

REFERENCE :

- H.A. Taha, "Operations Research: An Introduction", 5th Edition, Macmillan, New York, 1992.

- G. Hadley, "Linear programming", Narosa Publishing House, New Delhi, 1990.

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Ph.D. COURSE WORK SYLLABUS

MECHANICAL ENGINEERING

RESEARCH METHODOLOGY
(Effective from the academic year 2015-2016onwards)

<div align="right">

CODE: 15RME101

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COURSE OBJECTIVES
1. To impart knowledge in the concept of problem identification and research methodology
2. To familiarize with basic of research and the research process
3. To demonstrate the different types of research and its applicability
4. To comprehend the knowledge of social research
5. To exhibit in sampling design and sampling techniques
6. To enrich the knowledge in writing a good research report.

COURSE OUTCOMES
1. Read, interpret, and critically evaluate social research.
2. Identify, explain, and apply the basic concepts of research, such as variables, operationalization, sampling, reliability, and validity.
3. Recognize the ethical issues involved in research, and practice ethical research standards.
4. Identify and explain the difference between quantitative, qualitative, and mixed methods research and what types of research questions can be answered with each method.
5. Use theory and previous research to create research questions and hypotheses and to identify and analyze the appropriate method and variables needed for research questions.
6. Use a variety of research methods through hands-on experience.

UNIT I
INTRODUCTION TO RESEARCH
Research Methodology: An Introduction –Meaning of research—Objectives of Research-Motivation in Research—Types of Research. -Concept of Applied and Basic research – Quantitative and Qualitative Research Techniques – Need for theoretical frame work – Hypothesis development – Hypothesis testing with quantitative data. Research design – Purpose of the study: Exploratory, Descriptive, Hypothesis Testing. Impact Factor--Citation and Citation Index.

UNIT II
EXPERIMENTAL DESIGN
Laboratory and the Field Experiment – Internal and External Validity – Factors affecting Internal validity. Measurement of variables – Scales and measurements of variables. Developing scales – Rating scale and attitudinal scales – Validity testing of scales – Reliability concept in scales being developed – Stability Measures.

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UNIT III
DATA COLLECTION, ANALYSIS AND INFERENCE

Binomial, Poisson, Normal, Exponential, Weibull and Geometric Distributions.Random sampling, stratified sampling, systematic sampling and cluster sampling. Student–t-test, F-test and $\chi2$ test and their applications in research studies. Forecasting methods. Factor analysis, Cluster Analysis and Discriminant Analysis (Basic ideas only). Completely Randomized Design Randomized Block Design and Latin Square Design. Accuracy, Precision and error analysis.

UNIT IV
MULTIVARIATE STATISTICAL TECHNIQUES

Data Analysis – Factor Analysis – Cluster Analysis – Discriminant Analysis – Multiple Regression and Correlation – Canonical Correlation – Application of Statistical (SPSS) Software Package in Research.

UNIT V
RESEARCH REPORT AND ETHICS IN RESEARCH

Significance of Report Writing- different steps in report writing-Layout of Research Report—Types of Reports-- Integral parts of a report – Precautions for writing a research report—Oral Presentation. Policy on academic Honesty and Integrity—academic cheating and Plagiarism. Opportunities to carry out research projects with funding/assistance from government agencies.

REFERENCE BOOKS:

1. Donald R. Cooper and Ramela S. Schindler, "Business Research Methods", Tata McGraw-Hill, Publishing Company Limited, New Delhi, 2000.
2. Uma Sekaran, "Research Methods for Business", John Wiley and Sons Inc., New York, 2000.
3. C.K.Kothari, "Research Methodology, methods and techniques", New Age International, New Delhi, 2001.
4. Donald H.McBurney, "Research Methods", Thomson Asia Pvt. Ltd. Singapore, 2002.
5. G.W.Ticehurst and A.J.Veal, "Business Research Methods", Longman, 1999.
6. Ranjit Kumar, "Research Methodology", Sage Publications, London, New Delhi, 1999.
7. Garg, B.L.Karadia, R.Agarwal, &F.Agarwal, U.K. 2002. "An Introduction to Research Methodology", RBSA Publishers.
8. Panneerselvan.R., "Research Methodology", Prentice hall of India, New Delhi, 2004.
9. Ganesan R, "Research Methodology for Engineers", MJP Publishers, Chennai. 2011
10. Walpole R.A, Myers R.H, Myers S.L. and Ye King: "Probability & Statistics for Engineers and Scientists", Pearson Prentice Hall, Pearson Education, Inc. 2007.
11. Graziano, A.M.andRaulin, M.,L.: "Research Methods – A Process of Inquiry", Sixth Edition, Pearson, 2007.
12. Leedy, P.D."Practical Research – Planning and Design", Eighth Edition, Pearson.2005.

OPTIMIZATION TECHNIQUES
(Effective from the academic year 2015-2016onwards)

CODE: 15RME201

COURSE OBJECTIVES
This course will enable the students
1. To introduce various optimization techniques.
2. To give exposure to nonlinear programming.
3. To give exposure to nonlinear programming with constraints.
4. To provide exposure to integer and dynamic programming.
5. To explain the network optimization techniques.
6. To enlighten the recent optimization techniques.

COURSE OUTCOMES
At the end of the course, students will be able to
1. Formulate an optimization problem.
2. Apply the appropriate decision.
3. Formulate and solve a non-linear problem.
4. Determine the shortest path.
5. Describe nontraditional optimization techniques.
6. Apply newer optimization techniques for problem solving.

UNIT I
NONLINEAR OPTIMIZATION
Introduction – unconstrained optimization - one-dimensional optimization – elimination methods – Fibonacci method, golden section methods – interpolation methods – quadratic, direct route method – multivariable optimization **-** direct search methods – pattern search methods – univariate method, hooks and jeeves method, simplex method – descent methods – steepest descent, Newton methods.

UNIT II
CONSTRAINED NONLINEAR OPTIMIZATION
Direct methods – the complex method, cutting plane method – indirect methods – interior and exterior penalty function methods, Khun-Tucker conditions, Lagrangian method.

UNITIII
INTEGER AND DYNAMIC PROGRAMMING
Introduction to integer programming – solution techniques - graphical method, the branch and bound technique, gomary's cutting plane method, examples on the application in manufacturing / design systems – introduction to dynamic programming - bellman's principle of optimality, examples on the application on routing problem, inventory problem.

UNITIV

NETWORK OPTIMIZATION MODELS

Terminology of networks – the shortest route problem – the minimum spanning tree problem – the maximum flow problem – the minimum cost flow problem – the network simplex method.

UNITV

NON TRADITIONAL OPTIMIZATION MODELS

Introduction to non-traditional optimization, computational complexity – NP-hard, NP-complete, no free lunch theorem – working principles of simulated annealing, Tabu search, and neural networks, simple applications.Introduction to Genetic Algorithms, Ants Colony Algorithm, Particle Swarm Algorithm, Hybrid Algorithms, Simple Applications.

REFERENCE BOOKS:

1. Singiresu S Rao, "Engineering Optimization: Theory and Practice", Wiley-Interscience, Third Edition, 1996.
2. Kalyanmoy Deb, "Optimization for engineering design", Prentice Hall India Pvt. Ltd., New Delhi, 2000.
3. David E Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning",
4. Addison Wesley Pub Co., 1989.
5. Marco Dorigo and Thomas Stutzle, "Ant Colony Optimization", Prentice Hall of India, 2005.
6. Maurice Clerc, "Particle Swarm Optimization", ISTE, 2007
7. Dimitri P Bertsekas, "Dynamic Programming: Deterministic and Stochastic Models", Prentice Hall, 1987.
8. Stephen G Nash and ArielaSofer, "Linear and Nonlinear Programming", McGraw Hill College Div., 1995.
9. Fred Glover, Manuel Laguna and Fred Laguna, "Tabu Search", Kluwer Academic Publishers,1997.

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COMPUTATIONAL METHODS
(Effective from the academic year 2015-2016 onwards)

CODE:15RME202

COURSE OBJECTIVES
This course will enable the students
1. To understand the basic computational methods.
2. To solve problems by numerical approach
3. To understand the difference between various numerical methods.
4. To solve problems related to partial differential equations.
5. To solve problems related to parabolic and hyperbolic partial differential equations.
6. To fit the nonlinear curves through various curve fitting techniques.

COURSE OUTCOMES
At the end of the course, students will be able to
1. Explain the concept of computational methods.
2. Solve problems using various numerical methods.
3. Find numerical solutions for partial differential equations.
4. Apply partial differential equations for heat transfer problems.
5. Solve wave equation.
6. Apply various techniques to fit curves.

UNIT I
INTRODUCTION TO COMPUTATIONAL METHODS
Examples, solving sets of equations, Gauss elimination method, Choleski method, Iterative methods, Relaxation method, system of non-linear equations- Newton Raphson method, computer programs.

UNIT II
NUMERICAL INTEGRATION
Newton-Cotes integration formulas, Trapezoidal rule, Simpson's rules, Gaussian quadrature, adaptive integration, cubic spline functions - Bezier curves and B-splines, computer programs. Boundary value problems and characteristic value problems:Shooting method, solution through a set of equations, derivative boundary conditions, Rayleigh-Ritz method, characteristic value problems, solution using characteristic polynomial method, Jacobi method, power method and Inverse power method.

UNIT III
NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS
Laplace's equations, representations as a difference equation, Iterative methods for Laplace's equations, Poisson equation, derivative boundary conditions, irregular and non-rectangular grids, Matrix patterns, Sparseness, ADI method, applications to heat flow problems, computer programs.

UNIT IV
PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS

Explicit method, Crank-Nicholson method, derivative boundary condition, stability and convergence criteria, Parabolic equations in two or more dimensions, applications to heat flow problems, computer programs. Hyperbolic Partial differential equations**:**Solving wave equation by finite differences, stability of numerical method, method of characteristics, Wave equation in two space dimensions, computer programs.

UNIT V
CURVE FITTING AND APPROXIMATION OF FUNCTIONS

Least square approximation, fitting of non-linear curves by least squares, regression analysis, computer programs.

REFERENCE BOOKS:

1. Curtis F Gerald and Patrick O Wheatley, "Applied Numerical Analysis", Pearson Education, 2002.
2. Rajasekaran S, "Numerical Methods in Science and Engineering – A Practical Approach", Wheeler Publishing, 1999, Second Edition.
3. Douglas J Faires and Riched Burden, "Numerical Methods", Brooks/Cole Publishing Company, 1998, Second Edition.
4. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers with Software and Programming Applications", Tata McGraw Hill Edition, 2004.
5. John H Mathews and Kurtis D Fink, "Numerical Methods using MATLAB", Prentice Hall, 1998.
6. Ward Cheney and David Kincaid, "Numerical Mathematics and Computing", Brooks/Cole Publishing Company, 1999, Fourth Edition.

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MODELING SIMULATION AND ANALYSIS
(Effective from the academic year 2015-2016 onwards)

CODE:15RME203

COURSE OBJECTIVES
This course will enable the students
1. To define the basics of simulation modeling and replicating the practical situations in organizations
2. To generate random numbers and random variates using different techniques.
3. To develop simulation model using heuristic methods.
4. To analysis of Simulation models using input analyzer, and output analyzer
5. To explain Verification and Validation of simulation model.
6. To develop Model for the manufacturing system

COURSE OUTCOMES
At the end of the course, students will be able to
1. Describe the basics of simulation modeling and analysis.
2. Describe the role of important elements of discrete event simulation and modeling paradigm.
3. Conceptualize real world situations related to systems development decisions, originating fromsource requirements and goals.
4. Develop skills to apply simulation software to construct and execute goal-driven system models.
5. Examine the simulation model of a problem.
6. Interpret the model and apply the results to resolve critical issues in a real-world environment.

UNIT I
INTRODUCTION TO SIMULATION
Definition – history - nature of computer modeling and simulation, limitations of simulation, areas of application. System and environment**:** Components of a system – types of simulation - discrete and continuous systems. Modeling approaches – simulation examples - manual simulation using event scheduling, single channel queue, two server queue, simulation of inventory problem.

UNIT II
RANDOM NUMBER GENERATION AND TESTING
Techniques for generating random numbers - midsquare method - midproduct method - constant multiplier technique - additive congruential method - linear congruential method – combined linear congruential generators – feedback shift register generators - tests for random numbers – frequency test - the Kolmogorov-Smirnov test, the chi-square test. Independence test – runs up and runs down, runs above and below the mean, autocorrelation.

UNIT III
RANDOM VARIATE GENERATION

Inverse transform technique - exponential distribution, uniform distribution, Weibull distribution, Triangular distribution. Empirical continuous distribution - generating approximate normal variates - Erlang distribution. empirical discrete distribution - discrete uniform distribution - poisson distribution - geometric distribution - acceptance - rejection technique for poisson distribution - gamma distribution.

UNIT IV
STAGES IN MODEL BUILDING

Input modeling – data collection, identifying the distribution with data, parameter estimation, goodness of fit tests, selecting input models without data, models of arrival processes. verification and validation of simulation models – variance reduction techniques, antithetic variables, calibration and validation of models. output analysis –stochastic nature of output data, measures of performance and their estimation, output analysis for terminating simulation.

UNIT V
MANUFACTURING SYSTEMS MODELING

Objectives and performance measures – modeling system randomness – sources of randomness, machine downtime.

REFERENCES BOOKS:

1. Jerry Banks, John S, Carson II, Barry L Nelson and David M Nicol, "Discrete Event System Simulation", Prentice Hall Inc., 2006.
2. Law A M, "Simulation Modeling and Analysis", Tata McGraw Hill Companies Inc, 2008.
3. Gordon G, "Systems Simulation", Prentice Hall Ltd., 2006.
4. Narsingh Deo, "System Simulation with Digital Computer", Prentice Hall of India, 2007.
5. Francis Neelamkovil, "Computer Simulation and Modeling", John Wiley and Sons, 1987.
6. Ruth M Davis and Robert M O'Keefe, "Simulation Modeling with Pascal", Prentice Hall Inc., 1989.

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QUALITY CONCEPTS IN DESIGN
(Effective from the academic year 2015-2016 onwards)

CODE: 15RME204

COURSE OBJECTIVES
This course will enable the students
1. To introduce basic quality concepts.
2. To give exposure to design for quality.
3. To provide exposure to failure mode effect analysis.
4. To explain the design of experiment concept.
5. To explain the statistical consideration in experimental design.
6. To introduce basics of reliability and enlighten design for six sigma process.

COURSE OUTCOMES
At the end of the course, students will be able to
1. Understand the basic quality concepts.
2. Find the root cause through failure mode effect analysis.
3. Design the experiments for analysis for product testing.
4. Analyze the product testing experiment results.
5. Analyze the problems with the aid of charts.
6. Create quality designs with the help of six sigma like quality concepts.

UNIT I
DESIGN FOR QUALITY
Quality Function Deployment -House of Quality-Objectives and functions-Targets Stakeholders-Measures and Matrices-Design of Experiments –design process Identification of control factors, noise factors, and performance metrics - developing the experimental plan- experimental design – testing noise factors- Running the experiments –Conducting the analysis-Selecting and conforming factor-Set points-reflecting and repeating.

UNIT II
FAILURE MODE EFFECT ANALYSIS
Basic methods: Refining geometry and layout, general process of product embodiment checklist-Advanced methods: systems modeling, mechanical embodiment principles-FMEA method- linking fault states to systems modeling-Case study- computer monitor stand for a docking station.

UNIT III
DESIGN OF EXPERIMENTS
Design of experiments-Basic methods- Two factorial experiments-Extended method ,reduced tests and fractional experiments, orthogonality, base design method, higher dimensional fractional

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factorial design-Statistical analysis of experiments: Degree of freedom, correlation coefficient, standard error of the residual t-test, ANOVA-ratio test, other indicators-residual plots, Advanced DOE method for product testing-Product applications of physical modeling and DOE, Blender panel display evaluation, coffee grinder experimental optimization-Taguchi method.

UNIT IV
STATISTICAL CONSIDERATION AND RELIABILITY
Frequency distributions and Histograms- Run charts –stem and leaf plots- Pareto diagrams-Cause and Effect diagrams-Box plots- Probability distribution-Statistical Process control–Scatter diagrams –Multivariable charts –Matrix plots and 3-D plots.- Reliability-Survival and Failure-Series and parallel systems-Mean time between failure.Weibull distribution

UNIT V
DESIGN FOR SIX SIGMA
Basics of SIX SIGMA –Project selection for SIX SIGMA- SIX SIGMA problem solving- SIX SIGMA in service and small organizations - SIX SIGMA and lean production –Lean SIX SIGMA and services L -45

REFERENCE BOOKS:

1. "Product Design Techniques in Reverse Engineering and New Product Development", Kevin Otto & Kristin Wood, Pearson Education (LPE), 2001.
2. Product Design And Development, Karl T. Ulrich, Steven D. Eppinger, Tata Mcgraw-Hill-3rd Edition, 2003.
3. "The Management and control of Quality"-6th edition-James R. Evens, William M Lindsay Pubson south-western(www.swlearning.com)
4. "Fundamentals of Quality control and improvement", 2nd edition, Amitava Mitra, Pearson Education Asia, 2002.

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FINITE ELEMENT ANALYSIS
(Effective from the academic year 2015-2016onwards)

CODE:15RME205

COURSE OBJECTIVES
This course will enable the students
1. To formulate the problems related to bending of plates and shells.
2. To explain Numerical difficulties in solving nonlinear problems.
3. To understand the fundamental concepts of using FEA to model dynamic problems.
4. To understand the fundamental concepts of the theory of plasticity.
5. To understand the application of FEA concepts in fluid and heat transfer problems.
6. To select proper mesh refinement technique.

COURSE OUTCOMES
At the end of the course, students will be able to
1. Analyze the problems related to bending of plates and shells.
2. Develop and build appropriate finite element models to solve complex engineering problems.
3. Critique numerical results and their validity.
4. Synthesize information and ideas for use in the evaluation process.
5. Apply FE methods for solving fluid mechanics and heat transfer.
6. Select the appropriate mesh refinement technique

UNIT I
BENDING OF PLATES AND SHELLS
Review of Elasticity Equations – Bending of Plates and Shells – Finite Element Formulation of Plate and Shell Elements - Conforming and Non-Conforming Elements – C0 and C1 Continuity Elements –Degenerated shell elements- Application and Examples.

UNIT II
NON-LINEAR PROBLEMS
Introduction – Iterative Techniques – Material non-linearity – Elasto Plasticity – Plasticity – Visco Plasticity – Geometric Non linearity – large displacement Formulation –Solution procedure- Application in Metal Forming Process and Contact Problems.

UNIT III
DYNAMIC PROBLEM
Direct Formulation – Free, Transient and Forced Response – Solution Procedures – Eigen solution- Subspace Iterative Technique – Response analysis-Houbolt, Wilson, Newmark – Methods – Explicit &Implict Methods- Lanchzos, Reduced method for large size system equations.

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UNIT IV
FLUID MECHANICS AND HEAT TRANSFER

Governing Equations of Fluid Mechanics – Solid structure interaction - Inviscid and Incompressible Flow – Potential Formulations – Slow Non-Newtonian Flow – Metal and Polymer Forming – Navier Stokes Equation – Steady and Transient Solution.

UNIT V
ERROR ESTIMATES AND ADAPTIVE REFINEMENT

Error norms and Convergence rates – h-refinement with adaptivity – Adaptive refinement.

REFERENCE BOOKS:

1. Zienkiewicz, O.C. and Taylor, R.L., "The Finite Element Method", Fourth Edition, Volumes 1 & 2, McGraw Hill International Edition, Physics Services, 1991.
2. Cook R.D., "Concepts and Applications of Finite Element Analysis", John Wiley and Sons Inc., New York, 1989.
3. Bathe K.J., "Finite Element Procedures in Engineering Analysis", Prentice Hall, 1990.

COMPUTATIONAL FLUID DYNAMICS
(Effective from the academic year 2015-2016 onwards)

CODE:15RME206

COURSE OBJECTIVES

1. To introduce Governing Equations of viscous fluidflows.
2. To introduce numerical modeling and its role in the field of fluid flow and heattransfer
3. To enable the students to understand the various discretization methods, solution procedures and turbulencemodeling.
4. To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speedcomputers.
5. To equip them with skills to solve convection and diffusionproblems.
6. To understand the importance continuity and momentum equations for different types of fluidflow

COURSE OUTCOMES

Upon completion of this course, the students can able

1. Identify, solve engineering problems by computational fluiddynamics.
2. Understand the importance of governing equations involved inCFD.
3. Formulate and solve problems in the field of fluid flow and heattransfer.
4. Solve the heat conduction problems using finite differencemethod.
5. Analyze and provide solutions for convection and diffusionproblems.
6. Develop continuity and momentum equations for different types of fluidflow.

UNIT I
GOVERNING DIFFERENTIAL EQUATIONS AND FINITE DIFFERENCE METHOD

Classification, Initial and Boundary conditions – Initial and Boundary Value problems – Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.

UNIT II
CONDUCTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD

Steady one-dimensional conduction, Two and three dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.

UNIT III
CONVECTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD

Steady One-Dimensional and Two-Dimensional Convection – diffusion, Unsteady one-dimensional convection – diffusion, Unsteady two-dimensional convection – Diffusion.

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UNIT IV

INCOMPRESSIBLE FLUID FLOW BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD

Governing Equations, Stream Function – Vorticity method, Determination of pressure for viscous flow, SIMPLE, Computation of Boundary layer flow - Finite difference approach.

UNIT V

FINITE ELEMENT METHOD AND TURBULENCE MODELS

Introduction to finite element method – solution of steady heat conduction by FEM. Algebraic Models – One equation model, k – $\square$ models - Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes – Prediction of flow in a sudden pipe contraction and pipe.

REFERENCE BOOKS:

1. Muralidhar, K.and Sundararajan, T., "Computational Fluid Flow and Heat Transfer",NarosaPublishing House, New Delhi, 2003.
2. Ghoshdasdidar, P.S.,"Computer Simulation of flow and heat transfer" Tata McGraw-Hill Publishing Company Ltd., 1998.
3. Subas, V.Patankar "Numerical heat transfer fluid flow", Hemisphere Publishing Corporation, 1980.
4. Versteeg and Malalasekera, N, "An Introduction to computational Fluid Dynamics The Finite volume Method", Pearson Education, Ltd., 2007.
5. Taylor, C and Hughes, J.B. "Finite Element Programming of the Navier-Stokes Equation", Pineridge Press Limited, U.K., 1981.
6. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., "Computational fluid Mechanics and Heat Transfer "Hemisphere Publishing Corporation, New York, USA, 2012.
7. Fletcher, C.A.J. "Computational Techniques for Fluid Dynamics 1, Fundamental and GeneralTechniques", Springer – Verlag, 1991.
8. Fletcher, C.A.J. "Computational Techniques for fluid Dynamics 2 ,Specific Techniques for Different Flow Categories", Springer – Verlag, 1988.
9. Bose, T.K., "Numerical Fluid Dynamics" Narosa Publishing House, 1997

TRIBOLOGY IN DESIGN
(Effective from the academic year 2015-2016 onwards)

CODE: 15RME301

COURSE OBJECTIVES
1. To provide the knowledge and importance of Tribology in Design, friction, wear and lubrication aspects of machine components.
2. To select proper grade lubricant for specific application.
3. To understand the principles of lubrication, lubrication regimes,
4. To understand the theories of hydrodynamic and the advanced lubrication techniques.
5. To introduce the concept of surface engineering and its importance in tribology.
6. To understand the behavior of Tribological components.

COURSE OUTCOMES
At the end of this course students will be able to
1. Explain the topography of the surfaces.
2. Discuss about the theory of sliding friction.
3. Elaborate in detail about the wear mechanism and various surface treatments, also able to explain about the international standards followed for friction and wear measurements.
4. Describe the application of various types of lubricants and explain in detail about the lubricant regimes.
5. Explain the theory of hydrodynamic and hydrostatic lubrication.
6. Understand the concepts of elasto hydrodynamics lubrication.

UNIT I
SURFACE INTERACTION AND FRICTION
Topography of Surfaces – Surface features-Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction –Rolling Friction-Friction properties of metallic and non-metallic materials – friction in extreme conditions –Thermal considerations in sliding contact

UNIT II
WEAR AND SURFACE TREATMENT
Types of wear – Mechanism of various types of wear – Laws of wear –Theoretical wear models-Wear of Metals and Non metals – Surface treatments – Surface modifications – surface coatings methods- Surface Topography measurements –Laser methods – instrumentation - International standards in friction and wear measurements

UNIT III
LUBRICANTS AND LUBRICATION REGIMES
Lubricants and their physical properties- Viscosity and other properties of oils –Additives-and selection of Lubricants- Lubricants standards ISO,SAE,AGMA, BIS standards – Lubrication Regimes –Solid Lubrication-Dry and marginally lubricated contacts- Boundary Lubrication-

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Hydrodynamic lubrication — Elasto and plasto hydrodynamic - Magneto hydrodynamic lubrication – Hydro static lubrication – Gas lubrication.

UNIT IV
THEORY OF HYDRODYNAMIC AND HYDROSTATIC LUBRICATION

Reynolds Equation,-Assumptions and limitations-One and two dimensional Reynolds Equation-Reynolds and Sommerfeld boundary conditions- Pressure wave, flow, load capacity and friction calculations in Hydrodynamic bearings-Long and short bearings-Pad bearings and Journal bearings-Squeeze film effects-Thermal considerations-Hydrostatic lubrication of Pad bearing-Pressure , flow , load and friction calculations-Stiffness considerations- Various types of flow restrictors in hydrostatic bearings

UNIT V
HIGH PRESSURE CONTACTS AND ELASTO HYDRODYNAMIC LUBRICATION

Rolling contacts of Elastic solids- contact stresses – Hertzian stress equation- Spherical and cylindrical contacts-Contact Fatigue life- Oil film effects- Elasto Hydrodynamic lubrication heory-Soft and hard EHL-Reynolds equation for elasto hydrodynamic lubrication- - Film shape ithin and outside contact zones-Film thickness and friction calculation- Rolling bearings- stresses and deflections-Traction drives

REFERENCE BOOKS:

1. Rabinowicz.E, "Friction and Wear of materials", John Willey &Sons ,UK,1995
2. Cameron A. "Basic Lubrication Theory", Ellis Herward Ltd., UK, 1981
3. Halling J. (Editor) – "Principles of Tribology ", Macmillian – 1984.
4. Williams J.A. "Engineering Tribology", Oxford Univ. Press, 1994.
5. S.K.Basu, S.N.Sengupta&B.B.Ahuja ,"Fundamentals of Tribology", Prentice –Hall of India Pvt Ltd , New Delhi, 2005.
6. G.W.Stachowiak& A.W .Batchelor , "Engineering Tribology", Butterworth - Heinemann, UK,2005.

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ADVANCED MANUFACTURING PROCESSES
(Effective from the academic year 2015-2016 onwards)

CODE: 15RME302

COURSE OBJECTIVES
1. To provide knowledge on different aspects of powder metallurgy parameters.
2. To understand the importance of principle of advanced welding processes and its application.
3. To understand the importance of advanced forming processes and its application.
4. To familiarize the students to advanced manufacturing process for processing of different materials.
5. To acquaint the student to apply the suitable rapid prototyping mechanism for industry need.
6. To provide knowledge on optimum parametric for advanced manufacturing process.

COURSE OUTCOMES

Upon the completion of this course, the students will be able to
1. Understand different aspects of powder metallurgy parameters.
2. Understand basic principle of advanced welding processes and its application.
3. Understand basic principle of advanced forming processes and its application.
4. Select the best suitable advanced manufacturing process for processing of different materials.
5. Apply the suitable rapid prototyping mechanism for industry need.
6. Select the optimum parametric for advanced manufacturing process

UNIT I
NEW MACHINING PROCESSES
(Non thermal energy) – Abrasive machining – water jet machining - ultrasonic machining – chemical machining – electro chemical machining – construction working principle – steps - types – process parameters – derivations – problems, merits, demerits and applications .

UNIT II
NEWER MACHINING PROCESS
Wire cut EDM - Electro chemical machining – ECG - Electric discharge machining – construction – principle – types – control - circuits – tool design – merits, demerits & applications.

UNIT III
NEWER MACHINING PROCESS
Laser beam machining – Electron beam machining – Plasma arc machining – Ion beam machining – construction working principle types – process parameter – derivations – problems, merits, demerits and applications.

UNIT IV
FABRICATION OF MICRO DEVICES

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Semiconductors – films and film depurification – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA Process – Solid free form fabrication.

UNIT V
MICROFABRICATION TECHNOLOGY

Wafer preparation – monolithic processing – moulding – PCB board hybrid & mcm technology – programmable devices & ASIC – electronic material and processing.–steriolithography SAW devices, Surface Mount Technology.

REFERENCE BOOKS:

1. Seropekelpekijian&Stevan R. Schmid- "Manufacturing process and Engineering materials" – 2003
2. "Micro senors Mems & smart devices"- Julian W.Hardner – 2002
3. Brahem T. Smith, "Advanced machining", I.F.S. UK 1989.
4. Jaeger R.C., "Introduction to microelectronic fabrication", Addison Wesley, 1988.
5. Nario Taniguchi – "Nano technology" – Oxford University Press 1996.
6. Pandey P.C. & Shan HS,"Modern Machining Processes", Standard Publishing Co.,1980
7. More Madon, "Fundamentals of Micro fabrication", CRC Press, 1997

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PHYSICS OF SOLAR ENGINEERING
(Effective from the academic year 2015-2016 onwards)

CODE:15RME303

COURSE OBJECTIVES
1. To understand the basics of solar energy
2. To learn the origin of solar energy, tracking of the sunlight and atmospheric interaction of the solar radiation
3. To understand the working principle of the solar cells
4. To learn the working of different types of solar cells
5. To study about the different types of solar collectors
6. To learn about the energy storage systems

COURSE OUTCOMES
At the end of this course, the students will be able to
1. Know the basics of solar energy
2. Discuss about the origin of solar energy, how to track the sunlight
3. Explain the working of solar cells
4. Recognize the various types of solar cells
5. Identify the various types of solar collectors
6. Explain in brief about the energy storage systems

UNIT I
INTRODUCTION
Basics of solar energy - Brief History of solar energy utilization - Various approaches of utilizing solar energy - Blackbody radiation- Relation between radiation field energy density and radiation spectrum - Planck's formula in energy unit - Maximum spectral density - Planck's formula in wavelength unit -Wien displacement law - Stefan - Boltzmann law - Photoelectric effect - Einstein's theory of photons -Einstein's derivation of the black-body formula.

UNIT II
ORIGIN OF SOLAR ENERGY, TRACKING SUNLIGHT & ATMOSPHERIC INTERACTION
Basic parameters of the Sun - Measurement of the solar constant - The structure of the Sun - The origin of solar energy - Rotation and orbital motion of the Earth around the Sun - Solar time, sidereal time, universal standard time, local standard time - Equation of time - Intensity of sunlight on an arbitrary surface at any time - Interaction with the atmosphere - Absorption of the molecules - Air mass - Rayleigh scattering - Direct and scattered sunlight.

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UNIT III
SOLAR CELLS

Formation of a pn – junction - Space charge and internal field - Quasi - Fermi levels - The Shockley diode equation - Structure of a solar cell - The solar cell equation - Fill factor and maximum power - Various electron - hole-pair recombination mechanisms - Crystalline silicon solar cells - Thin film solar cells: CIGS, Cite and a – silicon - Tandem solar cells - Dye - sensitized solar cells - Organic solar cells

UNIT IV
CONCENTRATION OF SOLAR ENERGY

Three types of imaging optics: trough or linear collectors, central receiver with heliostats, and parabolic dish concentrator with on - axis tracking- Solar thermal electricity using Stirling engine or Ranking engine - Solar photovoltaic's with concentration.

UNIT V
ENERGY STORAGE

Necessity of storage for solar energy- Chemical energy storage - Thermal energy storage - Thermal Flywheels - Compressed air- Rechargeable batteries.

REFERENCE BOOKS:

1. Duffie, J.A., and Beckman, W.A. "Solar Energy Thermal Process", John Wiley and Sons, NewYork, Jui Sheng Hsieh, Solar Energy Engineering, Prentice-Hall, 2007.
2. M. Stix, "The Sun An Introduction", Second Edition, Springer 2002.
3. Nelson, "The Physics of Solar Cells". Imperial College Press, 2003.
4. Rai, G.D., "Solar Energy Utilization", Khanna Publishers, N. Delhi, 2010.
5. Sukhatme S.P., "Solar Energy", Tata McGraw Hills P Co., 3rd Edition, 2008.
6. B.G. Streetman and S. Banerjee, "Solid State Electronic Devices", Sixth Edition, Prentice Hall, 2006.

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WIND ENERGY TECHNOLOGIES
(Effective from the academic year 2015-2016 onwards)

CODE: **15RME304**

COURSE OBJECTIVES
This course enables the students to
1. Understand the basics of wind energy
2. Understand the measurement techniques
3. Discuss about the aerodynamic theory and types of wind turbines
4. Explain the working of gear coupled generator wind turbine components and their construction
5. Understand the construction and working of direct rotor coupled generator
6. Explain the controlling techniques of wind turbine

COURSE OUTCOMES
At the end of this course students will be able to
1. Explain the basics of the wind energy and its applications
2. Know how to measure the wind data and know about the various measuring instruments
3. Discuss in detail about the aerodynamic theory of wind turbines
4. Remember the working of gear coupled generator and wind turbine components
5. Explain the construction and working of direct rotor coupled generator
6. Describe the controlling technique of wind turbine

UNIT I
WIND ENERGY FUNDAMENTALS & WIND MEASUREMENTS
Wind Energy Basics, Wind Speeds and scales, Terrain, Roughness, Wind Mechanics, Power Content, Class of wind turbines, Atmospheric Boundary Layers, Turbulence. Instrumentation for wind measurements, Wind data analysis, tabulation, Wind resource estimation, Betz's Limit, Turbulence Analysis

UNIT II
AERODYNAMICS THEORY & WIND TURBINE TYPES
Airfoil terminology, Blade element theory, Blade design, Rotor performance and dynamics, Balancing technique (Rotor & Blade), Types of loads; Sources of loads Vertical Axis Type, Horizontal Axis, Constant Speed Constant Frequency, Variable speed Variable Frequency, Up Wind, Down Wind, Stall Control , Pitch Control, Gear Coupled Generator type, Direct Generator Drive /PMG/Rotor Excited Sync Generator.

UNIT III
GEAR COUPLED GENERATOR WIND TURBINE COMPONENTS AND THEIR CONSTRUCTION
Electronics Sensors /Encoder /Resolvers, Wind Measurement : Anemometer & Wind Vane, Grid Synchronisation System, Soft Starter, Switchgear [ACB/VCB], Transformer, Cables and assembly, Compensation Panel, Programmable Logic Control, UPS, Yaw & Pitch System : AC Drives, Safety Chain Circuits, Generator Rotor Resistor controller (Flexi Slip), Differential Protection Relay for

Generator, Battery/Super Capacitor Charger & Batteries/ Super Capacitor for Pitch System, Transient Suppressor / Lightning Arrestors, Oscillation & Vibration sensing.

UNIT IV
DIRECT ROTOR COUPLED GENERATOR (MULTIPOLE)

Excited Rotor Synch. Generator / PMG Generator, Control Rectifier, Capacitor Banks, Step Up / Boost Converter (DC-DC Step Up), Grid Tied Inverter, Power Management, Grid Monitoring Unit (Voltage and Current), Transformer, Safety Chain Circuits.

UNIT V
MODERN WIND TURBINE CONTROL & MONITORING SYSTEM

Details of Pitch System & Control Algorithms, Protections used & Safety Consideration in Wind turbines, Wind Turbine Monitoring with Error codes, SCADA & Databases: Remote Monitoring and Generation Reports, Operation &Maitenance for Product Life Cycle, Balancing technique (Rotor & Blade), FACTS control & LVRT & New trends for new Grid Codes.

REFERENCE BOOKS:

1. Freris, L.L., "Wind Energy Conversion Systems", Prentice Hall, 1990
2. Kaldellis J.K, "Stand alone and Hybrid Wind Energy Systems", CRC Press, 2010
3. Mario Garcia –Sanz, Constantine H. Houpis, "Wind Energy Systems",CRC Press 2012
4. Spera, D.A., "Wind Turbine Technology: Fundamental concepts of Wind Turbine Engineering",
5. ASME Press, 1994. 5. Duffie, A and Beckmann, W. A., "Solar Engineering of Thermal Processes", John Wiley, 1991.
6. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, 1996.
7. Twidell, J.W. and Weir, A., "Renewable Energy Sources", EFN Spon Ltd., 1983
8. John D Sorensen and Jens N Sorensen, "Wind Energy Systems", Woodhead Publishing Ltd, 2011

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ADVANCED HEAT AND MASS TRANSFER
(Effective from the academic year 2015-2016 onwards)

CODE: 15RME305

COURSE OBJECTIVES
1. To develop the ability to use conduction and radiation heat transfer concepts for various applications
2. To understand the theories of convective heat transfer.
3. To understand the basic concepts of phase change processes and mass transfer.
4. To use numerical methods for solving heat transfer based problems
5. To understand the concepts of engine heat transfer correlation
6. To understand mass transfer concepts of engine and it correlation

COURSE OUTCOMES
Students will learn
1. To understand applications of the heat transfer in various thermal application
2. To discuss thermal analysis based problems
3. To explain about turbulent forces
4. To solve numerical problems in heat transfer
5. To describe the concepts of engine heat transfer correlation
6. To explain mass transfers in engine

UNIT I
CONDUCTION AND RADIATION HEAT TRANSFER
One dimensional energy equations and boundary condition - three-dimensional heat conduction equations - extended surface heat transfer - conduction with moving boundaries - radiation in gases and vapour.Gas radiation and radiation heat transfer in enclosures containing absorbing and emitting media – interaction of radiation with conduction and convection.

UNIT II
TURBULENT FORCED CONVECTIVE HEAT TRANSFER
Momentum and energy equations - turbulent boundary layer heat transfer - mixing length concept - turbulence model – k Є model - analogy between heat and momentum transfer – Reynolds, Colburn, Prandtl turbulent flow in a tube - high speed flows.

UNIT III
PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGER
Condensation with shears edge on bank of tubes - boiling – pool and flow boiling - heat exchanger – Є -- NTU approach and design procedure - compact heat exchangers.

UNIT IV
NUMERICAL METHODS IN HEAT TRANSFER
Finite difference formulation of steady and transient heat conduction problems – discretization schemes – explicit - Crank Nicolson and fully implicit schemes - control volume formulation – steady one-dimensional convection and diffusion problems - calculation of the flow field – SIMPLER Algorithm.

UNIT V
MASS TRANSFER AND ENGINE HEAT TRANSFER CORRELATION
Mass transfer - vaporization of droplets - combined heat and mass transfers - heat transfer correlations in various applications like I.C. engines - compressors and turbines.

REFERENCEBOOKS:

1. YunusA.Cengal, "Heat and Mass Transfer – A practical Approach", 3rd edition, Tata McGraw Hill, 2007.
2. Holman.J.P, "Heat Transfer", Tata Mc Graw Hill, 2002.
3. Ozisik. M.N., "Heat Transfer – A Basic Approach", McGraw-Hill Co., 1985
4. Incropera F.P. and DeWitt. D.P., "Fundamentals of Heat & Mass Transfer", John Wiley &Sons, 2002.
5. Nag.P.K, "Heat Transfe"r, Tata McGraw-Hill, 2002
6. Ghoshdastidar. P.S., "Heat Transfer, Oxford University Press, 2004
7. Yadav, R., "Heat and Mass Transfer", Central Publishing House, 1995.

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ADDITIVE MANUFACTURING
(Effective from the academic year 2015-2016 onwards)

CODE:15RME306

COURSE OBJECTIVES
1. To know the principle, methods, possibilities and limitations of Additive Manufacturing technologies.
2. to understand the concept of reverse engineering and cad modeling
3. To gain knowledge about the classification of liquid and solid based AM process
4. To educate the principles and application of powder based AM systems
5. To understand the concept of 3D printing
6. To educate about the case studies and application related AM process.

COURSE OUTCOMES
The students will be able to
1. Understand history, concepts and terminology of additive manufacturing
2. Apply the reverse engineering concepts for design development
3. Understand the classifications of additive manufacturing techniques
4. Understand about powder based AM systems
5. Explain the principle and applications of 3D printing
6. Understand the challenges associated with AM

UNIT I
INTRODUCTION
Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes-Benefits-Applications.

UNIT II
REVERSE ENGINEERING AND CAD MODELING
Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

UNIT III
LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS
Stereolithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. Laminated Object

Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

UNIT IV
POWDER BASED ADDITIVE MANUFACTURING SYSTEMS

Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.

UNIT V
OTHER ADDITIVE MANUFACTURING SYSTEMS

Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.

REFERENCES BOOKS:

1. Gibson I., Rosen D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
2. Chua C.K., Leong K.F. and Lim C.S., "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2010.
3. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003.
4. Liou L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2011.
5. Kamrani A.K. and Nasr, E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.
6. Hilton P.D. and Jacobs, P.F., "Rapid Tooling: Technologies and Industrial Applications", CRCpress, 2005.

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AUTOMOBILE SYSTEMS
(Effective from the academic year 2015-2016onwards)

CODE:15RME307

COURSE OBJECTIVES
1. To understand about basics of automobile system
2. To understand the theoretical concepts of Engines
3. To understand the functions and designs of shaft and drives
4. To understand the terminology and working of suspension system
5. To understand applications of electronic in automobiles
6. To understand the purpose of alternate fuels and hybrid vehicles.

COURSE OUTCOMES
The students will be able to
1. Explain about specifications of automobile system
2. Explain the engine terminologies
3. Design and develop shaft and drives
4. Explain about braking systems
5. Explain about electronic systems in automobiles
6. Gain knowledge about alternate fuels and hybrid vehicles.

UNIT I
INTRODUCTION
Passenger, commercial vehicles, types and specifications, off highway vehicles. Resistance, power and torque curve, driving force against vehicle speed, acceleration and gradeability in different gears for a typical car or truck plotted from specifications. Calculation and plotting the curves of air, rolling and gradient resistances, driving force, engine power, speed, rear axle ratio. Torque and mechanical efficiency at different vehicle speeds.

UNIT II
ENGINE BASIC THEORY
Engine types and their operation, classification, Properties of I.C. engine fuels, actual cycle, air fuel cycle, combustion charts (equilibrium), two stroke engines, four stroke engine, characteristics of engines, air capacity of engine, valve timing diagram. Flywheel, clutch, gear box types, general function and design characteristics, decoupling of power, speed and torque characteristics of power transmission system.

UNIT III
SHAFT, DRIVE, WHEELS AND TYRES
Functional and design characteristics of propeller shaft, selection criteria for material and cross section of propeller shaft, need for differential and final drive. Use of different types of wheels and tyres, specification, materials.

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UNIT IV
STEERING, SUSPENSION AND BRAKES
Effort multiplication and geometry in steering, types of springs used in suspension system, need for damping. Distribution of braking force on front and rear wheels, stopping distance and braking efficiency, introduction to ABS.

UNIT V
ELECTRICAL AND ELECTRONIC AND ALTERNATE FUEL SYSTEMS
Application of electricity in automobiles, starting, charging, lighting and accessory systems. Application of basic electronic components in automobiles. Introduction to alternate fuels – LPG, CNG, Bio fuels, Alcohol fuels. Introduction to electric, hybrid and fuel cell vehicles.

REFERENCE BOOKS:

1. W H & Anglin D L, "Automotive Mechanics", Tata McGraw Hill Publishing Company, 2004.
2. Robert Bosch "Automotive Hand book", 5th edition, 2004.
3. Ganesan V , "Internal Combustion Engines", Tata McGraw Hill, New Delhi, 2003.
4. Mathur L and Sharma R P, "Internal Combustion Engines", Dhanpat Rai Publications
5. (P), Ltd, New Delhi, 2002.
6. Heinz Heisler, "Advanced Engine Technology", SAE 1995.
7. Richard Stone, "Introduction to IC Engines", 2nd edition, Macmilan,1992.
8. Obert E F, "Internal Combustion Engine analysis and Practice", International Text Book Co., Scranton, Pennsylvania, 1988.
9. John B Heywood, "Internal Combustion Engine Fundamentals", McGraw Hill International Editions, 1988.

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LEAN MANUFACTURING
(Effective from the academic year 2015-2016 onwards)

CODE:15RME308

COURSE OBJECTIVES
1. To study the various concept lean manufacturing (LM).
2. To understand the tools and methodologies in LM system
3. To understand the concepts of value stream mapping
4. To understand the principles of manufacturing and optimization technology to improve production
5. To study various cases based on assembly line
6. To understand the process involves in implementing lean

COURSE OUTCOMES
The students will be able to
1. Explain about lean manufacturing
2. Apply lean manufacturing tools in industries
3. Identify the scenarios in value stream mapping
4. Apply optimization techniques in industries related problems
5. Solve production related issues
6. implement lean manufacturing in industries

UNIT I
INTRODUCTION TO LEAN MANUFACTURING
Objectives of lean manufacturing-key principles and implications of lean manufacturing- traditional Vs lean manufacturing. Lean Manufacturing Concepts: Value creation and waste elimination- main kinds of waste- pull production-different models of pull production-continuous flow-continuous improvement / Kaizen- worker involvement -cellular layout- administrative lean.

UNIT II
LEAN MANUFACTURING TOOLS AND METHODOLOGIES
Standard work -communication of standard work to employees -standard work and flexibility -visual controls-quality at the source- 5S principles -preventative maintenance-total quality management-total productive maintenance -changeover/setup time -batch size reduction -production leveling.

UNIT III
VALUE STREAM MAPPING
The as-is diagram-the future state map-application to the factory simulation scenario-line balancing -Poke Yoke -Kanban – overall equipment effectiveness.

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UNIT IV
JUST IN TIME MANUFACTURING

Introduction - elements of JIT - uniform production rate - pull versus push method- Kanban system - small lot size - quick, inexpensive set-up - continuous improvement. Optimised production technology. One-piece flow: Process razing techniques – cells for assembly line – case studies.

UNIT V
IMPLEMENTING LEAN

Road map-senior management Involvement-best practices. Reconciling lean with other systems: Toyota production system-lean six sigma-lean and ERP-lean with ISO9001:2000.

REFERENCE BOOKS:

1. Askin R G and Goldberg J B, "Design and Analysis of Lean Production Systems", John Wiley and Sons Inc., 2003.
2. Michael L George, David T Rowlands, Bill Kastle, "What is Lean Six Sigma", McGraw Hill, New York, 2004.
3. Micheal Wader, "Lean Tools: A Pocket Guide to Implementing Lean Practices", Productivity and Quality Publishing Pvt Ltd, 2002.
4. Kenichi Sekine, "One-Piece Flow", Productivity Press, Portland, Oregon, 1992.
5. Alan Robinson "Continuous Improvement in Operations", Productivity Press, Portland,

   Oregon, 1991.
6. Joseph A De Feo, William W Bearnard , "Juran Institute's Six Sigma Break Through and Beyond", Tata McGraw Hill Edition, New Delhi, 2004.
7. Richard B Chase F Robert Jacobs and Nicholas J Aquilano, "Operations Management for Competitive Advantage", McGraw Hill/Irwin; Tenth Edition, 2003.
8. Poke - Yoke, "Improving Product Quality by Preventing Defects", Productivity Press, 1992.

SURFACE ENGINEERING
(Effective from the academic year 2015-2016 onwards)

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CODE:15RME309
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COURSE OBJECTIVES
1. To impart knowledge in the friction aspects of machine components
2. To understand the material properties which influence the tribological characteristics of Surfaces
3. To understand the principle and classifications of corrosion.
4. To understand the purpose of surface treatment.
5. To understand procedure and classification involves in surface coating
6. To understand the important and classification of engineering materials

COURSE OUTCOMES
   The students will be able to
1. Gain knowledge about friction and its application
2. Explain about wear behavior of materials
3. Recognize types of corrosion and its control procedures
4. Apply surface treatment on material surface
5. Apply surface coating based on the applications of material
6. Describe about the engineering materials and its applications

UNIT I
FRICTION
Topography of Surfaces – Surface features – Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction – Rolling Friction – Friction properties of metallic and non metallic materials – Friction in extreme conditions – Thermal considerations in sliding contact

UNIT II
WEAR
Introduction – Abrasive wear, Erosive, Cavitation, Adhesion, Fatigue wear and Fretting Wear- Laws of wear – Theoretical wear models – Wear of metals and non metals - International standards in friction and wear measurements

UNIT III
CORROSION
Introduction – Principle of corrosion – Classification of corrosion – Types of corrosion – Factors influencing corrosion – Testing of corrosion – In-service monitoring, Simulated service, Laboratory testing – Evaluation of corrosion – Prevention of Corrosion – Material selection, Alteration of environment, Design, Cathodic and Anodic Protection, Corrosion inhibitors

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UNIT IV
SURFACE TREATMENTS
Introduction – Surface properties, Superficial layer – Changing surface metallurgy – Wear resistant coatings and Surface treatments – Techniques – PVD – CVD – Physical CVD – Ion implantation – Surface welding – Thermal spraying – Laser surface hardening and alloying, Applications of coatings and surface treatments in wear and friction control – Characteristics of Wear resistant coatings – New trends in coating technology – DLC – CNC – Thick coatings – Nano-engineered coatings – Other coatings, Corrosion resistant coatings

UNIT V
ENGINEERING MATERIALS
Introduction – Advanced alloys – Super alloys, Titanium alloys, Magnesium alloys, Aluminium alloys, and Nickel based alloys – Ceramics – Polymers – Biomaterials – Applications – Bio Tribology Nano Tribology.

REFERENCE BOOKS:

1. G.W.Stachowiak& A.W .Batchelor , "Engineering Tribology", Butterworth-Heinemann, UK, 2005.
2. Rabinowicz.E, "Friction and Wear of materials", John Willey &Sons ,UK,1995
3. Halling, J. (Editor) – "Principles of Tribology", Macmillian – 1984.
4. Williams J.A. "Engineering Tribology", Oxford Univ. Press, 1994.
5. S.K.Basu, S.N.Sengupta&B.B.Ahuja, "Fundamentals of Tribology", Prentice –Hall of India Pvt Ltd , New Delhi, 2005.
6. Fontana G., "Corrosion Engineering", McGraw Hill, 1985

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INDUSTRIAL ROBOTICS & EXPERT SYSTEMS
(Effective from the academic year 2015-2016onwards)

CODE:15RME310

COURSE OBJECTIVES
1. Learn about the types of robots used in material handling systems.
2. Understand the use of vision systems in automation systems.
3. Gain knowledge on the different methods of material handling.
4. Apply knowledge about choosing sensors for robotics.
5. To design the methods of Robot Programming
6. To design robots in various industrial application.

COURSE OUTCOMES
The Student will be able to
1. Differentiate the various types of Industrial Robots and their architecture.
2. Apply the concepts of image processing for robotic inspection systems.
3. Analyze the applications of robots in various industrial application.
4. Design and fabricate simple grippers for pick and place application.
5. Identify the right Robot for a given industrial application.
6. Select the right material handling system for a given application

UNIT 1
INTRODUCTION AND ROBOT KINEMATICS
Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.

UNIT-II
ROBOT DRIVES AND CONTROL
Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

UNIT-III
ROBOT
Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

UNIT-IV
ROBOT CELL DESIGN AND APPLICATION
Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial applications of Robots.

UNIT-V
ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS
Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.

TEXT BOOK:

1. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, "Robotics Control, Sensing,Vision and Intelligence", Mc Graw Hill, 1987.

REFERENCE BOOKS:

1. Yoram Koren," Robotics for Engineers' Mc Graw-Hill, 1987.
2. Kozyrey, Yu. "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering-An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R." Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw-Hill, Int. 1986.
6. Timothy Jordanides et al, "Expert Systems and Robotics", Springer-Verlag, NewYork, May 1991.

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ADVANCED THERMODYNAMICS
(Effective from the academic year 2015-2016 onwards)

CODE:15RME311

COURSE OBJECTIVES

1. Identify the unique vocabulary associated with thermodynamics.
2. Explain the basic concepts of thermodynamics like system, properties, equilibrium, pressure, specific volume, temperature, zeroth law of thermodynamics, temperature measurement and temperature scales.
3. Calculate thermodynamic properties using tables of thermodynamic properties and analyze the processes on T-v diagrams to solve advanced engineering problems.
4. State and apply the first law of thermodynamics for closed and open systems undergoing different thermodynamic processes.
5. Evaluate the performance of steam power plants, refrigeration plants and their components using the first law of thermodynamics for open systems
6. Apply the inequality ofClausius and establish the property entropy of a system.

COURSE OUTCOMES

1. To apply the knowledge of mathematics, science and engineering fundamentals to model the energy conversion phenomenon.
2. To identify and formulate power production based on the fundamentals laws of thermal engineering.
3. To instill upon to envisage appropriate experiments related to heat engines.
4. To investigate the effectiveness of energy conversion process in mechanical power generation for the benefit of mankind.
5. To appreciate concepts learnt in fundamentals laws of thermodynamics from which learning ideas how to sustain in energy crisis and think beyond curriculum in the field of alternative and renewable sources of energy.
6. To communicate effectively the concepts of internal combustion engines and try to think beyond curriculum in alternative sources of energy.

UNIT I
AVAILABILITY ANALYSIS AND THERMODYNAMIC PROPERTY RELATIONS

Reversible work - availability - irreversibility and second – law efficiency for a closed system and steady – state control volume. Availability analysis of simple cycles. Thermodynamic potentials. Maxwell relations. Generalized relations for changes in entropy - internal energy and enthalpy - generalized relations for Cp and CV Clausius Clayperon equation, Joule – Thomson coefficient.Bridgeman tables for thermodynamic relations.

UNIT II
REAL GAS BEHAVIOUR AND MULTI – COMPONENT SYSTEMS

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Different equations of state – fugacity – compressibility - principle of corresponding States - Use of generalized charts for enthalpy and entropy departure - fugacity coefficient,Lee – Kesler generalized three parameter tables. Fundamental property relations for systems of variable composition. Partial molar properties.Real gas mixtures - Ideal solution of real gases and liquid - activity - equilibrium in multi phase systems - Gibbs phase rule for non – reactive components.

UNIT III
CHEMICAL THERMODYNAMICS AND EQUILIBRIUM
Thermochemistry - First law analysis of reacting systems - Adiabatic flame temperature – entropy change of reacting systems - Second law analysis of reacting systems - Criterion for reaction equilibrium.Equilibrium constant for gaseous mixtures - evaluation of equilibrium composition.

UNIT IV
STATISTICAL THERMODYNAMICS
Microstates and Macrostates - thermodynamic probability - degeneracy of energy levels - Maxwell – Boltzman, Fermi – Diarc and Bose – Einstein statistics - microscopic interpretation of heat and work, evaluation of entropy, partition function, calculation of the Macroscopic properties from partition functions.

UNIT V
IRREVERSIBLE THERMODYNAMICS
Conjugate fluxes and forces - entropy production Onsager's reciprocity relations - thermo – electric phenomena, formulations.

TEXT BOOKS:

1. Kenneth WarkJt.m, Advanced Thermodynamics for Engineers, McGrew – Hill Inc., 1995.
2. Bejan, A., Advanced Engineering Thermodynamics, John Wiley and Cons, 1988.
3. Holman, J.P., Thermodynamics, Fourth Edition, McGraw – Hill Inc., 1988.

REFERENCE BOOKS:

1. Smith, J.M. and Van Ness., H.C., Introduction to Chemical Engineering Thermodynamics, Fourth Edition, McGraw – Hill Inc., 1987.
2. Sonntag, R.E., and Van Wylen, G, "Introduction to Thermodynamics, Classical and StatisticalThemodynamics", Third Edition, John Wiley and Sons, 1991.
3. Sears, F.W. and Salinger G.I., "Thermodynamics, Kinetic Theory and StatisticalThermodynamics", Third Edition, Narosa Publishing House, New Delhi, 1993.
4. DeHotf, R.T., "Thermodynamics in Materials", Science, McGraw – Hill Inc., 1993. Rao,Y.V.C.,
5. "Postulational and Statistical Thermodynamics", Allied Publisher Limited, New Delhi, 1999.

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ADVANCED INTERNAL COMBUSTION ENGINEERING
(Effective from the academic year 2015-2016onwards)

CODE:15RME312

COURSE OBJECTIVES
1. To make familiar with the design and operating characteristics of engines
2. To understand the basic principles of combustion
3. To gain knowledge in the principles of SI engine combustion
4. To understand the concepts of CI engine system
5. To understand the basic concepts of gas turbine combustion and the latest technologicaladvances in low temperature combustion
6. To design the alternate fuels.

COURSE OUTCOMES
1. Given an engine design specification, predict performance and fuel economy trends
2. Apply basic concepts in the design of combustion systems
3. Able to design SI engine system
4. Develop an understanding of real-world diesel engine design issues
5. Develop an ability to optimize future engine design for better fuel economy,
6. Develop an ability to optimize performanceand emissions.

UNIT I
SPARK IGNITION ENGINES
Spark ignition Engine mixture requirements – Fuel – Injection systems – Monopoint, Multipoint injection, Direct injection – Stages of combustion – Normal and abnormal combustion – factors affecting knock – Combustion chambers.

UNIT II
COMPRESSION IGNITION ENGINES
States of combustion in C.I. Engine – Direct and indirect injection systems – Combustion chambers –Fuel spray behaviour – spray structure, spray penetration and evaporation – air motion – Introduction to Turbo charging.

UNIT III
POLLUTANT FORMATION AND CONTROL
Pollutant – Sources – Formation of carbon monoxide, Unburnt hydrocarbon, NOx, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters and Particulate Traps – Methods of measurements and Introduction to emission norms and Driving cycles.

UNIT IV
ALTERNATIVE FUELS
Alcohol, Hydrogen, Natural Gas and Liquefied Petroleum Gas- Properties, Suitability, Merits and Demerits as fuels, Engine Modifications.

UNIT V
RECENT TRENDS
Lean Burn Engines – Stratified charge Engines – homogeneous charge compression ignition engines – Plasma Ignition – Measurement techniques – laser Doppler, Anemometry.

TEXT BOOK

1. K.K. Ramalingam, "Internal Combustion Engine Fundamentals", Scitech Publications, 2002.

REFERENCE BOOKS

1. R.B.Mathur and R.P. Sharma, "Internal combustion Engines".
2. V. Ganesan, "Internal Combustion Engines", II Edition, TMH, 2002.
3. Duffy Smith, "Auto fuel Systems", The Good Heart Willox Company, Inc., 1998

REFRIGERATION SYSTEMS DESIGN
(Effective from the academic year 2015-2016onwards)

CODE:15RME313

COURSE OBJECTIVES
1. To provide a fundamentals of refrigeration systems
2. To accustom with various methods of production of cold with refrigeration systems
3. To impart knowledge about applications of refrigeration systems
4. To familiarize with industrial protocols, regulations in the field in refrigeration.
5. To design refrigeration system with respect to surroundings.
6. To design thermo Electric Refrigeration and Air Refrigeration cycles.

COURSE OUTCOMES
Students will be able to
1. Understand the principles and remember the applications of refrigeration systems
2. Analyze performance of vapor compression refrigeration system
3. Study the working principles of vapor absorption, thermoelectric, steam jet refrigerationsystem.
4. Create capacity to compute heating / cooling load
5. Create the eco-friendly refrigerants.
6. demonstrate an understanding of the engineering and operation of vaporcompression and possibly heat-driven refrigeration systems and evaporative cooling systems andunderstand contemporary issues of ozone depletion and global warming potential with respect torefrigeration systems.

UNIT I
REFRIGERATION CYCLES - ANALYSIS
Development of Vapor Compression Refrigeration Cycle from Reverse Carnot Cycle- conditions for high COP-deviations from ideal vapor compression cycle,MultipressureSystems, Cascade Systems-Analysis.

UNIT II
MAIN SYSTEM COMPONENTS
Compressor- Types,performance, Characteristics of Reciprocating Compressors, Capacity Control, Types of Evaporators & Condensers and their functional aspects, Expansion Devices and their Behavior with fluctuating load.

UNIT III
REFRIGERANTS
Classification of Refrigerants, Refrigerant properties, Oil Compatibility, Environmental Impact-Montreal / Kyoto protocols-Eco Friendly Refrigerants. Different Types of Refrigeration Tools , Evacuation and Charging Unit , Recovery and Recycling Unit , Vacuum Pumps.

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)

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Pollachi Main Road, Eachanari Post, Coimbatore - 641 021, Tamilnadu, India.

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UNIT IV
SYSTEM BALANCING & CONTROLS
Estimation of Cooling Load, System Equilibrium and Cycling Controls, Electric Circuits in-Refrigerators, Window A/C, Types of motors, Relays.

UNIT V
OTHER REFRIGERATION CYCLES
Vapor Absorption Systems-Aqua Ammonia &LiBr Systems, Steam Jet Refrigeration Thermo Electric Refrigeration and Air Refrigeration cycles.

TEXT BOOKS:

1. Dossat R.J., Principles of refrigeration, John Wiley, S.I. Version (2001).
2. Stoecker W.F., Refrigeration and Air conditioning, McGraw-Hill Book Company, 1989.

REFERENCE BOOKS:

1. Jordan and Priester , Refrigeration and Air conditioning 1985.
2. Goshnay W.B., Principles and Refrigeration, Cambridge, University Press, 1985.
3. Langley , Billy C., 'Solid state electronic controls for HVACR' pentice-Hall 1986.

COMPOSITE AND POLYMER MATERIALS
(Effective from the academic year 2015-2016 onwards)

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CODE:15RME314

COURSE OBJECTIVES

1. Explain the behavior of constituents in the composite materials
2. Enlighten the students in different types of reinforcement
3. Develop the student's skills in understanding the different manufacturing methods available for composite material.
4. Illuminate the knowledge and analysis skills in applying basic laws in mechanics to the composite materials.
5. To design the liquid state fabrication methods
6. To apply the knowledge about recycling of PMC

COURSE OUTCOMES

Upon completion of this course the student will be able to

1. Explain the mechanical behavior of layered composites compared to isotropicmaterials.
2. Apply constitutive equations of composite materials and understand mechanicalbehavior at micro and macro levels.
3. Determine stresses and strains relation in composites materials.
4. Develop competency in one or more common composite manufacturing techniques, and be able to select the appropriate technique for manufacture of fibre-reinforced composite products.
5. Analyse the elastic properties and simulate the mechanical performance of compositelaminates; and understand and predict the failure behaviour of fibre-reinforced composites
6. Apply knowledge of composite mechanical performance and manufacturing methods to a composites design project

UNIT I
PROPERTIES OF POLYMERS

Chemistry and Classification of Polymers – Properties of Thermo plastics – Properties of Thermosetting Plastics – Applications – Merits and Disadvantages.

UNIT II
PROCESSING OF POLYMERS

Extrusion – Injection Moulding – Blow Moulding – Compression and Transfer Moulding –
Casting – Thermo Forming General Machining properties of Plastics – Machining Parameters and their effect – Joining of Plastics – Mechanical Fasteners – Thermal bonding – Press Fitting.

UNIT III

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INTRODUCTION TO FIBRES AND COMPOSITE MATERIALS

Fibres – Fabrication, Structure, properties and applications - Glass, Boron, carbon, organic, ceramic and metallic fibers whiskers– Matrix materials structure – polymers, – metals and ceramics – Physical and chemical properties.

UNIT IV
PROCESSING OF POLYMER MATRIX COMPOSITES

Open mould process, bag moulding, compression moulding with BMC and SMC filament winding – pultrusion – centrifugal casting – injection moulding – structure, properties and application of PMC's – Carbon Matrix Composites - Interfaces – Properties – recycling of PMC.

UNIT V
PROCESSING OF METAL MATRIX COMPOSITES AND CERAMIC MATRIX COMPOSITES

Solid state fabrication techniques – diffusion bonding – powder metallurgy techniques plasma spray, chemical and physical vapour deposition of matrix on fibres Chemical vapour infiltration – Sol gel – liquid state fabrication methods – infiltration – squeeze, casting – rheo casting – compocasting - Interfaces properties– application of MMC and ceramic matrix composites.

REFERENCE BOOKS:

1. Krishnan K Chawla, "Composite Materials Science and Engineering", International Edition, Springer, 2006
2. Harold Belofsky, "Plastics, Product Design and Process Engineering", Hanser Publishers, 2002.
3. Bera.E and Moet.A, "High performance polymers", Hanser Publishers, 2001.
4. Rauwendaal,C., "Polymer extrusium", Hanser publishers, 2000.
5. Rosatao, D.V. "Blow moulding",HandBook, Hanser Publishers, 1989.
6. Seamour, E.B. "Modern Plastics Technology", Prentice Hall, 2002
7. Mallick, P.K. and Newman.S., "Composite Materials Technology", Hanser Publishers, 2003

ADVANCES IN CASTING AND WELDING PROCESSES
(Effective from the academic year 2015-2016 onwards)

CODE:15RME315

COURSE OBJECTIVES

1. To familiarize the students to apply various design considerations in casting, gating and risering.
2. To develop an understanding of casting metallurgy like solidification, shrinkage and degasification.
3. To explain about the recent trends in casting.
4. To understand the concept foundry layout and pollution control in foundry.
5. To study and acquire knowledge of welding metallurgy and design aspects of welding
6. To provide an overview of recent trends in welding and various welding methods.

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Apply suitable design considerations in casting, gating and risering.
2. Identify the effect of solidification, shrinkage and degasification.
3. Select the type of casting process.
4. Work with various foundry layouts and pollution control.
5. Identify the effect of metallurgy in welding and design aspects.
6. Select the type of welding method and recent trends.

UNIT I
CASTING DESIGN
Heat transfer between metal and mould — Design considerations in casting – Designing for directional solidification and minimum stresses - principles and design of gating and risering

UNIT II
CASTING METALLURGY
Solidification of pure metal and alloys – shrinkage in cast metals – progressive and directional solidification — Degasification of the melt-casting defects – Castability of steel , Cast Iron, Al alloys , Babbit alloy and Cu alloy.

UNIT III
RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT
Shell moulding, precision investment casting, CO_2 moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry — Computer aided design of casting.

UNIT IV
WELDING METALLURGY AND DESIGN

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Heat affected Zone and its characteristics – Weldability of steels, cast iron, stainless steel, aluminum, Mg , Cu , Zirconium and titanium alloys – Carbon Equivalent of Plain and alloy steels Hydrogen embrittlement – Lamellar tearing – Residual stress – Distortion and its control . Heat transfer and solidification - Analysis of stresses in welded structures – pre and post welding heat treatments – weld joint design – welding defects – Testing of weldment.

UNIT V
RECENT TRENDS IN WELDING
Friction welding, friction stir welding – explosive welding – diffusion bonding – high frequency induction welding – ultrasonic welding – electron beam welding – Laser beam welding –Plasma welding – Electroslag welding- narrow gap, hybrid twin wire active TIG – Tandem MIG- modern brazing and soldering techniques – induction, dip resistance, diffusion processes – Hot gas, wave and vapour phase soldering. Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.

REFERENCE BOOKS:

1. ASM Handbook, Vol 15, "Casting", 2004
2. ASM Handbook vol.6, "Welding, Brazing & Soldering", 2003
3. Parmer R.S., "Welding Engineering and Technology", Khanna Publishers,2002
4. Srinivasan N.K., "Welding Technology", Khanna Tech Publishers, 2002
5. Heineloper& Rosenthal, "Principles of Metal Casting", Tata McGraw Hill, 2000.
6. Jain P.L., "Principles of Foundry Technology",TataMcGrawHill Publishers, 2003
7. Carrry B., "Modern Welding Technology", Prentice Hall Pvt Ltd., 2002
8. Iotrowski – "Robotic welding – A guide to selection and application" – Society of Mechanical Engineers, 1987.
9. Schwariz, M.M. – "Source book on innovative welding processes" – American Society for Metals (OHIO), 1981
10. Cornu.J. "Advanced welding systems" – Volumes I, II and III, JAICO Publishers,1994.
11. Lancaster.J.F. – "Metallurgy of welding" – George Alien & Unwin Publishers, 1980