

DEPARTMENT OF MATHEMATICS
FACULTY OF ARTS, SCIENCE AND HUMANITIES
UG PROGRAM (CBCS) – B.Sc. Mathematics
(2021–2022 Batch and onwards)

Course Code	Name of the Course	CATEGORY	Objectives and Out Comes		Instruction Hours / Week			Credit(s)	Maximum Marks			PAGE NO.
			PEOs	POs	L	T	P		CIA	ESE	Total	
SEMESTER – I												
21LSU101	Language –I	AEC	III	k	4	0	0	4	40	60	100	8
21ENU101	English-I	AEC	II	l	4	0	0	4	40	60	100	12
21MMU101	Calculus and Trigonometry	CC	II	d	5	0	0	5	40	60	100	14
21MMU102	Classical Algebra	CC	II	j	6	0	0	6	40	60	100	16
21MMU103	Physics I	ALLIED	I	a, b	4	0	0	3	40	60	100	18
21MMU111	Calculus and Trigonometry- Practical	CC	II	d	0	0	3	2	40	60	100	20
21MMU112	Physics I-Practical	ALLIED	I	a, b	0	0	4	2	40	60	100	22
Semester Total					23	0	7	26	280	420	700	
SEMESTER – II												
21LSU201	Language – II	AEC	III	k	4	0	0	4	40	60	100	24
21ENU201	English-II	AEC	II	l	4	0	0	4	40	60	100	28
21MMU201	Differential Equations and Laplace Transforms	CC	I,II	a, i	4	0	0	4	40	60	100	30
21MMU202	Analytical Geometry	CC	I	c, j	4	0	0	4	40	60	100	32
21MMU203	Physics II	ALLIED	I	a, b	4	0	0	3	40	60	100	34
21MMU211	Differential Equations and Laplace Transforms -Practical	CC	I,II	a	0	0	3	2	40	60	100	36
21MMU212	Physics II-Practical	ALLIED	I	a, b	0	0	4	2	40	60	100	38

21AEC201	Environmental Studies	AEC	I	k	3	0	0	3	40	60	100	40
Semester Total					23	0	7	26	320	480	800	
SEMESTER – III												
21MMU301	Statistics	CC	I,II	a, i	5	0	0	5	40	60	100	43
21MMU302	Mechanics	CC	II	c, j	6	1	0	6	40	60	100	45
21MMU303A	Multivariate Calculus	SEC	I	E	4	2	0	4	40	60	100	47
21MMU303B	Computer Graphics	SEC	I	H								49
21MMU304	Object Oriented Programming using C++	ALLIED	III	G	4	0	0	3	40	60	100	52
21MMU311	Statistics -Practical	CC	II	I	0	0	4	2	40	60	100	54
21MMU312	Object Oriented Programming using C++ - Practical	ALLIED	II	I	0	0	4	2	40	60	100	56
Semester Total					19	3	8	22	240	360	600	
SEMESTER – IV												
21MMU401	Numerical Methods	CC	I	e	5	0	0	5	40	60	100	58
21MMU402	Discrete Mathematics	CC	II	d	6	1	0	6	40	60	100	60
21MMU403A	Operations Research	SEC	II	f	4	2	0	4	40	60	100	62
21MMU403B	Operating System: Linux	SEC	I	f								64
21MMU404	Programming in Python	ALLIED	III	g	4	0	0	3	40	60	100	67
21MMU411	Numerical Methods-Practical	CC	I	f, g	0	0	4	2	40	60	100	70
21MMU412	Programming in Python -Practical	ALLIED	I	f	0	0	4	2	40	60	100	72

Semester Total					19	3	8	22	240	360	600	
SEMESTER – V												
21MMU501	Real Analysis-I	CC	II	d	5	2	0	5	40	60	100	74
21MMU502A	Complex Analysis-I	DSE	II	j	6	2	0	6	40	60	100	76
21MMU502B	Industrial Mathematics	DSE	I,II	a								78
21MMU503A	Abstract Algebra	DSE	I	a	6	2	0	6	40	60	100	80
21MMU503B	Special Functions	DSE	I	h								82
21MMU504A	Number Theory	DSE	II	c	5	2	0	5	40	60	100	84
21MMU504B	Portfolio Optimization	DSE	II, III	g								86
Semester Total					22	8	0	22	160	240	400	
SEMESTER – VI												
21MMU601	Real Analysis-II	CC	II	e, j	5	1	0	4	40	60	100	88
21MMU602A	Complex Analysis-II	DSE	II	j	5	1	0	4	40	60	100	90
21MMU602B	Graph Theory	DSE	I,II	a, g								92
21MMU603A	Linear Algebra	DSE	I,II	a	5	1	0	4	40	60	100	94
21MMU603B	Mathematical Modeling	DSE	I	d								96
21MMU604A	Applied Statistics	DSE	I,II	a	5	1	0	4	40	60	100	98
21MMU604B	Differential Geometry	DSE	I	d								101
21MMU691	Project	CC	II	a	6	0	0	6	40	60	100	103
ECA / NCC / NSS / Sports / General interest etc.,											Good	
Semester Total					26	4	0	22	200	300	500	
Grand Total					132	18	30	140	1440	2160	3600	

Ability Enhancement Courses (AEC)		
Semester	Course Code	Name of the Course
I	21LSU101	Language –I
	21ENU101	English-I
II	21LSU201	Language – II
	21ENU201	English-II
	21AEC201	Environmental Studies

Generic Elective Courses (GE) /Allied Courses		
Semester	Course Code	Name of the Course
I	21MMU103	Physics I
	21MMU112	Physics I-Practical
II	21MMU203	Physics II
	21MMU212	Physics II-Practical
III	21MMU304	Object Oriented Programming using C++
	21MMU312	Object Oriented Programming using C++-Practical
IV	21MMU404	Programming in Python
	21MMU412	Programming in Python -Practical

Core Courses (CC)		
Semester	Course Code	Name of the Course
I	21MMU101	Calculus and Trigonometry
	21MMU102	Classical Algebra
	21MMU111	Calculus and Trigonometry -Practical
II	21MMU201	Differential Equations and Laplace Transforms
	21MMU202	Analytical Geometry
	21MMU211	Differential Equations and Laplace Transforms -Practical
III	21MMU301	Statistics
	21MMU302	Mechanics
	21MMU311	Statistics -Practical
IV	21MMU401	Numerical Methods
	21MMU402	Discrete Mathematics
	21MMU411	Numerical Methods-Practical
V	21MMU501	Real Analysis-I
VI	21MMU601	Real Analysis-II
	21MMU691	Project

Skill Enhancement Courses (SEC)		
Semester	Course Code	Name of the Course
III	21MMU303A	Multivariate Calculus
	21MMU303B	Computer Graphics
IV	21MMU403A	Operations Research
	21MMU403B	Operating System: Linux

Discipline Specific Elective Courses (DSE)		
Semester	Course Code	Name of the Course
V	21MMU502A	Complex Analysis-I
	21MMU502B	Industrial Mathematics
	21MMU503A	Abstract Algebra
	21MMU503B	Special Functions
	21MMU504A	Number Theory
	21MMU504B	Portfolio Optimization
VI	21MMU602A	Complex Analysis-II
	21MMU602B	Graph Theory
	21MMU603A	Linear Algebra
	21MMU603B	Mathematical Modeling
	21MMU604A	Applied Statistics
	21MMU604B	Differential Geometry

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PROGRAM OUTCOMES (POs)

- a. Familiarize the student's physical intuition and thinking process through the understanding of the theory and application of this knowledge to the solution of practical problems.
- b. Analyze the motion of particles under the influence of various forces.
- c. Estimates and check rigorous mathematical proofs in analysis and in the field of number theory.
- d. Acquire knowledge about the integral calculus and its geometrical applications.
- e. Familiarize some fundamental results and techniques from the theory of groups.
- f. Understanding of common numerical methods and how they are used to obtain approximate solutions to intractable mathematical problems.
- g. Analyze and resolve the conflicts of economic situations.
- h. Ability to formulate mathematical structure for computer and communication systems.
- i. Acquire knowledge about differential equations and integrating factor, separable equations and its applications.
- j. Enrich the facts on functions, relations and systems of linear equations.
- k. An understanding of professional, ethical, legal, security and social issues and responsibilities.
- l. An ability to communicate effectively with a range of audiences.

PROGRAM SPECIFIC OUTCOMES (PSOs)

- m. Ability to think in a conceptual, analytical and logical manner.
- n. Formulation and evaluation of appropriate mathematical models to optimize the real-life problems.

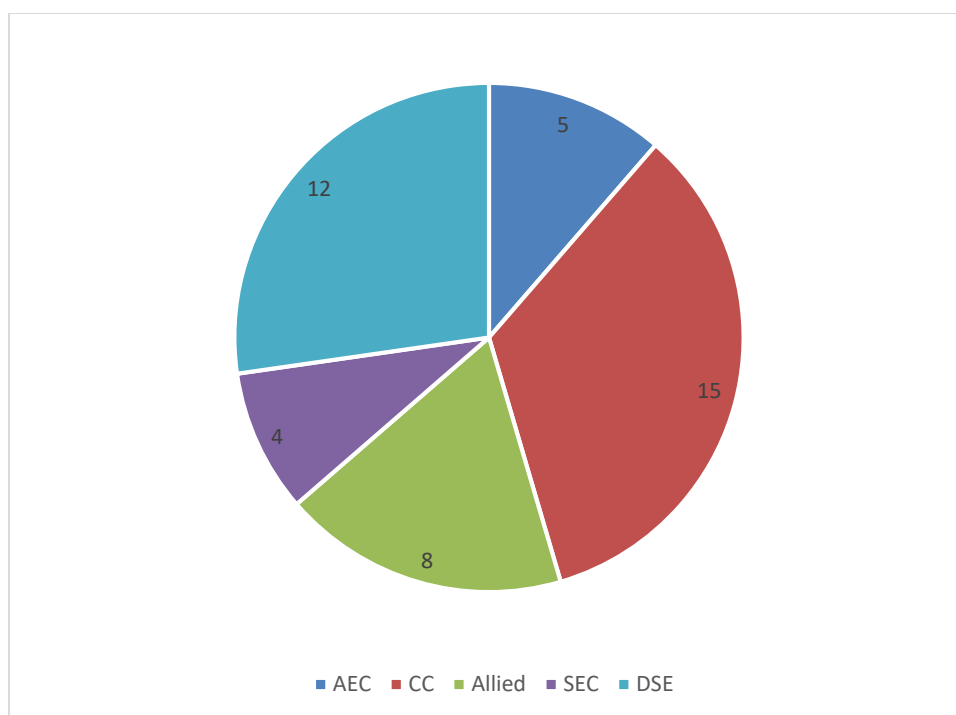
PROGRAM EDUCATIONAL OUTCOMES (PEOs)

PEO I: To enrich the students to solve numerous of physical problems in engineering and biological models.

PEO II: To stimulate the skills needed to pursue careers in education, business and / or industry.

PEO III: To develop the professional and managerial skills, especially in areas requiring the application of quantitative skills.

Pos	a	b	c	d	e	f	g	h	i	j	k	l	m	n
PEO I	X	X				X	X				X	X		X
PEO II			X	X	X				X	X	X			
PEO III	X						X	X				X	X	X

COURSE DETAIL USING PIE CHART

பகுதி – I, தமிழ்

முதல் பருவம்
தமிழ் முதல் தாள்
(இளநிலை அறிவியல் பட்ட வகுப்புகளுக்குரியது)

21LSU101
4-H,4-C

பருவம்	தாள்	கற்பிக்கும் நேரம்/வாரம்	தேர்வு மணிகள்	மதிப்பெண்	மொத்தம்	மதிப்பீடு
				அகமதிப்பீடு / எழுத்துத்தேர்வு		
ஒன்று	I	4 மணி	3	40 / 60	100	4

பாடத்திட்டப் பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும் மேம்படுத்துதல்.
- ஆய்வுநோக்கை மேம்படுத்துதல்.
- இலக்கியங்கள் உணர்த்தும் வாழ்வின் நுட்பமான பகுதிகளை உணர்த்துதல்.
- மனித மனத்தினைப் பக்குவப்படுத்துதலில் இலக்கியம் தரும் பங்கினை உணர்த்துதல்.
- வளர்ந்து வரும் சமூகத்தில் அறஉணர்வு, பண்பாடு போன்றவை குறித்து அறிவூட்டல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்.

பாடத்திட்டப் பயன் விளைவு

1. இந்திய குடியுரிமைப் பணி முதலான போட்டித் தேர்வுகளில், விருப்பப் பாடமாக இடம்பெறுகின்ற, 'தமிழ் இலக்கிய வரலாறு' குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்.
2. கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
3. தமிழின் வளர்ச்சித் துறையாகிய, 'அறிவியல் தமிழ்' ; 'இணைய தமிழ்' குறித்த பன்னோக்கு அணுகுமுறையிலான ஆய்வுச் சிந்தனை மேம்பாடு.
4. வேலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல் .
5. சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப் பேணுவதற்கு உறுதுணையாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை.
6. மொழிபெயர்ப்புத் துறைசார்ந்த வேலைவாய்ப்புத் திறன் பெற்றிருத்தல்.

அலகு – I : தமிழ் இலக்கிய வரலாறு – I

(8 மணிநேரம்)

முச்சங்க வரலாறு - சங்க இலக்கியத்தொகுப்பு - பாட்டும் தொகையும் - சங்கஇலக்கியச் சிறப்பியல்புகள் - சங்கம் மருவிய காலம் - பதினெண்கீழ்க்கணக்கு நூல்கள் - திருக்குறள் - நாலடியார் - நான்மணிக்கடிகை - பழமொழி நானூறு - பிற்கால அறஇலக்கியங்கள் - கொன்றை வேந்தன் - நீதிநூல் -

காப்பியங்கள் - தமிழில் காப்பிய இலக்கணம் - தமிழில் பெருங்காப்பியங்களும் சிறு காப்பியங்களும் - இரட்டைக்காப்பியங்களாகச் சிலம்பும் மேகலையும்.

அலகு - II : சங்க இலக்கியம்

(12 மணிநேரம்)

அ). எட்டுத்தொகை

நற்றிணை : கொண்டல் மாமழை - குறிஞ்சி - தலைவன் கூற்று - 140

குறுந்தொகை : வாரார் ஆயினும், வரினும் - முல்லை - தலைவி கூற்று - 110

ஐங்குறுநூறு : மருதம் - தோழி கூற்று - வேட்கைப்பத்து: வாழிஆதன் வாழி அவினி - 6

பதிற்றுப்பத்து : சிதைந்தது மன்ற - 27

பரிபாடல்: புறத்திரட்டு- மதுரை நகர்ச்சிறப்பு -

உலகம் ஒரு நிறையாத்தான்-7, மாயோன் கொப்பூழ்-8, செய்யாட்கு இழைத்த-9, கார்த்திகை காதில்-10, ஈவாரைக் கொண்டாடி-11.

கலித்தொகை : பாலைக்கலி- செவிலி - எறித்தரு கதிர்தாங்கி-9

அகநானூறு : அன்னை அறியினும் அறிக - தோழி - நெய்தல் - 110

புறநானூறு : யாதும் ஊரே யாவருங் கேளிர் - பொதுவியல்- 192

ஆ). பத்துப்பாட்டு: நெடுநல்வாடை - கார்காலச் சிறப்பு : வையகம் பனிப்ப - 1-70

அலகு - III : அற இலக்கியம்

(10 மணிநேரம்)

1. திருவள்ளுவர்- திருக்குறள்- அதிகாரம் 67 - வினைத்திட்டம், அதிகாரம் 100 - பண்புடைமை
2. முன்றுறையரையனார் - பழமொழி நானூறு 5 பாடல்கள்
உணற்கு இனிய 5, பரந்த திறலாரை 32, நெடியது காண்கிலாய் 46, இனி யாரும் 153, உரைசான்ற 195.
3. ஓளவையார் - கொன்றை வேந்தன் (1- 50 பாடல்கள்)
அன்னையும் பிதாவும் - புலையும் கொலையும் களவும் தவிர்

4. வேதநாயகம்பிள்ளை - நீதிநூல் - (அதிகாரம்-7-தாய்தந்தையரைப் போற்றுதல்-
தேர்ந்தெடுக்கப்பட்ட 5 பாடல்கள்)

சின்னவோர் பொருள், கடவுளை வருந்தி, எப்புவிகளும், வைத்தவர், ஈன்றவர்

அலகு - IV : காப்பிய இலக்கியம்

(10 மணிநேரம்)

(அ). சிலப்பதிகாரம் (5 மணிநேரம்)

மங்கல வாழ்த்துப் பாடல்: (21-29)- நாக நீள் நகரொடு-கண்ணகி என்பாண் மன்னோ. வழக்குரை காதை,
(48-56) - நீர்வார் கண்ணை-புகா ரென்பதியே .

வஞ்சின மாலை: (5-34) - வன்னிமரமும் - பிறந்த பதிப் பிறந்தேன்.

நடுகற் காதை: (207-234) - அருத்திற லரசர் - மன்னவ ரேறென்

வாழ்த்துக்காதை: (9) - என்னேயிஃ தென்னே - மீவிசும்பிற் றோன்றுமால்.

(ஆ). மணிமேகலை (5 மணிநேரம்)

பசியின் கொடுமை: பாத்திரம் பெற்ற காதை:

‘போதி நீழல்’ - ‘பெருகியதன்றோ’ , ‘ஆற்றுநார்க்களிப்போர்’ - ‘நல்லறம் கண்டனை’ (73-98).

சிறைக்கோட்டம் அறக்கோட்டமாக்கிய காதை: மாவண் கிள்ளிக்கு காவலன் உரைத்தவை:

‘பைஞ்சேறு மெழுகாப் பசும்பொன் மண்டபத்து -

அறவோர்க் காக்கினன் அரசாள் வேந்தன்’ (116-163).

அலகு- V : அடிப்படை இலக்கணமும் பயன்பாட்டுத்தமிழும் - I

(8 மணிநேரம்)

அ). எழுத்து, சொல், பொருள் இலக்கணங்கள் (4 மணிநேரம்)

1. முதல் மற்றும் சார்பெழுத்துகள் - பெயர், வினை, இடை, உரிச்சொல் முதலான அடிப்படை இலக்கண விளக்கப் பயிற்சிகள்

2). அகத்திணை மற்றும் புறத்திணை இலக்கணங்கள்

ஆ). கடிதப்பயிற்சி (4 மணிநேரம்)

1. தன்விவரக் குறிப்புடன் வேலை வேண்டி விண்ணப்பம் எழுதுதல்

2. பல்கலைக்கழகப் பன்னாட்டுக்கருத்தரங்கச் செய்தியை நாளிதழில் வெளியிட வேண்டி நாளிதழின் பதிப்பாசிரியருக்குக் கடிதம்

3. கருத்தரங்கப் பங்கேற்புக்கு அனுமதிக் கடிதம்
4. பல்கலைக்கழக விழாவுக்குத் தலைமையேற்க வேண்டி, மாவட்ட ஆட்சியருக்கு விண்ணப்பம்
5. கல்விகடன் வேண்டி வங்கிமேலாளருக்கு விண்ணப்பம்
6. வசிப்பிடத்திற்கு அடிப்படை வசதி வேண்டி வட்டாட்சியருக்கு விண்ணப்பம்
7. தேசியவிருது பெற்ற நண்பனுக்குப் பாராட்டுக் கடிதம்
8. புத்தகங்கள் அனுப்பி உதவவேண்டி, பதிப்பகத்தாருக்கு விண்ணப்பம்

பாட நூல்: கற்பகச்சோலை – தமிழ் ஏடு.

வெளியீடு: மொழிகள் துறை – தமிழ்ப்பிரிவு, கற்பகம் உயர்கல்விக்கழகம்.

Semester – I

4H – 4C

21ENU101

ENGLISH-I

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objective

This course enables the students to learn

- The basic knowledge on grammar.
- How to train communication in real life situation.
- How to familiar with the four basic skills of English.
- The acquire proficiency in English by reading different genres of literature and learning grammar.
- Provide aesthetic pleasure through literature.
- How to develop the moral values of students.

Course Outcomes (COs)

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

1. Retrieve fundamentals of English language to construct error free sentences.
2. Develop the knowledge of interpersonal skills.
3. Establish and maintain social relationships.
4. Develop communication skills in business environment.
5. Refine communication competency through LSRW skills.
6. Improving intrapersonal skills through literary works.

UNIT - I: Grammar

Types of Sentences, Subject and Predicate, Parts of Speech, Tenses, Preposition and Articles

UNIT – II: Communication Exercise

Importance of Business Language- Words often Confused- Words often Misspelt- Common Errors in English- Charts and Pictorial Writing.

UNIT – III: Interpersonal Skills

Greetings & Introduction- Giving & Denying Permission- Telephone Etiquette-

Oral Presentation – Plan, PowerPoint Presentation- Preparation of Speech- Audience psychology- Secrets of Good Delivery

UNIT - IV: LSRW Skills

Listening- Listening and its types, Basic Listening Lessons

Speaking- Basics of speaking, Regular English, Business English, Interview English

Reading- Reading and its purposes, Types of Reading, Reading Techniques

Writing- Types of Writing, Components of Writing, Language and Style with accordance to the contexts

UNIT - V: Literature

Prose: Let's Do What India Needs from Us - Dr. A.P.J. Abdul Kalam

Poem: A Prayer for My Daughter - W.B. Yeats

Short Story: Sparrows- K. Ahmad Abbas

SUGGESTED READINGS

1. Hewings Martin., (2013). Advanced Grammar in Use, Cambridge University Press
2. Haines Simon., (2015). Advanced Skills, A resource Book of Advanced- Level Skill Activities

Semester – I
5H – 5C

21MMU101

CALCULUS AND TRIGONOMETRY

Instruction Hours / week: L: 5 T: 0 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objective

This course enables the students to learn

- The Higher order derivatives and its applications in business, economics and life sciences
- The concepts of essentials of concavity, inflection points and its geometrical applications.
- About the Integration by parts methods.
- Understand the concept of single and multiple integration
- Trigonometric identities and the expansion of trigonometric functions
- Understand the concept of the expansion of series.

Course Outcomes (COs)

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

1. Apply Leibnitz rule in higher order derivatives
2. Understand the concepts of evolutes, envelopes, Concavity, Convexity and inflexion points.
3. Integrate complex functions with the help of Reduction formula
4. Use single and multiple integration to calculate the arc length, area and volume.
5. Apply the concepts and techniques of trigonometric functions
6. Understand the techniques of sketching conics and properties of conics.

UNIT I**DIFFERENTIAL CALCULUS**Hyperbolic functions- Higher order derivatives- Leibnitz rule and its applications to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax + b)^n\sin x$ and $(ax + b)^n\cos x$, L'Hospital's rule**UNIT II****APPLICATION OF DIFFERENTIAL CALCULUS**

Radius of curvature in Cartesian coordinates and polar coordinates, Center of curvature in polar and Cartesian coordinates, evolutes, envelopes, Concavity, Convexity and inflexion points.

UNIT III**INTEGRAL CALCULUS**

Integrals – Properties of Definite Integrals – Integration by parts – Bernoulli's Formula – Reduction formulae of the type

$$\int_0^{\frac{\pi}{2}} \sin^n x dx, \int_0^{\frac{\pi}{2}} \cos^n x dx, \int_0^{\frac{\pi}{2}} \operatorname{cosec}^n x dx, \int_0^{\frac{\pi}{2}} \sec^n x dx, \int_0^{\frac{\pi}{2}} x^n \sin x dx, \int_0^{\frac{\pi}{2}} \sin^n x dx, \int x^m (\log x)^n dx, \int_0^{\frac{\pi}{2}} \cos^m x \sin^n x dx, \int \cos^m x \sin^n x dx$$

UNIT IV

APPLICATIONS OF INTEGRATION

Volumes by slicing- Disks and washer's methods- Volumes by cylindrical shells- Parametric equations- Parameterizing a curve- Arc length- Arc length of parametric curves- Area of surface of revolution.

UNIT V

TRIGONOMETRY

Expansion in Series -Expansions of $\cos n\theta$, $\sin n\theta$ - Powers of sines and cosines of θ in terms of functions of multiples of θ - Expansion of $\cos^n \theta$, $\sin^n \theta$ and $\sin^n \theta \cos^n \theta$ - Hyperbolic functions: Definition - Relation between Hyperbolic Functions - Periods of hyperbolic functions - Separation into real and imaginary parts.

SUGGESTED READINGS

1. Nigam. H. N., (1996). Trigonometry, Krishna Prakashan Media Pvt. Ltd, Meerut.
2. Vittal.P.R., (2004). Trigonometry, Margham Publications, Chennai.
3. Sudha. S., (1998). Algebra Analytical Geometry(2D) and Trigonometry, Emerald Printing House Pvt. Ltd, Chennai.
4. Thomas G.B., and Finney R.L., (2008). Calculus, Ninth Edition, Pearson Education, Delhi.
5. Anton H., Bivens I., and Davis S., (2017). Calculus, Tenth Edition, John Wiley and Sons (Asia) P. Ltd., Singapore.
6. Strauss M.J., Bradley G.L and Smith K. J., (2007). Calculus, Third Edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
7. Courant R., and John F., (2000). Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York.
8. Debasish sengupta., (2019). Application of calculus, 4th Edition, Arunabha sen Books and Allied (p) Ltd, Kolkata.

WEBSITE LINK:

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>
2. <http://172.16.25.76/course/view.php?id=1630>
3. <https://www.youtube.com/watch?v=YFXKu16kWd0>

Semester – I
6H – 6C

21MMU102

CLASSICAL ALGEBRA

Instruction Hours / week: L: 6 T: 0 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Fundamentals of set theory and its algebraic properties.
- Momentous of divisibility concept and congruence relations.
- Techniques need to solve system of linear systems.
- Basic concepts of equations and its roots.
- Mean value theorem and its application in finding roots of an equation.
- Application of matrix in solving the system of linear equations.

Course Outcomes (COs)

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

1. Classify relations and functions and its properties
2. Apply the division algorithm and the fundamental theorem of arithmetic.
3. Solve system of linear equations with help of linear algebra.
4. Find the roots and position of roots of equations.
5. Approximate the root of an equations by Newton's method
6. Know about the applications of linear systems and linear independence.

UNIT I**BASICS OF SETS & FUNCTIONS**

Sets - Finite and infinite sets - Equality sets - Subsets - Comparability - Proper subsets - Axiomatic development of set theory - Set operations. Equivalence relations - Functions - Composition of functions - Invertible functions - One to one Correspondence and cardinality of a set.

UNIT II**DIVISIBILITY AND CONGRUENCE RELATIONS**

Division algorithm - Divisibility and Euclidean algorithm - Congruence relation between integers - Principles of Mathematical Induction - Statement of Fundamental Theorem of Arithmetic.

UNIT III**SYSTEM OF LINEAR EQUATIONS**

Systems of linear equations - Row reduction and echelon forms - Vector equations - The matrix equation $Ax = b$, Solution sets of linear systems - Applications of linear systems - Linear independence.

UNIT IV
THEORY OF EQUATIONS

Roots of an equation - Relations connecting the roots and coefficients - Transformations of equations - Character and position of roots - Descartes' Rule of signs - Symmetric function of roots - Reciprocal equations.

UNIT V
THEORY OF EQUATIONS (CONTINUITY)

Multiple roots - Rolle's theorem - Position of real roots of $f(x) = 0$, Newton's method of approximation to a root - Horner's method.

SUGGESTED READINGS

1. Edgar G. Goodaire and Michael M. Parmenter., (2015). Discrete Mathematics with Graph Theory, 3rd Edition, Pearson Education (Singapore) P. Ltd., Indian Reprint.
2. David C. Lay., (2015). Linear Algebra and its Applications, Third Edition, Pearson Education Asia, Indian Reprint.
3. Kenneth Hoffman., Ray Kunze., (2015). Linear Algebra, Second edition, Prentice Hall of India Pvt Ltd, New Delhi.
4. Manicavasagom Pillai. T.K., Natarajan. Ganapathy., (2006). Algebra, S. Viswanatham (Printer & publishers) Private Ltd.

WEBSITE LINK:

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>
2. <http://vidyamitra.inflibnet.ac.in/index.php/search?subject%5B%5D=&course%5B%5D=Linear+algebra&domain%5B%5D=Physical+%26+Basic+Sciences>
3. <http://172.16.25.76/course/view.php?id=1646>
4. <https://www.youtube.com/watch?v=jy0HFQQ8rAA>

21MMU103	PHYSICS I	Semester – I 4H – 3C
Instruction Hours / week: L: 4 T: 0 P: 0	Marks: Internal: 40	External: 60 Total: 100 End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The basic theories and experiments in Physics.
- The fundamentals of physics.
- About the electronic component like Diode, transistor etc.
- The analytical methods required to interpret and analyze results and draw conclusions as supported by their data.
- The graphical relationship of resistance, capacitor and inductor.
- About the circuit connection.

Course Outcomes (COs)

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

1. Demonstrate proficiency in mathematics and the mathematical concepts to understand physics.
2. Design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes.
3. Demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.
4. Know about the Laws of thermodynamics.
5. Know about the Intrinsic and extrinsic semiconductor.
6. Understand the graphical relationship of resistance, capacitor and inductor.

UNIT-I

ELASTICITY: Elastic constants of an isotropic solid -Stress – Strain - Relations connecting them - Poisson's ratio - Bending of beams - Uniform and non-uniform bending - Bending moment of a bent beam - cantilever - Static and dynamic methods - Torsion in a wire - Rigidity modulus determination by Static and dynamic methods.

SURFACE TENSION: Surface tension and Surface energy- Angle of contact - Vapour pressure over a flat and curved surface-Hare's apparatus (Difference between two different liquids).

UNIT-II

MECHANICS: Motion of bodies in 2-D - Newton's laws - projectile motion – range- maximum height – projectile from space flight- Rotational motion – Rotation with constant angular acceleration –angular

momentum of particles – rigid body – spinning top – conservation of angular momentum – Planetary motion – Kepler's laws – universal law of gravitation.

Moment of inertia of a rod, disc, spherical shell, solid and hollow spheres - Theory of compound pendulum and simple pendulum- Determination of 'g'. Relation between G and g.

UNIT-III

THERMAL PHYSICS: Laws of thermodynamics – Reversible and irreversible process – Heat engine – Carnot's theorem - Conduction- Convection- Radiation- Black body - Specific Heat- Experimental Methods- Expansion of solids, liquids and Gases (concepts)–Ideal Gas equation- Stefan's law – Newton's law of cooling – Experimental determination of Stefan's constant – Wien's displacement law – Rayleigh – Jean's law – Planck's law.

UNIT-IV

OPTICS: Nature of Light (Theories) - Reflection – Refraction – Snell's law – Total internal reflection – Interference – Diffraction – Polarization – Coherence-Spectrometer.

LASER PHYSICS: Stimulated emission and absorption – Einstein's theory of radiation - population inversion – optical pumping – meta stable state – conditions for laser actions – Ruby laser – Helium – neon laser – applications of lasers – Raman effect – Raman shift – stokes and anti-stokes lines – Laser Raman Spectrometer.

UNIT-V

BASIC ELECTRONICS: Intrinsic and extrinsic semiconductor – PN Junction diode – (Biasing of PN junction – V-I characteristics) – Rectifiers – Half wave – Full wave and bridge rectifiers –Characteristics of Zener diode – Voltage regulator – Transistor – Characteristics of transistor – CB, CE mode –Oscillators & its Classification.

SUGGESTED READINGS

1. Murugesan. R., Modern Physics, S. Chand & Co, New Delhi.
2. Brijlal and N. Subramanyam., (2004). Properties of matter, S. Chand & Company, New Delhi.
3. Aruldas and P. Rajagopal, Modern Physics, Prentice Hall of India, New Delhi.
4. Mathur. D.S., (2003). Elements of properties of matter - Shyamlal Charitable Trust, New Delhi.
5. V K Mehta and Rohit Mehta., (2008). Principles of Electronics, S. Chand & Company Ltd. Revised Eleventh Edition.
6. F. W. Sears and G. L. Salinger., (1998). Thermodynamics, Kinetic theory, and Statistical Thermodynamics, IIIrd ed., Narosa Publishing House.

Semester – I
3H – 2C

21MMU111

CALCULUS AND TRIGNOMERTY - PRACTICAL

Instruction Hours / week: L: 0 T: 0 P: 3

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- To demonstrate comprehension in relevant area of calculus
- Problem solving through (computer language) programming.
- The basic structure of the programme, declaration and usage of variables.
- The basics of Scilab-Coding programme.
- The usage of Scilab in order to facilitate understanding and visualization of mathematical problems
- The practical preparation knowledge to apply the acquired knowledge and skills.

Course Outcomes (COs)

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

1. Familiarize with the programming environment.
2. Acquire the problem solving skills through computer programming.
3. Understand to write diversified solutions using programming language.
4. Plot of graphs of functions (exponential, logarithmic, trigonometric).
5. Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid).
6. Deal with different input/output methods.

List of Practical (Any 8 programs)

1. Plotting of graphs of function $1/(ax + b)$, $|ax + b|$, $1/(ax + b)^2$, $|ax + b|^2$ and to illustrate the effect of a and b on the graph.
2. Plotting of graphs of trigonometric functions $e^{ax + b}$, $\log(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$ and to illustrate the effect of a and b on the graph.
3. Plotting the graphs of polynomial of degree 4, the derivative graph, the second derivative graph and comparing them.
4. Plotting the graphs of polynomial of degree 5, the derivative graph, the second derivative graph and comparing them.

5. Sketching the parametric curves of Trochoid and cycloid.
6. Evaluating definite integrals. (Line integral).
7. Evaluating integrals using Reduction formulae.
8. Sketching the parametric curves of epicycloids and hypocycloid.
9. Obtaining surface of revolution of curves.
10. Tracing of conics in Cartesian coordinates or polar coordinates.

SUGGESTED READINGS:

1. LAB Manual.
2. Kirani Singh. Y & Chaudhuri. B.B., (2008). MATLAB Programming, Prentice-Hall of India Pvt. Ltd, New Delhi.
3. Desmond. J. Higham & Nicholas J. Higham., (2005). MATLAB Guide MATLAB Guide, MATLAB Guide, 2nd edition, SIAM.
4. Hema Ramachandran, Achuthsankar S. Nair, Computer SCILAB—A Free Software to MATLAB, First Edition, S. Chand & Company Ltd, New Delhi.

WEBSITE LINK:

1. <http://spoken-tutorial.org/>
2. <http://wiki.scilab.org/Tutorialsarchives>
3. <https://www.scilab.org/tutorials>

21MMU112	PHYSICS I-PRACTICAL	Semester – I 4H – 2C
Instruction Hours / week: L: 0 T: 0 P: 4	Marks: Internal: 40	External: 60 Total: 100
End Semester Exam: 3 Hours		

Course Objectives

This course enables the students to learn

- The basic understanding of laboratory technique and to educate and motivate the students in the field of Physics.
- A deep knowledge of fundamentals of optics.
- The practical knowledge by applying the experimental methods to correlate with the Physics theory.
- The usage of electrical and optical systems for various measurements.
- The intellectual communication skills and discuss the basic principles of scientific concepts in a group.
- The physical Principles and applications of Electronics.

Course Outcomes (COs)

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

1. Perform basic experiments in mechanics and electricity and analyze the data.
2. Acquire engineering skills and Practical knowledge, which help the student in their everyday life.
3. Know the physical Principles and applications of Electronics.
4. Apply the analytical techniques and graphical analysis to the experimental data.
5. Apply the various procedures and techniques for the experiments.
6. Use the different measuring devices and meters to record the data with precision.

List of Experiments (Any 8 Experiments)

1. Young's Modulus Non-Uniform bending-Pin and Microscope
2. Young's Modulus-Static cantilever
3. Acceleration due to gravity-Compound pendulum
4. Determination of spring constant of the given spring.
5. Determine the radius of capillary tube using microscope.
6. Refractive Index of a solid prism (I-d) curve-Spectrometer
7. Co-efficient of thermal conductivity-Lee's disc method
8. Wavelength of spectral lines -Grating-minimum deviation method-Spectrometer.
9. Characteristics of a Zener and Junction diode

10. μ of a lens-Newton's ring method
11. Thickness of a thin wire-Air wedge method
12. Determine the surface tension - Drop weight method
13. Determine the wavelength of He-Ne laser.
14. Determination of the Coefficient of Viscosity of a given liquid using Burette method
15. Construct a single stage amplifier using transistor

SUGGESTED READINGS:

1. Ouseph C.C., U.J. Rao and Vijayendran.V., (2007). Practical Physics and Electronics, Viswanathan.S (Printers & Publishers) Pvt. Ltd., Chennai.
2. Singh S.P., (2003). Advanced Practical Physics – 1, 13th Edition, Pragathi Prakashan, Meerut.
3. Singh S.P., (2000). Advanced Practical Physics – 2, 12th Edition, Pragathi Prakashan, Meerut.

21LSU201

இரண்டாம்பருவம்
தமிழ் இரண்டாம் தாள்
(இளநிலை அறிவியல் பட்ட வகுப்புகளுக்குரியது)

பகுதி – I
4-H,4-C

தாள்கள் வரிசையும் தேர்வுச் செயல்திட்டமும் பகுதி-I தமிழ்

பருவம்	தாள்	கற்பிக்கும் நேரம்/வாரம்	தேர்வு மணிகள்	மதிப்பெண்	மொத்தம்	மதிப்பீடு
				அக மதிப்பீடு / எழுத்துத்தேர்வு		
இரண்டு	II	4	3	40 / 60	100	4

இளநிலைப் பட்ட அறிவியல் வகுப்புகள்

பாடத்திட்டப் பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும் மேம்படுத்துதல்.
- ஆய்வுநோக்கை மேம்படுத்துதல்.
- இலக்கியங்கள் உணர்த்தும் வாழ்வின் நுட்பமான பகுதிகளை உணர்த்துதல்.
- மனித மனத்தினைப் பக்குவப்படுத்துதலில் இலக்கியம் தரும் பங்கினை உணர்த்துதல்.
- வளர்ந்து வரும் சமூகத்தில் அறஉணர்வு, பண்பாடு போன்றவை குறித்து அறிவூட்டல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்.

பாடத்திட்டப் பயன் விளைவு

1. இந்திய குடியுரிமைப் பணி முதலான போட்டித் தேர்வுகளில், விருப்பப் பாடமாக இடம்பெறுகின்ற, 'தமிழ் இலக்கிய வரலாறு' குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்.
2. கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
3. தமிழின் வளர்ச்சித் துறையாகிய, 'அறிவியல் தமிழ்' ; 'இணைய தமிழ்' குறித்த பன்னோக்கு அணுகுமுறையிலான ஆய்வுச் சிந்தனை வளர்ச்சி.
4. வேலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல் .
5. சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப் பேணுவதற்கு உறுதுணையாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை.
6. மொழிபெயப்புத் துறைசார்ந்த வேலைவாய்ப்புத் திறன் பெற்றிருத்தல்.

அலகு - I : தமிழ் இலக்கிய வரலாறு- II**(5 மணிநேரம்)**

தமிழ் இலக்கிய வரிசையில் திருமுறைகளும் நாலாயிரத் திவ்யப்பிரபந்தமும் -பன்னிரு திருமுறைகள் அறிமுகம் - திருமுறை ஆசிரியர்களின் இலக்கியப் பங்களிப்பு-திருமுறைகளில் பக்திநெறியும் சமுதாய நோக்கும் - சமயக்குரவரின் அருள்நெறி - பன்னிரு ஆழ்வார்கள் வரலாறு - ஆழ்வார்களின் இலக்கியப் பங்களிப்பு - திவ்யப் பிரபந்தத்தில் பக்திநெறியும் இலக்கிய நயமும் - தமிழில் சிற்றிலக்கியக் காலமும் கருத்தும் - தொண்ணூற்றாறு வகைச் சிற்றிலக்கிய வரிசை - தமிழ் மொழியின் கவிதை - சிறுகதை - உரைநடை -இலக்கியங்களின் தோற்றம் - வளர்ச்சி - உத்திகள் - நாட்டுப்புற இலக்கியங்கள்-கொங்குநாட்டார் வாய்மொழி வழக்காறுகள்.

அலகு - II : பக்தி இலக்கியமும் சிற்றிலக்கியமும்:**(12 மணிநேரம்)****அ). பக்தி இலக்கியம் (6 மணிநேரம்)**

1. **சைவம்** - பெரியபுராணம் - இளையான்குடிமாறநாயனார் புராணம் - (19 பாடல்கள்) .

(அம்பொன் நீடிய, கொண்டு வந்து, ஆளு நாயகர், செல்வம் மேவிய, மாரிக் காலத்து, ஈர மேனியை, நமக்கு முன்பிங்கு, செல்லல் நீங்க, மற்றும் மாற்றம், உள்ளம் அன்பு, காலினால் தடவி, வந்தபின் மனைவியாரும், முறித்தவை அடுப்பின், வழிவரும் இளைப்பினோடும், மனைவியார் கொழுநர், கணவனார் தம்மை, அழுந்திய இடருள், மாலயற் கரிய, அன்பனே அன்பர் பூசை)

2. **வைணவம்** - ஆண்டாள் நாச்சியார் திருப்பாவை: (11 பாடல்கள்):

மார்கழித்திங்கள், வையத்து வாழ்வீர்காள், ஓங்கி உலகளந்த, ஆழி மழைக்கண்ணா, மாயனை மன்னுவட மதுரை, சிற்றம் சிறுகாலே, ஒருத்தி மகனாய், மாலே மணிவண்ணா, கூடாரை வெல்லும், கறவைகள் பின்சென்று, வங்கக்கடல் கடைந்த.

ஆ). சிற்றிலக்கியம் (6 மணிநேரம்)

1. **முக்கூடற் பள்ளு** - 2 பாடல்கள் - சித்திரக் காலிவாலான் (நெல்வகைகள்) குற்றாலத் திரிகூட மால்வரை (மீன் வகைகள்)

2. **நந்தி கலம்பகம்** - 5 பாடல்கள்- என்னையே புகழ்ந்தேன், பதிதொறு புயல்பொழி, இந்தப்புவிடில், அடிவிளக்கும் துகில், வானுறுமதியை

3. **மதுரைச் சொக்கநாதர் தமிழ்விடு தூது** - தமிழின் சிறப்பு

பாடியருள பத்துப்பாட்டும்-விளம்பக்கேள்.

அலகு – III: கவிதையும் சிறுகதையும்

(16 மணிநேரம்)

அ). கவிதை இலக்கியம் (8 மணிநேரம்)

- | | |
|---------------------------------|--------------------------|
| 1. மகாகவி பாரதியார் | – கண்ணன் – என் சீடன் |
| 2. புரட்சிக்கவிஞன் பாரதிதாசன் | – இளையார் ஆத்திசூடி – |
| அழுபவன் கோழை | |
| 3. கவிமணி தேசிக விநாயகம் பிள்ளை | – கோயில் வழிபாடு |
| 4. கவிக்கோ. அப்துல்ரகுமான் | – பாருக்குள்ளே நல்ல நாடு |
| 5. சிற்பி பாலசுப்பிரமணியன் | – மலையாளக் காற்று |
| 6. கவிஞர் தாமரை | – தொலைந்து போனேன் |
| 7. கவிஞர் கரிகாலன் | – விடுதலை |

ஆ). சிறுகதை இலக்கியம் (8 மணிநேரம்)

- | | |
|---------------------|-------------------|
| 1. சாபவிமோசனம் | – புதுமைப்பித்தன் |
| 2. நகரம் | – சுஜாதா |
| 3. அந்நியர்கள் | – ஆர். சூடாமணி |
| 4. இந்நாட்டு மன்னர் | – நாஞ்சில்நாடன் |

அலகு – IV : உரைநடை இலக்கியம்

(8 மணிநேரம்)

1. ஆளுமைத்திறன் அறிவோம் - தன்னம்பிக்கை மாத இதழிலிருந்து
2. திருக்குறளும் சமுதாயவியலும் – முனைவர் புரிசை நடராசன்
3. தமிழ் – உயர்தனிச் செம்மொழி – முனைவர் இரா. குணசீலன்
4. நொய்யல் – முனைவர் ப. தமிழரசி

அலகு- V : அடிப்படை இலக்கணமும் பயன்பாட்டுத்தமிழும் – II

(7 மணிநேரம்)

இலக்கணப் பயிற்சி: 1. அணி இலக்கணம்

உவமையணி - பிறிது மொழிதல் அணி - சிலேடை அணி - தீவக அணி - ஏகதேச உருவக அணி - வேற்றுமையணி - பின்வருநிலையணிக்கான விளக்கங்கள்.

2. துறை சார் கலைச்சொல் பயன்பாட்டாக்கம்

3. படைப்பிலக்கியப் பயிற்சிகள்

1. மரபுக்கவிதை, புதுக்கவிதை, சிறுகதை, கட்டுரை படைப்பாக்க உத்திகள் - பயிற்சிகள்

2. எழுத்தாளருடனான நேர்காணல் மற்றும் கள ஆய்வுக்கான வினா நிரல் தயாரித்தல் நுட்பங்களும் பயிற்சிகளும்.

4. மொழிபெயர்ப்புப்பயிற்சிகள்

1. தமிழ்-ஆங்கில மொழிபெயர்ப்புப் பயிற்சிகள் -2.
2. ஆங்கிலம்-தமிழ் மொழிபெயர்ப்புப் பயிற்சிகள்-2.

பாட நூல்: கற்பகச்சோலை – தமிழ் ஏடு.

வெளியீடு: மொழிகள் துறை – தமிழ்ப்பிரிவு, கற்பகம் உயர்கல்விக்கழகம்.

Semester – II

4H – 4C

21ENU201

ENGLISH-II

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objective

This course enables the students to learn

- The grammar knowledge of the students to improvise their language.
- How to speak and write error free English.
- The different kinds of communication.
- How to develop knowledge on the business environment communication.
- How to develop their listening, speaking, reading and writing skills.
- Introducing literary works to the students to enhance their analytical and aesthetic skills.

Course Outcomes (COs)

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

1. Strengthen the foundation of the language to elevate the command of standard grammar.
2. Inculcate the proper communication strategy.
3. Formulate and communicate persuasive arguments for specific business outcome.
4. Apply fundamentals of language for reading, writing and effective communication.
5. Standardize and demonstrate understanding of LSRW skills.
6. Introduce literature to enhance the moral and aesthetic values.

UNIT –I – Grammar

Voice, Idioms and Phrases, Clauses and Reported Speech

UNIT –II –Business and Technical Reports

Business Correspondence – Memo, Notices, Agenda, Minutes- Resume Writing- Report Writing- Letter Writing- Personal and Social Letters- E-mail Writing.

UNIT –III – Communication Practice

Verbal and Non-Verbal Communication- Group Discussion and Seminars- Note-Taking and Note-Making.

UNIT –IV – LSRW Skills

Listening - Listening Talks and Presentations

Speaking - Public Speaking- Preparatory steps, Time Management, Handling Questions and Meeting unexpected situations

Reading - Language of Newspapers, Magazines and Internet

Writing - Writing Paragraphs and Essays- Content Writing

UNIT –V – Literature

Prose- Morals in the Indian Context by Francis Nicholas Chelliah

Poetry- Telephone Conversation by Wole Soyinka

Short Stories- The Last Leaf by O' Henry

SUGGESTED READINGS

1. Oxford Handbook of Writing: St. Martins Handbook of Writing 2013 CU Press
Sound Business, Julian Treasure 2012OUP.

Semester – II

21MMU201 DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS 4H – 4C

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- First order differential equations with constant coefficients.
- Variety of second order differential equations and methods needed to solve them.
- The basic concepts of partial differential equations.
- To solve partial differential equations using Charpit's method.
- Laplace transforms of some momentous functions.
- Applications of inverse Laplace transform in solving differential equations.

Course Outcomes (COs)

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

1. Solve first order differential equations of higher degree.
2. Evaluate Exact differential equations, Clairaut's form of equations and linear equations with constant coefficients.
3. Solve any partial differential equations and describe different integrals of partial differential equations.
4. Apply Charpit's method to solve some standard types of partial differential equations
5. Describe inverse Laplace transforms of periodic functions and solve O.D.E by using Laplace transforms.
6. Estimate integral using Laplace transforms.

UNIT I**DIFFERENTIAL EQUATIONS**

Introduction – First order ordinary differential equations – Types of first order ordinary differential equations – Applications of first order ordinary differential equations – first order ordinary differential equations of higher degree.

UNIT II**TYPES OF DIFFERENTIAL EQUATIONS**

Linear Second Order Equations with constant coefficient and particular integral of the functions of the type X^m , $e^{ax}\cos bx$ and $e^{ax}\sin bx$ only. Homogeneous linear equations with variable coefficients - Variation of parameters - Simultaneous Equations - Linear equations of the second order with variable coefficients.

UNIT III**PARTIAL DIFFERENTIAL EQUATIONS**

Forming a PDE-Lagrange Method of solving linear equations - Standard forms of PDE – Charpit's Method

UNIT IV**LAPLACE TRANSFORMS**

Definition – Laplace transform of standard functions – Elementary theorems – Laplace transform of periodic functions – problems.

UNIT V**INVERSE LAPLACE TRANSFORMS**

Standard formulae – Elementary theorems – Applications to second order linear differential equations – Applications to simultaneous linear differential equations – problems.

SUGGESTED READINGS

1. Narayanan. S & Manickavasagam Pillai. T.K., (2009). Differential Equations, S. Viswanathan Pvt. Ltd., Chennai.
2. Veerarajan.T., (2012). Transforms and Partial Differential Equations, Tata McGraw Hill Education Private Ltd., New Delhi.
3. Arumugam& Isaac., (2003). Differential Equations and Applications New Gamma Publishing House.
4. Raisinghania. M. D., (2018). Advanced Differential equations, S. Chand Publications, New Delhi
5. Vairaamanickam, Nirmala .K, Ratchagar.P. & Tamilselvan.T., (2011). Transforms and Partial Differential Equations, SciTech Publications Pvt. Ltd.

WEBSITE LINK:

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>
2. <https://ocw.mit.edu/courses/mathematics/18-03sc-differential-equations-fall-2011/unit-iii-fourier-series-and-laplace-transform/laplace-transform-basics>

21MMU202	ANALYTICAL GEOMETRY	Semester – II 4H – 4C
Instruction Hours / week: L: 4 T: 0 P: 0	Marks: Internal: 40	External: 60 Total: 100
End Semester Exam: 3 Hours		

Course Objectives

This course enables the students to learn

- Geometrical figures in two dimensions and three dimensions.
- Graph lines and interrelate all of the following: slopes, intercepts, tables of values and equations
- Identify and classify geometric shapes using correct mathematical language.
- System of spheres and coaxial system of spheres.
- Cone and cylinder concepts and quadratic surfaces.
- Shapes of conicoid and ruled surfaces.

Course Outcomes (COs)

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

1. Understand the basic concepts of straight lines.
2. Acquire knowledge of representing the system of spheres.
3. Mastery in the concepts of planes and its properties as 3-dimensional objects.
4. Understand the concepts of cone and cylinder.
5. Solving problems related to geometry of two dimensions and three dimensions.
6. Identify the real-world problems related to geometrical concepts.

UNIT I

STRAIGHT LINES

Straight lines- Equations of a straight line – Co planarity of two lines – Angle between a plane and a line – Projection of a line – Perpendicular drawn to a line – Shortest distance between two skew lines – Line intersecting a given line – Lines of intersection of three planes – Equations of two given skew lines – Surface generated by a straight line– Simple problems

UNIT II

SPHERE

Sphere: Standard equation of a sphere – Results based on the properties of a sphere – Tangent plane – Radical plane – Equation of a circle – Simple problems

UNIT III

SYSTEM OF SPHERES

Tangency of spheres- coaxial system of spheres- radical planes- Orthogonal spheres.

UNIT IV**CONE AND CYLINDER**

Cone and Cylinder: Equation of a cone – Cone and Quadric cone whose vertex is at the origin – Right circular cone – Equation of a cylinder – Right circular cylinder – Quadric surfaces -Simple problem

UNIT V**CONICOIDS**

Conicoid: Nature of conicoid – Standard equation of central conicoid – Enveloping cone - Tangent plane – Condition for tangency – Director sphere and director plane - Normal to a Conicoid – Ruled surface - Simple problem

SUGGESTED READINGS

1. Durai Pandian.P, Laxmi Duraipandian Muhilan D., (2000), Analytical Geometry, Emerald Publishers & Distributors
2. Bali.N.P., (2011). Golden Solid Geometry ,5 th Edition., Laxmi Publications (P) Ltd, New Delhi.
3. Manikavasagam Pillai.T., and Natarajan.T., (2007). A Text book of Analytical Geometry Part-I- Two dimensions, First Edition., Visvanathan.S Printers & Publications.
4. Khanna.M.L, (2007). Solid Geometry,Jai Prakash Nath & Co, Meerut.

WEBSITE LINK:

1. <http://172.16.25.76/course/view.php?id=1637>
2. <https://ocw.mit.edu/resources/res-18-006-calculus-revisited-single-variable-calculus-fall-2010/part-i-sets-functions-and-limits/lecture-1-analytic-geometry/>

21MMU203	Physics II	Semester – II 4H – 3C
Instruction Hours / week: L: 4 T: 0 P: 0	Marks: Internal: 40	External: 60 Total: 100
End Semester Exam: 3 Hours		

Course Objectives

This course enables the students to learn

- Basic knowledge on material properties.
- Magnetism and digital electronics.
- To educate and motivate the students in the field of science.
- The unit cell for some crystal structure, be able to draw the atomic packing arrangement for a specific crystallographic plane.
- The use of X-ray diffraction measurements in determining crystalline structures.
- The relation in between Electromagnetic theory.

Course Outcomes (COs)

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

1. Explain how physics applies to phenomena in the world around them.
2. Recognize how and when physics methods and principles can help address problems in their major and then apply those methods and principles to solve problems.
3. Study the theory of Photoelectric effect.
4. List different types of atomic spectra.
5. Understand the importance of Mosley's law and Bragg's law.
6. Understand the concept of digital electronics.

UNIT – I

Electrostatics: Coulombs law – electric field – lines of force - electric potential – electric flux-Gauss's law and its applications – potential – potential due to various charge distribution. Parallel plate capacitors - series plate capacitor– dielectrics- current –ohm's law- resistivity- conductivity- galvanometer – voltmeter – ammeter- potentiometer- comparison of EMF of a given cell.

UNIT - II

Magnetism: Introduction to magnet- Magnetic dipole-Earth as a magnet - Coloumb's inverse square Law- Magnetic field -Tangent Galvanometer – Deflection magnetometer - Tan A position- Tan B- Tan C - Comparison of magnetic moments - Biot Savart's law – B due to a solenoid – Magnetic properties of

matter – Dia, para and ferro - Cycle of magnetization – Hysteresis – B-H curve – Applications of B-H curve.

UNIT - III

Modern Physics: Einstein's Photoelectric effect- Einstein's photo electric equations- verification of Einstein's photo electric equation by Millican's experiment – photo electric cells – applications.

Wave Mechanics: Compton effect-matter waves-De-Broglie Hypothesis -characteristics and calculation of De Broglie wave length. Experimental study of De Broglie matter wave by G.P.Thomson experiment - Heisenberg's uncertainty principle- Applications-Schrödinger's equation- particle in a box.

UNIT-IV

Atomic and Nuclear Physics: Atom Models: Sommer field's and Vector atom Models – Pauli's exclusion Principle – Various quantum numbers and quantization of orbits. X-rays: Continuous and Characteristic X-rays – Mosley's Law and importance – Bragg's Law.

Nuclear forces –characteristics - nuclear structure by liquid drop model – Binding energy – mass defect – Shell Model- particle accelerators – cyclotron and betatron – nuclear Fission and nuclear Fusion.

UNIT - V

Digital Electronics: Decimal – binary – octal and hexadecimal numbers– their representation, inter-conversion, addition and subtraction, negative numbers. Sum of products – product of sums – their conversion – Simplification of Boolean expressions - Basic logic gates – AND, OR, NOT, NAND, NOR and EXOR gates – NAND and NOR as universal building gates – Boolean Algebra – Laws of Boolean Algebra – De Morgan's Theorems – Their verifications using truth tables.

SUGGESTED READINGS

1. Narayanamurthi, Electricity and Magnetism.,(1988). The National Publishing Co, First edition,
2. Rajam.J.B.,(1990). Atomic Physics., S. Chand & Company Limited, New Delhi, First edition,
3. Srivastava.B.N.,(2005). Basic Nuclear Physic, Pragati Prakashan, Meerut,
4. Albert Paul Malvino.,(2002). Digital principles and Applications, McGraw-Hill International Editions,New York,
5. Digital fundamentals – by Floyd 8th edition Pearson education.
6. Sedha,R.S.,(2004). A text book of Digital Electronics, S. Chand & Co, New Delhi, First edition,

Semester – II

21MMU211

**DIFFERENTIAL EQUATIONS AND
LAPLACE TRANSFORMS- PRACTICAL**

3H – 2C

Instruction Hours / week: L: 0 T: 0 P: 3

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Problem-solving through programming.
- Hands-on training using lab components.
- Plotting of second order solution of differential equations and recursive sequences.
- Cauchy's root test and Ratio test by plotting the ratio.
- The exponential growth and decay, the population growth of species or the change in investment return over time.
- The usage of program to solve the differential equations.

Course Outcomes (COs)

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

1. Demonstrate comprehension in fundamental topics of computing, algorithms, computer organization and software systems.
2. Have applied knowledge of areas of computing to create solutions to challenging problems, including specify, design, implement and validate solutions for new problems.
3. Be aware of current research activity in computing through activities including reading papers, hearing research presentations.
4. Know about successfully planning and completing an individual research project in computing or its application.
5. Understand Cauchy's root test and Ratio test by plotting the ratio.
6. Acquire the knowledge on Growth model and Decay model.

LIST OF PRACTICAL (ANY 8 PROGRAMS)

1. Plotting of second order solution family of differential equation.
2. Growth model (exponential case only).
3. Decay model (exponential case only).
4. Lake pollution model (with constant/seasonal flow and pollution concentration).
5. Case of single cold pill and a course of cold pills.
6. Limited growth of population (with and without harvesting).
7. Predatory-prey model (basic Volterra model, with density dependence, effect of DDT, two

- prey one predator).
8. Plotting of recursive sequences.
 9. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.
 10. Study the convergence/divergence of infinite series by plotting their sequences of partial sum.
 11. Cauchy's root test by plotting n^{th} roots.
 12. Ratio test by plotting the ratio of n^{th} and $(n+1)^{\text{th}}$ term.

SUGGESTED READINGS:

1. LAB Manual.
2. Kirani Singh. Y & Chaudhuri. B.B., (2008). MATLAB Programming, Prentice-Hall of India Pvt. Ltd, New Delhi.
3. Desmond. J. Higham & Nicholas J. Higham., (2005). MATLAB Guide MATLAB Guide, MATLAB Guide, 2nd edition, SIAM.
4. Hema Ramachandran, Achuthsankar S. Nair, Computer SCILAB—A Free Software to MATLAB, First Edition, S. Chand & Company Ltd, New Delhi.

WEBSITE LINK:

1. <http://spoken-tutorial.org/>
2. <http://wiki.scilab.org/Tutorialsarchives>
3. <https://www.scilab.org/tutorials>

Semester – II

4H – 2C

21MMU212

Physics II-Practical

Instruction Hours / week: L: 0 T: 0 P: 4

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objective

This course enables the students to learn

- The concepts in integrated chips.
- The optical and electronic properties of solids through experimentations.
- The usage of electrical and optical systems for various measurements.
- The intellectual communication skills and discuss the basic principles of scientific concepts in a group.
- The physical Principles and applications of Electronics.
- The various procedures and techniques for the experiments.

Course Outcomes (COs)

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

1. Perform basic experiments in mechanics, heat and electricity and analyze the data.
2. Acquire engineering skills and Practical knowledge, which help the student in their everyday life.
3. Know the physical Principles and applications of Electronics.
4. Apply the various procedures and techniques for the experiments.
5. Apply the mathematical concepts/equations to obtain quantitative results.
6. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

Any 8 Experiments

1. Determine the magnetic dipole moment (m) of a bar magnet - Tan A
2. Determine the magnetic dipole moment (m) of a bar magnet - Tan B
3. Circular coil- Vibration magnetometer
4. Moment of a magnet-Circular coil-Deflection Magnetometer
5. Study of logic gates using IC's.

6. Study of NOR gate as Universal building block.
7. Study of NAND gate as Universal building block.
8. Verification of Basic logic gates using discrete components.
9. Tangent galvanometer
10. Comparison of EMF of two given cell.

SUGGESTED READINGS

1. Ouseph C.C., U.J. Rao and V. Vijayendran., (2007). Practical Physics and Electronics, S.Viswanathan (Printers & Publishers) Pvt. Ltd., Chennai
2. Singh S.P., (2003). Advanced Practical Physics – 1, 13th Edition, Pragathi Prakashan, Meerut
3. Singh S.P., (2000). Advanced Practical Physics – 2, 12th Edition, Pragathi Prakashan, Meerut

21AEC201	ENVIRONMENTAL STUDIES	Semester – II 3H – 3C
Instruction Hours / week: L: 3 T: 0 P: 0	Marks: Internal: 40	External: 60 Total: 100 End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The awareness about environmental problems among people.
- About various renewable and nonrenewable resources of the region.
- The appropriate judgments and decisions for the protection and improvement of the earth.
- The concept of Environmental Pollution, effects and control measures of urban and industrial wastes.
- About the concepts of Social Issues and the Environment.
- The causes and effects of Environmental pollution.

Course Outcomes (COs)

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

1. Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
2. Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
4. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
5. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
6. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

UNIT I

INTRODUCTION - ENVIRONMENTAL STUDIES & ECOSYSTEMS

Environment Definition -Scope and importance; Ecosystem - Structure and functions of ecosystem. Energy flow - Food chains and food webs - Ecological succession. Classification of ecosystem. Forest ecosystem - Grassland Ecosystem - Desert ecosystem - Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT II**NATURAL RESOURCES - RENEWABLE AND NON-RENEWABLE RESOURCES**

Natural resources - Renewable and Non – Renewable resources. Land resources and land use change, Land degradation, soil erosion and desertification. Forest resources - Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water resources - Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water. Use of alternate energy sources, growing energy needs, case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT III**BIODIVERSITY AND ITS CONSERVATION**

Levels of biological diversity - Genetic - Species and ecosystem diversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. Bio-geographical classification of India. Biodiversity patterns (global, National and local levels). Hot-spots of biodiversity. India as a mega-diversity nation. Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT IV**ENVIRONMENTAL POLLUTION**

Definition - Causes - Effects and control measures of Air pollution - Water pollution - Soil pollution - Noise pollution. Nuclear hazards and human health risks. Solid waste management and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Case studies.

UNIT V**SOCIAL ISSUES AND THE ENVIRONMENT**

Concept of sustainability and sustainable development. Water conservation - Rain water harvesting, watershed management. Climate change, global warming, ozone layer depletion, acid rain and its impacts on human communities and agriculture. Environment Laws (Environment Protection Act, Air Act, Water Act, Wildlife Protection Act, Forest Conservation Act). International agreements (Montreal and Kyoto protocols). Resettlement and rehabilitation of project affected persons. Disaster management (floods, earthquake, cyclones and landslides). Environmental Movements (Chipko, Silent valley, Bishnois of Rajasthan). Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi). Human population growth: Impacts on environment, human health and welfare.

SUGGESTED READINGS

1. Anonymous.,(2004). A text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research, New Delhi.
2. Anubha Kaushik., and Kaushik, C.P.,(2004). Perspectives in Environmental Studies. New Age International Pvt. Ltd. Publications, New Delhi.
3. Arvind Kumar., (2004). A Textbook of Environmental Science. APH Publishing Corporation, New Delhi.
4. Daniel, B. Botkin., and Edward, A. Keller.,(1995). Environmental Science John Wiley and Sons, Inc., New York.
5. Mishra, D.D.,(2010). Fundamental Concepts in Environmental Studies. S.Chand & Company Pvt. Ltd., New Delhi.
6. Odum, E.P., Odum, H.T. and Andrews, J.,(1971). Fundamentals of Ecology. Philadelphia: Saunders.
7. Rajagopalan, R.,(2016). Environmental Studies: From Crisis to Cure, Oxford University Press.
8. Sing, J.S., Sing. S.P. and Gupta, S.R.,(2014). Ecology, Environmental Science and Conservation. S. Chand & Publishing Company, New Delhi.
9. Singh, M.P., Singh, B.S., and Soma, S. Dey.,(2004). Conservation of Biodiversity and Natural Resources. Daya Publishing House, New Delhi.
10. Tripathy. S.N., and Sunakar Panda., (2004). Fundamentals of Environmental Studies (2nded.). Vrianda Publications Private Ltd, New Delhi.
11. Verma, P.S., and Agarwal V.K.,(2001). Environmental Biology (Principles of Ecology). S. Chand and Company Ltd, New Delhi.
12. Uberoi, N.K.,(2005). Environmental Studies. Excel Books Publications, New Delhi.

21MMU301	STATISTICS	Semester – III 5H – 5C
Instruction Hours / week: L: 5 T: 0 P: 0	Marks: Internal: 40	External: 60 Total: 100 End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The basic concepts of primary data and secondary data.
- Basic concepts in central tendency and statistical measures
- Commonly used probability distributions (both discrete and continuous)
- Central Limit theorem and their applications in various disciplines.
- To analyze forces and moments in two and three dimensions due to concentrated and distributed forces in various systems such as beams, frames and trusses.
- To understand the procedure for analysis of static objects; concepts of force, moment, and mechanical equilibrium.

Course Outcomes (COs)

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

1. Perform in primary and secondary data and illustrate in Bar and Pie diagrams.
2. Evaluate the mean, median and mode of any given data also evaluate quartiles and deviations.
3. Describe the Correlation, Rank Correlation and Regression of two variables.
4. Understand the basic concept of test of significance of z-test, t-test and chi-square test.
5. Compute probabilities and conditional probabilities in appropriate ways.
6. Derive the Binomial and Poisson distribution.

UNIT I

BASICS OF STATISTICS AND UNI VARIATE ANALYSIS

Meaning and definition of statistics - Frequency Distribution, Concepts of measurement, scales of measurement of data, Different types scales (ratio, interval, nominal and ordinal); Measures of central tendency: Arithmetic Mean, Median, Mode. Measures of dispersion – Range, Coefficient of range, - Quartile deviation - Coefficient of Quartile deviation - Standard deviation and Coefficient of variation

UNIT II

BIVARIATE ANALYSIS

Correlation – Meaning and definition - Scatter diagram –Karl Pearson’s Correlation Coefficient. Rank Correlation. Regression: Regression in two variables – Properties of Regression, uses of Regression.

UNIT III**BASICS OF PROBABILITY AND DISCRETE PROBABILITY DISTRIBUTIONS**

Trial, event -Sample space - Mutually exclusive event - Exclusive and exhaustive events - Dependent and independent events - Simple and compound events - Mathematical properties -Probability axioms - Addition and multiplication theorem - Real random variables (discrete and continuous) - Mathematical expectation - Binomial distribution - Poisson distribution and its properties.

UNIT IV**CONTINUOUS DISTRIBUTIONS**

Central Limit theorem, Uniform distribution - Normal distribution - conditions and properties, Standard normal distribution - Exponential distribution.

UNIT V**INTRODUCTION TO DATA ANALYTICS**

Problem definition, Data pre-processing; model building; Diagnostics and Validation, Simple linear regression: Coefficient of determination, Significance tests for predictor variables, Residual analysis, Confidence and Prediction intervals.

SUGGESTED READINGS

1. Gupta S.P.,(2021). Statistical Methods, 46th Edition., Sultan Chand & Sons, New Delhi.
2. Srivastava T.N., and Shailaja Rego., (2016). Statistics for Management,3e., McGraw Hill Education, New Delhi.
3. U Dinesh Kumar., (2021). Business Analytics: The Science of Data - Driven Decision Making, Wiley, New Delhi.
4. Sheldon Ross., (2019). Introduction to Probability Model, 12th Edition, Academic Press, Indian Reprint.
5. R. Evans James., (2019). Business Analytics, 3rd edition, Pearson Education, New Delhi.
6. Pillai R.S.N., and Bagavathi V., (2019). Statistics ,8th Edition., S. Chand & Company Ltd, New Delhi.
7. Arora.P.N., (2008). A foundation course statistic, S. Chand & Company Ltd, New Delhi.

WEBSITE LINK:

1. <https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/>
2. https://www.youtube.com/watch?v=COI0BUmNHT8&list=PLyqSpQzTE6M_JcleDbrVyP_nE0PixKs2JE
3. <https://nptel.ac.in/courses/110107114/>
4. <http://172.16.25.76/course/view.php?id=1642>

21MMU302	MECHANICS	Semester – III 7H – 6C
Instruction Hours / week: L: 6 T: 1 P: 0	Marks: Internal: 40	External: 60 Total: 100
End Semester Exam: 3 Hours		

Course Objectives

This course enables the students to learn

- Key concepts of mechanics
- Momentous role of various forces in the motion of particles.
- The basic concepts of energy and its relationship with derivatives
- The application of geometric and trigonometric properties in fluid
- Importance of Newton's law of motion.
- To visualize mathematical formulation of real-life issues

Course Outcomes (COs)

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

1. Mastery in the concept of forces and its properties
2. Expertise in moment of inertia.
3. Calculate moments of force.
4. Understand the concept stream line and path lines
5. Inspect the harmonic motions in straight line and two parallel lines and also express the simple and compound problem.
6. Apply the impact of an elastic sphere with a smooth fixed plane

UNIT I

BASIC CONCEPTS AND PRINCIPLES

Basic Concepts and Principles - Forces acting at a Point - Lami's Theorem and Applications - Parallel Forces - Like and Unlike Parallel Forces - Moment of a force - Couples– Related problems- Equilibrium of Three Forces acting on a rigid body - Friction - Laws of Friction -Angle of Friction - Cone of Friction - Properties and related problems.

UNIT II

MOMENTS

Definition of rigid body-Condition of rigidity- Moments and products of inertia of standard bodies- Momental ellipsoid- Principal axes- principal moments of inertia-Linear momentum and angular momentum about any point- Equations of motion in terms of linear and angular momenta- Motion of a

rigid body with a fixed point- Existence of an angular velocity- Euler's dynamical equations - the motion under no forces.

UNIT III

FORCE AND ENERGY

Conservative force field - Conservation for mechanical energy - Work energy equation-Kinetic Energy- Work kinetic energy - Moment of momentum equation -Translation - Rotation of rigid bodies - Chasles' theorem - General relationship between time derivatives of a vector for different references - Relationship between velocities of a particle for different references-Acceleration of particle for different references.

UNIT IV

STREAM AND PATH LINES

Kinematics - kinetics of motion- Expressions for velocity and acceleration in Cartesian- polar -Intrinsic coordinates- Motion in a vertical circle- Boundary surface- Streamlines-path lines-Velocity potential- Rotational and irrotational motion- Vorticity vector and vortex lines.

UNIT V

MOTIONS IN A PLANE

Velocity and acceleration of a particle along a curve- radial and transverse components (plane and curve) - tangential and normal components (space curve)-Newton's law of motion- Simple pendulum-Harmonic motion- Projectile motion- Cycloidal motion.

SUGGESTED READINGS

1. Venkataraman.M.K., (2004). Statics, Agasthiar Publications, Trichy.
2. Michel Rieutord., (2015). Fluid Dynamics an Introduction, Springer.
3. Loney, S. L., (2015). An elementary treatise on Statics, Kalyani Publishers, New Delhi.
4. Hibbeler R.C. and Ashok Gupta.,(2013). Engineering Mechanics: Statics and Dynamics, Eleventh Edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
5. Srivastava.P.L., (1964). Elementary Dynamics. Ram Narain Lal, Beni Prasad Publishers Allahabad.

WEBSITE LINK:

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>
2. <http://vidyamitra.inflibnet.ac.in/index.php/search?subject%5B%5D=&course%5B%5D=Mechanics&domain%5B%5D=Physical+%26+Basic+Sciences>
3. <https://www.youtube.com/watch?v=u5yywGvUHYM>
4. <http://172.16.25.76/course/view.php?id=1651>

Semester – III
6H – 4C

21MMU303A

MULTIVARIATE CALCULUS

Instruction Hours / week: L: 4 T: 2 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The basics concept of functions of several variables.
- Extrema of functions with the help of multipliers
- Applications of multiple integration in rectangular region
- Integral calculus for functions of more than one variable.
- Basic concepts of vector field
- The mathematical tools and methods are used extensively in the physical sciences, engineering and economics.

Course Outcomes (COs)

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

1. Understand the functions of several variables.
2. Find extrema of functions of two variables.
3. Use multiple integration and its applications.
4. Know about the change of variables in double integrals and triple integrals
5. Synthesize the key concepts of line integrals and its applications.
6. Apply the knowledge of Green's theorem and Stoke's theorem

UNIT I**FUNCTIONS OF SEVERAL VARIABLES**

Limit and continuity of functions of two variables - Partial differentiation - Total differentiability and differentiability - Sufficient condition for differentiability. Chain rule for one and two independent parameters - Directional derivatives - The gradient - Maximal and normal property of the gradient - Tangent planes.

UNIT II**EXTREMA OF FUNCTIONS OF TWO VARIABLES**

Method of Lagrange multipliers - Constrained optimization problems - Definition of vector field - Divergence and curl.

UNIT III**DOUBLE INTEGRATION OVER RECTANGULAR REGION**

Double integration over non-rectangular region - Double integrals in polar co-ordinates - Triple integrals - Triple integral over a parallelepiped and solid regions. Volume by triple integrals - Cylindrical and spherical co-ordinates. Change of variables in double integrals and triple integrals

UNIT IV**LINE INTEGRALS**

Applications of line integrals - Mass and Work. Fundamental theorem for line integrals - Conservative vector fields - Independence of path.

UNIT V**GREEN'S THEOREM**

Surface integrals - Integrals over parametrically defined surfaces. Stoke's theorem - The Divergence theorem.

SUGGESTED READINGS

1. Strauss M.J., Bradley G.L. and Smith K. J., (2007). Calculus, Third Edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
2. Thomas G.B., and Finney R.L., (2005). Calculus, Ninth Edition, Pearson Education, Delhi.
3. Marsden E., Tromba A.J. and Weinstein A., (2005). Basic Multivariable Calculus, Springer (SIE), Indian reprint, New Delhi.
4. James Stewart., (2018). Multivariable Calculus, Concepts and Contexts, Second Edition, Brooks Cole, Thomson Learning, USA.

WEBSITE LINK:

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>
2. <http://vidyamitra.inflibnet.ac.in/index.php/content/index/5704c5378ae36c6ab9b0b297>
3. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>
4. <http://172.16.25.76/course/view.php?id=1643>

21MMU303B

COMPUTER GRAPHICS

Semester – III

6H – 4C

Instruction Hours / week: L: 4 T: 2 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The scope of this course is to provide students with distinguished knowledge in the field of two- and three-dimensional computer graphics for Animation.
- Different hardware used for graphical requirement.
- How to display 3D objects in a 2D display devices using projection techniques.
- How to create realistic images using color and shading techniques.
- Computer Animation and Design of Animation Sequences.
- Designing and implementing practical graphic solutions to challenging problems in different application domains.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Transfer to the students the skills required for designing and implementing practical graphic solutions to challenging problems in different application domains and make them a competent product.
2. Understand different hardware used for graphical requirement.
3. Perform visual computations for geometrical drawings.
4. Display 3D objects in a 2D display devices using projection techniques.
5. Create realistic images using color and shading techniques.
6. Developed Computer Animation and Design of Animation Sequences.

UNIT I**A SURVEY OF COMPUTER GRAPHICS**

A Survey of Computer Graphics - Video Display Devices - Refresh Cathode Ray Tubes - Raster Scan Displays - Random Scan Displays - Color CRT Monitors - Direct –View Storage Tubes - Flat Panel Displays – Three Dimensional Viewing Devices – Raster Scan and Random Scan graphic storages Displays processors and Character generators, color display techniques.

UNIT II**INPUT DEVICES:**

Keyboards - Mouse –Track Ball and Space ball – Joysticks - Data Glove – Digitizers - Image Scanners - Touch Panels - Light Pens - Voice Systems. Hard Copy Devices: Printers and Plotters, Interactive input/output devices. Point, Lines And Curves : Scan conversion, Line Drawing Algorithms: DDA

Algorithm - Bresenham's Line Algorithm. Circle Generating Algorithms: Mid-Point Circle Algorithm, Ellipse Generating Algorithm, Conic-section generation, polygon filling anti-aliasing.

UNIT III

TWO DIMENSIONAL GEOMETRIC TRANSFORMATIONS

Basic Transformations: Translation – Rotation – Scaling - Composite Transformations: Translations – Rotations - Scalings. General Pivot Point Rotation - General Fixed Point Scaling. Two – Dimensional Viewing: The Viewing Pipeline - Window to viewport Transformation - Clipping Operations: Point Clipping - Line Clipping Algorithms- Cohen Sutherland Line Clipping - Polygon Clipping: Sutherland – Hodgeman Polygon Clipping Algorithm - Text Clipping.

UNIT IV

THREE-DIMENSIONAL CONCEPTS

Three – Dimensional Display methods, Three – Dimensional Transformations: Translation – Rotation – Scaling, Three Dimensional viewing: Viewing pipeline - Viewing coordinates - Parallel Projection – . Perspective Projections.

UNIT V

VISIBLE SURFACE DETECTION METHODS

Classification of Visible Surface Detection Algorithms - Back Face Detection - Depth Buffer Method - Area Sub division Method. Computer Animation: Design of Animation Sequences-General Computer Animation functions – Raster Animations – Computer animation Languages – Key Frame Systems – Motion Specifications.

SUGGESTED READINGS

1. Donald Hearn and M. Pauline Baker., (2010). Computer Graphics - C Version, Second Edition, Pearson Education, New Delhi.
2. Amarendra N. Sinha., (2008). Computer Graphics, First Edition, Tata McGraw Hill, New Delhi.
3. Foley, Vandan, Feiner and Hughes., (1999). Computer Graphics Principles and Practices, Second Edition, Addison Wesley, Singapore.
4. Zhigang Xiang and Roy A. Plastock., (2002). Theory and Problems of Computer Graphics, Second Edition, Tata McGraw-Hill publishers, New Delhi.
5. William M. Newman and Robert F. Sproull., (2007). Principles of Interactive Computer Graphics, Second Edition, Tata McGraw-Hill Publishers, New Delhi.
6. Rogers D.F., (2001). Procedural Elements in Computer Graphics, Second Edition, McGraw Hill Book Company, New Delhi.

7. Rogers D.F., Adams A.J., (1990). Mathematical Elements in Computer Graphics, Second Edition, McGraw Hill Book Company, New Delhi.

WEBSITE LINK:

1. http://www.fileformat.info/mirror/egff/ch02_01.html
2. <http://www.rw-designer.com/how-to>
3. http://en.wikipedia.org/wiki/3D_computer_graphics

Semester – III

21MMU304 OBJECT ORIENTED PROGRAMMING USING C++

4H – 3C

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- How C++ improves C with object-oriented feature.
- The syntax and semantics of classes in C++ programming language.
- How to perform operator overloading and inheritance.
- How to design C++ using pointers.
- The file handling in C++.
- To translate the computer algorithms to computer programs

Course Outcomes (COs)

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

1. Understand the difference between top-down and bottom-up approach.
2. Apply the concepts of object-oriented programming in constructor and destructor.
3. Understand how to apply the major object-oriented concepts to implement inheritance and polymorphism.
4. Apply pointer concepts in C++
5. Use the concepts of preprocessor directives and macros.
6. Understand the concept of Differentiating between static and dynamic memory allocation.

UNIT I**INTRODUCTION**

Principles of object-oriented programming: Basic concepts of object-oriented programming – Benefits of OOP – Applications of OOPs – Structure of C++ Program C++ Tokens – Control Statement – Decision Making Statements- Loop Statements - Inline Functions – Friend Function - Function Overloading.

UNIT II**CONTROL STRUCTURE, FUNCTIONS AND CONSTRUCTORS**

Classes and Objects: Specifying a class – Creating Objects – Accessing Class Members – Defining Member Functions – Static Data Members – Static Member Functions - Array of Objects – Friend Functions. Constructors and Destructors: - Constructors – Parameterized Constructors - Multiple Constructors in a Class – Constructors with Default Arguments - Copy Constructor - Dynamic Constructor – Destructors.

UNIT III**OPERATOR OVERLOADING AND INHERITANCE**

Operator overloading: Defining operator overloading – overloading unary operators – overloading binary operators – overloading binary operators using friends – type conversions. Inheritance: - Inheritance – defining derived classes – single, multilevel, multiple, hierarchical inheritance- hybrid inheritance – virtual base classes – abstract classes.

UNIT IV**POINTERS AND I/O OPERATIONS**

Pointers: Pointers to objects – this pointer – pointers to derived classes – virtual functions- Pure Virtual Functions. Managing console I/O operations:- C++ streams – C++ stream classes – unformatted I/O operations – formatted console I/O operations – Managing output with manipulators.

UNIT V**FILE MANAGEMENT**

Files - Classes for file stream operations – Opening and Closing a file – sequential input and output operations – updating a file random access – Command Line Arguments. Templates and Exceptions: - Templates – class templates – function templates – member function templates – exception handling.

SUGGESTED READINGS

1. Antonio Mallia, Francesco Zoffoli.,(2019). C++ Fundamentals, Packt Publishing, Ltd.
2. Joel Murach., Mary Delamater, (2018). C++ Programming ,Mike Murach & Associates Inc.
3. Bjarne Stroustrup., (2014). Programming - Principles and Practice using C++, 2nd Edition, Addison-Wesley.
4. Stefan Bjornander., (2016). C++ Windows Programming, Published by Packt Publishing Ltd.
5. Harry, H. Chaudhary., (2014). Head First C++ Programming: The Definitive Beginner's Guide, First Create space Inc, O-D Publishing, LLC USA.
6. Debasish Jana., (2014). C++ And Object-Oriented Programming Paradigm, Published by PHI Learning Pvt. Ltd
7. Richard L. Stegman., (2016). Focus on Object-oriented Programming with C++, 6th Edition, CreateSpace Independent Publishing Platform.

WEBSITES

1. www.programmingsimplified.com
2. [www.programiz.com / cpp-programming](http://www.programiz.com/cpp-programming)
3. www.cplusplus.com
4. www.learncpp.com
5. www.udemy.com
6. <https://nptel.ac.in/courses/106101208/>

LMS

<http://172.16.13.33/course/view.php?id=599>

Semester – III

4H – 2C

21MMU311

STATISTICS - PRACTICAL

Instruction Hours / week: L: 0 T: 0 P: 4

Marks: Internal: 40

External: 60 Total: 100
End Semester Exam: 3 Hours**Course Objectives**

This course enables the students to learn

- It is well recognized nowadays the importance of statistics as an indispensable tool for obtaining information.
- Importance has been enhanced by the use of computational resources and particularly the software SPSS, to be an effective tool for analyzing statistical data.
- Ability to use SPSS in handling data and performing statistical analysis, and to interpret the outputs of the program.
- Acquiring sensitivity and critical thinking towards arguments and conclusions based on statistical studies.
- Understanding the fundamental principles of statistical reasoning; ability to perform statistical analysis.
- Selecting the most appropriate techniques and methods for collecting and processing statistical data and also to recognize some of the pitfalls associated with statistical analysis.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Describe and classify data using statistical terminology.
2. Use SPSS package, to find mean, mode, median for large volume of data.
3. Use SPSS package, to find Variance and Standard Deviation for large volume of data and also can compare the results for two groups.
4. Calculate the Karl Pearson correlation coefficient and interpret the SPSS output.
5. Calculate the rank correlation coefficient in unpaired and tied ranks.
6. Calculate the regression coefficients and know how to find the dependency between the variables.

List of Practical

1. Introduction to SPSS Software Package for Data Analysis
2. Drawing of graphs and diagrams for both discrete and continuous data
3. Calculation of Mean, Median and Mode for ungrouped data
4. Calculation of Mean, Median and Mode for grouped data
5. Calculation of Harmonic mean and Geometric mean for grouped data
6. Calculation of Standard deviation and Variation for ungrouped data
7. Calculation of Standard deviation and Variation for grouped data
8. Calculation of Karl Pearson's Correlation for bivariate data
9. Calculation of Rank Correlation Coefficient for bivariate data
10. Fitting of Linear Regression

SUGGESTED READINGS

1. SPSS Lab Manual
2. U Dinesh Kumar (2017), Business Analytics: The Science of Data - Driven Decision Making, Wiley, New Delhi.
3. Daniel Y Chen (2017), Pandas for everyone - Python data Analysis,
4. R. Evans James (2017), Business Analytics, 2nd edition, Pearson Education, New Delhi.

Semester – III

21MMU312 OBJECT ORIENTED PROGRAMMING USING C++ - PRACTICAL 4H – 2C**Instruction Hours / week: L: 0 T: 0 P: 4****Marks: Internal: 40****External: 60 Total: 100****End Semester Exam: 3 Hours****Course Objectives**

This course enables the students to learn

- About the basic concepts of C ++.
- How C++ improves C with object-oriented feature.
- The syntax and semantics of classes in C++ programming language.
- How to perform operator overloading and inheritance.
- How to design C++ using pointers.
- File handling in C++.

Course Outcomes (COs)

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

1. Understand the difference between top-down and bottom-up approach.
2. Apply the concepts of object-oriented programming in constructor and destructor.
3. Understand how to apply the major object-oriented concepts to implement inheritance and polymorphism.
4. Apply pointer concepts in C++.
5. Use the concepts of preprocessor directives and macros.
6. Write a program to demonstrate the try, catch block in C++.

List of Programs

1. Write a C++ program to print sum of digits.
2. Write a C++ program to check palindrome number.
3. Write a program to swap numbers using friend function.
4. Write a program to perform multiplication of two matrices using operator overloading.
5. Write a program that will read 10 integers from user and store them in an array. Implement array using pointers.
6. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main () function.

7. Create the Person class. Create some objects of this class (by taking information from the user). Inherit the class Person to create two classes Teacher and Student class. Maintain the respective information in the classes and create, display and delete objects of these two classes (Use Runtime Polymorphism).
8. Write a C++ Program to store GPA of n number of students and display it where n is the number of students entered by user (Memory Management).
9. Write a program to demonstrate the try, catch block in C++
10. Write a C++ program that uses a single file for both reading and writing the data.

SUGGESTED READINGS

1. Antonio Mallia, Francesco Zoffoli., (2019). C++ Fundamentals, Packt Publishing, Ltd.
2. Joel Murach., Mary Delamater., (2018). C++ Programming ,Mike Murach & Associates Inc.
3. Bjarne Stroustrup., (2014). Programming - Principles and Practice using C++, 2nd Edition, Addison-Wesley.
4. Stefan Bjornander., (2016). C++ Windows Programming, Published by Packt Publishing Ltd.
5. Harry, H. Chaudhary., (2014). Head First C++ Programming: The Definitive Beginner's Guide, First Create space Inc, O-D Publishing, LLC USA.
6. Debasish Jana., (2014). C++ And Object-Oriented Programming Paradigm, Published by PHI Learning Pvt. Ltd
7. Richard L. Stegman., (2016). Focus on Object-oriented Programming with C++, 6th Edition, CreateSpace Independent Publishing Platform.

WEBSITES

1. www.programmingsimplified.com
2. [www.programiz.com / cpp-programming](http://www.programiz.com/cpp-programming)
3. www.cplusplus.com
4. www.learncpp.com
5. www.udemy.com

Semester – IV
5H – 5C

21MMU401

NUMERICAL METHODS

Instruction Hours / week: L: 5 T: 0 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- To solve the algebraic and transcendental equations numerically.
- Momentous methods to solve the system of equations.
- Solving difference method of equations.
- Solve interpolation problems
- Solve forward and backward difference equations in unequal interval scenario
- Solve engineering problems which are impossible to solve by analytical means.

Course Outcomes (COs)

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

1. Solve the algebraic and transcendental equations.
2. Evaluate the solution of simultaneous linear algebraic equations.
3. Relate the forward and backward differences and its operators.
4. Apply the Newton forward, backward and divided differences.
5. Proficiency in inverse interpolations
6. Solve many physical problems using numerical methods.

UNIT I**THE SOLUTION OF NUMERICAL ALGEBRAIC AND TRANSCENDENTAL EQUATIONS**

Bisection method – Iteration Method – Convergence condition – Regula Falsi Method – Newton Raphson method - Convergence – Order of Convergence.

UNIT II**SOLUTION OF SIMULTANEOUS LINEAR ALGEBRAIC EQUATIONS**

Introduction - Gauss elimination method – Gauss Jordan method – Method of Triangularization – Gauss Jacobi method – Gauss Seidel method

UNIT III**FINITE DIFFERENCES**

Differences – operators – forward and backward difference tables – Differences of a polynomial – Factorial polynomial – Error propagation in difference table.

UNIT IV**INTERPOLATION (FOR EQUAL INTERVALS)**

Newton's forward and backward formulae – equidistant terms with one or more missing values – Central differences and central difference table – Gauss forward and backward formulae – Stirling's formula.

UNIT V**INTERPOLATION (FOR UNEQUAL INTERVALS)**

Divided differences – Properties – Relations between divided differences and forward differences – Newton's divided differences formula – Lagrange's formula and inverse interpolation.

SUGGESTED READINGS

1. Kandasamy. P, Thilagavathi. K and Gunavathi. K., (2007). "Numerical methods" – S. Chand and Company Ltd, New Delhi – Revised Edition (Chapters: 3,4,5,6,7 and 8).
2. Sankara Rao K., (2018). "Numerical Methods for Scientists and Engineers" 4th Edition Prentice Hall India.
3. Jain. M.K., Iyengar. S.R.K., and Jain R.K., (2016). Numerical Methods for Scientific and Engineering Computation, 6th Edition., New Age International Publishers, New Delhi.
4. Bradie B., (2007). A Friendly Introduction to Numerical Analysis, Pearson Education, India,
5. Gerald C.F., and Wheatley P.O., (2006). Applied Numerical Analysis, 7th Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi.

WEBSITE LINK:

1. <http://youtube.be/TfG12TeKyqY>
2. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>
3. <http://vidyamitra.inflibnet.ac.in/index.php/search?subject%5B%5D=&course%5B%5D=Numerical+analysis&domain%5B%5D=Physical+%26+Basic+Sciences>
4. <http://172.16.25.76/course/view.php?id=1648>

Semester – IV
7H – 6C

21MMU402

DISCRETE MATHEMATICS

Instruction Hours / week: L: 6 T: 1 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Fundamental concepts of mathematical logic.
- Normal forms and its properties.
- In-depth concepts of relations and functions.
- Semi groups and formal languages.
- Lattice and its algebraic properties.
- The concept of direct product and homomorphism

Course Outcomes (COs)

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

1. Express a logic sentence in terms of predicate and logical connectives.
2. Communicate various concepts of mathematics effectively.
3. Acquire the concept of relations and functions.
4. Understand the importance of algebraic concepts in formal languages.
5. Understand the concepts of the lattice with applications.
6. Acquire knowledge of some momentous mathematical algebraic structures

UNIT I**MATHEMATICAL LOGIC**

Connections well-formed formulas, Tautology, Equivalence of formulas, Tautological implications, Duality law, Normal forms, Predicates, Variables, Quantifiers, Free and bound Variables. Theory of inference for predicate calculus.

UNIT II**NORMAL FORMS**

Normal Forms – Disjunctive Normal Forms – Conjunctive Normal Forms Principal Disjunctive Normal Forms – Principal Conjunctive Normal Forms - Ordering and Uniqueness of Normal Forms – The Theory of Inference for the Statement Calculus – Validity using Truth tables - Rules of Inference - Consistency of premises and indirect method of proof.

UNIT III**RELATIONS AND FUNCTIONS**

Composition of relations, Composition of functions, Inverse functions, one-to-one, onto, one-to-one & onto, onto functions, Hashing functions, Permutation function, Growth of functions, Relations, Properties of binary relation in a set

UNIT IV**SEMI GROUPS AND FORMAL LANGUAGES**

Algebraic systems – Definition & Examples – Semi groups and monoids – definition and examples – homomorphism of semi groups & monoids – sub semi groups & sub monoids – Grammars – Formal Definition of a Language – Notions of Syntax Analysis.

UNIT V**LATTICES AS PARTIALLY ORDERED SETS**

Definition and Examples – some properties of Lattices – Lattices as Algebraic systems – sub Lattices – Direct product and homomorphism.

SUGGESTED READINGS

1. Trembly. J.B., Manohar.R., (2008). Discrete mathematical structures with applications to computer science., 35th Reprint., Tata Mc Graw Hill, New Delhi.
2. Sundaresan Ganapathy., Subramanian.K.S., Ganesan.K., (2000). Discrete Mathematics., Tata Mc Graw Hill, New Delhi.
3. Lovarz.L, Pelikan. J., Vexztergombi.K., (2002). Discrete Mathematics., Springer International Edition.
4. Chandrasekaran. N., Uma Parvathi.M., (2010). Discrete Mathematics., PHI Learning P. Ltd.

WEBSITE LINK:

1. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-fall-2010/>
2. <http://vidyamitra.inflibnet.ac.in/index.php/content/index/5704c5378ae36c6ab9b0b3b5>
3. <https://nptel.ac.in/courses/106106094/>
4. <http://172.16.25.76/course/view.php?id=1650>

Semester –IV

6H – 4C

21MMU403A

OPERATIONS RESEARCH

Instruction Hours / week: L: 4 T: 2 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Solving methods to linear programming problems.
- Solving technique of Transportation problem.
- The simplex method to solve small linear programming models by hand, given a basic feasible point in Assignment Problems.
- Formulation of a given simplified description of a suitable real-world problem as a linear programming model.
- Fundamental concepts of duality, economic interpretation of dual constraints and game theory. the rules of network construction and critical path analysis.
- Mathematical Formulation of LPP, Solution of LPP: Graphical Method with special cases, Simplex Method, Big-M Method, Two Phase method. Special cases in simplex method, Duality theory, Dual Simplex algorithm.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Formulate a LPP and solve it by simplex and graphical method. Also do post optimal analysis of the formulated problem or other application areas.
2. Solve a Transportation and its types.
3. Analysis Assignment problem and its models.
4. Know the concept of game theory.
5. Study critical path analysis and probability considerations in PERT.
6. Use game theory concepts to find the solution of linear programming problems.

UNIT I**LINEAR PROGRAMMING**

Introduction to Linear Programming Problem –Advantages and Limitations of LP model - Graphical Linear Programming Solution- Theory of Simplex Method-Optimality and unboundedness-the Simplex algorithm –Simplex method in tableau format- Introduction to artificial variables – Two –phase method – Big –M method and their comparison.

UNIT II**TRANSPORTATION MODEL**

Definition of the Transportation model – Non-traditional Transportation model – The Transportation

Algorithm: Determination of the Starting Solution-Northwest –corner method,

Least – corner method, Vogel approximation method- Iterative Computations of the Transportation

Algorithm- Use of linear programming to solve transportation problem.

UNIT III**THE ASSIGNMENT MODEL**

Introduction to Assignment model- Mathematical Formulation of Assignment model- Hungarian method

for solving assignment problem –unbalanced assignment problem and its solution-Simplex Explanation of the Hungarian method.

UNIT IV**GAME THEORY**

Formulation of two person zero games – Solving two-person zero sum games, games with mixed strategies, graphical solution procedure, linear programming solution of games.

UNIT V**PERT AND CPM**

Basic components- logical sequencing - rules of network construction- critical path analysis-probability considerations in PERT.

SUGGESTED READINGS

1. Gupta. P. K., Manmohan and Kanti Swarup., (2001). Operations Research 9th Edition., Sultan Chand & Sons, Chennai.
2. Kalavathy. S., (2002). Operations Research 2nd Edition., Publishing House Pvt Ltd, New Delhi.
3. Hamdy Taha., (2017). Operations Research, 10th Edition., Prentice Hall India New Delhi.

WEBSITE LINK:

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>
2. <http://vidyamitra.inflibnet.ac.in/index.php/search?subject%5B%5D=&course%5B%5D=Linear+programming+problems&domain%5B%5D=Physical+%26+Basic+Sciences>
3. <https://www.youtube.com/watch?v=M4K6HYLHREQ>

Course Objectives

This course enables the students to learn

- The main components of OS and their working.
- The memory allocation methods, page replacement algorithms, file allocation methods, multi-threading, process synchronization, and CPU scheduling.
- The basic components of a computer operating system, and the interactions among the various components.
- The capabilities and limitations of computer operating systems, process management, processor scheduling, deadlocks, memory management, secondary memory management, file management and I/O systems.
- Introduce the concepts of process and thread and their scheduling policies.
- Design the components of operating system.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Familiar with the memory allocation methods, page replacement algorithms, file allocation methods, multi-threading, process synchronization, and CPU scheduling.
2. Describe the main components of OS and their working.
3. Explain the concepts of process and thread and their scheduling policies.
4. Solve synchronization and deadlock issues.
5. Compare the different techniques for managing memory, I/O, disk and files.
6. Design components of operating system.

UNIT I**INTRODUCTION**

Mainframe systems Desktop Systems – Multiprocessor systems – distributed systems – real time systems.

Process: - Process concepts – Operation on process – cooperation process - Inter process Communication -

Mutual Exclusion - Critical sections- primitives – Semaphores – Deadlock: System Model, Deadlock characterization, Deadlock prevention, avoidance, detection, recovery from deadlock.

UNIT II**STORAGE MANAGEMENT**

Memory Management - swapping- Contiguous memory allocation – paging, segmentation – segmentation with paging – Virtual memory: Virtual storage organization – Demand Paging, Process Creation – Page replacement – Thrashing.

UNIT III**PROCESSOR SCHEDULING**

preemptive scheduling: - Scheduling Criteria – Scheduling Algorithms – FCFS- SJF- Priority – Round Robin –Multilevel Queue – Multilevel Feedback Queue . Multi process schedule: Real time schedule, Algorithm evaluation: Deterministic Modeling, Queue Model, Simulation.

UNIT IV**FILE SYSTEMS**

Introduction – File System Concepts – Access Methods – Directory structure – File Sharing – Allocation Methods – Free space management – Efficiency and performance – Recovery. Disk Performance Optimization: Introduction – Disk structure – Disk scheduling – Disk management

UNIT V**LINUX-THE OPERATING SYSTEM**

Linux History, Linux features, Linux distributions, Linux's relationship to Unix, Overview of Linux Architecture, Installation, Startup scripts, system process (an overview), Linux Security, The Ext2 and Ext3 File Systems: General characteristics of the Ext3 File System, File permissions, User Management: Types of users, the powers of Root, Managing users (adding and deleting) : using the command line and GUI Tools.

Resource Management in Linux: File and Directory management, system calls for files process management, Signals, IPC: Pipes, FIFOs, System V IPC, Message Queues, System calls for processes, Memory Management, Library and System calls for Memory.

SUGGESTED READINGS

1. Silberschatz Galvin Gagne., (2012). Operating system concepts, Ninth Edition, Wiley India (pvt), Ltd, New Delhi.
2. Deitel H.M., (2005). Operating systems, Third Edition, Addison Wesley Publication, New Delhi.
3. Pramod Chandra P. Bhatt., (2007). An Introduction to Operating Systems, Second Edition, Prentice Hall India, New Delhi.

4. Tanenbaum Woodhull., (2005). Operating Systems., Second Edition, Pearson Education (LPE) , New Delhi.
5. William Stallings., (2010). Operating Systems internals and Design Principles, Sixth Edition, Prentice Hall India, New Delhi.
6. Arnold Robbins., (2008). Linux Programming by Examples The Fundamentals, Second Edition., Pearson Education.,
7. Cox K., (2009). Red Hat Linux Administrator's Guide, PHI.
8. Stevens R., (2009). UNIX Network Programming, Third Edition., PHI.
9. Sumitabha Das., (2009). Unix Concepts and Applications, Fourth Edition., TMH.
10. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins., (2009). Linux in a Nutshell, Sixth Edition, O'Reilly Media.
11. Neil Matthew, Richard Stones, Alan Cox., (2004) Beginning Linux Programming, Third Edition.

WEBSITES

1. www.cs.columbia.edu/~nieh/teaching/e6118_s00/
2. www.clarkson.edu/~jnm/cs644
3. pages.cs.wisc.edu/~remzi/Classes/736/Fall2002/

Semester – IV
4H – 3C

21MMU404

PROGRAMMING IN PYTHON

Instruction Hours / week: L: 4 T: 0 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Syntax and Semantics and create Functions in Python.
- Understand the basic logic statements in Python
- Handle Strings in Python.
- Understand Lists, Dictionaries in Python.
- Build Graphical User Interface applications
- Know about Boolean Functions and main function.

Course Outcomes (COs)

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

1. Develop algorithmic solutions to simple computational problems
2. Structure simple Python programs for solving problems.
3. Decompose a Python program into functions.
4. Represent compound data using Python lists, tuples, dictionaries.
5. Read and write data from/to files in Python Programs.
6. Build Graphical User Interface and apply its applications.

UNIT I**PYTHON OVERVIEW, DATA TYPES, EXPRESSIONS**

Python programming - variable, Datatype, Keywords, Literals, Operator, Expression, type conversion, Comments, input and output, Strings, Assignment and Comments - Numeric Data Types and Character Sets, Expressions.

UNIT II**FUNCTIONS, MODULES AND CONTROL STATEMENTS**

Functions and Modules - Calling Functions, The math Module, The Main Module, Program Format and Structure and Running a Script from a Terminal Command Prompt - Iteration - for loop - Selection - Boolean Type, Comparisons, and Boolean Expressions, if-else Statements, One-Way Selection Statements, Multi-way if Statements, Logical Operators and Compound Boolean Expressions, Short- Circuit Evaluation and Testing Selection Statements - Conditional Iteration - while loop

UNIT III**STRINGS AND TEXT FILES**

Strings - Accessing Characters and Substrings in Strings, Data Encryption, Strings and Number Systems and String Methods - Text Files - Text Files and Format, Writing Text to a File, Writing Numbers to a File, Reading Text from a File, Reading Numbers from a File and Accessing and Manipulating Files and Directories on Disk.

UNIT IV**LISTS AND DICTIONARIES**

Lists - List Literals and Basic Operators, Replacing an Element in a List, List Methods for Inserting and Removing Elements, Searching and Sorting a List, Mutator Methods and the Value None, Aliasing and Side Effects, Equality and Tuples - Defining Simple Functions - Syntax, Parameters and Arguments, return Statement, Boolean Functions and main function, dictionaries - Dictionary Literals, Adding Keys and Replacing Values, Accessing Values, Removing Keys and Traversing a Dictionary.

UNIT V**DESIGN WITH FUNCTIONS AND CLASSES, GRAPHICAL USER INTERFACE**

Design with Functions and Design with Classes - Functions as Abstraction Mechanisms, Design with Recursive Functions and Managing a Program's Namespace Data Modeling and Structuring Classes with Inheritance and Polymorphism, Behavior of terminal based programs and GUI based programs- Coding simple GUI based programs- Other useful GUI resources- Case Study: GUI based ATM.

SUGGESTED READINGS

1. Kenneth A. Lambert, Martin Osborne., (2018). "Fundamentals of Python: First Programs, Cengage Learning", second edition, ISBN 13:978-1337560092.
2. Allen B. Downey.,(2016). "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers., (<http://greenteapress.com/wp/thinkpython/>)
3. Guido van Rossum and Fred L. Drake Jr.,(2011). —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd.,
4. John V Guttag.,(2013). Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press.,
5. Robert Sedgewick, Kevin Wayne, Robert Dondero.,(2016). Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.,
6. Timothy A. Budd.,(2015). Exploring Python, Mc-Graw Hill Education (India) Private Ltd.,
7. Kenneth A. Lambert.,(2012). Fundamentals of Python: First Programs, CENGAGE Learning,
8. Charles Dierbach.,(2013). Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition,

9. Paul Gries, Jennifer Campbell and Jason Montojo.,(2013). Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC.,

WEBSITES

1. <https://www.learnpython.org/>
2. <https://www.codecademy.com/learn/learn-python>
3. <https://docs.python.org/3/tutorial/>
4. <https://runestone.academy/runestone/books/published/thinkcspy/index.html>
5. <https://nptel.ac.in/courses/106106182/>
6. <http://172.16.25.76/course/view.php?id=1225>

Semester – IV
4H – 2C

21MMU411

NUMERICAL METHODS - PRACTICAL

Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Exercise user defined functions to solve real time problems.
- Illustration of flowchart and algorithm for the given problem.
- The basic structure of the programme, declaration and usage of variables.
- The basic of programming and numerical computing platform to analyze.
- Iterative analysis and design processes with a programming language
- Practical tactic to apply the acquired knowledge and skills in professional and specialist courses.

Course outcomes (COs)

On successful completion of this course, the student will be able to

1. Makes in solving mathematical problem numerical through computer programming.
2. Proficiency in writing programming comments.
3. Visualize and explore data
4. Plot solution as 2D and 3D graphs.
5. Understand the richness of programming complex analytics method rather than using for finding solution.
6. Apply programming techniques to solve problems at advanced level.

List of Practical (Any 10 Programs)

1. Calculate the sum $1/1 + 1/2 + 1/3 + 1/4 + \dots + 1/N$.
2. To find the absolute value of an integer.
3. Enter 100 integers into an array and sort them in an ascending order.
4. Bisection Method.
5. Newton Raphson Method.
6. Secant Method.
7. Regula Falsi Method.
8. LU decomposition Method.
9. Gauss-Jacobi Method.
10. Gauss-Seidel Method.
11. Lagrange Interpolation or Newton Interpolation.
12. Simpson's rule.

SUGGESTED READINGS:

1. LAB Manual.
2. Kirani Singh. Y & Chaudhuri. B.B., (2008). MATLAB Programming, Prentice-Hall of India Pvt. Ltd, New Delhi.
3. Desmond. J. Higham & Nicholas J. Higham., (2005). MATLAB Guide MATLAB Guide, MATLAB Guide, 2nd edition, SIAM.
4. Hema Ramachandran, Achuthsankar S. Nair., Computer SCILAB—A Free Software to MATLAB, First Edition, S. Chand & Company Ltd, New Delhi.

WEBSITE LINK:

1. <http://spoken-tutorial.org/>
2. <http://wiki.scilab.org/Tutorialsarchives>
3. <https://www.scilab.org/tutorials>

Semester – IV
4H – 2C

21MMU412

PROGRAMMING IN PYTHON - PRACTICAL

Instruction Hours / week: L: 0 T: 0 P: 4 Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The basics of python programming concepts.
- About develop programs using object-oriented features.
- The graphical user interfaces and image processing.
- The high-performance programs designed to build up the real proficiency.
- Understand basic structure of the programme, declaration and usage of chat applications.
- About Object oriented programming in Python.

Course Outcomes (COs)

Upon completion of this course the students will be able to

1. Describe the Control statement, String, List, and Dictionaries in Python.
2. Understand the different types of function and File handling operations.
3. Interpret Object oriented programming in Python
4. Design an algorithmic solution to simple image processing problems
5. Build the interactive python application using GUI.
6. Develop the basic structure of the programme, declaration and usage of chat applications.

List of Programs

1. Write a python program using Control statements
2. Write a python program using Functions and String Operations
3. Write a python program using List, Tuples and List comprehensions
4. Write a python program using Inheritance
5. Write a python program using Synchronization
6. Write a python program using Text Files
7. Write a python program using Graphical user Interfaces
8. Write a python program using Exceptional Handling
9. Write a python program using Classes and Objects
10. Write a python program using Chat Applications

SUGGESTED READINGS

1. Kenneth A. Lambert, Martin Osborne.,(2018). “Fundamentals of Python: First Programs, Cengage Learning”, second edition, ISBN 13:978-1337560092.
2. Allen B. Downey.,(2016). “Think Python: How to Think Like a Computer Scientist“, 2nd edition, Updated for Python 3, Shroff/O’Reilly Publishers., (<http://greenteapress.com/wp/thinkpython/>)
3. Guido van Rossum and Fred L. Drake Jr.,(2011). —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd.,
4. John V Guttag.,(2013). Introduction to Computation and Programming Using Python“, Revised and expanded Edition, MIT Press.,
5. Robert Sedgewick, Kevin Wayne, Robert Dondero.,(2016). Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.,
6. Timothy A. Budd.,(2015). Exploring Python, Mc-Graw Hill Education (India) Private Ltd.,
7. Kenneth A. Lambert.,(2012). Fundamentals of Python: First Programs, CENGAGE Learning,
8. Charles Dierbach.,(2013). Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition,
9. Paul Gries, Jennifer Campbell and Jason Montojo.,(2013). Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC,

Websites

1. <https://www.learnpython.org/>
2. <https://www.codecademy.com/learn/learn-python>
3. <https://docs.python.org/3/tutorial/>
4. <https://runestone.academy/runestone/books/published/thinkcspy/index.html>

Semester – V
7H – 5C

21MMU501

REAL ANALYSIS-I

Instruction Hours / week: L: 5 T: 2 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The fundamental concepts of real number system.
- Comprehensive idea about the sequence of real numbers.
- About Cauchy sequence and Cauchy's convergence criterion.
- About the extreme points, Root test and Ratio test.
- Alternating series and its properties.
- The uniform convergence of the sequence and series.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand many properties of the real number systems.
2. Study Convergent sequence and Monotone convergence theorem.
3. Calculate limit superior, limit inferior of a bounded real sequences.
4. Mastery in the test the convergence of an infinite series of real numbers.
5. Construct the Rearrangement of series and Riemann's theorem.
6. Know about the absolute and conditional convergence.

UNIT I**REAL NUMBER SYSTEM**

Algebraic and order properties of \mathbb{R} - Absolute value of a real number-Bounded above and bounded below sets-Supremum and infimum of a nonempty subset of \mathbb{R} -The completeness property of \mathbb{R} - Archimedean property-Intervals-Cantor set-Cantor function.

UNIT II**SEQUENCES OF REAL NUMBERS**

Convergent sequence - Limit of a sequence-Bounded sequence - Limit theorems, Monotone sequences - Monotone convergence theorem.

UNIT III**CAUCHY SEQUENCE**

Subsequences – Bolzano-Weierstrass theorem for sequences Limit superior and limit inferior of a sequence of real numbers– Cauchy sequence – Cauchy's convergence criterion. Theorems on Cauchy sequence.

UNIT IV

INFINITE SERIES

Infinite series - Convergence and divergence of infinite series of positive real numbers - Cauchy convergence criterion for series - Positive term series - Geometric series - Comparison test - Convergence of p-series - Root test - Ratio test - Alternating series - Leibnitz's test (Tests of Convergence without proof).

UNIT V

ALTERNATING SERIES

Alternating series - Leibnitz's test (Tests of Convergence without proof) - Definition and examples of absolute and conditional convergence – Cauchy's nth root test - Integral test; Rearrangement of series and Riemann's theorem.

SUGGESTED READINGS

1. Bartle R.G. and Sherbert D. R., (2015). Introduction to Real Analysis, John Wiley and Sons (Asia) Pvt. Ltd.
2. Arumugam. S and Thangapandi Isaac . A., (2012). Modern Analysis, New Gamma Publishing House Palayamkottai.
3. Arumugam S and Thangapandi Isaac A., (2000). Sequences and series, New Gamma Publishing House, Palayamkottai.
4. Apostol T. M., (2002). Calculus (Vol.I), John Wiley and Sons (Asia) P. Ltd.
5. Bali N. P., (2005). Real Analysis, An imprint of Laxmi Publications Pvt. Ltd., New Delhi.
6. Shanthi Narayan., (2013). A Course of Mathematical Analysis, S. Chand & Co, India.

WEBSITE LINK:

1. http://mathematicalpathshala.com/admin/uploads/1576852429_real%20analysis.pdf
2. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>
3. <http://vidyamitra.inflibnet.ac.in/index.php/content/index/5a5dcb5b8007be86ccbc2ff5>
4. <http://vidyamitra.inflibnet.ac.in/index.php/content/index/5704c5378ae36c6ab9b0afbf>

Semester – V

8H – 6C

21MMU502A

COMPLEX ANALYSIS-I

Instruction Hours / week: L: 6 T: 2 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The concepts of complex numbers and analytic functions.
- The concept of conformal mapping and bilinear transformation.
- The basics of Power Series and its convergence.
- About the Bilinear Transformation and its properties.
- Techniques of complex analysis that make practical problems easy (e.g. graphical rotation and scaling as an example of complex multiplication).
- To understand how complex numbers, provide a satisfying extension of the real numbers.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Explain the basic concepts of complex number system and complex plane.
2. Bilinear transformation and stereographic projection.
3. Describe the convergence of power series and elementary functions.
4. Evaluate cross ratio and construct conformal and bilinear transformation.
5. Perform integration on complex valued function.
6. Evaluate complex integration over a simple and closed curve.

UNIT I**COMPLEX NUMBER SYSTEM**

Complex number system – Field of Complex numbers – Conjugation – Absolute value – Argument – Analytical function defined in a region – necessary conditions for differentiability – sufficient conditions for differentiability – Cauchy-Riemann equation in polar coordinates.

UNIT-II**BILINEAR TRANSFORMATION**

Definition of entire function - Simple Mappings. i) $w = z + \alpha$ ii) $w = az$ iii) $w = 1/z$. invariance of cross-ratio under bilinear transformation – Definition of extended complex plane – Stereographic projection.

UNIT III**POWER SERIES**

Power Series: Absolute convergence – circle of convergence – Analyticity of the sum of power series in the Circle of convergence (term differentiation of a series) Elementary functions, Exponential,

Logarithmic, Trigonometric and Hyperbolic functions.

UNIT IV

HARMONIC FUNCTIONS

Conjugate Harmonic functions: Definition and determination, Conformal Mapping: Isogonal mapping – Conformal mapping-Mapping $z \rightarrow f(z)$, where f is analytic, particularly the mappings. $w = e^z$; $w = z^2$; $w = \sin z$; $w = \cos z$; $w = z + 1/z$

UNIT V

COMPLEX INTEGRATION

Complex Integration: Simply and multiply connected regions in the complex plane. Integration of $f(z)$ from definition along a curve joining Z_1 and Z_2 . Proof of Cauchy's Theorem (using Goursat's lemma for a simply connected region). Cauchy's integral formula for higher derivatives (statement only)-Morera's theorem.

SUGGESTED READINGS

1. Arumugam. S Thangapandi Isaac. A and Somasundaram.A., (2004). Complex Analysis, ScitechPublications India, Pvt., Ltd.
2. Duraipandian P and Kayalal Pachaiyappa., (2009). Complex Analysis, Muhil Publishers.
3. Ponnusamy, S., (2005). Foundations of Complex Analysis, 2nd Edition, Narosa Publication, New Delhi.
4. Churchill R.V and Brown J.W., (2013). Complex variables and applications, 9th Edition., McGraw Hill, London.

WEBSITE LINK:

1. <https://nptel.ac.in/courses/111107056/>
2. <https://nptel.ac.in/courses/111103070/>
3. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>
4. <http://vidyamitra.inflibnet.ac.in/content/index/5a5dcb5b8007be86ccbc2ff3/SL>

Semester – V
8H – 6C

21MMU502B

INDUSTRIAL MATHEMATICS

Instruction Hours / week: L: 6 T: 2 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The basic facts about mathematics.
- Display the knowledge of conventions such as annotations, terminology and recognize basic geometrical figures and graphical displays, state important facts resulting from their studies.
- A relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved with mathematical reasoning.
- Translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
- Application of Fourier and inverse Fourier transforms.
- The concepts of Medical Imaging and Inverse Problems.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Get adequate exposure to global and local concerns so as to explore many aspects of Mathematical Sciences.
2. Apply their skills and knowledge, that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
3. Know about the X-ray: Introduction, X-ray behavior and Beers Law.
4. Aware of history of mathematics and hence of its past, present and future role as part of our culture.
5. Know the concept of Radon Transform.
6. Use the application of Fourier and inverse Fourier transforms.

UNIT I**MEDICAL IMAGING AND INVERSE PROBLEMS**

The content is based on Mathematics of X-ray and CT scan based on the knowledge of calculus, elementary differential equations, complex numbers and matrices.

UNIT II**INVERSE PROBLEMS**

Introduction - Illustration of Inverse problems through problems taught in Pre-Calculus - Calculus –

Matrices and differential equations. Geological anomalies in Earth's interior from measurements at its surface (Inverse problems for Natural disaster) and Tomography.

UNIT III

X-RAY

Introduction, X-ray behaviour and Beers Law (The fundamental question of image construction) Lines in the plane.

UNIT IV

RADON TRANSFORM

Definition and Examples – Linearity - Phantom (Shepp - Logan Phantom - Mathematical phantoms). Back Projection: Definition - Properties and examples.

UNIT V

CT SCAN

Revision of properties of Fourier and inverse Fourier transforms and applications of their properties in image reconstruction. Algorithms of CT scan machine. Algebraic reconstruction techniques abbreviated as ART with application to CT scan.

SUGGESTED READINGS

1. Timothy G. Feeman., (2010). The Mathematics of Medical Imaging, A Beginners Guide, Springer Under graduate Text in Mathematics and Technology, Springer.
2. Andreas Kirsch., (2011). An Introduction to the Mathematical Theory of Inverse Problems, 2nd Ed., Springer.
3. Groetsch C.W.,(1999). Inverse Problems, Activities for Undergraduates, The Mathematical Association of America.

WEBSITE LINK:

1. <https://ocw.mit.edu/courses/mathematics/18-086-mathematical-methods-for-engineers-ii-spring-2006/readings/>
2. <https://nptel.ac.in/courses/122104017/>

21MMU503A	ABSTRACT ALGEBRA	Semester – V 8H – 6C
Instruction Hours / week: L: 6 T: 2 P: 0	Marks: Internal: 40	External: 60 Total: 100 End Semester Exam: 3 Hours

Course Objectives

On successful completion of this course, the student will be able to

- Concept of binary operations, groups, subgroup.
- The concept of cyclic group and properties of cyclic group.
- Homomorphism, isomorphism, automorphism and its related properties.
- Know about the concepts of rings and its properties.
- Ideals and quotient rings.
- About the field of Quotients of an Integral Domain.

Course Outcomes

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

1. Expertise on fundamental theorems of groups.
2. Know about cyclic group and its properties.
3. Study the concepts of homomorphism and Fundamental theorem of homomorphism.
4. Understand the concept of ring and Special Classes of rings.
5. Acquire the knowledge on Ideals and quotient rings.
6. Knowledge about the field of Quotients of an Integral Domain.

UNIT I**GROUP**

Relations and binary operation – Groups – Abelian group – Symmetric group – definitions – examples – Basic properties – Subgroups – examples of subgroup.

UNIT II**CYCLIC GROUP**

Cyclic group – properties of cyclic group – Index of a group – Order of an element – Euler's theorem – Fermat theorem – Co-sets – properties of co-set – normal subgroup – factor groups.

UNIT III**GROUP HOMOMORPHISM**

Homomorphism – kernel – isomorphism – Fundamental theorem of homomorphism – automorphism – inner automorphism – Cayley's theorem – Permutation group – Alternative group.

UNIT IV**RING**

Definition and examples of rings – properties of rings – Subring – Some special classes of rings – Commutative ring – division ring – field – Integral domain – characteristic – homomorphism.

UNIT V**IDEALS**

Ideals and quotient rings – More ideals and Quotient rings – Maximal ideal – The field of Quotients of an Integral Domain.

SUGGESTED READINGS

1. Herstein.I.N., (2010). Topics in Algebra, Second Edition, Willey and sons Pvt Ltd, Singapore.
2. Joseph A. Gallian., (2021). Contemporary Abstract Algebra, Tenth Edition., Narosa Publishing House, New Delhi.
3. Fraleigh.J.B., (2004). A First Course in Abstract Algebra, Seventh edition, Pearson Education Ltd, Singapore.
4. Surjeet Singh and Qazi Zameeruddin., (2006). Modern Algebra, 8th Edition., Vikas Publishing house.
5. Vasishtha.A.R., (2019). Modern Algebra, Krishna Prakashan Mandir, Meerut.

WEBSITE LINK:

1. <http://vidyamitra.inflibnet.ac.in/index.php/search?subject%5B%5D=&course%5B%5D=Abstract+algebra&domain%5B%5D=Physical+%26+Basic+Sciences>
2. https://www.youtube.com/watch?v=IP7nW_hKB7I
3. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>

21MMU503B	SPECIAL FUNCTIONS	Semester – V 8H – 6C
Instruction Hours / week: L: 6 T: 2 P: 0	Marks: Internal: 40	External: 60 Total: 100
		End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Analyze properties of gamma functions by their integral representations and symmetries.
- About solution of Bessel functions and its properties.
- The concepts of Recurrence Formulae.
- Solution of Legendre polynomial as an application of special functions.
- The properties of Greens functions and Green's Identities.
- Know about the concepts of Orthogonality of Legendre polynomials.

Course Outcomes

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

1. Use the gamma function, beta function and special functions to evaluate different types of integral calculus problems.
2. Determine properties of Bessel's equation and Bessel's function.
3. Classify and explain the generating functions of different types of differential equations.
4. Find Solution of Legendre polynomial.
5. Analysis the properties of Greens functions and Green's Identities.
6. Understand the concepts of Orthogonality of Legendre polynomials.

UNIT I

GAMMA AND BETA FUNCTIONS

Gamma and Beta Functions and Elliptic Functions.

UNIT II

BESSEL'S FUNCTIONS

Special functions, power series solution of differential equations, ordinary point; Solution about singular points, Frobenius method. Bessel's equation, solution of Bessel's equation, Bessel's functions $J_n(x)$.

UNIT III

RECURRENCE FORMULAE

Recurrence Formulae, Equations reducible to Bessel's equation, orthogonality of Bessel's Functions, A generating function for $J_n(x)$.

UNIT IV**LEGENDRE'S EQUATIONS**

Legendre's equation, Legendre's polynomial $P_n(x)$, Legendre's function of the second kind $[Q_n(x)]$, General solution of Legendre's equation, Rodrigue's formula, Legendre polynomials, A generating function of Legendre's polynomial.

UNIT V**GREEN'S FUNCTIONS**

Orthogonality of Legendre polynomials, Recurrence formulae for $P_n(x)$ Green's function – Green's Identities – Generalized functions.

SUGGESTED READINGS

1. Raisinghania.M.D, (2017). Ordinary and Partial Differential Equations, 19th edition, S.Chand Company.
2. Sneddon.I.N., (2009). Special Functions of mathematical Physics & Chemistry, 3 Oliver & Boyd, London.
3. Lebedev.N.N., (2013). Special Functions and Their Applications, PHI.
4. Askey.R and Roy.R., (2013). Special Functions, Cambridge.

WEBSITE LINK:

1. <https://www.youtube.com/watch?v=JoyvDWZ0aMY>
2. <https://www.youtube.com/watch?v=6n5QyYMe9U0>

Semester – V
7H – 5C

21MMU504A

NUMBER THEORY

Instruction Hours / week: L: 5 T: 2 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Numbers, functions and its properties.
- Beauty and clarity of number theoretic functions.
- The challenging problems in number theory.
- How number theory is related to and used in cryptography.
- The concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization.
- The Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand the Linear Diophantine equation.
2. Know about the Fermat's Little theorem.
3. Mastery in the Mobius Inversion formula.
4. Familiar with the concepts of primitive roots
5. Acquire knowledge of the Legendre symbol and its properties.
6. Acquire concepts of Public key encryption, RSA encryption and decryption.

UNIT I**DIVISIBILITY, PRIMES AND CONGRUENCES**

Linear Diophantine equation - Prime counting function - Statement of prime number theorem - Goldbach conjecture - Linear congruences - Complete set of residues - Chinese Remainder theorem.

UNIT II**FERMAT'S LITTLE THEOREM**

Fermat's little theorem - Wilson's theorem. Number theoretic functions - Sum and number of divisors
Totally multiplicative functions - Definition and properties of the Dirichlet product.

UNIT III**NUMBER THEORETIC FUNCTIONS**

The Mobius Inversion formula - The greatest integer function - Euler's phi-function - Euler's theorem reduced set of residues- Some properties of Euler's phi-function.

UNIT IV**PRIMITIVE ROOTS AND INDICES**

Order of an integer modulo n, primitive roots for primes- Composite numbers having primitive roots- Euler's criterion - The Legendre symbol and its properties.

UNIT V**THE QUADRATIC RECIPROCITY LAW**

Quadratic reciprocity- Quadratic congruences with composite moduli. Public key encryption, RSA encryption and decryption -The equation $x^2 + y^2 = z^2$ - Fermat's Last theorem.

SUGGESTED READINGS

1. David M. Burton., (2015). Elementary Number Theory, 7th Edition., Tata McGraw-Hill, Delhi.
2. Neville Robinns., (2007). Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Ltd., Delhi.
3. Neal Koblitz., (2006). A course in Number theory and cryptography, Second Edition, Hindustan Book Agency, New Delhi.

WEBSITE LINK:

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2. <http://vidyamitra.inflibnet.ac.in/index.php/content/index/5704c5378ae36c6ab9b0b9d1>
3. <http://172.16.25.76/course/view.php?id=1653>

Semester – V
7H – 5C

21MMU504B

PORTFOLIO OPTIMIZATION

Instruction Hours / week: L: 5 T: 2 P: 0

Marks: Internal: 40

External: 60 Total: 100
End Semester Exam: 3Hours**Course Objectives**

This course enables the students to learn

- The changing domestic and global investment scenario in general and Indian capital market in particular with reference to availability of various financial products and operations of stock exchanges.
- The theory and practice of portfolio management.
- Important theories, techniques, regulations and certain advancements in theory of investment will be covered with an aim of helping the participants make sound investment decisions in the context of portfolio investment.
- The Risk-free assets and one fund theorem, efficient frontier.
- The various strategies followed by investment practitioners.
- The measure and the relationship between risk and return.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand the various alternatives available for investment.
2. Learn to measure risk and return.
3. Find the relationship between risk and return.
4. Value the equities and bonds.
5. Gain knowledge of the various strategies followed by investment practitioners.
6. Study Index tracking optimization models.

UNIT I**FINANCIAL MARKETS**

Financial markets -Investment objectives - Measures of return and risk -Types of risks- Risk free Assets- Mutual funds -Portfolio of assets.

UNIT II**PROTFOLIO RISKS**

Expected risk and return of portfolio - Diversification - Mean - variance portfolio optimization - The Markowitz model and the two - fund theorem.

UNIT III**SHORT SALES**

Risk-free assets and one fund theorem - Efficient frontier. Portfolios with short sales.

UNIT IV**CAPITAL MARKET THEORY**

Capital market theory. Capital assets pricing model - The capital market line – Beta of an asset- Beta of a portfolio -Security market line.

UNIT V**PORTFOLIO PERFORMANCE**

Index tracking optimization models - Portfolio performance evaluation measures.

SUGGESTED READINGS

1. Reilly . F. K., Keith C. Brown., (2011). Investment Analysis and Portfolio Management, Tenth Edition, South-Western Publishers.
2. Markowitz H.M., (2000). Mean-Variance Analysis in Portfolio Choice and Capital Markets, Blackwell, New York.
3. Best. M.J., (2010). Portfolio Optimization, Chapman and Hall, CRC Press.
4. Luenberger. D.G., (2013). Investment Science, Second Edition., Oxford University Press.

WEBSITE LINK:

1. <https://ocw.mit.edu/courses/mathematics/18-s096-topics-in-mathematics-with-applications-in-finance-fall-2013/video-lectures/lecture-14-portfolio-theory/>
2. <http://vidyamitra.inflibnet.ac.in/index.php/content/index/5704c5378ae36c6ab9b0bad6>
3. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/109104104/lec6.pdf

Semester – VI
6H – 4C

21MMU601

REAL ANALYSIS-II

Instruction Hours / week: L: 5 T: 1 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Fundamental ideas and theorems about metric space.
- Enrich their knowledge in completeness of a metric space.
- About continuous and discontinuous functions on Real number system.
- The connectedness and connected subsets of \mathbb{R} .
- The compactness and compact subspaces of \mathbb{R} .
- Enrich their knowledge in homeomorphism and uniform continuity.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Attain mastery in metric spaces.
2. Comfortably work with topological concepts such as closed sets.
3. Demonstrate completeness, limits, continuity.
4. Study in details the intermediate value theorem.
5. Demonstrate compactness and its characterization.
6. Analyze connected sets.

UNIT I**METRIC SPACES**

Metric Spaces -Definitions and examples - Bounded sets in a metric space - Open ball in a metric space - Open sets - equivalent metrics.

UNIT II**SUBSPACES**

Subspaces of a metric space - Interior of a set - Closed sets –Closure- Limit point - Dense sets- - Complete metric space - Cantor's intersection theorem - Baire's category Theorem.

UNIT III**CONTINUITY**

Continuity of functions- Continuity of composition of functions-Equivalent conditions for continuity – Algebra of continuous functions- Homeomorphism - Uniform continuity.

UNIT IV**CONNECTEDNESS**

Connectedness - Equivalent conditions - Connected subsets of \mathbb{R} - Connectedness and continuity - Intermediate Value theorem- Contraction mapping theorem.

UNIT V**COMPACTNESS**

Compactness - Compact Metric spaces - Heine Borel theorem – Equivalent characterization for compactness - Totally bounded - Sequentially compact metric spaces - Compactness and Continuity. .

SUGGESTED READINGS

1. Arumugam. S and Thangapandi Isaac . A., (2012). Modern Analysis, New Gamma Publishing House Palayamkottai,
2. Malik.S.C & Savita Arora., (2009). Mathematical Analysis, New Age International LTD., New Delhi.
3. Bartle R.G. and Sherbert. D. R., (2015). Introduction to Real Analysis, John Wiley and Sons (Asia), Pvt. Ltd.
4. Shanthi Narayan., (2019). A Course of Mathematical Analysis, S. Chand & Co, India.
5. Apostol T. M., (2002). Calculus (Vol.I), John Wiley and Sons (Asia) P. Ltd.
6. Goldberg, R., (2020). Methods of Real Analysis, Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
7. Bali N. P., (2019). Real Analysis, An imprint of Laxmi Publications Pvt. Ltd., New Delhi.

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1. http://mathematicalpathshala.com/admin/uploads/1576852429_real%20analysis.pdf
2. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>
3. <http://vidyamitra.inflibnet.ac.in/index.php/content/index/5a5dcb5b8007be86ccbc2ff5>
4. <http://vidyamitra.inflibnet.ac.in/index.php/content/index/5704c5378ae36c6ab9b0afbf>

Semester – VI

6H – 4C

21MMU602A

COMPLEX ANALYSIS-II

Instruction Hours / week: L: 5 T: 1 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The concept of analytic function of complex number system
- Convergence of Taylor's and Laurent's series.
- The concept of Singularities and its kinds.
- Applications of residue theorems.
- Momentous of complex-differentiable functions
- About the Integrals and Contour integration

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Explain the role of complex analysis and in modern mathematics and applied contexts.
2. Differentiate Taylor's and Laurent's series.
3. Analyze the types of singularities of complex functions
4. Understand the concepts of residue.
5. Evaluate the poles and using integration of rational functions.
6. Describe the definite Integrals through contour integration.

UNIT I**CAUCHY'S THEOREM AND ITS APPLICATIONS**

Cauchy's Theorem and its applications: Zeros of an analytic function - Theorems based on Cauchy's theorem – Cauchy's inequality – Liouville's theorem - Maximum modulus theorem.

UNIT-II**TAYLOR'S AND LAURENTS'S SERIES**

Taylor's and Laurent's Series - Singular points - Isolated and non-isolated singular points – Taylor's and Laurent's Series – Taylor's series – Laurent's Series - Examples.

UNIT III**SINGULARITIES**

Singularities - Classification of isolated singularities - Removable singularity - Poles - Essential singularity - Behaviour of a function at a singularity - Behaviour at a removable singularity - Behaviour at a pole - Behaviour at an essential singularity - Examples.

UNIT IV**RESIDUES**

Residues - Residue at a removable singularity - Residue at a pole - Residue theorem – Examples – Applications of the Residue theorem – The Logarithmic residue.

UNIT V**DEFINITE INTEGRALS**

Definite Integrals – Contour integration -Definite integrals of Type 1 - Type 2 and Type-3 problems - Examples.

SUGGESTED READINGS

1. Arumugam. S Thangapandi Isaac. A and Somasundaram. A., (2015). Complex Analysis, Scitech Publications India, Pvt., Ltd.
2. Duraipandian P and Kayalal Pachaiyappa., (2009). Complex Analysis, Muhil Publishers.
3. Ponnusamy, S., (2011). Foundations of Complex Analysis, 2nd Edition, Narosa Publication, New Delhi.
4. Churchill R.V and Brown J.W., (2013). Complex variables and applications, McGraw Hill, London.
5. Singaravelu A., (2019). Engineering Mathematics-II, Meenakshi Agency, Medavakkam, Chennai.

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1. <https://nptel.ac.in/courses/111107056/>
2. <https://nptel.ac.in/courses/111103070/>
3. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25>
4. <http://vidyamitra.inflibnet.ac.in/content/index/5a5dcb5b8007be86ccbc2ff3/SL>

Semester – VI
6H – 4C

21MMU602B

GRAPH THEORY

Instruction Hours / week: L: 5 T: 1 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Fundamental properties of graphs.
- The topological concept connectedness in graphs.
- Applications of the conceptual idea such graph coloring.
- The concept of Trees and its properties.
- Necessity of algorithms such as Kruskal's algorithm and shortest path Dijkstra's algorithm in networking
- Matrix representations of graphs and their properties

Course Outcomes (COs)

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

1. Understand basic concepts in graph theory.
2. Attain mastery in Eulerian and Hamiltonian graphs.
3. Explain applications of Chromatic polynomial, Matching and Covering
4. Know the importance of conceptual idea trees.
5. Analyze the applications of various algorithms
6. Attain Mastery in Dijkstra's algorithm-Floyd-Warshall algorithm.

UNIT I**GRAPHS**

Definition and Examples of a graph-subgraph-degree of a graph - Complete graphs - Bipartite graphs – Pseudo graphs- Isomorphism of graphs- Matrix representation of graphs.

UNIT II**CONNECTEDNESS**

Walks, Trails- Paths and circuits - Strongly Connected Components -Connected graph – Connectivity of a graph -Eulerian Graphs-Hamiltonian Graphs.

UNIT III**GRAPH COLORING**

Chromatic Number – Chromatic partitions-Chromatic polynomial – Matching - Covering - Four Color Problem.

UNIT IV**TREES**

Trees and its properties - Pendant vertices in a tree -Distance and centers in a tree - Rooted and binary tree- Spanning trees.

UNIT V**APPLICATIONS OF GRAPHS**

Travelling salesman's problem-NP-Hard Problem -Kruskal's algorithm - Shortest path Dijkstra's algorithm.

SUGGESTED READINGS

1. Arumugam S and Ramachandran S., (2018). Invitation to Graph Theory, SciTech Publications (India) Pvt. Ltd., Chennai.
- 2.Narsingh Deo., (2004). Graph Theory with applications to Engineering and Computer Science, Prentice Hall of India.
- 3.Bondy J. A & Murty U.S.R., (2013). Graph Theory with Applications, Elsevier, New York.
- 4.Choudam S. A., (2007). A first course in Graph Theory, Macmillian, India Ltd., Delhi.
- 5.Harary. F., (2013). Graph Theory, Narosa Publishing House, India.

WEBSITE LINK:

1. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-fall-2010/video-lectures/lecture-6-graph-theory-and-coloring/>
2. <https://www.youtube.com/watch?v=E40r8DWgG40&list=PLWzOdn8-n94O2v4Ll7Enf37HLeh04eHSI>
3. <http://youtube.be/E40r8DWgG40>
4. <http://172.16.25.76/course/view.php?id=2073>

21MMU603A	LINEAR ALGEBRA	Semester – VI 6H – 4C
Instruction Hours / week: L: 5 T: 1 P: 0	Marks: Internal: 40	External: 60 Total: 100 End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- Advances of vector spaces with their properties.
- Several classes of linear transformations and their properties.
- Decomposition of a given vector space into certain canonical forms.
- Visualization of linear transformations as matrix form.
- Solution of simultaneous linear equations and its applications.
- Momentous properties of Eigen values of matrices

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Recognize some advances of linear transformations.
2. Understand the concepts of linear combinations and its problems.
3. Explain applications of inner product space.
4. Study in detail about elementary transformation.
5. Discuss solution of simultaneous linear equation.
6. Analyze the properties of Eigen values and Eigen vectors.

UNIT I

VECTOR SPACE

Vector Spaces – Definition – properties – examples – subspace – direct sum – linear transformation – kernel – fundamental theorem of homomorphism – isomorphism theorems.

UNIT II

DIMENSION

Linear combination – span – Linear independence – linearly dependent – Dimension of a vector space – bases – maximal linearly independent set – minimal generating set – Quotient space – dimension of quotient space – rank and nullity – matrix of a linear transformation – problems.

UNIT III**INNER PRODUCT SPACE**

Inner product spaces – Definition – Examples – Applications – norm – orthogonal set – orthonormal set – Orthonormal & Orthonormal Basis - Gram Schmidt Orthogonalization process – problems – Orthogonal complement of a sub space.

UNIT IV**MATRICES**

Algebra of matrices – transpose –conjugate transpose – symmetric – skew symmetric – Hermitian – skew Hermitian – unitary matrix – determinant – inverse of the matrix – problems – elementary transformation – canonical form of a matrix – rank of matrix – problems.

UNIT V**APPLICATIONS OF MATRICES**

Simultaneous linear equation – solution of simultaneous linear equation – problems – characteristic equation – Cayley Hamilton theorem – problems – eigen value – properties of eigen values – eigen vector – problems.

SUGGESTED READINGS

1. Kumaresan. S., (2006). Linear Algebra: A Geometric approach, Prentice Hall of India.
2. Herstein.I.N., (2010). Topics in Algebra, Second Edition, Willey and sons Pvt Ltd, Singapore.
3. Balakrishnan.R and Ramabadran.N., (1986). A Text Book of Modern Algebra, Vikas Publishing Limited, New Delhi
4. Vasishtha. A. R,(2019). Modern Algebra, Krishna Prakashan Mandir, Meerut.
5. Arumugam.S & Isaac. A.T., (2015). Modern Algebra, SciTech Publications, India Pvt. Ltd.
6. Kennath M. Hoffman and Ray Kunze., (2018). Linear Algebra, 2 Edition, Pearson India Publishing, New Delhi.

WEBSITE LINK:

1. <http://vidyamidra.inflibnet.ac.in/index.php/content/index/5a3ca15b8007be446465cc03>
2. <https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/>
3. <http://172.16.25.76/course/view.php?id=2081>

Semester – VI
6H – 4C

21MMU603B

MATHEMATICAL MODELING

Instruction Hours / week: L: 5 T: 1 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objectives

This course enables the students to learn

- The basics concepts of mathematics modelling.
- Mathematical models with a differential equation of first order.
- Mathematical modeling through linear differential equations of second order.
- Analytic methods of probability theory and simple models.
- Mathematical modeling through graphs and its properties.
- How to construct a mathematical model of a given physical system and analyze it.

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Know about the Modeling Change with Dynamic problems and Geometrical problems.
2. Understand the basic concepts of Mathematical modeling through linear differential equations of second order
3. Study the basic concepts of Miscellaneous mathematical models.
4. Study the Probabilistic Modeling with Economics and Finance.
5. Knowledge the Fitting Models to Data Graphically and experimental models.
6. Understand the concepts of modelled through graphs.

UNIT I**MATHEMATICAL MODELLING THROUGH ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER**

Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Dynamic problems – Geometrical problems.

UNIT II**MATHEMATICAL MODELLING THROUGH SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER**

Population Dynamics – Epidemics – Compartment Models – Economics – Medicine, Arms Race, Battles and International Trade – Dynamics.

UNIT III**MATHEMATICAL MODELLING THROUGH ORDINARY DIFFERENTIAL EQUATIONS OF SECOND ORDER**

Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modeling through Linear Differential Equations of Second Order – Miscellaneous Mathematical Models.

UNIT IV**MATHEMATICAL MODELLING THROUGH DIFFERENCE EQUATIONS**

Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – Probability Theory.

UNIT V**MATHEMATICAL MODELLING THROUGH GRAPHS**

Solutions that can be Modelled Through Graphs – Mathematical Modelling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Unoriented Graphs.

SUGGESTED READINGS

1. Shepley L. Ross., (2004). Differential Equations, Fourth Edition, John Wiley and Sons, New York.
2. Sneddon I., (2006). Elements of Partial Differential Equations, McGraw-Hill, International Edition, New York.
3. Tyn Myint-U and Lokenath Debnath., (2007). Linear Partial Differential Equation for Scientists and Engineers, Springer.
4. Frank R. Giordano, Maurice D. Weir and William P. Fox., (2003). A First Course in Mathematical Modeling, Thomson Learning, London and New York.
5. Kapur. J.N., (1994). Mathematical Modelling, Wiley Eastern Limited, New Delhi.

WEBSITE LINK:

1. <https://nptel.ac.in/courses/112107214/>
2. <https://ocw.mit.edu/courses/sloan-school-of-management/15-023j-global-climate-change-economics-science-and-policy-spring-2008/lecture-notes/lec3.pdf>
3. <http://172.16.25.76/course/view.php?id=1654>

21MMU604A	APPLIED STATISTICS	Semester – VI 6H – 4C
Instruction Hours / week: L: 5 T: 1 P: 0	Marks: Internal: 40	External: 60 Total: 100
End Semester Exam: 3 Hours		

Course Objectives

This course enables the students to learn

- How population parameter and sample statistics reveal to make inferences from the data
- Commonly to discover truths from the statistical data and learn
- Leads to learn total quality management and quality control tools.
- The concepts of elementary parametric relations and analysis.
- Complete knowledge on six sigma (6σ) originated as a performance measure or a measure of quality and how six sigma,
- Process goals are set in parts per million (PPM) in all areas of the production process which evolved into a methodology for improving business efficiency and effectiveness by focusing on productivity, cost reduction, and enhanced quality

Course Outcomes (COs)

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

1. Understand the concepts of population parameter and sample statistics to make inferences from the data.
2. Know about the Judgement sampling, Cluster sampling and Convenience sampling.
3. Applications of statistical measures and tools in Total Quality Management (TQM) and quality control tools.
4. Focus on General factorial effect-best estimates and testing the significance of factorial effects.
5. Apply six sigma (6σ) concepts for zero defective in quality control,
6. Apply the process goals in parts per million (PPM) in production process for improving business efficiency and effectiveness

UNIT I

ESTIMATION THEORY

Population, Sample, Sampling, Parameter and Statistic – Criteria for good sample, Types of sampling: probability sampling - Simple random sampling, stratified random sampling – Estimation of the population mean, Systematic sampling-comparison of systematic sampling- and stratified random sampling, proportional allocation-optimum allocation and Stratified random sampling.

UNIT II

NON-PROBABILITY SAMPLING

Non-probability sampling: Judgement sampling, Cluster sampling, Convenience sampling. Sampling error and non-sampling errors. Introduction to confidence interval-confidence interval for population mean - confidence interval for population proportion confidence interval for population mean when standard deviation is unknown - confidence interval for population variation.

UNIT III**QUALITY MANAGEMENT**

Introduction to Quality Management – Japanese System of total Quality Management, Quality Circles – 7 Quality Control tools- 7 New Quality Control tools.

UNIT IV**DESIGNING OF EXPERIMENTS**

Elementary concepts (one- and two-way classified data) Review of elementary design (CRD, RBD, LSD) Missing plot technique in RBD and LSD with one and two missing values. Gauss-Markov- BIBD: Elementary parametric relations, analysis. PBIBD- General factorial effect-best estimates and testing the significance of factorial effects study of 23 and 24 factorial experiments.

UNIT V**SIX SIGMA CONCEPTS**

ISO 9000 Quality System Standards – Project Planning- Process and Measurement system capability analysis. Area properties of Normal Distribution – Metrics of Six sigma. The DMAIC cycle – Design for Six Sigma- Lean Sigma – Statistical tools for Six Sigma..

SUGGESTED READINGS

1. Ravichandran. J., (2012)., Probability and Statistics for Engineers., 1st Edition, Wiley India.
2. Srivastava T.N., and Shailaja Rego., (2016). 3e, Statistics for Management, McGraw Hill Education, New Delhi.
3. Dinesh Kumar U., (2017), Business Analytics: The Science of Data - Driven Decision Making, Wiley, New Delhi.
4. Evans James R., (2019), Business Analytics, 3rd edition, Pearson Education, New Delhi.
5. Pillai R.S.N., and Bagavathi V., (2010). Statistics, S. Chand & Company Ltd, New Delhi.
6. Arora, P.N., (2018). A foundation course statistic, S. Chand & Company Ltd, New Delhi.
7. Cochran. W.C. (2007), Sampling Techniques, Third Edition, Wiley Eastern.
8. Montgomery Douglas C., 2009., Introduction to Statistical Quality Control., Sixth Edition, John Wiley & sons
9. Gupta S.P., (2012). Statistical Methods, Sultan Chand & Sons, New Delhi.
10. Ishikawa K., (1986). Guide to Quality Control., 2nd Edition, Asian Productivity Organization, Tokyo.
11. Harry .M and Schroeder R., (2006). Six sigma: The Breakthrough Management Strategy., Currency Publishers, USA.

WEBSITE LINKS

1. <https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/>
2. https://www.youtube.com/watch?v=COI0BUmNHT8&list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE

e-Resources

1. <https://nptel.ac.in/courses/110107114/>

KAHE – Learning Management System

1. <http://172.16.25.76/course/view.php?id=1655>
2. <http://172.16.25.76/course/view.php?id=1642>

Semester – VI
6H – 4C

21MMU604B

DIFFERENTIAL GEOMETRY

Instruction Hours / week: L: 5 T: 1 P: 0

Marks: Internal: 40

External: 60 Total: 100

End Semester Exam: 3 Hours

Course Objective

This course enables the students to learn

- Evolutes and involutes of a space curve
- Basics of theory of surfaces
- Conformal mapping and its properties
- Importance of tensor algebras
- Applications of tensor form of Laplacian operators
- The Parallel propagation of vectors, Covariant and intrinsic derivatives

Course Outcomes (COs)

On successful completion of this course, the student will be able to

1. Understand the theory of space curves with examples.
2. Study the concept of parametric curves on surfaces.
3. Know about the torsion of a geodesic and geodesic curvature.
4. Discuss the different types of tensors
5. Explain the physical components of tensor calculus.
6. Understand Laplacian operators in tensor form.

UNIT I**THEORY OF SPACE CURVES**

Space curves - Planer curves, Curvature, torsion and Serret-Frenet formulae - Osculating circles, Osculating circles and spheres - Existence of space curves - Evolutes and involutes of curves.

UNIT II**THEORY OF SURFACES**

Parametric curves on surfaces - Direction coefficients -First and second Fundamental forms - Principal and Gaussian curvatures - Lines of curvature - Euler's theorem - Rodrigue's formula - Conjugate and Asymptotic lines.

UNIT III**DEVELOPABLES**

Developable associated with space curves and curves on surfaces – Minimal surfaces.

Geodesics: Canonical geodesic equations - Nature of geodesics on a surface of revolution -Clairaut's theorem. -Normal property of geodesics -Torsion of a geodesic - Geodesic curvature - Gauss - Bonnet theorem - Surfaces of constant curvature -Conformal mapping. Geodesic mapping- Tissot's theorem.

UNIT IV**TENSORS ALGEBRA**

Summation convention and indicial notation - Coordinate transformation and Jacobian, Contra-variant and Covariant vectors - Tensors of different type - Algebra of tensors and contraction - Metric tensor and 3-index Christoffel symbols.

UNIT V**TENSORS CALCULUS**

Parallel propagation of vectors, Covariant and intrinsic derivatives - Curvature tensor and its properties - Curl, Divergence and Laplacian operators in tensor form - Physical components.

SUGGESTED READINGS

1. Willmore T.J., (2013). An Introduction to Differential Geometry, Dover Publications, New York.
2. O'Neill. B., (2006). Elementary Differential Geometry, 2nd Ed., Academic Press, New Delhi.
3. Weatherburn C.E., (2016). Differential Geometry of Three Dimensions, Cambridge University Press, Cambridge.
4. Struik D.J., (2012). Lectures on Classical Differential Geometry, 2nd Edition, Dover Publications, New York.
5. Lang S., (2001). Fundamentals of Differential Geometry, Springer, New York.
6. Spain B., (2003). Tensor Calculus: A Concise Course, Dover Publications, New York.

WEBSITE LINK:

1. <https://nptel.ac.in/courses/111/104/111104095/>
2. <https://ocw.mit.edu/courses/mathematics/18-950-differential-geometry-fall-2008/>
3. <https://www.youtube.com/watch?v=-iOcBqxTkx0>

21MMU691	PROJECT	Semester – VI 6H – 6C
Instruction Hours / week: L: 6 T: 0 P: 0	Marks: Internal: 40	External: 60 Total: 100 End Semester Exam: 3Hours

LIST OF VALUE-ADDED COURSES

- ❖ Data Analysis using SPSS
- ❖ LATEX
- ❖ Vedic Mathematics
- ❖ Mathematical Modelling with Excel
- ❖ MATLAB
- ❖ MAPLE
- ❖ GEOGEBRA
- ❖ DIA
- ❖ Statistical Quality Control
- ❖ Six Sigma Analysis