DEPARTMENT OF MATHEMATICS
FACULTY OF ARTS, SCIENCE AND HUMANITIES
UG PROGRAM (CBCS) – B.Sc. Mathematics
(2020–2021 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	
									40	**60**	**100**	
SEMESTER – I												
20LSU101	Language –I	AECC	III	n,o	4	0	0	4	40	60	100	9
20ENU101	English-I	AECC	II	n,p	4	0	0	4	40	60	100	12
20MMU101	Calculus and Trigonometry	CC	II	g, e	5	0	0	5	40	60	100	13
20MMU102	Classical Algebra	CC	II	m	6	0	0	6	40	60	100	15
20MMU103	Physics I	ALLIED	I	a, c	4	0	0	3	40	60	100	17
20MMU111	Calculus and Trigonometry-Practical	CC	II	g, e	0	0	3	2	40	60	100	19
20MMU112	Physics I-Practical	ALLIED	I	a, c	0	0	4	2	40	60	100	20
Semester Total					23	0	7	26	280	420	700	
SEMESTER – II												
20LSU201	Language – II	AECC	III	n,o	4	0	0	4	40	60	100	22
20ENU201	English-II	AECC	II	n,p	4	0	0	4	40	60	100	25
20MMU201	Differential Equations and Laplace Transforms	CC	I,II	a, l	4	0	0	4	40	60	100	26
20MMU202	Analytical Geometry	CC	II	d, m	4	0	0	4	40	60	100	28
20MMU203	Physics II	ALLIED	I	a, c	4	0	0	3	40	60	100	30
20MMU211	Differential Equations and Laplace Transforms -	CC	I,II	a	0	0	3	2	40	60	100	32

	Practical											
20MMU212	Physics II-Practical	ALLIED	I	a, c	0	0	4	2	40	60	100	33
20AEC201	Environmental Studies	AECC	I	o	3	0	0	3	40	60	100	34
Semester Total					**23**	**0**	**7**	**26**	**320**	**480**	**800**	
SEMESTER – III												
20MMU301	Statistics	CC	I,II	a, l	5	0	0	5	40	60	100	37
20MMU302	Mechanics	CC	II	d,	6	1	0	6	40	60	100	39
20MMU303A	Multivariate Calculus	SEC	I	f	4	2	0	4	40	60	100	41
20MMU303B	Computer Graphics	SEC	I	b, k								43
20MMU304	Object oriented programming using C++	ALLIED	III	i	4	0	0	3	40	60	100	45
20MMU311	Statistics -Practical	CC	II	l	0	0	4	2	40	60	100	47
20MMU312	Object oriented programming using C++ - Practical	ALLIED	II	l	0	0	4	2	40	60	100	48
Semester Total					**19**	**3**	**8**	**22**	**240**	**360**	**600**	
SEMESTER – IV												
20MMU401	Numerical Methods	CC	I	h	5	0	0	5	40	60	100	50
20MMU402	Discrete Mathematics	CC	II	f	6	1	0	6	40	60	100	52
20MMU403A	Operations Research	SEC	II	k	4	2	0	4	40	60	100	54
20MMU403B	Operating System: Linux	SEC	I	k								56
20MMU404	Programming in Python	ALLIED	III	i	4	0	0	3	40	60	100	58
20MMU411	Numerical Methods-Practical	CC	I	h, j	0	0	4	2	40	60	100	60

20MMU412	Programming in Python -Practical	ALLIED	I	h, j	0	0	4	2	40	60	100	61
Semester Total					**19**	**3**	**8**	**22**	**240**	**360**	**600**	
SEMESTER – V												
20MMU501	Real analysis-I	CC	II	e, g	5	2	0	5	40	60	100	63
20MMU502A	Complex Analysis-I	DSE	II	m	6	2	0	6	40	60	100	65
20MMU502B	Industrial Mathematics	DSE	I,II	a, b								67
20MMU503A	Abstract Algebra	DSE	I	a	6	2	0	6	40	60	100	69
20MMU503B	Special functions	DSE	I	k								71
20MMU504A	Number Theory	DSE	II	j	5	2	0	5	40	60	100	73
20MMU504B	Portfolio Optimization	DSE	II, III	i								75
Semester Total					**22**	**8**	**0**	**22**	**160**	**240**	**400**	
SEMESTER – VI												
20MMU601	Real analysis-II	CC	II	d, m	5	1	0	4	40	60	100	77
20MMU602A	Complex Analysis-II	DSE	II	m	5	1	0	4	40	60	100	79
20MMU602B	Graph Theory	DSE	I,II	a, i								81
20MMU603A	Linear Algebra	DSE	I,II	a, b	5	1	0	4	40	60	100	83
20MMU603B	Mathematical Modeling	DSE	I	e								85
20MMU604A	Applied Statistics	DSE	I,II	a, b	5	1	0	4	40	60	100	87
20MMU604B	Differential Geometry	DSE	I	e								90
20MMU691	Project	CC	II	n	6	0	0	6	40	60	100	92
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	20LSU101	Language –I
	20ENU101	English-I
II	20LSU201	Language – II
	20ENU201	English-II
	20AEC201	Environmental Studies

Generic Elective Courses (GE) /Allied Courses		
Semester	**Course Code**	**Name of the Course**
I	20MMU103	Physics I
	20MMU112	Physics I-Practical
II	20MMU203	Physics II
	20MMU212	Physics II-Practical
III	20MMU304	Object Oriented Programming with C++
	20MMU312	Object Oriented Programming with C++-Practical
IV	20MMU404	Programming in Python
	20MMU412	Programming in Python -Practical

Core Courses (CC)		
Semester	**Course Code**	**Name of the Course**
I	20MMU101	Calculus and Trigonometry
	20MMU102	Classical Algebra
	20MMU111	Calculus and Trigonometry -Practical
II	20MMU201	Differential Equations and Laplace Transforms
	20MMU202	Analytical Geometry
	20MMU211	Differential Equations and Laplace Transforms -Practical
III	20MMU301	Statistics
	20MMU302	Mechanics
	20MMU311	Statistics -Practical
IV	20MMU401	Numerical Methods
	20MMU402	Discrete Mathematics
	20MMU411	Numerical Methods-Practical
V	20MMU501	Real analysis-I
VI	20MMU601	Real analysis-II
	20MMU691	Project

Skill Enhancement Courses(SEC)		
Semester	**Course Code**	**Name of the Course**
III	**20MMU303A**	Multivariate Calculus
	20MMU303B	Computer Graphics
IV	**20MMU403A**	Operation Research
	20MMU403B	Operating System: Linux

Discipline Specific Elective Courses (DSE)		
Semester	**Course Code**	**Name of the Course**
V	**20MMU502A**	Complex Analysis-I
	20MMU502B	Industrial Mathematics
	20MMU503A	Abstract Algebra
	20MMU503B	Special Functions
	20MMU504A	Number Theory
	20MMU504B	Portfolio Optimization
VI	**20MMU602A**	Complex Analysis-II
	20MMU602B	Graph Theory
	20MMU603A	Linear Algebra
	20MMU603B	Mathematical Modeling
	20MMU604A	Applied Statistics
	20MMU604B	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. Acquire insight into the classifications of mathematical models stating examples and the features of good models.
c. Analyze the motion of particles under the influence of various forces.
d. Gear up with rigorous mathematical proofs of basic results in analysis.
e. Acquire knowledge about the line integral and its geometrical applications.
f. Familiarize some fundamental results and techniques from the theory of groups.
g. Application of integration in various fields.
h. Understanding of common numerical methods and how they are used to obtain approximate solutions to intractable mathematical problems.
i. Analyze and resolve the conflicts of economic situations.
j. Estimates and check mathematical results for reasonableness.
k. Ability to formulate mathematical structure for computer and communication systems.
l. Acquire knowledge about differential equations and integrating factor, separable equations and its applications.
m. Enrich the facts on functions, relations and systems of linear equations.
n. An ability to function effectively on teams to accomplish a common goal.
o. An understanding of professional, ethical, legal, security and social issues and responsibilities.
p. An ability to communicate effectively with a range of audiences.

PROGRAM SPECIFIC OUTCOMES (PSOs)

q. Ability to solve diverse situation problems in physics, engineering and other science fields.
r. Ability to think in a conceptual, analytical and logical manner.
s. 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	o	p	q	r	s
PEO I	X	X	X				X	X	X					X	X	X	X		X
PEO II				X	X	X				X		X	X		X		X		
PEO III	X								X	X	X				X			X	X

COURSE DETAIL USING PIE CHART

Chart Title

5

12

4

15

8

■ AEC ■ CC ■ Allied ■ SEC ■ DSE
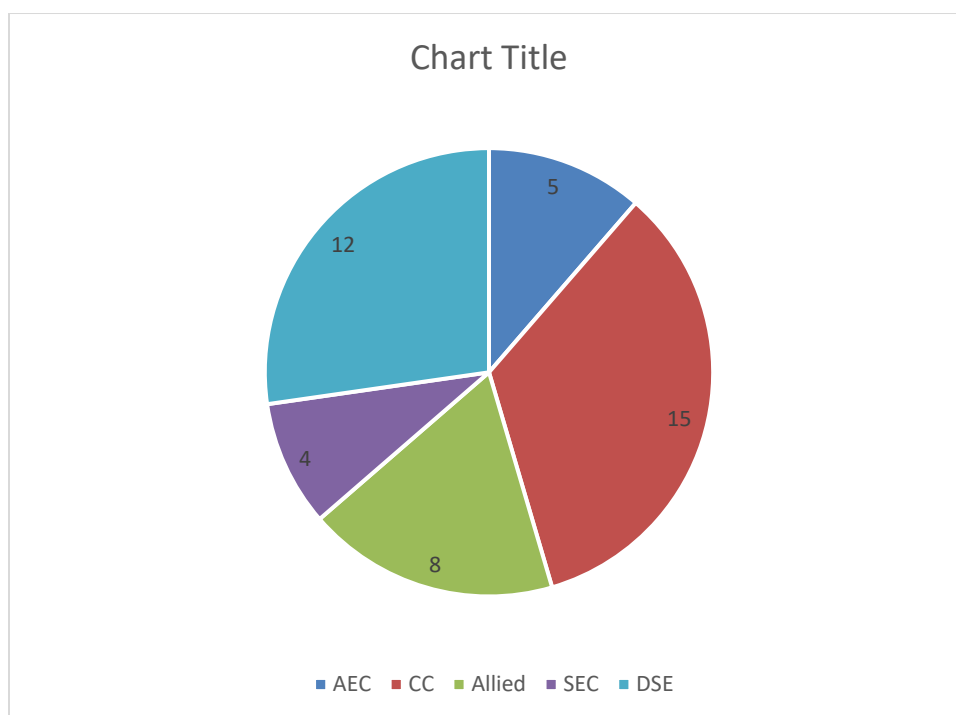
பகுதி – I, தமிழ்   முதல் பருவம்   **20LSU101**

தமிழ் முதல் தாள்   4-H,4-C

(இளநிலை அறிவியல் பட்ட வகுப்புகளுக்குரியது)

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 பன்நோக்கு அணுகுமுறையிலான ஆய்வுச் சிந்தனை மேம்பாடு.

4. வேலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல் .

5. சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப் பேணுவதற்குக் கருவியாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை வளர்ச்சி.

6. மொழிபெயப்பூத் துறைசார்ந்த வேலைவாய்புத் திறன் பெற்றிருத்தல்

தாள்கள் வரிசையும் தேர்வுச் செயல்திட்டமும்

பகுதி-I தமிழ்

இளநிலைப் பட்ட அறிவியல் வகுப்புகள்

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

அலகு – I : தமிழ் இலக்கிய வரலாறு – I   **(8 மணிநேரம்)**

முச்சங்க வரலாறு - சங்க இலக்கியத்தொகுப்பு - பாட்டும் தொகையும் - சங்கஇலக்கியச் சிறப்பியல்புகள் - சங்கம் மருவிய காலம் - பதினெண்கீழ்க்கணக்கு நூல்கள் – திருக்குறள் -நாலடியார் -

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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 – வினைத்திட்பம்,

   அதிகாரம் 100 - பண்புடைமை

2. முன்றுறையரையனார் – பழமொழி நானூறு 5 பாடல்கள்

   உணற்கு இனிய 5, பரந்த திறலாரை 32, நெடியது காண்கிலாய் 46, இனி யாரும் 153, உரைசான்ற 195.

3. ஒளவையார் – 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 என்பாள் 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' , 'ஆற்றுநர்க்களிப்போர் - '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

		Semester – I
20ENU101	**ENGLISH-I**	**4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0   **Marks:** Internal: **40**   External: **60** Total: **100**
End Semester Exam: 3 Hours

Course Objective:
- To give basic knowledge on grammar.
- To train communication in real life situation.
- To be familiar with the four basic skills of English.
- To train students to acquire proficiency in English by reading different genres of literature and learning grammar.
- To provide aesthetic pleasure through literature.
- To develop the moral values of students.

Course Outcome:
1. Retrieve fundaments 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 Reading:
Hewings Martin,2013Advanced Grammar in Use, Cambridge University Press
Haines Simon,2015 Advanced Skills, A resource Book of Advanced- Level Skill Activities

	Semester – I
20MMU101 **CALCULUS AND TRIGONOMETRY**	**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 concepts of essentials of concavity, inflection points and its geometrical applications.
- Trigonometric identities, the expansion of trigonometric functions, hyperbolic functions, inverse hyperbolic functions, logarithmic functions etc., which plays a crucial role in pure and applied Mathematics.
- Understand single and multiple integration to calculate the arc length, area and volume.
- The Higher order derivatives and its applications in business, economics and life sciences.
- Learn about the Integration by parts methods.
- Understand the concept of the Expansion of Series.

Course Outcomes (COs)

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

1. Explore the concept of reduction formula and calculate limits in indeterminate forms by a repeated use of L'Hospitals rule.
2. Understanding the concept of polar and cartesian coordinates.
3. Use integrals and properties of definite integrals.
4. Understand the application and properties of integration.
5. Learn about the basic concepts and techniques of trigonometric functions with its applications.
6. Know the concept of separation into real and imaginary parts.

UNIT I
DIFFERENTIAL CALCULUS

Hyperbolic functions- Higher order derivatives- Leibniz 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'Hospitals 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

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

UNIT IV
APPLICATIONS OF INTEGRATION

Volumes by slicing- Disks and washers 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 nθ , sin nθ -Powers of sines and cosines of θ in terms of functions of multiples of θ- Expansion of $\cos^n θ$, $\sin^n θ$ and $\sin^m θ \cos^n θ$- 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 .,(2012) .Application of calculus ,First Edition, Arunabha sen Books and
    Allied P.Ltd, Kolkata.

WEBSITE LINK:

1. http://vidyamitra.inflibnet.ac.in/index.php/search?subject%5B%5D=&course%5B%5D=Trigonom etric+Functions&domain%5B%5D=Physical+%26+Basic+Sciences
2. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25
3. http://172.16.25.76/course/view.php?id=1630
4. https://www.youtube.com/watch?v=YFXKu16kWd0

20MMU102 **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
- The functions, relations, systems of linear equations.
- How to identify, evaluate and simplify algebraic expressions using the correct operations.
- The basic concepts of linear algebra.
- The concepts of principles of mathematical induction.
- The solution and application of linear systems.
- The application of matrix, inverse of matrix and system of linear equations.

Course Outcomes (COs)
On successful completion of this course, the students will be able to
1. Know about the basic concepts of set theory.
2. Describe the categories of functions.
3. Understand the algorithms on operation.
4. Use matrix operations to solve system of linear equations.
5. Learn how to find characteristic equation, eigen value and eigen vector for matrix.
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., (2008). 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. T.K.Manicavasagom Pillai, T.Natarajan, .S.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

		Semester – I
20MMU103	**PHYSICS 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

- 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

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. Aruldhas 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. Principles of Electronics, V K Mehta and Rohit Mehta, S.Chand & Company Ltd. Revised Eleventh Edition 2008.
6. F. W. Sears and G. L. Salinger, Thermodynamics, Kinetic theory, and Statistical Thermodynamics, IIIrd ed., Narosa Publishing House (1998).

		Semester – I
20MMU111	**CALCULUS AND TRIGNOMERTY - 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
- 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.

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		Semester – I
20MMU112	**PHYSICS I-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

- 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 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

பகுதி – I, தமிழ்   இரண்டாம்பருவம்   **20LSU201**

தமிழ் இரண்டாம் தாள்   4-H,4-C

(இளநிலை அறிவியல் பட்ட வகுப்புகளுக்குரியது)

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 பன்நோக்கு அணுகுமுறையிலான ஆய்வுச் சிந்தனை மேம்பாடு.

4. வேலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல் .

5. சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப் பேணுவதற்குக் கருவியாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை வளர்ச்சி.

6. மொழிபெயப்புத் துறைசார்ந்த வேலைவாய்புத் திறன் பெற்றிருத்தல்

தாள்கள் வரிசையும் தேர்வுச் செயல்திட்டமும்

பகுதி-I தமிழ்
இளநிலைப் பட்ட அறிவியல் வகுப்புகள்

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

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

(அம்பொன் நீடிய, கொண்டு வந்து, ஆளு நாயகர், செல்வம் மேவிய, மாரிக் காலத்து, ஈர மேனியை, நமக்கு முன்பிங்கு, செல்லல் நீங்க, மற்றம் 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,
   இந்தப்புவியில், 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.

கற்பகம் உயர்கல்வி கலைக்கழகத் தமிழ்த்துறை வெளியீடு.

		Semester – II
20ENU201	**ENGLISH-II**	**4H – 4C**

Instruction Hours / week: L: 4 T: 0 P: 0   **Marks:** Internal: **40**   External: **60** Total: **100**

End Semester Exam: 3 Hours

End Semester Exam: 3 Hours

Course Objective:
- To refresh the grammar knowledge of the students to improvise their language.
- To make the students to speak and write error free English.
- To make the students understand different kinds of communication.
- To develop knowledge on the business environment communication.
- To help the students develop their listening, speaking, reading and writing skills.
- Introducing literary works to the students to enhance their analytical and aesthetic skills.

Course Outcome:
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

Books for References

Oxford Handbook of Writing: St. Martins Handbook of Writing 2013 CU Press

Sound Business, Julian Treasure 2012OUP

20MMU201 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 exact differential equations, linear homogeneous and non-homogeneous equations of higher order with constant coefficients.
- The complete solution of a non-homogeneous differential equation with constant coefficients by the method of undetermined coefficients.
- The basic concepts of Partial Differential Equations.
- How to solve Partial Differential Equations using Charpit's method.
- The transform of a periodic function.
- The applications of the inverse Laplace transform.

Course Outcomes (COs)

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

1. Solve any first order homogenious and non homogenious differential equations.
2. Evaluate Exact differential equations, Clairaut's form of equtaions and linear equations with constant coefficients.
3. Solve any patial differential equations and describe different integrals of pratial differential equations.
4. Estimate the standard types of partial differential equations and solve Larange's equations using Charpit's method.
5. Evaluate Laplace transforms of periodic functions and estimate integral using Laplace transforms.
6. Describe inverse Laplace transforms of periodic functions and solve Ode by using Laplace transforms.

UNIT I
DIFFERENTIAL EQUATIONS

Differential Equations: Introduction – First order O.D.E – Types of first order O.D.E – Applications of first order O.D.E – first order O.D.E 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, $e^{ax}cosbx$ and e^{ax} sinbx 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 EQUATION

Partial Differential Equations (PDE) Forming a PDE - Lagrange Method of solving Linear Equations - Standard forms of PDE - Charpits Method

UNIT IV
LAPLACE TRANSFORMS

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

UNIT V
INVERSE LAPLACE TRANSFORMS

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

SUGGESTED READINGS

1. S. Narayanan &T.K. Manickavasagam Pillai.,(1995) Differential Equations, S. Viswanathan Pvt. Ltd., Chennai.
2. T.Veerarajan.,(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. M. D. Raisinghania., (2004). Advanced Differential equations, S. Chand Publications, New Delhi
5. K.Vairaamanickam,, Nirmala P. Ratchagar & T. Tamilselvan.,(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

		Semester – II
20MMU202	**ANALYTICAL GEOMETRY**	**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 conicoids 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 a 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

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

SUGGESTED READINGS

1. P.Durai Pandian, Laxmi Duraipandian   Muhilan D (1998), Analytical Geometry, Emerald Publishers & Distributors
2. N.P. Bali(2001). Solid Geometry ,Laxmi Publications (P) Ltd ,New Delhi.
3. T.K. M. Pillai and T. Natarajan(2009). Analytical Geometry of 2D, Visvanathan Publications
4. M.L. Khanna(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/

		Semester – II
20MMU203	**Physics 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:

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: Sommerfield'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, The National Publishing Co, First edition,1988.

2. J. B. Rajam, Atomic Physics., S. Chand & Company Limited, New Delhi, First edition, 1990.

3. B. N. Srivastava, Basic Nuclear Physic, Pragati Prakashan, Meerut, 2005.

4. Albert Paul Malvino, Digital principles and Applications, McGraw-Hill International Editions, New York, 2002.

5. Digital fundamentals – by Floyd 8th edition Pearson education 2006

6. R. S. Sedha, A text book of Digital Electronics, S. Chand & Co, New Delhi, First edition ,2004.

20MMU211   **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 nth roots.

12. Ratio test by plotting the ratio of nth and $(n+1)^{th}$ term.

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:

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

Instruction Hours / week: L: 3 T: 0 P: 0   **Marks:** Internal: **40**   External: **60** Total: **100**
                                                                                                End Semester Exam: 3 Hours

Course Objectives

- 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)

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. AnubhaKaushik., 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.

		Semester – III
20MMU301	**STATISTICS**	**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., (2001). Statistical Methods, Sultan Chand & Sons, New Delhi.
2. Srivastava T.N., and ShailajaRego., (2012). 2e, Statistics for Management, McGraw Hill Education,New Delhi.
3. U Dinesh Kumar .,(2017), Business Analytics: The Science of Data - Driven Decision Making, Wiley, New Delhi.
4. Sheldon Ross., (2007). Introduction to Probability Model, Ninth Edition, Academic Press, IndianReprint.
5. R. Evans James .,(2017), Business Analytics, 2nd edition, Pearson Education, New Delhi.
6. Pillai R.S.N., and Bagavathi V., (2002). Statistics , S. Chand & Company Ltd, New Delhi.
7. Dr.P.N.Arora., (2002). A foundation course statistics, 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_JcleDbrVyPnE0PixKs2JE
3. https://nptel.ac.in/courses/110107114/
4. http://172.16.25.76/course/view.php?id=1642

		Semester – III
20MMU302	**MECHANICS**	**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

- The strong foundation in the concepts of mechanics to know how the friction is regulating the motion of objects.

- About the motion of particles under the influence of various forces like gravitational force, central force, impulsive force etc., which plays an essential role in Applied Mathematics.

- The application of geometric and trigonometric properties in equilibrium and motion of particles.

- The basic concepts of Moments, Friction and Motions.

- To develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering.

- To help the student develop this ability to visualize, which is so vital to problem formulation

Course Outcomes (COs)

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

1. Describe the Parallelogram, analytical expression, perpendicular triangle and polygon of forces.
2. Evaluate the resultant of parallel forces of two equal and unequal forces.
3. Measure the angle, coefficient and cone of friction and calculate moments of force.
4. Explain the concept of equation of motions and moment momentum, angular momentum in any physical situation.
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. M. K. Venkataraman(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. P.L. Srivastava (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
20MMU303A	**MULTIVARIATE CALCULUS**	**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 basics concept of functions of several variables.
- Mastery in the skills of limit and continuity functions of two variables.
- Definition and compute partial derivatives, directional derivatives and differentials.
- Find local extreme values of functions of several variables, test for saddle points, examine the conditions for the existence of absolute extreme values.
- Differential, integral and double integral calculus for functions of more than one variable.
- 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. Know about the Extrema of functions of two variables.
3. Use double, triple 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. Ability to 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., (2001). 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

Semester – III

20MMU303B	**COMPUTER GRAPHICS**	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 - Bresenhams 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, Vandam, 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

20MMU304   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
- To understand how C++ improves C with object-oriented feature.
- To learn the syntax and semantics of classes in C++ programming language.
- To learn how to perform operator overloading and inheritance.
- To learn how to design C++ using pointers.
- To learn file handling in C++.
- To learn to translate the computer algorithms to computer programs

Course Outcomes (COs)
Upon 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 Stroustroup, 2014, Programming - Principles and Practice using C++, 2nd Edition, Addison-Wesley.
4. Stefan Bjornander, 2016, C++ Windows Programming, Published byPackt 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
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

20MMU311   **STATISTICS - PRACTICAL**   **4H – 2C**

Instruction Hours / week: L: 0 T: 0 P: 4   **Marks:** Internal: **40**   External: **60** Total: **100**
                                                                                          End Semester Exam: 3 Hours

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Course Objectives

This course enables the students to learn

- It is well recognized nowadays the importance of Statistics as an indispensable tool for obtaining and spreading information.
- Importance has been enhanced by the use of computational resources and particularly the software SPSS, that showed, during the last decades, to be an effective tool for treating and analyzing statistical data.
- Ability to use SPSS procedures in handling data files and performing statistical analysis, and to interpret the outputs provided by the program.
- Acquiring sensitivity and critical thinking towards arguments and conclusions based on statistical studies.
- Understanding the fundamental principles underlying descriptive and inferential statistical reasoning; ability to perform current statistical analysis, selecting the most appropriate techniques and methods for collecting and processing statistical data.
- 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. Apply SPSS Package, to find mean, mode, median for any data.

3. Test the significance of hypothesis using Z and Chi-square test.

4. Calculate the rank correlation in united and tied ranks.

5. Design a program for analyzing data in SPSS package.

6. Know when to use basic statistical hypothesis tests (t-tests, chi-squared tests, correlation) and how to carry out these tests using SPSS.

LIST OF PRACTICAL

1. Introduction to problem solving software
2. Excel as a tool for Data Analysis
3. Data Feeding and functions used in Excel
4. Drawing of graphs and diagrams using Excel
5. Introduction to SPSS Software Package for Data Analytics

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6. Calculation of Basic Statistical Measures using Excel.
7. Introduction to SPSS Software Package for Data Analytics
8. Drawing of graphs and diagrams using SPSS software
9. Calculation of Mean, Median and Mode
10. Calculation of Standard deviation and Coefficient of Variation
11. Calculation of Karl Pearson's Correlation
12. Calculation of Rank Correlation Coefficient
13. Fitting of Linear Regression
14. Calculation of Mean and Variance for Binomial and Poisson Distribution
15. Various other Software Package available for Data Analytics

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

20MMU312 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).

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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 Stroustroup, 2014, Programming - Principles and Practice using C++, 2nd Edition, Addison-Wesley.
4. Stefan Bjornander, 2016, C++ Windows Programming, Published byPackt 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
3. www.cplusplus.com
4. www.learncpp.com
5. www.udemy.com

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 to solve the algebraic and transcendental equations.
- Solve engineering problems which are impossible to solve by analytical means.
- To solve the simultaneous linear algebraic equations.
- To find the numerical solution for differential and integral equation.
- To prove results for various numerical root finding methods.
- To derive appropriate numerical methods to solve interpolation-based problems.

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 to find interpolation of equal and unequal intervals.
5. Express numerical integration and differentiation in applied areas.
6. Evaluate the numerical solution of ordinary differential equations.

UNIT I
THE SOLUTION OF NUMERICAL ALGEBRAIC AND TRANSCENDENTAL EQUATIONS
Bisection method – Iteration Method – Convergence condition – Regular 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., (2004)"Numerical Methods for Scientists and Engineers" 2nd Edition Prentice Hall India.
3. Jain. M.K., Iyengar. S.R.K.,and Jain R.K., (2012). Numerical Methods for Scientific and Engineering Computation, 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, Sixth 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

20MMU402   **DISCRETE MATHEMATICS**   **7H – 6C**

Instruction Hours / week: L: 6 T: 1 P: 0   **Marks:** Internal: **40**   External: **60** Total: **100**
                                                                              End Semester Exam: 3 Hours

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Course Objectives
This course enables the students to learn
- Understand the basic concepts of mathematical logic.
- The basic concepts of ordered relations and structures.
- Study Normal Forms and its properties.
- About relations, functions and Properties of binary relation in a set.
- Semi groups and formal languages.
- Lattice and its algebraic properties.

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. Understand the concept of Composition of relations and functions.
4. Understand the importance of mathematics as precursor to various Notions of Syntax Analysis and formal languages.
5. Study Lattice and its algebraic properties.
6. Get the knowledge about Direct product and homomorphism and sub lattice.

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

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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. J.P.Trembly, R.Manohar ,(2001).Discrete mathematical structures with applications to computer science, Tata Mc Graw Hill, NewDelhi.
2. Prof.V.Sundaresan, K.S.GanapathySubramaniyan, K.Ganesan (2000).Discrete Mathematics , ,Tata Mc Graw Hill, New Delhi.
3. L.Lovarz, J.Pelikan, K.Vexztergombi ,(2002).Discrete Mathematics , Springer International Edition.
4. N. Chandrasekaran M. Uma parvathi ,(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

| 20MMU403A | **OPERATIONS RESEARCH** | 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 simplex method to solve small linear programming models by hand, given a basic feasible point.
- Formulation of a given simplified description of a suitable real-world problem as a linear programming model.
- 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.
- Solution of Transportation problem and Assignment Problems.
- Fundamental concepts of duality, economic interpretation of dual constraints and game theory.
- About the rules of network construction and critical path analysis.

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. Use game theory concepts to find the solution of linear programming problems.
6. Study critical path analysis and probability considerations in PERT.

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

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

		Semester – IV
20MMU403B	**OPERATING SYSTEM: LINUX**	**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 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, Start up 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, Addision 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

20MMU404   **PROGRAMMING IN PYTHON**   **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
- 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, "Fundamentals of Python: First Programs, Cengage Learning", second edition, 2018, ISBN 13:978-1337560092.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
3. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
4. John V Guttag, ―Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015.
7. Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
8. Charles Dierbach, ―Introduction to Computer Science using Python: A Computational ProblemSolving Focus, Wiley India Edition, 2013.
9. Paul Gries, Jennifer Campbell and Jason Montojo, ―Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

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
20MMU411	**NUMERICAL METHODS - 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

- Exercise user defined functions to solve real time problems.
- Illustrate flowchart and algorithm to the given problem.
- The basic structure of the programme, declaration and usage of variables.
- The mathematical skills of the students in the areas of numerical methods.
- Practical approach to apply the acquired knowledge and skills in professional and specialist courses.
- To find the approximate solution to complicated mathematical problems

Course outcomes (COs)
On successful completion of this course, the student will be able to

1. Use different memory allocation methods.
2. Deal with different input/output methods.
3. Use different data structures.
4. Express their ideas in terms of the syntax of the computer package.
5. Apply the programme in the real-world situation involving numerical problems.
6. Mastery in mathematical programming software.

List of Practical (Any 10 Programs)
1. Calculate the sum $1/1 + 1/2 + 1/3 + 1/4 + $ ----------$+ 1/$ 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. Regular Falsi Method.

8. LU decomposition Method.

9. Gauss-Jacobi Method.

10. Gauss-Seidel Method.

11. Lagrange Interpolation or Newton Interpolation.

12. Simpson's rule.

		Semester – IV
20MMU412	**PROGRAMMING IN PYTHON - 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

- 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, "Fundamentals of Python: First Programs, Cengage Learning", second edition, 2018, ISBN 13:978-1337560092.

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

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
20MMU501	**REAL ANALYSIS-I**	**7H – 5C**

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:

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2. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25
3. http://vidyamitra.inflibnet.ac.in/index.php/content/index/5a5dcb5b8007be86ccbc2ff5
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<div style="text-align:right">**Semester – V**</div>

20MMU502A	**COMPLEX ANALYSIS-I**	**8H – 6C**

Instruction Hours / week: L: 6 T: 2 P: 0   **Marks:** Internal: **40**   External: **60** Total: **100**

<div style="text-align:right">**End Semester Exam:** 3 Hours</div>

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 Complex Integration
- 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 ration 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 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→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, Sci tech Publications 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., (2009). Complex variables and applications, McGraw Hill, London.

WEBSITE LINK:

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2. https://nptel.ac.in/courses/111103070/
3. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25
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	Semester – V
20MMU502B **INDUSTRIAL MATHEMATICS**	**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

- The basic facts about application of mathematics.
- Display the knowledge of conventions such 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 behavior and Beers Law (The fundament question of image construction) Lines in the place.

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/

		Semester – V
20MMU503A	**ABSTRACT ALGEBRA**	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

- 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., (2001). Contemporary Abstract Algebra, Fourth 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, (1992), Modern Algebra, Vikas Publishing house.
5. A.R.Vasishtha, (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&domai   n%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

		Semester – V
20MMU503B	**SPECIAL FUNCTIONS**	**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

LEGENDER'S EQUATIONS

Legendre's equation, Legendre's polynomial Pn(x), Legendre's function of the second kind [Qn(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 Pn(x) Green's function – Green's Identities – Generalized functions.

SUGGESTED READINGS

1. M.D. Raisinghania (2016), Ordinary and Partial Differential Equations, 18th edition, S.Chand Company.

2. I. N. Sneddon (2009). Special Functions of mathematical Physics & Chemistry, 3 Oliver & Boyd, London.

3. N. N. Lebedev (1972). Special Functions and Their Applications , PHI.

4. R. Askey and R. Roy, (2013).Special Functions, Cambridge.

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

20MMU504A	**NUMBER THEORY**	**Semester – V** **7H – 5C**

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, (2007). Elementary Number Theory, Sixth 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.

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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

| 20MMU504B | **PORTFOLIO OPTIMIZATION** | 7H – 5C |

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 RIKS

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
PORTPOLIO 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
20MMU601	**REAL ANALYSIS-II**	**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
- Assist the students in learning fundamental ideas and theorems about metric space
- Enrich their knowledge in completeness and connectedness of a metric space
- Study about continuous and Discontinuous functions on Real number system
- Know about the connectedness and connected subsets of $\mathbb{R}$
- Learn about 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. Give a strong foundation to take up advanced level courses in analysis.
2. Construct proofs, counter arguments or counter examples in reals.
3. Demonstrate completeness, limits, continuity.
4. Describe and prove contraction mapping theorem
5. Demonstrate compactness and its characterization.
6. Make the student a good background on basic real analysis

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 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. S. C. Malik &SavitaArora, (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., (2012). Methods of Real Analysis, Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
7.Bali N. P. (2005). Real Analysis, An imprint of Laxmi Publications Pvt. Ltd., New Delhi.

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3. http://vidyamitra.inflibnet.ac.in/index.php/content/index/5a5dcb5b8007be86ccbc2ff5
4. http://vidyamitra.inflibnet.ac.in/index.php/content/index/5704c5378ae36c6ab9b0afbf

Semester – VI

20MMU602A   **COMPLEX ANALYSIS-II**   **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

- The concepts of analytic function of complex number system, complex function and complex integration
- The concept of Taylor's and Laurent's series.
- The concept of Singularities, real definite integrals and Meromorphic functions.
- The applications of residue theorems.
- The concept 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 fundamental concepts of complex analysis and mean value theorem and their role in modern mathematics and applied contexts.
2. Express the concepts of Taylor's and Laurent's series.
3. Evaluate the types of singularities of complex functions and its properties.
4. Understand the concepts of residue and its applications.
5. Evaluate the poles and using integration of rational functions.
6. Describe the definite Integrals – 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 Logaraithmic 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 (2004). Complex Analysis, ScitechPublications India, Pvt., Ltd.
2. Duraipandian P and KayalalPachaiyappa (2009).Complex Analysis, Muhil Publishers.
3. Ponnusamy, S(2005). Foundations of Complex Analysis, 2ndEdition, Narosa Publication, New Delhi.
4. Churchill R.V and Brown J.W., (2009). Complex variables and applications, McGraw Hill, London.
5. Singaravelu A. (2005). Engineering Mathematics-II, Meenakshi Agency, Medavakkam, Chennai.

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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
20MMU602B	**GRAPH THEORY**	**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

- Definitions and Basic properties of graphs.
- The fundamental concepts in graph theory.
- A blended method to prove theorems.
- The concept of Trees, spanning trees and its properties.
- Basic concepts in graph theory and a variety of different problems in Graph Theory.
- Gain the knowledge of various graphs algorithms will also be taught along with its analysis.

Course Outcomes (COs)

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

1. Understand and Apply the fundamental concepts in graph theory.
2. Understand basic results related with Eulerian and Hamiltonian graphs.
3. Study about Chromatic polynomial, Matching and Covering.
4. Know about the fundamental concepts of trees.
5. Understand the Spanning trees, rank and nullity.
6. 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 – Pseduo 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, (2001) .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-n94O2v4Ll7Enf37HLeh04eHSl
3. http://youtube.be/E40r8DWgG40
4. http://172.16.25.76/course/view.php?id=2073

		Semester – VI
20MMU603A	**LINEAR ALGEBRA**	**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

- Normalize vectors, obtain vectors of a given length in a given direction, and explain how to tell if two vectors are orthogonal.
- Be able to use and understand matrix and Linear combinations.
- Mathematical maturity and enables to build mathematical thinking and use results from canonical forms and inner product spaces to solve contemporary problems.
- Construct visualizations of matrices related to vector fields. Explain how eigenvalues and eigenvectors relate to vector fields.
- Understand the concepts of matrix and its applications.
- Normalize vectors, obtain vectors of a given length in a given direction, and explain how to tell if two vectors are orthogonal.

Course Outcomes (COs)

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

1. Recognize some advances of vector spaces and linear transformations.
2. Understand the concepts of linear combinations and its problems.
3. Study about the inner product space and its applications.
4. Visualize linear transformations as a matrix form.
5. Know the concept of solution of simultaneous linear equation.
6. Knowledge about properties of eigen values and eigen vector.

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. S. Kumaresan, (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. Dr.R.Balakrishnan and Dr.N.Ramabadran, (1984), A Text Book of Modern Algebra, Vikas Publishing Limited, NewDelhi
4. A.R.Vasishtha, (2019) Modern Algebra, Krishna Prakashan Mandir, Meerut.
5. S. Arumugam&A. T. Isaac, (2003).Modern Algebra, SciTech Publications, India Pvt. Ltd.
6. Kennath M. Hoffman and Ray Kunze, (2015). Linear Algebra, 2 Edition, Pearson India Publishing, New Delhi.

WEBSITE LINK:

1. http://vidyamitra.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

20MMU603B   **MATHEMATICAL MODELING**   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

- 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.

SUGGESTEDREADINGS

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. TynMyint-U and Lokenath Debnath, (2006).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

		Semester – VI
20MMU604A	**APPLIED STATISTICS**	**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 form 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 tolls 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
DESINING 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 Enginners.,1st Edition ,Wiley India.
2. Srivastava T.N., and ShailajaRego., (2012). 2e, Statistics for Management, McGraw Hill Education, New Delhi.
3. U Dinesh Kumar ., (2017), Business Analytics: The Science of Data - Driven Decision Making, Wiley, New Delhi.
4. R. Evans James ., (2017), Business Analytics, 2nd edition, Pearson Education, New Delhi.
5. Pillai R.S.N., and Bagavathi V., (2002). Statistics , S. Chand & Company Ltd, New Delhi.
6. Dr.P.N.Arora., (2002). A foundation course statistics, S.Chand& Company Ltd, New Delhi.
7. Cochran.W.C. 1977, Sampling Techniques, Third Edition, Wiley Eastern.
8. Montgomery Douglas C., 2008., Introduction to Statistical Quality Control., Sixth Edition, John Wiley & sons
9. Gupta S.P., (2001). Statistical Methods, Sultan Chand & Sons, New Delhi.
10. Ishikawa K., 1983. Guide to Quality Control., 2 nd Edition, Asian Productivity Organization, Tokyo.
11. Harry .M And Schroeder R., 2000. Six sigma: The Breakthrough Management Strategy., Currency Pulishers, 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
20MMU604B **DIFFERENTIAL GEOMETRY**	**6H – 4C**

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

- To get introduced to the concept of a regular parameterized curve in n
- To Understand the concept of curvature of a space curve and signed curvature of a plane curve.
- To be able to understand the fundamental theorem for plane curves.
- To get introduced to the notion of Serret-Frenet frame for space curves and the
- Involutes and evolutes of space curves with the help of examples. To be able to compute the curvature and torsion of space curves.
- 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. Study the Tensors of different type, Algebra of tensors and contraction.
5. Know about the Parallel propagation of vectors.
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., (2012). An Introduction to Differential Geometry, Dover Publications, New York.
2. B. O'Neill., (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

Semester – VI

20MMU691	PROJECT	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