KAMARAJ COLLEGE

(AUTONOMOUS)

Accredited with A+ Grade by NAAC

Among Top 150 Colleges in India - NIRF Ranking 2025

இந்து நாடார் சங்கங்களால் 1966-ல் தொடங்கப்பட்ட கல்லூரி

(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

THOOTHUKUDI - 628 003.

B.Sc., Mathematics

Semester - I to VI

(for the students those who joined from the academic year 2024-2025)

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SYLLABUS

(for the students those who joined from the academic year 2024-2025)

Department Profile

Name of the Programme - B.Sc., Mathematics

Programme Code - 03002

Year of Establishment -1966

Vision

- To nurture curiosity and creativity in learning
- To develop student's ability to solve problems
- To contribute to the community through mathematical projects and initiatives
- To promote better living conditions for the underprivileged

Mission

- Provide students with advanced mathematical content
- Prepare students to be global representatives
- Encourage students to appreciate the beauty of mathematics
- Apply mathematical knowledge to develop society

College mail ID kamarajcoll@gmail.com

College website www.kamarajcollege.ac.in

Under Graduate Degree Programme

1. Introduction

Programme Outcome, Programme Specific Outcomes and Course Outcomes

Students completing this programme will be able to present their core under-graduate discipline clearly and precisely, make abstract ideas precise by formulating them in the language of the specific discipline, describe related ideas from multiple perspectives and explain fundamental concepts. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in various other public and private enterprises.

Eligibility: Students who have completed +2 course with Mathematics, Physics, Chemistry and Biology (or) Mathematics, Computer Science, Physics and Chemistry.

Learning outcomes- Based curriculum frame work guidelines based regulations for undergraduate programme	
Programme	**B.Sc.(Mathematics)**
Programme Code:	**03002**
Duration:	**3 Years (UG)**

Programme Outcomes:	
PO1	**Disciplinary knowledge**: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study.
PO2	**Communication Skills**: Ability to express thought sand ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.
PO3	**Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyze and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO4	**Problem solving:** Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.
PO5	**Analytical reasoning**: Ability to evaluate their liability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
PO6	**Research-related skills:** A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause- and-effect relationships; ability to plan, execute and report the results of an experiment or investigation
PO7	**Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team
PO8	**Scientific reasoning:** Ability to analyze, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

Programme Specific Outcomes (PSOs)

PSO1: Placement: To prepare the students who will demonstrate respectful engagement with others ideas, behaviour and beliefs. Also apply diverse frames of reference to decisions and actions.

PSO2: Entrepreneur: To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skills that will facilities start-ups and high potential organisations.

PSO3: Research and Development: Design and implement HR system and practices grounded in research that complies with employment laws, leading the organisation towards growth and development.

PSO4: Contribution to Business Words: To produce employability, ethical and innovative professionals to sustain in the dynamic business world.

PSO5: Contribution to the Society: To contribute to the development of the society by collaborating with stakeholders for mutual benefits.

Methods of Assessment	
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or Overview
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate Between various ideas, Map knowledge
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons
Create (K6)	Check knowledge in specific or off beat situations, Discussion, Debating or Presentations

Methods of Evaluation		**Marks**	
Internal Evaluation	Continuous Internal Assessment Test	15	25
	Assignment (PPT) and Seminar	5	
	Group Discussion and Viva	5	
External Evaluation	End Semester Examination		75
Total			**100**

Extra Credits

Curricular Activities	Co-Curricular Activities	Extra-Curricular Activities
Paper Presentation	Cultural Competitions	NCC
Paper Publication	Domain Clubs	NSS
Placement Training		Sports
Quiz		YRC
Competitions		UBA
SWAYAM /NPTEL/MOOCs		

Level	Credit			
	Participation	III Prize	II Prize	I Prize
Intra college	1	2	3	4
Intercollegiate	2	3	4	5
District	3	4	5	6
University	4	5	6	7
State	5	6	7	8
National	6	7	8	9
International	7	8	9	10

****Paper Presentation for each paper: 1credit**

Total credits Under–Graduate Courses including Lab Hours – 2024 to 2025

Semester	Hours	Credits	Additional Credits
I	30	23	2
II	30	23	2
III	30	22	2
IV	30	23	2
V	30	28	3
VI	30	24	3
Total		**143**	**14**

*

**Extra Credit will be given on the basis of student's performances

Written Examination: Theory Paper (Bloom's Taxonomy based) Question paper Model Assessment Pattern

Continuous Internal Assessment (CIA) & End Semester Examination (ESE)

- CIA : 25
- ESE: 75

Theory Course:

For theory courses there shall be two tests conducted by the faculty concerned and the average of the two can be taken as the Continuous Internal Assessment (CIA). CIA is for 30 marks max and will be converted in to 15 marks. The duration of each test shall be 1 ¼ hrs.

Continuous Internal Assessment (Writing)	15 marks
Assignment (PPT) & Seminar	5 marks
Viva & Group Discussion	5 marks

For theory Papers:

- Part A (10×1=10) Marks-Answer all questions (Multiple choice)
- Part B (5×5=25) Marks-Choosing either(a) or (b)
- Part C (5×8=40) Marks-Choosing either (a) or (b)

  Total =75 marks

Laboratory Courses Assessment

- CIA-40marks
- ESE-60marks
- Mandatory Record submission, attendance and class participation.
- Two CIA for 40 marks max. The average of the two can be taken as the Continuous Internal Assessment.
- The duration of each test shall be 3 hours. In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum. The S, M, L is based on the Course Outcomes. The mapping is based on the revised Bloom's

Taxonomy Verbs used to describe your Course outcomes.

- Remember and Understanding–Lower level
- Apply and Analyse– Medium Level
- Evaluate and Create–Strong Level

Pedagogy:

- Technology Based Learning (PPT)
- Peer Teaching (Chalk & Talk)
- Virtual Lab
- Blended Learning (Online & Offline)
- Group Learning
- Self - Study
- Games Based Learning

Course Structure for Science Stream
First Year – Semester I
B.Sc., Mathematics
(With effect from the academic year 2024 - 2025 onwards)

Semester I	Course Code	Title of the Course	Hours / Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part - I	24ULTL11	தமிழ் இலக்கிய வரலாறு - I	6	3	3	25	75	100
Part - II	24ULEN11	General English - I	6	3	3	25	75	100
Part - III Core - I	24UMMA11	Algebra and Trigonometry	4	4	3	25	75	100
Core - II	24UMMA12	Differential Calculus	4	4	3	25	75	100
EC - I Discipline /Generic (Select any one)	24UEPH11 24UEPHL1 24UECS11 24UECSL1	1. Allied Physics -I Allied Physics Lab - I (OR) 2. Allied Computer Science Programming Language C Allied Computer Science Practical	6	T-3 P-2	3	25 40	75 60	100 100
Part - IV SEC - I	24USMA11	Mathematics for Competitive Examinations–I	2	2	3	25	75	100
FC	24UFMA11	Bridge Mathematics	2	2	3	25	75	100
		Total	**30**	**23**				

****SEC - Skill Enhancement Course** ****CIA – Continuous Internal Assessment**

****EC – Elective Course** ****ESE – End Semester Examination**

****FC - Foundation Course**

Course Structure for Science Stream
First Year – Semester – II
B.Sc., Mathematics
(With effect from the academic year 2024 - 2025onwards)

Semester II	Course Code	Title of the Course	Hours /Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part - I	24ULTL21	தமிழ் இலக்கிய வரலாறு - II	6	3	3	25	75	100
Part - II	24ULEN21	General English – II	6	3	3	25	75	100
Part - III Core - III	24UMMA21	Analytical Geometry (2 and 3 dimensions)	4	4	3	25	75	100
Core - IV	24UMMA22	Integral Calculus	4	4	3	25	75	100
EC - II Discipline /Generic (Select any one)	24UEPH21 24UEPHL2 24UECS21 24UECSL2	1. Allied Physics -II 2. Allied Physics Lab - II (OR) 3. Allied Computer Science Programming Language C ++ 4. Allied Computer Science Practical	6	T-3 P-2	3	T-25 P-40	T-75 P-60	100 100
Part - IV SEC - II	24USMA21	Mathematics for Competitive Examinations – II	2	2	3	25	75	100
SEC - III	24USMA22	LaTex	2	2	3	25	75	100
		Total	**30**	**23**				

**** SEC-Skill Enhancement Course** **** CIA- Continuous Internal Assessment**
**** EC –Elective Course** **** ESE- End Semester Examination**

Course Structure for Science Stream
Second Year – III Semester
B.Sc., Mathematics
(With effect from the academic year 2024 - 2025 onwards)

Semester III	Course Code	Title of the Course	Hours /Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part I	24ULTL31	தமிழக வரலாறும் பண்பாடும்	6	3	3	25	75	100
Part II	24ULEN31	General English - II	6	3	3	25	75	100
Part III Core V	24UMMA31	Vector Calculus and Applications	4	4	3	25	75	100
Core VI	24UMMA32	Differential Equations and Applications	4	4	3	25	75	100
EC III Discipline /Generic	24UEMA31	*Statistics – I	6	4	3	25	75	100
	24UEMA32	Difference Equations						
Part-IV SEC IV	24USMA31	*Computational Mathematics	2	2	3	25	75	100
Part - IV	24UYOG31	Yoga, Culture & Heritage	2	2	1.5	25	75	100
		Total	**30**	**22**				

**** SEC-Skill Enhancement Course** **** CIA- Continuous Internal Assessment**
**** EC –Elective Course** **** ESE- End Semester Examination**
***For statistics –I and Computational Mathematics, Scientific calculator should be provided.**

Course Structure for Science Stream
Second Year – Semester – IV
B.Sc., Mathematics
(With effect from the academic year 2024 – 2025 onwards)

Semester IV	Course Code	Title of the Course	Hours /Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Part - I	24ULTL41	தமிழும் அறிவியலும்	6	3	3	25	75	100
Part - II	24ULEN41	General English - IV	6	3	3	25	75	100
Part - III Core - VII	24UMMA41	Sequences and Series	5	5	3	25	75	100
Core - VIII	24UMMA42	Fourier Series and Integral Transforms	5	5	3	40	60	100
EC - IV Discipline /Generic (Select any one)	24UEMA41	*Statistics – II	4	3	3	25	75	100
	24UEMA42	*Numerical Methods						
Part-IV SEC -V	24USMA41	Geogebra	2	2	3	25	75	100
Part - IV	24UEVS41	Environmental Studies	2	2	3	25	75	100
Part - V	24UEA41	NCC/ NSS/ YRC/ SPORTS	-	1	-	-	-	100
		Total	**30**	**24**				

**** SEC-Skill Enhancement Course** **** CIA- Continuous Internal Assessment**
**** EC –Elective Course** **** ESE- End Semester Examination**
*** For statistics –II, Scientific calculator, Area table for standard normal distribution, table for ordinated for the standard normal curve, table for student's t- distribution, table for χ^2- distribution, table for F – distribution, F- test 5% points should be provided.**
***For Numerical Methods, Scientific calculator should be provided.**

Course Structure for Science Stream
Third Year – Semester – V
B.Sc., Mathematics
(With effect from the academic year 2024– 2025 onwards)

Semester V	Course Code	Title of the Course	Hours /Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Core - IX	24UMMA51	Abstract Algebra	5	5	3	25	75	100
Core - X	24UMMA52	Real Analysis	5	5	3	25	75	100
Core - XI	24UMMA53	Graph Theory	5	5	3	25	75	100
Core – XII (Select any one)	24UMMA54	1. Mathematical Modelling	5	4	3	25	75	100
	24UMMAP1	2. Group Project with Viva -Voce	5	4	1.5	50	50	100
EC - V (Select any one)	24UEMA51 24UEMA52	1. *Operations Research –I 2. Discrete Mathematics	5	3	3	25	75	100
EC - VI (Select any one)	24UEMA53 24UEMA54	1. Combinatorial Mathematics 2. Fuzzy Sets and Applications	5	3	3	25	75	100
Part - IV	24UPDT51	Personality Development	2	2	3	25	75	100
Training	24UINT51	*Internship	-	2	1.5	50	50	100
		Total	**30**	**28**				

**** SEC-Skill Enhancement Course** **** CIA- Continuous Internal Assessment**
**** EC –Elective Course** **** ESE- End Semester Examination**

***For Operations Research - I, scientific calculator should be allowed.**
***Internship – course duration - 7 to14 days (Report should be submitted & Viva-Voce will be conducted for the report which is equivalent to the project Viva – Voce)**

Course Structure for Science Stream

Third Year – Semester – VI

B.Sc., Mathematics

(With effect from the academic year 2024 – 2025 onwards)

Semester VI	Course Code	Title of the Course	Hours /Week L/P	Credit	Duration of ESE (Hrs.)	Marks Allotted		
						CIA	ESE	Total
Core - XIII	24UMMA61	Linear Algebra	6	6	3	25	75	100
Core - XIV	24UMMA62	Complex Analysis	6	6	3	25	75	100
Core - XV	24UMMA63	Mechanics	6	6	3	25	75	100
EC - VII (Select any one)	24UEMA61 24UEMA62	1. *Operations Research – II 2. Financial Mathematics	6	3	3	25	75	100
EC - VIII (Select any one)	24UEMA63 24UEMA64	1. Number Theory 2. Astronomy	6	3	3	25	75	100
		Total	**30**	**24**				

**** SEC-Skill Enhancement Course** **** CIA- Continuous Internal Assessment**

**** EC –Elective Course** **** ESE- End Semester Examination**

***For Operations Research - II, scientific calculator should be allowed.**

Semester – I

Algebra and Trigonometry

Title of The Course		**Algebra And Trigonometry**			
Course Type		**Core - I**			
Course Code		**24UMMA11**			
Year	**I**	**Semester**	**I**	**Credits**	**4**

Instructional Hours Per week	**Lecture**	**Tutorial**	**Lab Practices**	**Total**
	4	**--**	**--**	**4**

Learning Objectives	
	Basic ideas on the theory of equations and to,
LO1	Understand the Basic ideas on the theory of equations
LO2	Find numerical solution of an equation
LO3	Find the summation of Series
LO4	To gain Knowledge to find expansions of trigonometry functions
LO5	Solve theoretical and applied problems.

Unit	**Contents**
I	Reciprocal Equations – Standard form–Increasing or decreasing the roots of a given equation – Removal of terms – Related problems. (Chapter 6 : Sections - 16 to 19)
II	Symmetric function of roots – Sum of powers of the roots of an equation – Newton's theorem –Approximate solutions of roots of polynomials– Horner's method – General solutions of the cubic equation – Cardon's method – Trigonometrical method – Related problems. (Chapter 6: Sections-12 to 14, 30, 34)
III	Summation of Series: Binomial – Exponential – Logarithmic Series (Theorems without proof) – Approximations–Related problems. (Chapter 3 : Sections-10, 14 : Chapter 4 : Sections -3, 5, 7, 9, 11)

IV	Expansions of $\sin n\theta$, $\cos n\theta$ in powers of $\sin\theta$, $\cos\theta$ Expansion of $\tan n\theta$ in terms of $\tan\theta$, Expansions of $\cos^n\theta$, $\sin^n\theta$, $\cos^m\theta \sin^n\theta$–Expansions of $\tan(\theta_1 + \theta_2 + \cdots \theta_n)$– Expansions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ interms of θ–related problems. (Chapter 3)
V	Hyperbolic functions – Relation between circular and hyperbolic functions Inverse hyperbolic functions, Logarithm of complex quantities – Related problems. (Chapter 4, Chapter 5 : Section- 5)

Extended Professional Component (is a part of intimal Component only not to be include in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, professional communication and transfer able skill.

Recommended Texts	
1	T.K. Manicavachagam Pillay, T. Natarajan and K.S. Ganapathy, Algebra VolI, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 2017.
2	S. Narayanan and T.K. Manicavachagam Pillay, Trigonometry, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 2009.

Reference Books	
1	W.S. Burns's tine and A.W. Panton, Theory of equations.
2	C.V. Durrell and A.Robson, Advanced Trigonometry, Courier Corporation, 2003.
3	J. Stewart, L. Redlin and S. Watson, Algebra and Trigonometry, C Engage Learning, 2012.
4	Calculus and Analytical Geometry, G.B. Thomas and R.L. Finny, Pearson Publication, 9th Edition, 2010.
5	David C.Lay, Linear Algebra and its Applications, 3rdEd., Pearson Education Asia, Indian Reprint, 2007
6	G.B. Thomas and R.L. Finney, Calculus, 9th Ed. Pearson Education, Delhi, 2005.

Course Outcomes

CO No.	On Completion of the course, students will be able to
CO1	Classify And Solve Reciprocal equations.
CO2	Find the sum of powers of the roots of an equation.
CO3	Find the sum of Binomial, exponential and logarithmic series.
CO4	Expand the powers and multiples of trigonometric functions in terms of sine and cosine.
CO5	Determine relationship between circular and hyperbolic functions.

Mapping With Programme Outcomes and Programme Specific Outcomes

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	3	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Differential Calculus

Title Of The Course	**Differential Calculus**				
Course Type	**Core - II**				
Course Code	**24UMMA12**				
Year	**I**	**Semester**	**I**	**Credits**	**4**
Instructional Hours Per week		**Lecture**	**Tutorial**	**Lab Practices**	**Total**
		3	**1**	**--**	**4**

Learning Objectives Basic ideas on the theory of equation sand to,	
LO1	The basic skills of differentiation, successive differentiation.
LO2	Basic Skills of Partial differential equations.
LO3	Basic knowledge on the notions of curvature, evaluates, involutes.
LO4	Basic knowledge on polarco-ordinate sand insolving related problems
LO5	Improving knowledge on applications of differentiation.

Unit	Contents
I	**Successive Differentiation**: Introduction (Review of basic concepts) – The n^{th} derivative – Standard results – Trigonometrically transformation – Formation of equations involving derivatives Leibnitz formula for the n^{th} derivative of a product. (Chapter 3: Sections - 1.1 to 1.6, 2.1)
II	**Partial Differentiation**: Partial derivatives – Successive partial derivatives – Function of a function rule – Total differential coefficient – A special case – Implicit functions. (Chapter 8: Sections - 1.1 to 1.5)

III	**Partial Differentiation (Continued)**: Homogeneous functions – Partial derivatives of a function of two variables – Maxima and Minima of two variables. (Chapter 8 : Sections - 1.6, 1.7, 4 and 5)
IV	**Envelope:** Method of finding the envelope–Another definition of envelope – Envelope of family of curves which are quadratic in the parameter. (Chapter 10: Sections -1.1 to 1.4)
V	**Curvature:** Definition of Curvature – Circle, Radius and Centre of Curvature – Evaluates and Involutes – Radius of Curvature in Polar co-ordinates. (Chapter 10: Sections -2.1 to 2.6)

Extended Professional Component (is a part of intimal Component only not to be include in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, professional communication and transfer able skill.

Recommended Texts

1	S.Narayanan and TK. Manicavachagom Pillay, Calculus, Vol1, S.Viswanathan (Printers &Publication) PVT. LID.2015.

Reference Books	
1	R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer- Verlag, New York, Inc., 1989.
2	T. Apostol, Calculus, VolumesI and II...
3	S.Goldberg, Calculus and mathematical analysis
4	H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
5	G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2010.
6	M.J. Strauss, G.L. Bradley and K.J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India)P. Ltd. (Pearson Education), Delhi,2007

Course Outcomes

CO No.	On Completion of the course, students will be able to
CO1	Find the n^{th} derivative, form equations involving derivatives and apply Leibnitz formula
CO2	Find the partial derivative and total derivative coefficient
CO3	Determine the maxima and minima of functions of two variables
CO4	Find the envelope of a given family of curves
CO5	Find the evaluate sand in volutes and to find the radius of curvature using polar co-ordinates.

Mapping With Programme Outcomes and Programme Specific Outcomes

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	3	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Programming Language C

Title Of The Course	Programming Language C				
Course Type	Elective - I				
Course Code	24UECS11				
Year	I	Semester	I	Credits	3
Instructional Hours Per week		Lecture	Tutorial	Lab Practices	Total
		3	-	2	5

Learning Objectives	
	Basic ideas on the theory of equations and to,
LO1	Study of constants and variables
LO2	Know about operators and their uses
LO3	Know about statements and looping
LO4	Know about one, two and multi-dimensional arrays
LO5	Getting knowledge of functions and how to apply these functions in programme.

Unit	Contents
I	Introduction–Character set–C Tokens–Keywords and Identifiers – Constants – Variables – Data types. (Chapter 2: Sections - 2.1 to 2.7)
II	Operators: Arithmetic – Relational –Logical – Assignment– Increment and Decrement – Conditional – Bitwise – Special – Precedence of Arithmetic operators – Managing input and output operation: Reading and writing a character – Formatted input and output. (Chapters 3 and 4 : Sections - 3.1 to 3, 9, 3.12, 4.2 to 4.5)
III	Decision making and branching: Statements: IF, IF …ELSE, Nesting of IF … ELSE, ELSE IF Ladder and Switch statements –The (conditional Operator) - The GO TO statement– Decision making and looping: The WHILE, DO and FOR statements –Jumps in loops. (Chapters 5 & 6: Sections -5.3 to 5.9, 6.2 to 6.5)

IV	Array: One dimensional and two dimensional arrays– Declaration, Initialization of arrays – Multi dimensional arrays- Character arrays and strings: Declaring and initializing string variables – Reading and writing of strings – String and ling functions. (Chapters 7 & 8: Sections 7.1 to 7.7, 8.1 to 8.8)
V	User defined functions: Definition of function –Return values and their types– Function calls–Function declaration–Category of functions – Nesting of functions – Recursion. (Chapter 9: Sections 9.5 to 9.9, 9.15, 9.16)

Extended Professional Component (is a part of intimal Component only not to be include in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, professional communication and transferable skill.

Recommended Texts	
1	E. Balaguruswamy – Programming in ANSIC – Tata McGraw Hill Publishing company limited – III Edition, 2017

Reference Books	
1	C.Reema Thareja, Programming in C-Oxford University Press, 2018
2	Ramasamyet.al.-Programming in C-Sec tech Publication (INDIA) Pvt. Ltd. II Edition, 2015.
3	Ashok N.Kamathane - Programming with Anise and Turbo C– Dorling Kindersley (India) Pvt. Ltd., 2009.

Course Outcomes

CO No.	On Completion of the course, students will be able to
CO1	Identify the keywords, constants and variables
CO2	Classify different operators and their uses
CO3	Apply suitable statements and looping
CO4	Define one, two and multidimensional arrays and the use of string variables
CO5	Define user defined functions and how to apply these functions in programme.

Mapping With Programme Outcomes and Programme Specific Outcomes

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	3	3	2	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	1	3	3
CO5	3	2	3	3	2	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Programming Language C - Practicals

Title of the Course		**Programming in C - Practicals**					
Course Type		**Skill Enhancement Course - III**					
Year	**I**	**Semester**	**I**	**Credits**	**2**	**Course Code**	**24UECS11**

List of Practicals

1. Program to print the even numbers from1to100.
2. Program to read three values using scan statement and print the following results:

   a)Sum of the values b)Average of the three values c) Largest of the three
3. Program to read and display the following table of data:

Name	Code	Price
Fan	67831	1234.50
Motor	450	5786.70

   The name and code must be left justified and price must be right justified.
4. Program to compute the real roots of a quadratic equation.
5. Program to evaluate the investment equation $V=(1+r)^n$ and print the tables which would give the value of V for various combination of the following values of P,r and n.

   P: 1000, 2000, . . . ,10000

   r: 0.10,0.11, . . . ,0.20

   n : 1, 2, . . . ,10
6. Program to print all integers that are not divisible by either 2 or 3 and lie between 1 and 100 and also should account the number of integers and print the result.
7. Program to merge two given one dimensional arrays A and B (which are sorted in ascending order) into a single sorted array C which is in ascending order.
8. Program to read a string from the keyboard and determine whether the string is a palindrome or not.

Mathematics for Competitive Examinations - I

Title of The Course	**Mathematics for Competitive Examinations – I**				
Course Type	**Skill Enhancement Course – I**				
Course Code	**24USMA11**				
Year	**I**	**Semester**	**I**	**Credits**	**2**
Instructional Hours Per week		**Lecture**	**Tutorial**	**Lab Practices**	**Total**
		2	**--**	**--**	**2**

Learning Objectives Basic ideas on the theory of equations and	
LO1	To Simplify an expression and to find average for given data.
LO2	To find solution of problems on numbers.
LO3	To find Profit and Loss.
LO4	To find Ratio and Proportion.
LO5	To find Percentages.

Unit	**Contents**
I	Simplification–Averages.
II	Problems on Numbers.
III	Profit and Loss.
IV	Ratio and Proportion.
V	Partnership–Percentages.

Extended Professional Component (is a part of intimal Component only not to be include in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, professional communication and transferable skill.

Recommended Texts	
1	R.S. Agarwal –Objective arithmetic, Published by S. Chand &Colt., 2018.

Reference Books	
1	R. S. Agarwal – Arithmetic subjective and Objective, Published by S. Chand & Co Ltd., Revised Edition, 2017.
2	Rajesh Verma, Fast track Objective arithmetic, Arihant Publications India Limited Fourth Edition, 2018.

Course Outcomes

CO No.	On Completion of the course, students will be able to
CO1	Simplify an expression and to find average for given data.
CO2	Illustrate the solution of problems on numbers.
CO3	Solve and find Profit and Loss.
CO4	Compare Ratio and Proportion.
CO5	To explain Percentages.

Mapping With Programme Outcomes and Programme Specific Outcomes

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Bridge Mathematics

Title of the Course	**Bridge Mathematics**				
Course Type	**Foundation Course**				
Course Code	**24UFMA11**				
Year	**I**	**Semester**	**I**	**Credits**	**2**
Instructional Hours Per week		**Lecture**	**Tutorial**	**Lab Practices**	**Total**
		2	**--**	**--**	**2**

Learning Objectives Basic ideas on the theory of equations and	
LO1	To prove the binomial theorem and solve the related problems.
LO2	To find the various sequences and explain the principle of counting.
LO3	To find the number of permutations and combinations in different cases.
LO4	To explain various trigonometric ratios and solve the problems using the transformations.
LO5	To find the limit and derivative of a function at a point and find the points of min/max of a function.

Unit	Contents
I	Algebra: Binomial theorem, General term, middle term, problems based on these concepts
II	Sequences and series (Progressions).Fundamental principle of counting. Factorial n.
III	Permutations and combinations, Derivation of formulae and their connections, simple applications, combinations with repetitions, arrangements with in groups, formation of groups.
IV	Sets – Union, intersection, difference and symmetric difference. Functions – Type of functions, bijective function and inverse of a function. Relation – Reflexive, Symmetric, Transitive Equivalence.
V	Calculus: Limits, standard formulae and problems, differentiation, first principle, uvrule, u/$v$rule, methods of differentiation, application of derivatives, integration-product Rule and substitution method.

Extended Professional Component (is a part of intimal Component only not to be include in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, professional communication and transfer able skill.

Recommended Texts	
1	NCERT class XI and XII text books.
2	Any State Board Mathematics text books of class XI and XII
3	S. Arumugam and A. Thangapandi Issac, Modern Algebra, Scitech 2014.

Course Outcomes

CO No.	On Completion of the course, students will be able to
CO1	Prove the binomial theorem and apply it to find the expansions of any $(x+ y)$ also, solve the related problems.
CO2	Find the various sequences and series and solve the problems related to them. Explain the principle of counting.
CO3	Find the number of permutations and combinations in different cases. Apply the principle of counting to solve the problems on permutations and combinations
CO4	Understand the basic concepts of sets, various operations on sets and relations and types of relations. Also, they can solve the problems using sets and relations.
CO5	Find the limit and derivative of a function at a point, the definite and in definite integral of a function. Find the points of min/max of a function.

Mapping With Programme Outcomes and Programme Specific Outcomes

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	3	3	3
CO4	3	3	2	3	3	2	3	2
CO5	3	2	3	3	2	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Allied Mathematics
Algebra and Differential Equations
(For B.Sc., Physics & Chemistry)

Title of the Course	**Algebra and Differential Equations**				
Course Type	**Elective - I**				
Course Code	**24UEMA11**				
Year	**I**	**Semester**	**I**	**Credits**	**5**
Instructional Hours Per week		**Lecture**	**Tutorial**	**Lab Practices**	**Total**
		6	--	--	**6**

Learning Objectives	
	Basic ideas on the theory of equations and
LO1	Formation of equation, relation between the roots and coefficients and solving reciprocal equations.
LO2	Approximate the roots of the equation through Horner's method.
LO3	Find eigen values and eigen vectors for given square matrix and find inverse by using Cayley-Hamilton theorem.
LO4	Solving differential equations and partial differential equations.
LO5	Knowing Laplace transformation and inverse Laplace transformation for a given function.

Unit	Contents
I	Theory of Equations - Formation of equations –Relation between roots and coefficients – Reciprocal equations.
II	Transformation of equations – Approximate solutions to Equations – Newton's method and Horner's method.
III	Matrices – Characteristics equations of a matrix – Eigen values and Eigen vactors – Cayley Hamilton theorem and simple problem.
IV	Differential equation of first order but of higher degree – Equations solvable for p, x, y, - Partial differential equations – formations – solutions – standard form Pp + Qq = R.
V	Laplace transformation – Inverse Laplace transform.

Extended Professional Component (is a part of intimal Component only not to be include in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, professional communication and transfer able skill.
Recommended Texts	
Dr.S.Arumuganm and A. Thangapandi Isaac – Allied Mathematics Paper I, New Gamma Publishing House, 2012.	

Reference Books	
1	I.S.Narayanan and T.K.Manikavachagom Pillay – Differential Equation and its applications, S.Viswanathan Printers PVT.LTD, 2006.
2	T.Veerarajan – Algebra and Trigonometry – Yes Dee Publishing PVT.LTD, 2009

Course Outcomes

CO No.	On Completion of the course, students will be able to
CO1	Form the equation, relation between the roots and classify and solve reciprocal equations.
CO2	Find approximate solution to equation by Horner's method Find approximate solution to equations by Horner's method.
CO3	Find eigen values and eigen vectors for given square matrix and find inverse by using Cayley – Hamilton theorem.
CO4	Find solution of differential equations and partial differential equations.
CO5	Find Laplace transformation and inverse Laplace transformation for a given function.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	3	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	2	3	2
CO4	3	3	3	3	3	3	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Semester - II

Analytical Geometry (2 & 3 Dimensions)

Title of the Course		Analytical Geometry (2 & 3 Dimensions)					
Course Type		Core - III					
Year	I	Semester	II	Credits	4	Course Code	24UMMA21
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		4	--		--	4	

Learning Objectives	
LO1	Necessary skills to analyze characteristics of two- and three-dimensional geometric shapes
LO2	Develop the skills to analyze properties of two- and three-dimensional geometric shapes
LO3	To present mathematical arguments about geometric relationships
LO4	Basic knowledge on straight lines, planes and spheres.
LO5	To solve real world problems on geometry and its applications.

Unit	Contents
I	Pole, Polar- conjugate points and conjugate lines – diameters – conjugate diameters of an ellipse –Semi diameters – Conjugate diameters of hyperbola – Related problems only. (Chapters: 9 and 10)
II	Polar coordinates: General polar equation of straight line – Polar equation of a circle given a diameter, Equation of a straight line, circle, conic–Equation of chord, tangent, normal. (Chapter 9: Sections - 1 to 3, 5 to 10, 12)
III	System of Planes – Length of the perpendicular–Orthogonal projection. (Chapter 2: Sections - 1 to 11)
IV	Representation of line– Angle between a line and a plane – coplanar lines– Shortest distance between two skew lines– Length of the perpendicular. (Chapter 3: Sections - 1 to 8)
V	Equation of a sphere- General equation – Section of a sphere by a plane Equation of the circle –Tangent plane – Angle of intersection of two spheres –Condition for the or thogonality. (Chapter 4: Sections - 1 to 8)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, professional communication and transferable skill.

Recommended Texts:	
1	P. R. Vittal and V. Malini, Analytical Geometry & Trigonometry, Margam Publications, 2018.
2	T.K. Manicavachagom Pillay and T. Natarajan, Analytical Geometry (Part I - Two dimensions), S.Viswanathan Printers and Publishers Pvt. Ltd., 2012.
3	T.K. Manicavachagom Pillay and T. Natarajan, Analytical Geometry (Part II-Three dimensions), S.Viswanathan (Printers and Publishers) Pvt. Ltd., 2012.
Reference Books:	
1	S.L.Loney, Co-ordinate Geometry.
2	T. RobertJ. T. Bell, Co-ordinate Geometry of Three Dimensions.
3	William F. Osgood and William C. Graustein, Plane and Solid Analytic Geometry, Macmillan Company, New York, 2016.
4	Calculus and Analytical Geometry, G.B.Thomas and R.L.Finny, Pearson Publication, 9th Edition, 2010
5	Robert C.Yates, Analytic Geometry with Calculus, Prentice Hall, Inc., New York, 1961.
6	Earl W. Swokowski and Jeffery A. Cole, Algebra and Trigonometry with Analytic Geometry, Twelfth Edition, Brooks/Cole, CEng age Learning, CA, USA, 2010
7	William H. McCrea, Analytical Geometry of Three Dimensions, Dover Publications, Inc., New York, 2006.
8	John F.Randelph, Calculus and Analytic Geometry, Wadsworth Publishing Company, CA, USA, 1969.
9	Ralph Palmer Agnew, Analytic Geometry and Calculus with Vectors, McGraw-Hill Book Company, Inc. New York, 1962.

Course outcomes	On completion of this course, students will be able to:
CO1	To define the concepts of pole, types of diameters, the equation of chard, tangent and normal, the leash of the perpendicular, the angle between a line and a plane, coplanar lines, shortest distance between two skew lines.
CO2	To classify the type's diameters and find the regulation of a straight line, circle and conic, the equation of the chord, tangent and normal, the angle between a line and a plane formula for shortest distance between two skew lines few the equation of a sphere & the condition for orthogonal of two spheres.
CO3	To identify the various types of diameters, the types of curves like straight line, circle, and conic, to construct the orthogonal projection, to verify the given lines are coplanar or not, to find the angle of intersection of two spheres. Construct the condition for the orthogonality.
CO4	To analyze the conjugate diameters of hyperbola the equation of straight line, circle and conic, to the shortest distance between two skew lines, check the orthogonal condition of two spheres.
CO5	To compare the various diameters of hyperbola and ellipse determine the polar apply of a straight line, circle and conic, to explain the system of places, to explain coplanar lines and shortest distance between two skew lines.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Integral Calculus

Title of the Course		Integral Calculus					
Course Type		Core - IV					
Year	I	Semester	II	Credits	4	Course Code	24UMMA22

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total
	4	--	--	4

Learning Objectives	
LO1	Knowledge on integration and its geometrical applications
LO2	Skill on double, triple integrals and improper integrals
LO3	Knowledge about Beta and Gamma functions
LO4	Applications of Beta and Gamma functions.
LO5	Skills to Determine Fourier series expansions

Course outcomes	On completion of this course, students will be able to:
CO1	Know the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae.
CO2	Evaluate double and triple integrals and problems using change of order of integration.
CO3	Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution.
CO4	Explain beta and gamma functions and to use them in solving problems of integration.
CO5	Explain Geometric applications of integral calculus.

Unit	Contents
I	Reduction formulae – Types, integration of product of powers of algebraic and trigonometric functions, integration of product of powers of algebraic and logarithmic functions–Bernoulli's formula. (Chapter 1: Sections -13.1 to 13.9, 14, 15.1)
II	Geometrical Applications of Integral calculus: Area – Volume – Length of a curve – Area of surface of revolution. (Chapter 2: Sections -1.1 to 1.4, 3, 4 and 5)
III	Multiple Integrals–Definition of double integrals– Evaluation of double integrals – Double integrals in polar coordinates – Change of order of integration. (Chapter 5: Sections - 1, 2.1, 2.2, 3.1, 3.2)
IV	Triple integrals –Applications of multiple integrals – Areas of curved surfaces–Change of variables– Jacobian. (Chapter 5: Sections - 4, 5.1 to 5.4; Chapter 6: Sections – 1 and 2)
V	Beta and Gamma functions – infinite integral –Definitions– Recurrence formula of Gamma functions – Properties of Beta and Gamma functions- Relation between Beta and Gamma functions - Applications. (Chapter 7: Sections - 2.1 to 2.3 and 3 to 6)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper).	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour).
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, professional communication and transferable skill.

Recommended Texts:

1	S.Narayanan and T.K.Manicavachagom Pillay, Calculus Vol II, S.Viswanathan (Printers and Publishers) Pvt. Ltd., 2012.

Reference Books:	
1	H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2	G.B.Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3	D. Chatterjee, Integral Calculus and Differential Equations, Tata-McGraw Hill Publishing Company Ltd.
4	P. Dyke, An Introduction to Laplace Transforms and Fourier Series, Springer Undergraduate Mathematics Series, 2nd Edition, 2001.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	2
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	1	3	2
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Allied Computer Science - Programming Language C ++

Title of the Course	Allied Computer Science - Programming Language C ++						
Course Type	Elective - II						
Year	I	Semester	II	Credits	3	Course Code	24UECS21
Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total			
	4	--	2	6			

Learning Objectives	
LO1	Know what tokens, keywords, constants, variables is.
LO2	Know basic data types, functions and their usage in programme.
LO3	Familiarize different constructors.
LO4	Know the overloading operator of unary and binary.
LO5	Know the types of inheritance.

Unit	Contents
I	Introduction, Tokens, Keywords, Identifiers and constants, Basic data types, User defined data types, storage classes, Derived data types, Symbolic constants.
II	Introduction, The main function, function prototyping, Call by reference, Return by reference, Inline functions, Default arguments, constant Arguments, Recursion, Function overloading, Friend and virtual functions, Math library functions, Specifying a class, Defining member functions, C++ program with class, Making an outside functions inline, Nesting member functions, Private member functions, Arrays within a class, Memory allocation for objects, Static member functions, Array of objects, objects as function arguments, Friend functions, Returning objects.
III	Introduction, Constructors, Parameterized constructors, Multiple constructors in a class, Constructors with default arguments, Dynamic initialization of objects, Copy constructor, Constructing Two- dimensional arrays, constant objects, Destructors.

IV	Introduction, Defining operator overloading, Overloading unary operator, Overloading Binary operator, Overloading Binary operators using Friends, Manipulation of strings using operators, Some other operator overloading examples, Rules for Overloading Operators
V	Introduction, Defining Derived classes, Single inheritance, Making a private member inheritable, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	E. Balagurusamy, Object Oriented Programming with C++, Tata Mc Graw Hill Education Private Limited, New Delhi (Fifth Print 2012).
Reference books:	Reema Thareja, Object Oriented Programming with C++, Oxford University Press(January 2018)

Course outcomes:

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	Identify the tokens, keywords, constants, variables and basic data types
CO2	Know functions and how to use them in programme
CO3	Know different constructors
CO4	Define the overloading operator of unary and binary
CO5	Know various types of inheritance.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	2	3	3
CO4	3	3	3	3	3	3	3	2
CO5	3	2	3	3	2	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Programming Language C++ - Practicals

Title of the Course		Programming in C++ - Practicals					
Course Type		Skill Enhancement Course - III					
Year	I	Semester	II	Credits	2	Course Code	24PSMAL2

List of Practicals:

1. Programs to evaluate sin x, cos x, e^{-x} to 0.0001% accuracy.
2. Program to calculate the variance and standard deviation of a set of numbers.
3. Program to find Product of matrices, inverse of a matrix using functions. Macro that obtains largest of three numbers.
4. Define a class of students and prepare a statement containing name, total marks of Ranks (using functions).
5. Program to check whether a number/ string is a palindrome without using the corresponding standard function.
6. Write a program to conversion between polar and rectangle co-ordinates
7. Define a class string and exhibit the use of string manipulations.
8. Write a program to finding area of 2 different shapes
9. Create a class FLOAT that contains one float data. Overload all the four arithmetic.
10. Write a C++ program implement a class 'Complex' of complex numbers. The class could be include member functions to add and subtract two complex numbers.
11. Write a C ++ program to implement a class for complex numbers with add and multiply as member functions. Overload ++ operator to increment a complex number.
12. Write a program in C++ to demonstrate friend function.

Mathematics for Competitive Examinations - II

Title of the Course		Mathematics for Competitive Examination - II					
Course Type		Skill Enhancement Course					
Year	I	Semester	II	Credits	2	Course Code	24USMA21

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total
	2	--	--	2

Learning Objectives:	
LO1	To know about Chain Rule.
LO2	To practice problems on Time and Work.
LO3	To learn about Pipes and Cistern.
LO4	To practice problems on Time and Distance.
LO5	To understand the difference between Simple interest and Compound interest.

Unit	Contents
I	Chain Rule.
II	Time and work.
III	Pipes and Cistern.
IV	Time and Distance.
V	Simple interest and Compound interest.

Extended Professional Component (is a part of internal component only, not to be included in the External Examination Question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved. (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	R.S. Agarwal – Objective Arithmetic, Published by S. Chand & Co, Ltd., Edition (2018).
Reference Books	1. Rajesh Verma – Fast track Objective arithmetic, Arihant Publications (India) Limited. Fourth Edition 1st January2018. 2. R. S. Aggarwal, Arithmetic Subjective and objective, Published by S. Chand and Co. Ltd. Revised Edition.1st April 2017.

Course Outcome

Course outcomes CO	On completion of this course, the students will be able to:
CO1	To define direct proportion and indirect proportion. To tell the facts about inlet and outlet. To list out of the formulas of speed time and distance. To recall the formula of simple interest and compound interest.
CO2	To classify the direct proportion and indirect proportion. To compare time and work. To illustrate problems on pipes and cistern. To relate time and distance. To compare simple interest and compound interest.
CO3	To identify the problems whether it is indirect proportion and indirect proportion. To solve the problems regarding time and work. To apply the formula in inlet and outlet problems. To plan how to do the problems related with time and distance. To identify the problems and solve simple interest and compound interest.

CO4	To categorize the proportion indirect and direct. To classify the types of time and work categorized the problems with inlet or outlet. To know the relationship between time and work. To compare simple interest and compound interest.
CO5	To decide whether it is a direct proportion or indirect proportion. To explain time and work. To justify whether it is inlet or outlet. To evaluable problems in time and distance. To explain simple interest and compound interest.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	3	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

LaTex

Title of the Course		LaTex					
Course Type		Skill Enhancement Course - III					
Year	I	Semester	II	Credits	2	Course Code	24USMA22

Instructional	Lecture	Tutorial	Lab Practice	Total
Hours per week	2	--	--	2
Learning Objectives	To introduce coding and decoding concepts. Also to develop the students in the field of coding theory			

Unit	Contents
I	LaTex – Sample Files, Editing Cycle, Three productivity tools, Typing text, Typing Math, Anatomy of an article, Sectioning, Invoking proclamations, Inserting references, LaTex error messages. (Chapter 1: Sections - 1.2 to 1.4; Chapter 2: Sections - 2.1 to 2.4; Chapter 3: Sections - 3.1 to 3.4; Chapter 4: Sections - 4.1, 4.2.2 to 4.2.4, 4.3.1)
II	Typing Text: The keyboard, Word Sentences and paragraphs, Symbols not on the keyboard (Quotation marks, Dashes, Special Characters only), Comments and foot notes. (Chapter 5: Sections - 5.1, 5.2, 5.4.1, 5.4.2, 5.4.4, 5.5)
III	Typing Text: Changing Font Characteristics, Lines paragraphs and pages. (Chapter 5: Sections - 5.6, 5.7)
IV	Text Environments: Some general rules for displayed text environments, Lists environments, Style and size environments, Proclamations (theorem-like structures), Proof environments, Tabular environments. (Chapter 6: Sections - 6.1 to 6.6)
V	Typing Math: Math environments, Spacing Rules, Equations, Basic Constructs, Delimiters, and Operators. (Chapter 7: Sections - 7.1 to 7.6)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination Question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	George Gratzer, More Mathin to Latex, 4th Edition, Springer, 2007.
Reference Books	1. Helmut Kopka and Patric W. Daly, Aguideto Latex, Fourth edition, Addison-Wesley. 2. DavidR. Wilkins, Getting started with Latex, Second Edition.
Web Resource	https://nptel.ac.in

Course Outcomes

Course outcomes: CO	On completion of this course, the students will be able to:
CO1	Explain to type text and anatomy of an article.
CO2	Explain the different comments and foot notes.
CO3	Explain the changing of font characteristic.
CO4	Explain the different text environments.
CO5	Know the spacing rules and operators.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	1	3	3
CO4	3	3	3	3	3	3	3	3
CO5	3	2	3	3	2	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Allied Mathematics
Vector Calculus and Fourier series
(For first year Physics / Chemistry)

Title of the Course	**Vector Calculus and Fourier series**						
Course Type	**Elective**						
Year	**I**	**Semester**	**II**	**Credits**	**5**	**Course Code**	**24UEMA21**
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		6	**--**		**--**	**6**	
Learning Objectives							
LO1	Know about derivative of vector and to find gradient, divergence and curl of a vector						
LO2	Use of double and triple integrals						
LO3	Know about line, surface and volume integrals						
LO4	Know about theorems of Gauss, Stoke's and Green's						
LO5	Finding Fourier series of even and odd functions and half-range Fourier series.						

Unit	Contents
I	Vector differentiation–Gradient–Divergence and curl.
II	Evaluation of double and triple integrals
III	Vector integration–Line, surface and volume integrals.
IV	Green's, Stoke's and Divergence theorems (without Proof)–Simple problems.
V	Fourier series–Even and odd functions–Half range Fourier series.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	1. S. Arumugam and A. Thangapandi Isaac, Allied Mathematics Paper-II, New Gamma Publishing House, Palayamkottai, 2012. 2. T. K. Manicavachagom Pillay, Calculus (Vol - III), S.Vishvanathan Printer and Publisher PVT.LTD, 2012.
Reference books:	1. S. Arumugam and others, Analytical Geometry 3D &Vector Calculus, New Gamma Publishing House, Palayamkottai, 2017. 2. J. C. Susan, Vector Calculus (4thEdition), Pearson Education, Boston, 2012. 3. Murray Spiegel, Vector analysis, Schaum Publishing company, New York, 2009.

Course Outcomes

Course outcomes CO	On completion of this course, the students will be able to:
CO1	Find the derivative of vector and to find gradient, divergence and curl of a vector
CO2	Evaluate double and triple integrals
CO3	Find line, surface and volume integrals
CO4	Verify the theorems of Gauss, Stoke's and Green's
CO5	Find Fourier series of even and odd functions and half-range Fourier series.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Semester - III

Vector Calculus and Its Applications

Title of the Course	**Vector Calculus And Its Applications**				
Course Type	**Core – V**				
Course Code	**24UMMA31**				
Year	**II**	**Semester**	**III**	**Credits**	**4**
Instructional Hours Per week		**Lecture**	**Tutorial**	**Lab Practices**	**Total**
		4	**-**	**-**	**4**

Learning Objectives

LO1	To understand about the vectors, scalars and their sum and products
LO2	Know about solenoidal and irrotational vectors
LO3	Evaluation of line integrals
LO4	Evaluation of surface integrals
LO5	Evaluation of volume integrals

Unit	Contents
I	Vector point function - Scalar point function - Derivative of a vector and derivative of a sum of vectors - Derivative of a product of a scalar and a vector point function - Derivative of a scalar product and vector product. (Chapter 1: Sections -1.1 to 1.5)
II	The vector operator 'del', The gradient of a scalar point function - Divergence of a vector - Curl of a vector - solenoidal and irrotational vectors – simple applications. (Chapter 2: Sections -2.1 to 2.7)
III	Laplacian operator, Vector identities – Line integral - simple problems. (Chapter 2: Section - 2.8 and Chapter 3: Sections - 3.1 to 3.4)
IV	Surface integral – Volume integral – Applications. (Chapter 3: Sections - 3.5, 3.6)
V	Gauss Divergence Theorem, Stoke's Theorem, Green's Theorem in two dimensions – Applications to real life situations. (Chapter 4: Sections - 4.1 to 4.5)

Extended Professional Component (Is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	P. Duraipandian and Laxmi Duraipandian, Vector Analysis, Emerald Publishers, 2005. Ref
Reference Books	J. C. Susan, Vector Calculus, (4th Edition) Pearson Education, Boston, 2012. A. Gorguis, Vector Calculus for College Students, Xilbius Corporation, 2014. J. E. Marsdenand A.Tromba,Vector Calculus, (5th Edition), W. H. Freeman, NewYork,1988. **NOTE: Latest Edition of Textbooks May be Used**

Course Outcomes

Course Outcomes	On completion of this course, the students will be able to
CO1	To define vector point function and scalar point function, vector operator the gradient of a scalar point function. List out of the properties of laplacian operator. To know how to define surface integral and volume integral. To tell the statement of gauss divergence theorem, Stokes theorem and Green's theorem.
CO2	To classify the derivations. To understand the concepts of the gradient of a scalar point function- divergence of a vector and cure of a vector. To classify vector identities, compare causes divergence theorem, stokes theorem, and Green theorem.
CO3	To apply the rule of finding derivatives. Find whether the given vector is r rotational and irrotational. To solve the line integral and surface integral. To apply gauss divergence theorem and stokes theorem.
CO4	To find the derivative of a sum of vectors. To analyse the type of vectors, evaluate the line integral and surface integral. To apply greens theorem.
CO5	To explain derivatives of scalar products and vector product. To determine the divergences of vector and scale of the vector. To evaluate volume integral and to know how to apply it. To justify Greens theorem in 2 dimensions.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	3	3	3
CO5	3	2	3	3	2	2	3	3

S-Strong (3) M-Medium (2) L-Low

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Differential equations and applications

Title of the Course	**Differential equations and applications**				
Course Type	**Core – VI**				
Course Code	**24UMMA32**				
Year	**II**	**Semester**	**III**	**Credits**	**4**
Instructional Hours Per week		**Lecture**	**Tutorial**	**Lab Practices**	**Total**
		4	**-**	**-**	**4**

Learning Objectives	
LO1	Finding solutions of homogeneous and non-homogeneous equations of degree one in two variables. Solving Bernoulli's equation and exact differential equations.
LO2	Understand particular integrals of algebraic, exponential, trigonometric functions and their products.
LO3	To know about linear equations of second order and its applications.
LO4	Formation of PDE by eliminating arbitrary constants and arbitrary functions. Find complete, singular and general integrals, to solve Lagrange's equations.
LO5	To know about standard forms of PDE and finding solutions.

Unit	Contents
I	Ordinary Differential Equations: Variable separable – Homogeneous Equation – Non-Homogeneous Equations of first degree in two variables – Linear Equation – Bernoulli's Equation – Exact differential equations. (Chapter 2: Sections – 1 to 6)
II	Equation of first order but of higher degree: Equation solvable for dy/dx - Equation solvable for y–Equation solvable for x– Clairaut's form – Linear Equations with constant coefficients: Definition – The operator D – Complete solution – Particular integrals of algebraic, exponential, trigonometric functions and their products. (Chapter 4: Sections -1 to 3 and Chapter 5: Sections – 1 to 4)
III	Linear equations of second order: Complete solution in terms of a known integral – Reduction to normal form – Change of independent variable - Applications of first order equations: Flow of water from an orifice – Falling bodies and other rate problems, Free fall under gravity – The Brachistochrone problem – Fermat and Bernoulli – Simple electric circuits. (Chapter 3: Sections - 2 to 6 Chapter 8: Sections - 1 to 3)
IV	Partial differential equation: Formation of PDE by Eliminating arbitrary constants and arbitrary functions – Complete integral – Singular integral – General integral – Lagrange's Linear Equations. (Chapter 12: Sections - 1 to 4)
V	Special methods – Standard forms. (Chapter 12: Sections - 5.1 to 5.5)

Extended Professional Component (Is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts	
1	S. Narayanan and T. K. Manicavachagom Pillay, Differential equations and its application, S. Viswananthan Printers Pvt. Ltd., 2012.

Reference Books	
1	Shepley L. Ross, Differential Equations, 3rd Edition, John Wiley and Sons, 1984.
2	I. Sneddon, Elements of Partial Differential Equations, Mc Graw - Hill, International Edition, 1967.
3	G. F. Simmons, Differential equations with applications and historical notes, 2ndEd, Tata Mc Graw Hill Publications, 1991.
4	H. T. H. Piaggio, Elementary Treaties on Differential Equations and their applications, C.B.S Publisher & Distributors, Delhi,1985.
5	Horst R. Beyer, Calculus and Analysis, Wiley, 2010.
6	M. Braun, Differential Equations and their Applications. (3rdEdition), Springer- Verlag, New York, 1983.
7	S. Arumugam, A. Thangapandi Isaac and A. Somasundarua, Differential Equations and Applications, Yes Dee Publishing, 2020.
8	V. Sundrapandian, Ordinary and Partial Differential Equations, Tata Mc Graw Hill Education Pvt. Ltd. New Delhi, 2013.
NOTE: Latest Edition of Textbooks May be Used	

Course Outcomes	On completion of this course, the students will be able to
CO1	Determine solutions of homogeneous equations, non-homogeneous equations of degree one in two variables, solve Bernoulli's equation and exact differential equations
CO2	Find the solutions of equations of first order but not of higher degree and to Determine particular integrals of algebraic, exponential, trigonometric functions and their products
CO3	Find solutions linear equations of second order and know some applications
CO4	Form a PDE by eliminating arbitrary constants and arbitrary functions, find complete, singular and general integrals, to solve Lagrange's equations
CO5	Explain standard forms of PDE and find solutions.

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	2	3	3	2	1	3	3
CO3	3	3	3	2	3	3	3	3
CO4	2	3	3	3	3	3	3	3
CO5	3	3	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Statistics - I

Title of the Course	**Statistics - I**				
Course Type	**Elective – III**				
Course Code	**24UEMA31**				
Year	**II**	**Semester**	**III**	**Credits**	**2**
Instructional Hours Per week		**Lecture**	**Tutorial**	**Lab Practices**	**Total**
		4	**-**	**-**	**4**

Learning Objectives	
LO1	Understanding of coefficient of dispersion, moments, skewness and kurtosis
LO2	Acquiring knowledge on correlation and rank correlation
LO3	Acquiring knowledge on regression lines and regression coefficients
LO4	Understand theory of attributes and to analyze consistency of data
LO5	Finding the Index number and analyzing its usage

Unit	**Contents**
I	Dispersion – Measures of Dispersion – Coefficients of Dispersion – Moments – Skewness – Kurtosis. (Chapter 2: Sections - 2.12 to 2.17)
II	Correlation – Scatter Diagram – Karl Pearson's coefficient of correlation – Probable error of Correlation Coefficient – Rank Correlation. (Chapter 10: Sections - 10.2 to 10.4, 10.6, 10.7)
III	Curve Fitting and Regression: Linear Regression – Curve linear Regression – Regression Curve. (Chapter 11: Sections - 11.2 to 11.4)
IV	Theory of Attributes: Notations and Terminology – Classes and Class Frequency – Consistency of Data – Independence of Attributes – Association of Attributes. (Chapter 13: Sections - 13.2 to 13.6)
V	Index Numbers – Consumer Price Index Numbers – Conversion of Chain Base Index Number into Fixed Base Index and conversely. (Chapter 9: Sections - 9.1 to 9.3)

Extended Professional Component (Is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts	
1	S. G. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand& Sons, New Delhi, 2021.
2	S. Arumugam and A. Thangapandi Isaac, Statistics, New Gamma Publishing House, 2016.
Reference Books	
1	P. R. Vittal, Mathematical Statistics, Margham Publications, 2004.
2	D.C. Sachetiand V. K. Kapoor, Statistics, Sultan Chand & Sons, New Delhi, 2017.
NOTE: Latest Edition of Textbooks May be Used	

Course Outcomes	On completion of this course, the students will be able to
CO1	Find coefficient of dispersion, moments, skewness and kurtosis.
CO2	Find Karl Pearson's correlation and rank correlation.
CO3	Fit a straight line and parabolic curve by the method of least squares and find the regression lines and regression coefficients.
CO4	Develop the statistical techniques used in the theory of attributes and to analyze consistency of data.
CO5	Find the Index number.

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	3	3	3
CO4	2	3	2	3	3	3	3	3
CO5	3	2	3	3	2	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Difference Equations

Title of the Course	Difference Equations				
Course Type	Elective - III				
Course Code	24UEMA32				
Year	II	Semester	III	Credits	2
Instructional Hours Per week		Lecture	Tutorial	Lab Practices	Total
		4	-	-	4

Learning Objectives	
LO1	Utilization of difference operators.
LO2	Acquiring knowledge for first order equations and linear equations.
LO3	To know about the equations with variable coefficients.
LO4	Practical understanding on initial value problems for linear systems.
LO5	Practice of the Fundamental Matrices

Unit	Contents
I	The Difference Calculus: The Difference operator –Summation Generating functions and approximate summation. (Chapter 2: Sections - 2.1 to 2.3)
II	Linear Difference Equations: First order equations – General results for linear equations – Solving linear equations. (Chapter 3: Sections - 3.1 to 3.3)
III	Linear Difference Equations: Applications – Equations with variable coefficients – Nonlinear equations that can be linearized. (Chapter 3: Sections - 3.4 to 3.6)
IV	Stability Theory: Initial value problems for linear systems – Stability of linear systems. (Chapter 4: Sections - 4.1, 4.2)
V	Stability Theory: Phase plane Analysis for Linear Systems, Fundamental Matrices and Floquet Theory. (Chapter 4: Sections - 4.3, 4.4)

Extended Professional Component (Is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts	
1	W. G. Kelley and A. C. Peterson, Difference Equations, 2nd Edition, Academic Press, New York, 2012.

Reference Books	
1	R. P. Agarwal, Difference Equations and Inequalities, 2nd Edition, Marcel Dekker, New York, 2000.
2	S. N. Elaydi, An Introduction to Difference Equations, 3rd Edition, Springer, India, 2008.
3	R. E. Mickens, Difference Equations, 3rd Edition, CRC Press, 2015.
NOTE: Latest Edition of Textbooks May be Used	

Course Outcomes	On completion of this course, the students will be able to
CO1	Learn the basics of ratio, proportion, indices and logarithm
CO2	Familiarize with calculations of simple and compound interest and arithmetic, geometric and harmonic progressions.
CO3	Determine the various measures of central tendency
CO4	Calculate the correlation and regression co-efficient.
CO5	Assess problems on time series analysis

Mapping With Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	3	3
CO2	2	3	3	2	2	3	3	2
CO3	3	3	3	2	3	2	3	3
CO4	3	3	2	3	3	3	3	3
CO5	3	2	3	3	2	3	3	2

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Computational Mathematics

Title of the Course	Computational Mathematics				
Course Type	Skill Enhancement Course - IV				
Course Code	24USMA31				
Year	II	Semester	III	Credits	2
Instructional Hours Per week		Lecture	Tutorial	Lab Practices	Total
		2	-	-	2

Learning Objectives	
LO1	Finding the roots of algebraic equations using different methods
LO2	Bisection method, Newton-Raphson method and Horner‟s method.
LO3	Solving a given system of simultaneous equation
LO4	Usage of substitution, elimination and iteration method
LO5	Find numerical solutions of partial differential equations
Unit	**Contents**
I	Algebraic and Transcendental Equations: Errors in Numerical Computation – Iteration method – Regula Falsie method. (Chapter 3: Sections - 3.1, 3.2, 3.4)
II	Algebraic and Transcendental Equations: Bisection method – Newton-Raphson method – Horner's method. (Chapter 3: Sections - 3.3, 3.5, 3.6)
III	Simultaneous Equations: Simultaneous equations – Back substitution – Gauss Elimination method – Gauss-Jordan Elimination method – Calculation of inverse of a matrix. (Chapter 4: Sections - 4.1 to 4.5)
IV	Simultaneous equations: Iterative Methods – Gauss Jacobi iteration method – Gauss-Seidel Iteration method – Relaxation method – Newton- Raphson method for simultaneous equations. (Chapter 4: Sections - 4.7 to 4.10)

V	Numerical Solutions of Partial Differential Equations: Classification of partial differential equations of second order – Finite Difference Approximations to Derivatives – Laplace equation – Poisson's equation. (Chapter 11: Sections - 11.0 to 11.4)
Extended Professional Component (Is a part Of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	
1	S. Arumugam, A. Thangapandi Isaac and A. Somasundaram, Numerical Methods, Scitech, 2017.

Course Outcomes

Course Outcomes	On completion of this course, the students will be able to
CO1	Describe the roots of algebraic different methods like method and Regula Falsie method
CO2	Find the real root of an equation by Bisection method, Newton-Raphson method and Horner's method.
CO3	Solve a given system of simultaneous equation by using substitution and elimination methods
CO4	Solve a given system of simultaneous equation by using iteration method
CO5	Find numerical solutions of partial differential equations

Mapping With Programme Outcomes and Programme Specific Outcomes

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	3	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Semester – IV

Sequences and Series

Title of the Course		Sequences and Series					
Course Type		Core - VII					
Year	II	Semester	IV	Credits	5	Course Code	24UMMA41
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		5	-		-	5	

Learning Objectives	
LO1	Explain Sequences and Subsequence of real numbers and to find the limit of sequence to test for convergent, divergent and bounded sequences.
LO2	Know the behaviour of monotonic sequences and the Cauchy sequence
LO3	Explain series and to verify convergent of series by using comparison test
LO4	Understand Kummer's test and Ratio test
LO5	Classify the series of real numbers and the alternating series and their convergence and divergence, the conditional convergence and absolute convergence and solve problems on convergence of the sequences.

Unit	Contents
I	Sequences - Bounded sequences - Monotonic Sequences – Convergent Sequences –Divergent and Oscillating Sequences – The Algebra of limits. (Chapter 3: Sections - 3.1 to 3.7)
II	Behaviour of Monotonic Sequences – Some theorems on limits – Sub sequences –Limit points – Cauchy sequence. (Chapter 3: Sections - 3.8 to 3.12)
III	Series of positive terms: Infinite series – Comparison test. (Chapter 4: Sections -4.1, 4.2)
IV	Kummer's test – Root test – Integral Test. (Chapter 4: Sections - 4.3 to4.5)
V	Series of arbitrary terms: Alternative series – Absolute convergence – Tests for convergence of series of arbitrary terms. (Chapter 5: Sections - 5.1 to 5.3)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts	Recommended Text 1. S. Arumugam, A. Thangapandi Isaac and A. Somasundaram, Sequence and Series, Yes Dee Publications, 2021.
Reference books:	• Reference Books 1. Richard R. Goldberg ,Methods of Real Analysis • Oxford and IBH Publishing, 2020. • Ethan D.Bloch, the Real Numbers and Real Analysis, Springer, 2011. • G. M. Fikhtengol‟ts the Fundamentals of Mathematical Analysis, Vol I. Pergamon Press, New York, 1965. • T.M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002. • R. G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000. • E .Fischer, Intermediate Real Analysis, Springer Verlag, 1983. • K. A. Ross, Elementary Analysis - The Theory of Calculus Series - Undergraduate Texts in Mathematics, Springer Verlag 2003.

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	To define the sequences and classify their types. Define monotonic sequence and series of positive terms and series of arbitrary terms.
CO2	To illustrate the sequence classify the Bounded and monotonic sequence compare the series and Alternative series.
CO3	To identify the convergent, divergent and oscillating sequence. To construct the behaviour of monotonic sequence. To identify the convergence of the series.
CO4	To determine the convergence of the sequence by using the behaviour of monotonic sequence list out of the Kummer's test, Root test & Integral test to analyse the convergence of the series.
CO5	Recommended some theorem for sequences which are very useful in calculating limits of sequences. Identify the application of (Kummer's test, Root test, integral test) compare the convergent and absolutely convergent of the series.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	2
CO2	2	3	3	3	2	3	3	3
CO3	3	2	3	2	3	2	3	3
CO4	3	3	2	3	3	3	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Fourier series and Integral Transformation

Title of the Course		Fourier series and Integral Transformation					
Course Type		Core – VIII					
Year	II	Semester	IV	Credits	5	Course Code	24UMMA42

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total
	5	-	-	5

Learning Objectives	
LO1	Determine the Fourier coefficients and Fourier series for a given periodic Function.
LO2	Determine the Half range Fourier series and the complex form of Fourier series.
LO3	Find the Fourier transform of a given function and to know the properties of FT.
LO4	Find the Laplace transform of periodic functions and evaluation of certain integrals.
LO5	Find the inverse Laplace transform and to solve differential equations using Laplace transform.

Unit	Contents
I	Fourier Series–Definition – Fourier coefficients and Fourier series for a given periodic function with period 2π and $2l$, odd and even functions – Convergence of Fourier series. (Chapter 1: Sections - 1.4 to 1.8)
II	Half range Fourier series – Parseval's theorem – Root - Mean square value of a function – Harmonic analysis – Complex form of Fourier series. (Chapter 1: Sections - 1.9 to 1.12)
III	Fourier Transforms – Fourier Integral theorem – Fourier sine and cosine transforms – Properties of Fourier transform – Convolution theorem – Parseval's identity. (Chapter 2: Sections - 2.2 to 2.6)
IV	Laplace Transforms – Definition – Results – Laplace transform of periodic functions – Some general Theorems –Evaluation of certain integrals. (Chapter 9: Sections - 1 to 5)
V	The Inverse Transform – Results – Solving ordinary differential equations with constant coefficients, simultaneous linear differential equations and differential equations with variable coefficients by Laplace Transform. (Chapter 9: Sections - 6 to 10)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	• T. Veerarajan, Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2001. • S. Narayanan and T. K. Manicavachagom Pillay, Differential equations and its application, S. Viswananthan Printers Pvt. Ltd., 2012.
Reference books:	• M.K. Venkataraman and Manorama Sridhar, Vector Calculus and Fourier Series, The National Publishing company, Chennai-1, 2002 • J. Ray Hanna Fourier Series, Transforms and Boundary value Problems, Dover Publications, New York, 2008. • P. R. Mittal, Differential Equations, Fourier and Laplace Transforms, Probability, Margham Publications, Chennai, 2012. • S. Arumugam A. Thangapandi Issac, Trigonometry and Fourier series.

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	Determine the Fourier coefficients and Fourier series for a given periodic function
CO2	Determine the Half range Fourier series and the complex form of Fourier series.
CO3	Find the Fourier transform of a given function and to know the properties of FT
CO4	Find the Laplace transform of periodic functions and evaluation of certain integrals
CO5	Find the inverse Laplace transform and to solve differential equations using Laplace transform

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	3	3	3
CO5	3	2	3	3	2	1	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Statistics – II

Title of the Course	Statistics - II						
Course Type	Elective - IV						
Year	II	Semester	IV	Credits	2	Course Code	24UEMA41
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		4	-		-	4	

Learning Objectives	
LO1	Define Random variables, Probability mass function, probability density function, and Distribution functions.
LO2	Compute Expectation, Variance.
LO3	Know about Moment Generating functions and Characteristic functions.
LO4	Solve problems involving the concepts of theoretical discrete distributions.
LO5	Solve problems involving the concepts of theoretical continuous distributions

Unit	Contents
I	Random variables - Discrete random variable - Continuous random variable– Mathematical Expectations - Moment Generating functions - Characteristic function. (Chapter 12: Sections – 12.0 to 12.6)
II	Binomial Distribution - Poisson Distribution (Chapter 13: Sections - 13.0 to 13.2)
III	Normal distribution - Some more Continuous Distributions. (Chapter 13: Sections – 13.3 to 13.4)
IV	Sampling – Sampling Distribution – Testing of Hypothesis – Procedure for testing of Hypothesis large samples - Tests of Significance for large samples - Test of Significance for means - - Test of Significance for difference of samples means. (Chapter 14: Section 14.0 to 14.5)
V	Test of Significance based on t-distribution - Test of Significance based on F-distribution - Test of Significance of an observed sample correlation χ^2-test for population variance - χ^2-test to test the goodness of fit- Test for Independence of attributes. (Chapter 15 Section 15.0 to 15.3, Chapter 16: Section 16.0 to 16.3)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	• S. Arumugam and A. Thangapandi Isaac, Statistics, New Gamma Publication, 2016.
Reference books:	• S. C. Gupta and V. K. Kapoor, Elements of Mathematical Statistics, 3rd Edition, Sultan Chand &Sons, New Delhi, 2001. • P. R. Vittal, Mathematical Statistics, Margham Publications, Chennai, 2020. • S. C. Gupta S.C. and V. K. Kapoor V.K, Fundamentals of Mathematical Statistics, 12thEdition, Sultan Chand &Sons, New Delhi, 2021.

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	Know Random variables, Probability mass function, probability density function, and Distribution functions
CO2	Compute Expectation, Variance and Covariance
CO3	Know about Moment Generating functions and Characteristic functions
CO4	Solve problems involving the concepts of theoretical discrete distributions
CO5	Solve problems involving the concepts of theoretical continuous distributions

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2
CO3	3	3	3	2	3	2	3	2
CO4	2	3	3	3	3	3	3	3
CO5	3	2	3	3	3	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Numerical Methods

Title of the Course		**Numerical Methods**					
Course Type		**Elective - IV**					
Year	**II**	**Semester**	**IV**	**Credits**	**2**	**Course Code**	**24UEMA42**
Instructional Hours per week		**Lecture**		**Tutorial**	**Lab Practice**	**Total**	
		4		**-**	**-**	**4**	

Learning Objectives	
LO1	Describe the roots of algebraic equations using different methods like, Bisection Method, False Method, Newton- Raphson method, Ramanujan's Method etc.
LO2	Find the real root of an equation and to find a quadratic factor of a polynomial.
LO3	Find the missing term a given series
LO4	Solve a given algebraic equation using direct and iterative methods.
LO5	Find a polynomial for given data

Unit	**Contents**
I	Finite Differences: Difference Operators – Other Difference Operators – Error propagation in a difference table. (Chapter 6: Sections - 6.1 to 6.3)
II	Interpolation: Newton's Interpolation Formulae – Central Difference Interpolation Formulae: Gauss Forward and Backward and Sterling's (only) –Lagrange's Interpolation Formula– Divided Differences – Newton's Divided Differences formula. (Chapter 7: Sections - 7.1 to 7.5) [Except Bessel's and Laplace Everett's formulae in 7.2)
III	Numerical Differentiation and Integration: Derivatives using Newton's forward difference formula –Derivatives using Newton's backward difference formula –Derivatives using central difference formula – Maxima and Minima of the Interpolating polynomial – Numerical Integration. (Chapter 8: Sections - 8.1 to 8.5)
IV	Numerical Solutions of Ordinary Differential Equations: Taylor's Series Method – Picard's method – Euler's method – Runge - Kutta method. (Chapter 10: 10.1 to 10.4)
V	Numerical Solutions of Ordinary Differential Equations: Predictor Corrector method – Milne's Method – Adams-Bashforth method. (Chapter 10: Sections – 10.5 to 10.7)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	S. Arumugam, A. Thangapandi Isaac and A. Somasundaram, Numerical Methods, Scitech, 2017.
Reference books:	1. R.M. Somasundaram and R.M. Chandrasekaran, Numerical Methods with C++Programming, Prentice Hall India Pvt.Ltd., New Delhi, 2005. 2. S. S. Sastry, Introductory Methods of Numerical Analysis, Fourth Edition, PHI Learning Private Limited, New Delhi-1, 2009. 3. PallabGhosh , Numerical Methods with Computer Programs in C++, Prentice Hall India Pvt. Ltd., New Delhi, 2009. 4. T. Veerarajan and T. Ramachandran, Numerical Methods with Programs in C, 5. Second Edition, McGraw Hill Education Pvt. Ltd, New Delhi, 2006.

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	Describe the roots of algebraic equations using different methods like, Bisection Method, False Method, Newton- Raphson method, Ramanujan‟s Method etc.
CO2	Find the real root of an equation and to find a quadratic factor of a polynomial.
CO3	Find the missing term a given series
CO4	Solve a given algebraic equation using direct and iterative methods.
CO5	Find a polynomial for given data

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	3	3	2	3	3
CO2	2	3	3	3	2	3	2	3
CO3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	2	3	2
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Geogebra

Title of the Course	Geogebra						
Course Type	Skill Enhancement Course - IV						
Year	II	Semester	IV	Credits	2	Course Code	24USMA41
Instructional Hours per week		Lecture		Tutorial	Lab Practice	Total	
		2		--	-	2	

Learning Objectives	
LO1	Install the Geogebra App and draw geometrical figures
LO2	Know the commands and functions used in Geogebra
LO3	Export of Pictures to the Clipboard and Insert Pictures into the Graphics View
LO4	Insert Text into the Graphics View
LO5	Combine Spreadsheet View & Graphics View.

Unit	Contents
I	Installation and Introduction of Geogebra - Drawing versus Geometric Construction. (Chapters: 1 and 2)
II	Practice Block I – Basic Algebraic Input, Commands and Functions. (Chapters: 3 and 4)
III	Export of Pictures to the Clipboard – Practice Block II – Inserting Pictures into the Graphics View (Chapters:5, 6 and 7)
IV	Inserting Text into the Graphics View – Practice Block III. (Chapters: 8 and 9)
V	Combining Spreadsheet View & Graphics View - Creating Static Instructional Materials – Creating Dynamic Worksheets. (Chapters: 10, 11 and 12)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	• Steve Phelps, an Introduction to GeoGebra, 2011.
Reference books:	• Judith and Markus Hohenwarter, Introduction to GeoGebra, 2011.

Course outcomes: CO	**On completion of this course, the students will be able to:**
CO1	Install the GeoGebra App and draw geometrical figures.
CO2	Know the commands and functions used in GeoGebra.
CO3	Export of Pictures to the Clipboard and Insert Pictures into the Graphics View.
CO4	Insert Text into the Graphics View.
CO5	Combine Spreadsheet View & Graphics View.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	2	3	2
CO3	3	2	3	2	3	3	3	2
CO4	3	3	3	3	3	3	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Semester – V
Abstract Algebra

Title of the Course	Abstract Algebra						
Course Type	Core – IX						
Year	III	Semester	V	Credits	5	Course Code	24UMMA51
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		5	-		-	5	

Learning Objectives	
LO1	Learning about groups, sub groups, cosets, normal subgroup and quotient groups
LO2	Learn to apply Lagrange's theorem for a given finite group has a subgroup
LO3	Learning Cayley's theorem and functions for homomorphism
LO4	Learn about Rings and its properties
LO5	Learn about the quotient ring and to discuss about the field

UNIT	CONTENTS
I	Groups: Definition and Examples – Properties – Permutation Groups – Subgroups – Cyclic Groups. (Chapter 3: Sections-3.1, 3.2, 3.4 to 3.6)
II	Order of an element – Cosets and Lagrange's Theorem – Normal subgroups and Quotient groups. (Chapter3: Sections-3.7 to 3.9)
III	Isomorphism– Cayley's Theorem–Homomorphisms- Fundamental Theorem (Chapter3: Sections-3.10 and 3.11)
IV	Definition and examples –Properties – Types of rings – Characteristic of a ring – Subrings – Ideals. (Chapter4: Section-4.1, 4.2, 4.4 to 4.7)
V	Quotient Rings – Maximal and Prime Ideals –Homomorphism and Isomorphism of Ring – The field of quotients of an Integral Domain. (Chapter4: Section-4.3, 4.8 to 4.11)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	S. Arumugam and A. Thangapandi Isaac, Modern Algebra, Sci tech Publications, 2014.
Reference books	1. N. Herstein, Topicsin Algebra, Wiley Eastern Ltd. Second Edition, 2006. 2. John B. Fraleigh, a First Course in Abstract Algebra, 7th Ed., Pearson, 2002. 3. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011. 4. Joseph A Gallian, Contemporary Abstract Algebra, 4th Edition, Narosa, 1999.

Course outcomes CO	**On completion of this course, the students will be able to**
CO1	Understand and explain the fundamental concepts of group theory including groups, subgroups, cyclic groups, and permutation groups.
CO2	Apply the concepts of cosets, order of elements, Lagrange's theorem, normal subgroups, and quotient groups to solve algebraic problems.
CO3	Analyze algebraic structures using homomorphisms, isomorphisms, Cayley's theorem, and the fundamental theorem of homomorphism.
CO4	Understand and classify ring structures including types of rings, subrings, ideals, characteristics of rings, and special classes of rings.
CO5	Apply the concepts of quotient rings, maximal and prime ideals, ring homomorphisms, and fields of quotients to theoretical and problem-solving contexts.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	2
CO3	3	2	3	2	3	3	3	3
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	2	1
CO2	2	3	1	3	1
CO3	3	3	3	3	1
CO4	2	1	3	3	1
CO5	3	3	3	3	1

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Real Analysis

Title of the Course	Real Analysis						
Course Type	Core – X						
Year	III	Semester	V	Credits	5	Course Code	24UMMA52
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		5	-		-	5	
Learning Objectives							
LO1	To learn about the concepts of open sets closed sets interior and closure of sets						
LO2	To explain the concepts of limit point and complete metric space						
LO3	To define and verify continuous, uniform continuous and discontinuous function on R						
LO4	To know the concept of connected and continuity						
LO5	To explain the concept of compact subset of R and equivalent characterization of compactness.						

UNIT	CONTENTS
I	Metric spaces: Definition and Examples – Bounded sets – Open ball– Open sets – Subspaces– Interior of a set. (Chapter 2: Section - 2.1to 2.7)
II	Closed sets– Closure– Limit point– Dense set– Complete metric space: Completeness –Cantor's Intersection Theorem– Baire's Category Theorem. (Chapter 2: Sections – 2.8 to 2.11 and Chapter 3: Sections – 3.1, 3.2 & 3.3)
III	Continuity: Continuity –Homeomorphism–Uniform Continuity – Discontinuous functions on R. (Chapter 4: Sections- 4.1 to 4.5)
IV	Connectedness: Definition and Examples –Connected subsets of R–Connectedness and Continuity–Contraction mapping theorem. (Chapter 5: Sections-5.1 to 5.4 and Chapter 8: Section - 8.2)
V	Compactness: Compact metric spaces–Compact subsets of R– Equivalent characterizations for compactness–Compactness and Continuity. (Chapter 6: Sections- 6.1 to 6.5)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	S. Arumugam and A. Thangapandi Issac, Modern Analysis, New Gamma Publishing House, Palayamkottai, 2015
Reference books	1. Richard R.Goldberg, Methods of Real Analysis, (John Wiley &sons, 2nd Edition) (Indian edition –Oxford and IBH Publishing Co, New Delhi, 1st January 2020) 2. Walter Rudin, Principles of Mathematical Analysis, Tata McGraw Hill Education, Third Edition (1 July 2017). 3. Tom M Apostal, Mathematical Analysis, Narosa Publishing House, 2nd edition (1974), Addison-Wesley publishing company, New Delhi.

Course outcomes CO	**On completion of this course, the students will be able to**
CO1	Explain the concepts of bounded, open and closed sets and to find interior and closure of a given set
CO2	Explain the concepts of limit point and dense set and define complete metric space
CO3	Define and verify continuous, uniform continuous and discontinuous function on R
CO4	Explain the concept of connected and theorems on connected and continuity
CO5	Explain the concept of compact, compact subset of R and equivalent characterization of compactness

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	3
CO2	3	3	3	3	1
CO3	3	3	3	3	2
CO4	3	3	3	1	2
CO5	3	3	3	3	3

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Graph Theory

Title of the Course		Graph Theory					
Course Type		Core – XI					
Year	III	Semester	VI	Credits	5	Course Code	24UMMA53

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total
	5	--	--	5

Learning Objectives	
LO1	Learn about Graph, Subgraph, Walks, Paths, and Cycles.
LO2	Learn about Connected, Disconnected graphs, Eulerian graphs, Hamiltonian Paths and Trees.
LO3	Give Matrix Representations of Graphs.
LO4	Know about Planar Graphs, Chromatic number and Chromatic Polynomial of a Graph
LO5	Know Matching and to describe about digraph and Euler diagraph.

UNIT	CONTENTS
I	Definition and examples of graphs –degrees- subgraphs–isomorphism–independent sets and coverings–matrices–operations of graphs. (Chapter 2: Section- 2.0 to 2.4, 2.6, 2.8 & 2.9)
II	Degree sequences– graphic sequences– walks–trails and paths –connectedness and components–connectivity (Chapter 3: Section – 3.0 to 3.2 and Chapter 4: Section- 4.0 to 4.2 & 4.4)
III	Eulerian graphs–Hamiltonian graphs, Trees and its characterization–centre of a tree. (Chapter 5 and 6)
IV	Planar graphs-Definition and properties–chromatic number and chromatic index (Chapter 8: Section-8.0 to 8.2 and Chapter 9: Section - 9.0 & 9.1)
V	Chromatic polynomials, definition and basic properties of digraphs, paths and connectedness in digraphs. (Chapter 9: Section - 9.4 and Chapter 10: Section - 10.0 to10.3)

Extended Professional Component (is a part of internal component only, Not to be included inthe External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	S. Arumugam and S. Ramachandran, Invitation to Graph Theory, Scitech Publications, Chennai, 2001
Reference books	1. Frank Harary, Graph Theory, Narosa Publishing House Pvt Ltd, New Delhi, 2001. 2. Narsingh Deo, Graph Theory with Applications to Engineering & Computer Science, Prentice Hall of India, New Delhi, 1974. 3. S. P. Rajagopalan and R. Sattanathan, Graph Theory, Margham Publications, Chennai. 4. Neeraj Pant and Shahab Faruqi, Graph Theory, CBS Publisher, 2017.

Course outcomes CO	**On completion of this course, the students will be able to**
CO1	Define and explain fundamental concepts of graph theory, including graphs, degrees, subgraphs, isomorphism, independent sets, coverings, graph matrices, and graph operations.
CO2	Analyze degree sequences and graphic sequences, and apply concepts of walks, trails, paths, connectedness, components, and connectivity in solving graph-theoretic problems.
CO3	Identify and characterize special classes of graphs such as Eulerian graphs, Hamiltonian graphs, and trees, and determine structural properties including the center of a tree.
CO4	Explain and apply the concepts of planar graphs, graph coloring, chromatic number, and chromatic index to theoretical and practical graph problems.
CO5	Evaluate chromatic polynomials and analyze directed graphs (digraphs) with respect to paths, connectivity, and structural properties.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	3	3	2	3	3
CO2	3	1	3	3	2	3	3	3
CO3	3	1	3	2	3	3	3	2
CO4	3	1	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Mathematical Modelling

Title of the Course	Mathematical Modelling						
Course Type	Core – XII						
Year	III	Semester	V	Credits	4	Course Code	24UMMA54
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		5	-		-	5	

Learning Objectives	
LO1	To explain simple mathematical modelling
LO2	To know model using differential equations in-terms of linear growth and decay models
LO3	To discuss about various models under the categories Epidemic's and Medicine
LO4	To explain in detail about difference equations
LO5	To evaluate model using difference equations

UNIT	CONTENTS
I	Mathematical modelling: Simple situations requiring mathematical modelling, characteristics of mathematical models. (Chapter 1: Sections -1.1 and 1.4)
II	Mathematical modelling through differential equations: Linear growth and decay models, Non-linear growth and decay models, Compartment models. (Chapter 2: Sections -2.1 to 2.4)
III	Mathematical modelling through system of ordinary differential equations of first order: Prey-predator models, Competition models, Model with removal and model with immigrations, Epidemics: simple epidemic model, Susceptible-infected- susceptible (SIS) model, SIS model with constant number of carriers, Medicine: Model for diabetes mellitus. (Chapter 3: Sections -3.1.1,3.1.2, 3.2.1 to 3.2.4,3.2.6, 3.5.1)
IV	Introduction to difference equations. (Chapter 5: Sections -5.1, 5.2.1 to 5.2.3)
V	Mathematical modelling through difference equations: Harrod Model, cob web model application to Actuarial Science. (Chapter 5: Sections - 5.3.1,5.3.2, 5.3.4)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	JN Kapur, Mathematical Modelling, New Age International Publishers, 2009.
Reference books	1. Bimal K. Mishra and Dipak K. Satpathi, Mathematical Modeling, Ane Books India, 2007. 2. Sandip Banerjee, Mathematical Modeling Models, Analysis and Applications, CRC Press, Taylor & Francis group, 2014. 3. Mathematical Modeling applications with Geogebra by Jonas Hall & Thomas Ligefjard, John Wiley & Sons, 2017 4. Mark M. Meerschaert: Mathematical Modeling, Elsevier Publ., 2007. 5. Edward A. Bender: An introduction to Mathematical Modeling, CRC Press,2002 6. Walter J. Meyer, Concepts of Mathematical Modeling, Dover Publ., 2000

Course outcomes CO	**On completion of this course, the students will be able to**
CO1	Explain simple situations requiring Mathematical Modelling and to determine the characteristics of such models
CO2	Model using differential equation sin-terms of linear growth and decay models
CO3	Model using systems of ordinary differential equations of firs to order, to discuss about various models under the categories Epidemic's and Medicine
CO4	Explain in detail about difference equations
CO5	Model using difference equations

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	3	3	3	2
CO3	3	2	3	3	2
CO4	3	3	3	3	2
CO5	3	3	3	2	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Project with Viva-Voce

Title of the Course		**Project with Viva Voce**					
Course Type		**Project**					
Year	**III**	**Semester**	**V**	**Credits**	**4**	**Course Code**	**24UMMAP1**
Instructional Hours per week		**Lecture**		**Tutorial**	**Lab Practice**		**Total**
		5		**-**	**-**		**5**
Objectives of the Course		• **Motivate the students to get thorough idea on a specific topic and an idea for doing research.**					

Project Viva-Voce Examination:

- Internal: 50 Marks and External: 50 Marks (Total: 100 Marks)
- Group (Maximum five students)

Project report should be submitted. External 50 marks will be evaluated by external examiners

Operations Research - I

Title of the Course		Operations Research – I					
Course Type		Elective – V					
Year	III	Semester	V	Credits	3	Course Code	24UEMA51

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total
	5	-	-	5

Learning Objectives	
LO1	Provide a strong foundation in linear programming and optimization techniques.
LO2	Develop the ability to formulate managerial decision problems into mathematical models.
LO3	Enable students to apply simplex, duality, transportation, and assignment methods to real-world problems.
LO4	Enhance analytical reasoning and quantitative decision-making skills.
LO5	Promote scientific and research-oriented thinking in business optimization problems.

UNIT	CONTENTS
I	Linear Programming: Linear Programming Problem: Mathematical formulation of the problem– Illustration on mathematical formulation of LPP - Graphical solution method-Some exceptional cases-General Linear Programming Problem-Canonical and Standard forms of LPP. (Chapter 2: Sections - 2.1 to 2.4, Chapter 3: Section - 3.1 to 3.5)
II	Simplex Method: The computational procedure – Use of artificial variable-Degeneracy in Linear Programming (Chapter 4: Section - 4.3 to 4.5)
III	Duality in LPP: General Primal-Dual pair – Formulating a Dual problem – Primal-Dual pair in matrix form-Duality Theorems– Duality and Simplex method – Dual Simplex method. (Chapter 5: Sections - 5.2 to 5.5, 5.7, 5.9)
IV	Transportation Problem (TP): Formulation of the TP- Existence of solution in TP – Duality in TP –Solution of a TP – Finding an initial basic feasible solution-Degeneracy in TP – Transportation Algorithm(MODI method). (Chapter 10: Sections – 10.2 to 10.4, 10.8, 10.9, 10.12, 10.13)

V	Assignment Problem (AP): Mathematical formulation of an AP – Solution methods of AP - Hungarian assignment method– Special case in AP - Dual of the AP. (Chapter 11: Sections – 11.1 to 11.3, 11.4, 11.6)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	Kanti Swarup, P. K. Gupta and Man Mohan, Operations Research, [19th Revised Edition], Sultan Chand & Sons, New Delhi, 2018.
Reference books	P. K. Gupta, and D. S. Hira, Operations Research, Sultan Chand & Sons, New Delhi, 2020. P. K. Gupta and Man Mohan. Problems in Operations Research [Ninth Edition], Sultan Chandand Sons, New Delhi, 2014. S. Kalavathy, Operations Research [Fourth Edition], Vikas Publishing House, Chennai, 2012.

Course outcomes CO	**On completion of this course, the students will be able to**
CO1	Formulate linear programming problems (LPP) from real-life situations and solve the using graphical methods.
CO2	Apply the Simplex method, including artificial variable techniques, to obtain optimal solutions and interpret degeneracy.
CO3	Analyze and construct primal-dual relationships and solve problems using duality concepts and the Dual Simplex method.
CO4	Formulate and solve Transportation Problems using initial basic feasible solutions and the MODI method.
CO5	Develop and solve Assignment Problems using the Hungarian method and analyze special cases including dual formulations.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1
CO2	3	2	3	2	1
CO3	3	3	3	3	1
CO4	3	3	2	3	1
CO5	3	3	3	3	1

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Discrete Mathematics

Title of the Course		Discrete Mathematics					
Course Type		Elective – V					
Year	III	Semester	V	Credits	3	Course Code	24UEMA52
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		5			-	5	

Learning Objectives	
LO1	To learn about mathematical logic statement and notations
LO2	To know about tautology and contradiction
LO3	To find the theory of inference for the predicate calculus
LO4	To define relations, ordering and types of functions
LO5	To define lattice and study the properties of lattice

UNIT	CONTENTS
I	Mathematical logic: Statements and Notations – Connectives– Negation – Conjunction –Disjunction –Statement formulas and truth table – Conditional and Biconditional–Well-formed Formulas–Tautologies. (Chapter 1: Sections- 1.1,1.2.1 to 1.2.4, 1.2.6 to 1.2.8)
II	Normal forms–Disjunctive Normal forms– Conjunctive Normal forms – Principal Disjunctive Normal forms – Principal conjunctive Normal forms – Ordering and Uniqueness of Normal forms – Validity using truth tables – Rules of inference. (Chapter 1: Sections- 1.3.1 to1.3.5,1.4.1,1.4.2)
III	The Predicate calculus–Predicates –The Statement function, Variables and quantifiers –Predicate formulas–Free and bound variables – The Universe of discourse. (Chapter 1: Sections -1.5.1 to 1.5.5)
IV	Relations and Ordering–Relations –Properties of Binary relations in a set– Partial ordering– Partially ordered set: Representation and Associated terminology - Functions: Definition and Introduction–Composition of functions – Inverse functions. (Chapter 2: Sections -2.3.1, 2.3.2, 2.3.8, 2.3.9, 2.4.1 to 2.4.3)
V	Lattices as partially ordered sets: Definition and examples–Some properties of Lattices–Sub lattices, Direct product and Homomorphism – Boolean algebra: Definition and examples – Sub Algebra, Direct product and Homomorphism. (Chapter4: Sections -4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	J.P. Tremblay, R. Manohar, Discrete Mathematical structures with Applications to Computer Science, Tata McGraw hill, 2001.
Reference books	1. M.K. Sen and B.C. Charraborthy, Introduction to Discrete Mathematics, Arunabha Sen Books & Allied Pvt. Ltd, Kolkatta. 2. Kenneth H.Rosen, Discrete Mathematics and Its Applications, Fourth Edition.

Course outcomes CO	On completion of this course, the students will be able to
CO1	Find mathematical logic statement and notations
CO2	Determine whether a given statement is a tautology, a contradiction, or satisfiable using a decision procedure that terminates in a finite number of steps.
CO3	Find the predicate logic and find the theory of inference for the Predicate calculus
CO4	Define Relations, Ordering and types of functions
CO5	Define Lattice and study the properties of Lattice

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	1
CO2	3	3	3	3	1
CO3	3	3	3	2	1
CO4	3	3	3	3	1
CO5	3	3	2	3	1

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Combinatorial Mathematics

Title of the Course		Combinatorial Mathematics					
Course Type		Elective – VI					
Year	III	Semester	V	Credits	3	Course Code	24UEMA53
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		5	-		-	5	

Learning Objectives	
LO1	To find binomial coefficients and classify ordered selections
LO2	To solve pairing problems
LO3	To explain recurrence and generating functions
LO4	To illustrate the inclusion and exclusion principles
LO5	To construct and solve block designs and square block designs

UNIT	CONTENTS
I	Selections and Binomial coefficients–Permutations–Ordered selections–unordered selections–Miscellaneous Problems. (Chapter1:Sections - 1.1 to 1.4)
II	Parings Problems: Pairings within a set–Pairing between sets. (Chapter2:Sections -2.1 and 2.2)
III	Recurrence–Fibonacci-type relations using generating functions–Miscellaneous methods. (Chapter 3:Sections - 3.1 to 3.4)
IV	The Inclusion-Exclusion Principles – Rook Polynomial. (Chapter 4:Sections- 4.1to 4.3)
V	Block designs– Square block designs. (Chapter 5:Sections- 5.1, 5.2)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts	Ian C. Andersen, A First Course in Combinatorial Mathematics, Clarendon Press, Oxford, 1989.
Reference books	Ralph P. Grimaldi, Discrete and Combinatorial Mathematics-An Applied Introduction, V Edition, Pearson, 2004.

Course outcomes CO	**On completion of this course, the students will be able to**
CO1	Explain selections and to find binomial coefficients and classify ordered selections and unordered selections
CO2	Solve pairing problems
CO3	Explain recurrence and classify the types of relations using generating functions
CO4	Illustrate the inclusion and exclusion principles
CO5	Construct and solve block designs and square block designs

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) M-Medium (2) L-Low (1)

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1
CO2	3	3	3	3	1
CO3	3	3	2	3	1
CO4	3	3	3	2	1
CO5	3	2	3	3	1

S-Strong (3) M-Medium (2) L-Low (1)

Fuzzy Sets and Applications

Title of the Course		**Fuzzy Sets and Applications**					
Course Type		**Elective – VI**					
Year	**III**	**Semester**	**V**	**Credits**	**3**	**Course Code**	**24EUMA54**
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		5	**-**		**-**	**5**	

Learning Objectives	
LO1	To explain crisp sets and fuzzy sets
LO2	To explain of α-cuts and the extension principle for fuzzy sets
LO3	To determine fuzzy complements, fuzzy intersections and fuzzy unions
LO4	To apply arithmetic operations on intervals and on fuzzy numbers
LO5	To analyze decision making, multi-person decision making problems.

UNIT	**CONTENTS**
I	From Crisp sets to Fuzzy sets: Crisp Sets – Fuzzy Sets – Basic Types – Basic Concepts – Characteristics and Significance of Paradigm Shift. (Chapter1: Sections - 1.1 to 1.5)
II	Fuzzy sets verses Crisp sets: Additional properties of α-cuts – Representations of Fuzzy sets – Extension principle of Fuzzy sets. (Chapter 2: Sections - 2.1 to 2.3)
III	Operations on Fuzzy sets: Types of Operations – Fuzzy Complements – Fuzzy intersections: t-Norms –Fuzzy Unions: t-Conorms – Combinations of operations. (Chapter 3: Sections - 3.1 to 3.5)
IV	Fuzzy Arithmetic: Fuzzy Numbers – Linguistic Variables – Arithmetic Operations on Intervals – Arithmetic Operations on Fuzzy Numbers - Lattice of Fuzzy numbers - Fuzzy Equations. (Chapter 4: Sections - 4.1 to 4.6)
V	Fuzzy Decision Making: – Individual Decision Making – Multi- Person Decision Making – Multicriteria Decision Making – Fuzzy Linear Programming. (Chapter 15: Sections - 15.1 to 15.4 and 15.7)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	George J. Klir and Bo Yuan, Fuzzy sets and Fuzzy Logic Theory Applications, Prentice Hall of India, New Delhi, 2002.
Reference books	1. GeorgeJ. Klir and Tina A. Folger, Fuzzy sets, Uncertainty and Information, Prentice Hall ofIndia, New Delhi, 2003. 2. S. Nanda and N. R. Das, Fuzzy Mathematical Concepts, Narosa Publishing House, 2012.

Course outcomes: CO	**On completion of this course, the students will be able to**
CO1	Explain Crisp sets and Fuzzy sets and illustrate the characteristics and significance of Paradigm Shift
CO2	Elaborate the Additional properties of α-cuts and the extension principle for fuzzy sets
CO3	Perform Fuzzy set operations and to determine Fuzzy complements, Fuzzy intersections and Fuzzy unions
CO4	Determine Fuzzy numbers and Linguistic variables and to apply arithmetic operations on intervals and on Fuzzy numbers
CO5	Analyze and classify Fuzzy decision making, Individual decision making, and Multi-Person decision making problems.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1
CO2	3	3	2	3	1
CO3	3	3	3	3	1
CO4	3	2	3	2	1
CO5	3	3	3	3	1

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Personality Development

Title of the Course		Personality Development			
Course Type		Indian Knowledge System (IKS)			
Course Code		24UPDT51			
Year	III	Semester	V	Credits	2

Instructional Hours Per week	Lecture	Tutorial	Lab Practices	Total
	1	1	--	2

UNIT – I

Personality - Definition – Determinants – Personality Traits –Theories of Personality – Importance of Personality Development. Self-Awareness – Meaning – Benefits of Self – Awareness – Developing Self – Awareness. Swot – Meaning – Importance- Application – Components. Goal Setting Meaning- Importance – Effective goal setting – Principles of goal setting – Goal setting at the Right level.

UNIT – II

Self-Monitoring – Meaning – High self – monitor versus low self-monitor – Advantages and Disadvantages self-monitor- Self –monitoring and job performance. Perception- Definition- Factor influencing perception- Perception process –Errors in perception – Avoiding perceptual errors. Attitude – Meaning- Formation of attitude – Types of attitude - Measurement of Attitudes – Barriers to attitude change – Methods to attitude change. Assertiveness - Meaning – Assertiveness in Communication – Assertiveness Techniques – Benefits of being Assertive – Improving Assertiveness.

UNIT – III

Team Building – Meaning – Types of teams – Importance of Team building- Creating Effective Team. Leadership – Definition – Leadership style- Theories of leadership – Qualities of an Effect leader. Negotiation Skills – Meaning – Principles of Negotiation – Types of Negotiation – The Negotiation Process – Common mistakes in Negotiation process. Conflict Management – Definition- Types of Conflict- Levels of Conflict – Conflict Resolution – Conflict management.

UNIT –IV

Communication – Definition – Importance of communication – Process of communication - Communication Symbols – Communication network – Barriers in communication – Overcoming Communication Barriers. Transactional Analysis – Meaning – Ego States – Types of Transactions – Johari Window- Life Positions. Emotional Intelligence- Meaning – Components of Emotional Intelligence- Significance of managing Emotional intelligence – How to develop Emotional Quotient. Stress Management – Meaning – Sources of Stress – Symptoms of Stress – Consequences of Stress – Managing Stress

UNIT – V

Social Graces – Meaning – Social Grace at Work – Acquiring Social Graces. Table Manners – Meaning – Table Etiquettes in Multicultural Environment- Do's and Don'ts of Table Etiquettes. Dress Code – Meaning- Dress Code for selected Occasions – Dress Code for an Interview. Group Discussion – Meaning – Personality traits required for Group Discussion- Process of Group Discussion- Group Discussion Topics. Interview – Definition- Types of skills – Employer Expectations –Planning for the Interview – Interview Questions- Critical Interview Questions.

References:

1. Dr.S. Narayana Rajan, Dr. B. Rajasekaran, G. Venkadasalapthi, V. Vijuresh Nayaham and Herald M.Dhas, **Personality Development**, Publication Division, Manonmaniam Sundaranar University, Tirunelveli
2. Stephan P.Robbins, **Organisational Behaviour**, Tenth Edition, Prentice Hall of India Private Limited, New Delhi,2008
3. Jit S. Chandan, **Oragnisational Behaviour**, Third Edition, Vikas Publishing House Private Limited, 2008
4. Dr.K.K. Ramachandran and Dr.K.K. Karthick, **From Campus to Corporate**, Macmillan Publishers India Limited, New Delhi, 2010.

Semester - VI
Linear Algebra

Title of the Course		**Linear Algebra**					
Course Type		**Core - XIII**					
Year	**III**	**Semester**	**VI**	**Credits**	**6**	**Course Code**	**24UMMA51**
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**		
		6	**--**	**--**	**6**		

Learning Objectives	
LO1	Acquire a detailed knowledge about vector spaces and subspaces
LO2	Explain the concepts of Linear Dependence, Linear Independence, Bases and Dimension of basis
LO3	Explain the concept of Linear Transformations and their Matrix representation, Inner product and norms and to apply Gram Schmidt Orthogonalization
LO4	Know the concept of elementary transformations which is applied to find rank of a matrix and solve simultaneous linear equations
LO5	Find the Eigen values and Eigen vectors and to know the quadratic forms.

UNIT	**CONTENTS**
I	Vector Spaces: Definition and examples– Subspaces– Linear Transformations– Fundamental theorem of homomorphism. (Chapter 5: Sections - 5.1 to 5.3)
II	Span of a set– Linear Dependence and Independence– Basis and Dimension. (Chapter 5: Sections - 5.4 to 5.6)
III	Rank and Nullity of a transformation – Matrix of a linear transformation – Inner product space: Definition and examples– Orthogonality – Orthogonal complement. (Chapter 5: Sections - 5.7, 5.8 and Chapter 6: Sections - 6.1 to 6.3)
IV	Matrices – Elementary transformation – Rank of a matrix – Simultaneous linear equations – Characteristic equation and Cayley - Hamilton Theorem. (Chapter 7: Sections - 7.4 to 7.7)
V	Eigen values and Eigen vectors – Properties and problems – Bilinear forms – Quadratic forms – Reduction of quadratic form to diagonal form. (Chapter 7: Sections - 7.8 and Chapter 8: Sections - 8.1, 8.2)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination Question paper)	Questions related to the above topics from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	S. Arumugam and A. Thangapandi Isaac, Modern Algebra, Scitech, 2014.
Reference Books	1. I.N. Herstein, Topicsin Algebra, Wiley Eastern Ltd. Second Edition, 2006. 2. N.S.Gopalakrishnan, University Algebra, New Age International Publications, Wiley Eastern Ltd. 3. JohnB. Fraleigh, First course in Algebra, Addison Wesley. 4. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 5th Edition, Prentice Hall of India Pvt. Ltd., 2018. 5. David C.Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007. 6. S.Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005. 7. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.

Course outcomes CO	On completion of this course, the students will be able to
CO1	Acquire a detailed knowledge about vector spaces and subspaces
CO2	Explain the concepts of Linear Dependence, Linear Independence, Bases and Dimension of basis
CO3	Explain the concept of Linear Transformations and their Matrix representation, Inner product and norms and to apply Gram Schmidt Orthogonalization
CO4	Know the concept of Elementary transformations which is applied to find Rank of a matrix and solve Simultaneous linear equations
CO5	Find the Eigen values and Eigen vectors and to know the quadratic forms

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	2	3	2	2
CO5	3	3	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Complex Analysis

Title of the Course		Complex Analysis					
Course Type		CORE – XIV					
Year	III	Semester	VI	Credits	6	Course Code	24UMMA62

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total
	6	--	--	6

Learning Objectives	
LO1	Analytic functions, their differentiation and continuity
LO2	Explain the concept of linear transformations and to find fixed points of transformations
LO3	Explain the concept matrix representation, inner product and norms and to apply Gram Schmidt Orthogonalization
LO4	Find the convergence of series and derive Taylor's and Laurent's series
LO5	Find the zeros of analytic function, understand zeros and singularities of an analytic function, apply their properties in the evaluation of definite integral

UNIT	CONTENTS
I	Functions of a complex variable –Limits –Theorem on limits – Continuity – Derivatives – Differentiation formulas - Cauchy Riemann equation – conditions for differentiability - Polar coordinates– Analytic functions– Harmonic functions. (Chapter 2: Sections - 2.1 to 2.8)
II	Conformal Mapping – Elementary Transformation – Bilinear Transformation – Cross Ratio – Fixed Points. (Chapter 2: Section - 2.9 and Chapter 3: Sections – 3.1 to 3.4)
III	Complex Integration: Definite Integral – Cauchy's Theorem– Cauchy's integral formula – Higher Derivatives. (Chapter 6: Sections - 6.1 to 6.4)
IV	Sequence and Series – Power Series – Taylor's series – Laurent series– Zeros of an Analytic function – Singularities. (Chapter 4: Sections - 4.1, 4.3 and Chapter 7: Sections - 7.1 to 7.4)
V	Residues– Cauchy Residue theorem– Evaluation of definite integrals. (Chapter 8: Sections -8.1 to 8.3)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	S. Arumugam, A. Thangapandi Isaac and A.Somasundaram, Complex Analysis, Scitech Publications, 2002.
Reference books	1. James Ward Brownand Ruel V.Churchill, Complex Variables and Application, Seventh Edition, McGraw Hill Book Co., International Edition, 2009. 2. Theodore W.Gamelan, Complex Analysis,SpringerVerlag,2008 3. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997. 4. Richard A. Silverman, Introductory Complex Analysis, Dover Publications, 1972. 5. S.Ponnusamy and H.Silverman, Complex Variables with Applications, Birkhauser, 2006.

Course outcomes CO	**On completion of this course, the students will be able to**
CO1	Explain about analytic functions, their differentiation and continuity and to verify the harmonic functions using analyticity conditions
CO2	Explain the concept of conformal mappings and mappings by linear transformations and to find fixed points of transformations
CO3	Explain the concept of linear transformations and their matrix representation, inner product and norms and to apply Gram Schmidt Orthogonalization
CO4	Find the convergence of sequences and series and derive Taylor's and Laurent's series
CO5	Find the zeros of analytic function, the residue of a given function at a given singular point and to evaluate definite integrals.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	1
CO2	3	3	3	3	1
CO3	3	2	3	3	1
CO4	3	3	3	3	1
CO5	3	3	3	2	1

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Mechanics

Title of the Course		Mechanics					
Course Type		Core – XV					
Year	III	Semester	VI	Credits	6	Course Code	24UMMA63
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		6	--		--	6	

Learning Objectives	
LO1	Equilibrium of a particle under the action of given forces
LO2	Define moment of a force and couple with examples, acting along a triangle, solve problems on frictional forces.
LO3	Define work, energy, power, rectilinear motions harmonic motion and find its geometrical representation.
LO4	Define projectile, impulse find the direct and oblique impact of smooth elastic spheres
LO5	Explain conic as centered orbits and solve problems related to central orbits.

UNIT	CONTENTS
I	Force: Newton's laws of motion –Resultant of two forces on a particle - Equilibrium of a Particle: Equilibrium of a particle – Limiting equilibrium of a particle on an inclined plane. (Chapter 2: Section-2.1, 2.2 and Chapter 3: Section 3.1, 3.2)
II	Forces on a Rigid Body: Moment of a Force – General motion of a rigid body – Equivalent systems of forces- Parallel Forces – Forces acting along a Triangle - A specific reduction of Forces: Reduction of coplanar forces into a force and a couple – Problems involving frictional forces. (Chapter 4: Section-4.1 to 4.5 and Chapter 5: Sections - 5.1, 5.2)
III	Work, Energy and Power: Work – Conservative field of force – Power – Rectilinear Motion under varying force: Simple Harmonic Motion - along a horizontal line – along a vertical line. (Chapter 11 : Sections - 11.1 to 11.3 and Chapter 12: Sections – 12.1 to 12.3)

IV	Projectiles: Forces on a projectile–Projectile projected on an inclined plane. (Chapter 13: Sections -13.1, 13.2)
V	Central Orbits: General orbits–Central orbit–Conic as centered orbit. (Chapter 16: Sections -16.1 to 16.3)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	P. Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasm, Mechanics, S.Chand & Company Ltd, 2007
Reference books	1. A.Ruinaand R .Pratap, Introduction to Statics and Dynamics, Oxford University Press, 2014. 2. S.L. Loney, the Elements of Statics and Dynamics, Cambridge University Press, 1904. 3. J.L. Meriam, L. G. Kraige and J.N. Bolton, Engineering Mechanics, Dynamics,8th edn, Wiley and sons Pvt ltd., New York, 2015. 4. A.K.Dhiman, P.Dhinam and D.Kulshreshtha, Engineering Mechanics (Statics and Dynamics) , McGraw Hill Education (India) Private Limited, New Delhi, 2015

Course outcomes CO	**On completion of this course, the students will be able to**
CO1	Define resultant, component of a force, coplanar forces, like and unlike parallel forces, equilibrium of a particle, limiting equilibrium of a particle on an inclined plane.
CO2	Define moment of a force and couple with examples. Define parallel forces and forces acting along a triangle, solve problems on frictional forces.
CO3	Define work, energy, power, rectilinear motions under varying forces, define simple harmonic motion and find its geometrical representation.
CO4	Define projectile, impulse, impact and laws of impact, prove that the path of a projectile is a parabola, find the direct and oblique impact of smooth elastic spheres
CO5	Define central orbits, explain conic as centered orbits and solve problems related to central orbits.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	2	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	2	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Operations Research - II

Title of the Course		Operations Research – II					
Course Type		Elective – VII					
Year	III	Semester	VI	Credits	3	Course Code	24UEMA61

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total
	6	--	--	6

Learning Objectives

LO1	Develop analytical skills to solve operational and managerial decision problems.
LO2	Provide knowledge of quantitative techniques such as sequencing, network analysis, game theory, queuing theory, and inventory management.
LO3	Enable students to apply mathematical models to real-life business situations.
LO4	Enhance problem-solving and decision-making abilities using scientific and logical approaches.
LO5	Build research orientation and analytical reasoning in business operations.

UNIT	CONTENTS
I	Operations Scheduling: Problem of Sequencing –Basic terms used in sequencing – Processing n jobs through two machines – Processing n jobs through k machines- Processing two jobs through k machines (Chapter 12: Sections – 12.1 to 12.6)
II	Network Scheduling: Network basic components – Logical Sequencing – Rules of Network construction – Critical path analysis – Probability consideration in PERT and CPM – Application of network techniques. (Chapter 25: Sections – 25.1 to 25.4, 25.6 to 25.9)
III	Game Theory: Two-Person Zero-sum Game – Solution of Two-person Zero-sum Game – The Maximin- Minimax Principle –Saddle point – A Games with Pure strategy, mixed strategy – 2 × 2 Games – Graphical Solution for 2 × n and m × 2 Games– Dominance Property. (Chapter 17: Sections – 17.1 to 17.7)

IV	Queuing Theory: Queuing system – Deterministic, Characteristic and Probability Distributions in Queuing system – Classification of Queuing models – Probabilistic Queuing models – Poisson-Exponential Models($(M/M/1):\infty/FIFO$) and ($M/M/1$) : ($N/FIFO$) only) (Chapter 21: Sections -21.1 to 21.9)
V	Inventory Management: Types of Inventory–Inventory Decisions– Costs associated with Inventories – Factors affecting inventory control – The concept of EOQ– Deterministic inventory problems with no shortages– Problems of EOQ and price breaks. (Chapter 19: Sections – 19.1, 19.2, 19.4, 19.6, 19.7, 19.9, 19.10, 19.12)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	Kanti Swarup, P. K. Gupta and Man Mohan, Operations Research, [19th Revised Edition], Sultan Chand & Sons, New Delhi, 2018.
Reference books	1. P. K. Gupta, and D. S. Hira, Operations Research, Sultan Chand & Sons, New Delhi, 2020. 2. P. K. Gupta and Man Mohan, Problems in Operations Research [Ninth Edition], Sultan Chand and Sons, New Delhi, 2014. 3. S. Kalavathy, Operations Research [Fourth Edition], Vikas Publishing House, Chennai, 2012.

Course outcomes CO	On completion of this course, the students will be able to
CO1	Apply sequencing models to optimize job scheduling and minimize processing time in operations.
CO2	Construct and analyze project networks using CPM and PERT techniques for effective project management.
CO3	Analyze competitive situations using game theory and determine optimal strategies. Making use of mixed strategies and dominance property.
CO4	Evaluate queuing systems and compute performance measures using appropriate probabilistic models.
CO5	Develop and analyze inventory models including EOQ and price-break models for cost optimization.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) M-Medium (2) L-Low (1)

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	3	3	2	2
CO3	3	3	2	3	2
CO4	3	3	3	3	2
CO5	3	2	3	3	2

S-Strong (3) M-Medium (2) L-Low (1)

Financial Mathematics

Title of the Course		**Financial Mathematics**					
Course Type		**Elective - VII**					
Year	**III**	**Semester**	**VI**	**Credits**	**3**	**Course Code**	**24UEMA62**
Instructional Hours per week		**Lecture**		**Tutorial**	**Lab Practice**		**Total**
		6		**--**	**--**		**6**

Learning Objectives	
LO1	Know stocks, bonds
LO2	Know, capital and ratio
LO3	Measure risk of the investment
LO4	Know the life annuities
LO5	Explain the property

UNIT	**CONTENTS**
I	Mathematics of Investment: Stocks – Bonds – Mutual funds. (Chapter 5: Sections - 1 to 3)
II	Mathematics of Investment: Options –Cost of Capital and Ratio. (Chapter 5: Sections - 4 and 5)
III	Mathematics of Return and Risk: Measuring Return and Risk – The Capital Asset Pricing Model. (Chapter 6: Sections -1 and 2)
IV	Mathematics of Insurance: Life Annuities – Life Insurance. (Chapter 7: Sections - 1, 2.1 to 2.8)
V	Mathematics of Insurance: Life Insurance – Property and Casualty Insurance. (Chapter 7: Sections - 2.9 to 2.14, 3)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	M. J. Alhabeeb, Mathematical Finance, A John Wiley & Sons, Inc., Publication, 2012.
Reference books	1. S. P. Gupta and S. K. Jain, Financial Mathematics, Sahitya Bhawan Publications, 2022 2. Bimal Jaiswal and Leena S. Shimpi, Financial Mathematics, New Royal Book Company, 2020. 3. Marek Capinski and Tomasz Zastawniak, Mathematics for Finance: An Introduction to Financial Engineering, Springer, 2010.

Course outcomes CO	**On completion of this course, the students will be able to**
CO1	Know stocks, bonds and mutual funds
CO2	Know the options, capital and ratio
CO3	Measure return and risk of the investment
CO4	Know the life annuities and life insurance
CO5	Explain the property and casualty insurance

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	2	3	3	2
CO4	3	3	2	3	2
CO5	3	3	3	2	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Number Theory

Title of the Course		Number Theory					
Course Type		Elective – VIII					
Year	III	Semester	V	Credits	3	Course Code	24UEMA63
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		5	1		-	6	

Learning Objectives	
LO1	To explain the concept of binomial theorem
LO2	To study division algorithm and Diophantine equation $ax+by=c$
LO3	To explain the fundamental theorem of arithmetic and The Sieve of Eratosthenes
LO4	To learn congruence's and to apply Chinese Remainder Theorem
LO5	To discuss Fermat's Theorem and Wilson's Theorem

UNIT	CONTENTS
I	Preliminaries: Mathematical induction–The Binomial Theorem– Early Number Theory. (Chapter 1: Sections - 1.1, 1.2 and Chapter 2: Section – 2.1)
II	Division Algorithm–GCD–Euclidean Algorithm– The Diophantine equation $ax+by=c$. (Chapter 2: Sections - 2.3 to 2.5)
III	The Fundamental Theorem of Arithmetic – The Sieve of Eratosthenes– The Gold batch conjecture. (Chapter 3: Sections - 3.1 to 3.3)
IV	Basic properties of congruence's – Binary and decimal representation of integers – Linear congruence and The Chinese Remainder Theorem. (Chapter 4: Sections – 4.2 to 4.4)
V	Fermat's Theorem–Wilson's Theorem– The Fermat Kraitchik Factorization Method. (Chapter 5: Sections - 5.1 to 5.4)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	David M. Burton, Elementary Number Theory, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2014.
Reference books	1. Neville Robinns, Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Limited, Delhi, 2006. 2. Richard E.K lima, Neil Sigmon, Ernest Stitzinger, Applications of Abstract Algebra with Maple, CRC Press ,Boca Raton, 2000. 3. S. Kumaravelu and Susheela Kumaravelu, Elements of Number Theory, Raja Sankar Offset Printers, 2002.

Course outcomes CO	On completion of this course, the students will be able to
CO1	Explain mathematical induction and to make use of binomial theorem
CO2	Illustrate division algorithm and to determine the GCD of given two numbers and solution of Diophantine equation $ax+by=c$
CO3	Interpret the fundamental theorem of arithmetic and to explain The Sieve of Eratosthenes and to use Gold batch conjecture
CO4	Summarize the basic properties of congruence's and to apply Chinese Remainder Theorem
CO5	Elaborate Fermat's Theorem, Wilson's Theorem and to apply Kraitchik Factorization Method.

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	2	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	2	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	2	2
CO5	3	3	3	3	2

S-Strong (3) **M-Medium (2)** **L-Low (1)**

Astronomy

Title of the Course		Astronomy					
Course Type		Elective - VIII					
Year	III	Semester	VI	Credits	3	Course Code	24UEMA64

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total
	6	--	--	6

Learning Objectives

LO1	Explain spherical trigonometry and to elaborate the fundamental of spherical trigonometry, the sine, the cosine, four parts and Napier's formula
LO2	Imagine the celestial sphere, illustrate about the rising and setting of a star and to identify and classify circumpolar stars and morning, evening stars.
LO3	Imagine earth and to explain refraction and to deduce tangent formula and Cassini's formula
LO4	Illustrate geocentric parallax and heliocentric parallax
LO5	Elaborate Kepler's laws and to classify true anomaly, mean anomaly and eccentric anomaly and to obtain the relationship between them

UNIT	CONTENTS
I	Spherical Trigonometry: Spherical triangle –The fundamental formula of spherical trigonometry, the sine, cosine, four parts and Napier formula (without proof) and simple problems. (Chapter 1: Pages - 1 to 40)
II	The Celestial Sphere: Celestial co-ordinates – Diurnal motion –Rising and setting of a star sidereal time – circumpolar stars – Morning and Evening stars. (Chapter 2: Pages - 41 to 97)
III	Earth – Length of a day – Refraction – Tangent formula – Cassini's formula – Effects of refraction. (Chapter 3: Pages - 98 to 143 and 154 to 174)

IV	Geocentric parallax – Effects – Heliocentric parallax – Effects. (Chapter 5: Pages - 175 to 190 and Chapter 8: Pages – 263 to 293)
V	Kepler's laws – Verification of Kepler's laws – True anomaly, Mean anomaly, Eccentric anomaly – Relation between them. (Chapter 6: Pages - 191 to 219 and Chapter 7: Pages – 220 to 237)

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical Ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	S. Kumaravelu and Susheela Kumaravelu, Astronomy for degree classes, Rainbow Printers, Nagercoil, 2005.
Reference books	1. G. V. Ramachandran, Astronomy, Mission Press, Palayamkottai, 1965. 2. Andrew Fraknoi, David Morrison and Sidney C. Wolff, 2. Introduction to Astronomy, OpenStax, 2012.

Course outcomes CO	**On completion of this course, the students will be able to**
CO1	Explain spherical trigonometry and to elaborate the fundamental of spherical trigonometry, the sine, the cosine, four parts and Napier's formula
CO2	Imagine the celestial sphere, illustrate about the rising and setting of a star and to identify and classify circumpolar stars and morning, evening stars.
CO3	Imagine earth and to explain refraction and to deduce tangent formula and Cassini's formula
CO4	Illustrate geocentric parallax and heliocentric parallax
CO5	Elaborate Kepler's laws and to classify true anomaly, mean anomaly and eccentric anomaly and to obtain the relationship between them

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6		PO8
CO1	3	3	2	3	3	2		3
CO2	2	3	3	3	2	3		3
CO3	3	3	3	2	3	3		2
CO4	3	3	3	3	3	2	3	3
CO5	3	2	3	3	2	3	3	2

S-Strong (3) M-Medium (2) L-Low (1)

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	3	3	3	2
CO3	3	3	2	3	2
CO4	3	2	3	3	2
CO5	3	3	3	3	2

S-Strong (3) M-Medium (2) L-Low (1)

Blue Print – End Semester Examinations Semester – I to VI

Class: U.G **Time: 3 Hours** **Max. Marks: 75**

Section A **(10 x 1 = 10)**

Answer all questions.
Choose the correct answer. (With four options)

	Unit I	Unit II	Unit III	Unit IV	Unit V
Question Nos.	1 & 2	3 & 4	5 & 6	7 & 8	9 & 10

Section B **(5 x 5 = 25)**

Answer all questions choosing either (a) or (b). Answer should not exceed 250 words

	Unit I	Unit II	Unit III	Unit IV	Unit V
Question Nos.	11 (a) & 11 (b)	12 (a) & 12 (b)	13 (a) & 13 (b)	14 (a) & 14 (b)	15 (a) & 15 (b)

Section C **(5 x 8 = 40)**

Answer all questions choosing either (a) or (b). Answer should not exceed 500 words

	Unit I	Unit II	Unit III	Unit IV	Unit V
Question Nos.	16 (a) & 16 (b)	17 (a) & 17 (b)	18 (a) & 18 (b)	19 (a) & 19 (b)	20 (a) & 20 (b)