JP COLLEGE OF ARTS & SCIENCE

(AUTONOMOUS)

(Run by DMI Sisters)

(Affiliated to Manonmaniam Sundaranar University – Tirunelveli)

Accredited by NAAC with "B++" Grade

2(f) status of UGC Act, 1956 | ISO 9001:2015 Certified Institution

Ayikudy, Tenkasi District - 627852.

SYLLABUS

Bachelor of Mathematics

Choice Based Credit System (CBCS)
(w.e.f. June 2026-2027)

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SYLLABUS

PROGRAMME OUTCOMES (PO) FOR UG PROGRAMME

The successful completion of the B.Sc Maths programme shall enable the students to:

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	**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.
PO3:	**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 earning to real life situations.
PO4:	**Analytical Reasoning:** Ability to evaluate the reliability 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.
PO5:	**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.
PO6:	**Self-directed & Lifelong Learning:** Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including learning how to learn, through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives

JP COLLEGE OF ARTS AND SCIENCE
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Regulations 2026–2027 for Undergraduate Programme

Learning Outcomes Based Curriculum Framework–(LOCF) model with Choice Based Credit System (CBCS)

Programme: Bachelor of Mathematics

(Applicable for the Students admitted during the Academic Year 2026-27 onwards)

Mathematics

- The primary objectives of a Mathematics Programme are to develop logical reasoning, numeracy, and problem-solving skills, while cultivating a positive attitude towards the subject. It enables students to understand mathematical concepts, apply them to real-life situations, think critically, and communicate mathematical ideas effectively.

VISION

- To provide exceptional mathematics education that fosters analytical thinking, encourages innovation, and supports impactful research, preparing students for success in both academic and practical fields.

MISSION

- To offer a strong mathematics program that aligns with the goals of providing quality education at both undergraduate and master's levels
- To meet the diverse needs of students by teaching them practical mathematical skills for various fields.
- To deliver quality mathematics education that helps students develop strong skills in math and its applications.

Program Outcomes (POs)

The successful completion of the B.Sc Maths programme shall enable the students to:

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	**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.
PO3:	**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 earning to real life situations.
PO4:	**Analytical Reasoning:** Ability to evaluate the reliability 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.
PO5:	**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.
PO6:	**Self-directed & Lifelong Learning:** Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including learning how to learn, through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives

Program Specific Outcomes (PSOs)

PSO1	Acquire good knowledge and understanding, to solve specific theoretical and applied problems in dif area of mathematics & statistics.
PSO2	Understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.
PSO3	To prepare the students who will demonstrate respectful engagement with other's ideas, behaviors, and beliefs and apply diverse frames of references to decisions and actions. To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.

Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System For all UG Courses including Lab Hours

First Year
Semester-I

Part	List of Courses	Credit	Hours per Week (L/T/P)
Part-I	Language–Tamil	3	5
Part-II	Language–English	3	5
Part-III	Core Course CC1: Algebra & Trigonometry	4	4
	Core Course CC2:Differential Calculus	4	4
	Elective Course EC1: Choose any one from the following: 1.Programming Language C 3 2. Allied Physics I 3. Allied Chemistry I	3	4
	Elective Course EC1: Choose any one from the following: 1. Programming Language C Practical* 2. Allied Physics I Practical 3. Allied Chemistry I Practical	2	4
Part-IV	Foundation Course FC – Essential Mathematics Skills	2	2
	NME – Fundamentals of Statistics I	2	2
		23	**30**

Semester-II

Part	List of Courses	Credit	Hours per Week(L/T/P)
Part-I	Language–Tamil	3	5
Part-II	Language–English	3	5
Part-III	Core Course CC3: Analytical Geometry (Two & Three Dimensions)	4	4
	Core Course CC4: Integral Calculus	4	4
	Elective Course EC2: Choose any one from the following: 1. Programming Language C++ 2.Allied Physics II 3. Allied Chemistry II	3	4
	Elective Course EC2: Choose any one from the following: 1. Programming Language C++ Practical* 2. Allied Physics II Practical 3. Allied Chemistry II Practical	2	4
Part-IV	Skill Enhancement Course SEC1: LaTeX	2	2
	NME- Fundamentals of Statistics II	2	2
		23	**30**

Second Year
Semester-III

Part	List of Courses	Credit	Hours per Week (L/T/P)
Part-I	Language–Tamil	3	5
Part-II	Language–English	3	5
Part-III	Core Course CC5: Vector Calculus and Applications	4	5
	Core Course CC6: Differential Equations and Applications	4	5
	Elective Course EC3: (Statistics I / Difference Equations)	3	4
Part-IV	Skill Enhancement Course SEC2: Computational Mathematics	2	2
	Skill Enhancement Course SEC3: Mathematics for Competitive Examination1	2	2
	Environmental Studies– EVS	2	2
		23	**30**

Semester-IV

Part	List of Courses	Credit	Hours per Week (L/T/P)
Part-I	Language–Tamil	3	5
Part-II	Language–English	3	5
Part-III	Core Course CC7: Sequence and Series	4	5
	Core Course CC8: Fourier Series and Integral Transforms	4	5
	Elective Course EC4: (Statistics II / Numerical Methods)	3	4
Part-IV	Skill Enhancement Course SEC4: GeoGebra	2	2
	Skill Enhancement Course SEC 5 Mathematics for Competitive Examination 2	2	2
	Value Education	2	2
		23	**30**

Third Year
Semester-V

Part	List of Courses	Credit	Hours per Week (L/T/P)
Part-III	Core Course CC9: Abstract Algebra	4	5
	Core Course CC10: Real Analysis	4	5
	Core Course CC11: Mathematical Modeling	4	5
	Core Course CC12: Number Theory	4	5
	Core Course CC13: Operation Research	4	4
	Elective Course EC5 (One course from Group A other than EC5)	3	4

Part-IV	Ability Enhancement Course – Empowered Vocational English	2	2
	Internship / Industrial training / Field Visit / Knowledge Updating Activity **	1	-
		26	**30**

Semester-VI

Part	List of Courses	Credit	Hours per Week (L/T/P)
Part-III	Core Course CC14: Linear Algebra	4	5
	Core Course CC15: Complex Analysis	4	5
	Core Course CC16: Mechanics /	4	5
	Core Course CC17: Project with Viva-voce	5	5
	Elective Course EC6: (One course from Group B)	3	4
	Elective Course EC7: (One course from Group B other than EC7)	3	4
Part-IV	Ability Enhancement Course – Design Thinking	2	2
Part-V	Extension Activity ***	1	-
		26	**30**

Total Credits: 144

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	11	11	23	23	94
Part IV	4	4	6	6	3	2	25
Part V	-	-	-	-	-	1	1
Total	23	23	23	23	26	26	**144**

*Part I. II, and Part III components will be separately taken into account for CGPA calculationandclassificationfortheundergraduateprogrammeandtheothercomponents. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.

Part I – Tamil / Other Languages
Part II - English
Part III – Core Papers, Electives and Project
Part IV – Environmental Studies, Value Based Education, Skill Enhancement Courses, NME, Foundation Course and Internship
Part V – Extension Activity

Curriculum

Semester–1									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours.	**Max Marks**			
						CIA	**ESE**	**Total**	
26U1TL11	I	Language- I	Tamil–I	5	3	50	50	100	3
26U1HD11	I		Hindi –I						
26U1MY11	I		Malayalam–I						
26U1FR11	I		French – I						
26U2EN11	II	Language- II	English–I	5	3	50	50	100	3
26UCMA11	III	Core- I	Algebra & Trigonometry	4	3	50	50	100	4
26UCMA12	III	Core -II	Differential Calculus	4	3	50	50	100	4
26UEMA1A	III	EC - I	Programming Language C	4	3	50	50	100	3
26UEMA1B			Allied Physics II						
26UEMA1C			Allied Chemistry II						
26UEMA1AP1	III	EC II	Programming Language C Practical	4	3	50	50	100	2
26UEMA1BP1			Allied Physics II Practical						
26UEMA1CP1			Allied Chemistry II Practical						
26UFMA11	IV	FC	Essential Mathematics Skills	2	3	50	50	100	2
26UNMA11	IV	NME - I	Fundamentals Of Statistics – I	2	3	50	50	100	2
Total				**30**				**800**	**23**

Semester–2									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
26U1TL21	I	Language-I	Tamil–II	5	3	50	50	100	3
26U1HD21	I		Hindi –II						
26U1MY21	I		Malayalam–II						
26U1FR21	I		French – II						
26U2EN21	II	Language-II	English–II	5	3	50	50	100	3
26UCMA21	III	Core-III	Analytical Geometry (Two & Three Dimensions)	4	3	50	50	100	4
26UCMA22	III	Core IV	Integral Calculus	4	3	50	50	100	4
26UEMA2A	III	EC - III	Programming In C++ With Practical	4	3	50	50	100	3
26UEMA2B			Allied Physics II with Practical						
26UEMA2C			Allied Chemistry II with Practical						
26UEMA2AP2	III	EC IV	Programming Language C Practical	4	3	50	50	100	2
26UEMA2BP2			Allied Physics II Practical						
26UEMA2CP2			Allied Chemistry II Practical						
26USMA21	IV	SEC - I	LaTeX	2	3	50	50	100	2
26UNMA21	IV	NME - II	Fundamentals Of Statistics – II	2	3	50	50	100	2
			Total	**30**				**800**	**23**

Semester–3									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
26U1TL31	I	Language–I	Tamil–III	5	3	50	50	100	3
26U1HD31	I		Hindi –III						
26U1MY31	I		Malayalam– III						
26U1FR31	I		French – III						
26U2EN31	II	Language–II	English–III	5	3	50	50	100	3
26UCMA31	III	Core– V	Vector Calculus And Its Applications	5	3	50	50	100	4
26UCMA32	III	Core –VI	Differential Equations And Applications	5	3	50	50	100	4
26UEMA31	III	EC - III	Statistics I	4	3	50	50	100	3
26UEMA32			Difference Equations						
26USMA31	IV	SEC - II	Computational Mathematics	2	3	50	50	100	2
26USMA32	IV	SEC – III	Mathematics For Competitive Examination I	2	3	50	50	100	2
26UEVS31	IV	Common	Environmental Studies	2	50	50	50	100	2
Total				**30**				**800**	**23**

Semester–4									
Course Code	**Part**	**Course category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
26U1TL41	I	Language– I	Tamil–IV	5	3	50	50	100	3
26U1HD41	I		Hindi –IV						
26U1MY41	I		Malayalam–IV						
26U1FR41	I		French – IV						
26U2EN41	II	Language– II	English–IV	5	3	50	50	100	3
26UCMA41	III	Core– VII	Sequence and Series	5	3	50	50	100	4
26UCMA42	III	Core –VIII	Fourier Series and Integral Transforms	5	3	50	50	100	4
26UEMA41	III	EC – IV	Statistics II	4	3	50	50	100	3
26UEMA42			Numerical Methods						
26USMA41	III	SEC –IV	GeoGebra	2	3	50	50	100	2
26USMA42	IV	SEC - V	Mathematics for Competitive Examination II	2	3	50	50	100	2
26UVBE41	V	Common	Value Based Education	2	3	50	50	100	2
			Total	**30**				**800**	**23**

Semester – 5									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in hrs.	**Max Marks**			
						CIA	**ESE**	**Total**	
26UCMA51	III	Core-IX	Abstract Algebra	5	3	50	50	100	4
26UCMA52	III	Core -X	Real Analysis	5	3	50	50	100	4
26UCMA53	III	Core -XI	Mathematical Modelling	5	3	50	50	100	4
26UCMA54	III	Core -XII	Number Theory	5	3	50	50	100	4
26UCMA55	III	Core -XIII	Operations Research I	4	3	50	50	100	4
26UEMA53	III	Elective- VII	Discrete mathematics	4	3	50	50	100	3
26UEMA54			Combinatorial Mathematics						
26UEMA55			Fuzzy Sets And Applications						
26UFIK51	IV	Internship	Internship/Industrial Visit/Field Visit/Knowledge Updation Activity	-	3	50	50	100	1
26UAEC51	IV	AEC - I	Empowered Vocational English	2	3	50	50	100	2
Total				**30**				**800**	**26**

Semester–6									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours / Week**	**Examination**				**Credits**
					Duration in hrs.	**Max Marks**			
						CIA	**ESE**	**Total**	
26UCMA61	III	Core– XIV	Linear Algebra	5	3	50	50	100	4
26UCMA62	III	Core - XV	Complex Analysis	5	3	50	50	100	4
26UCMA63	III	Core - XVI	Mechanics	5	3	50	50	100	4
26UCMA64		Core – XVII	Project	5	3	50	50	100	5
26UEMA61	III	Elective- VII	Operations Research-II	4	3	50	50	100	3
26UEMA62			Graph Theory						
26UEMA63		Elective- VIII	Financial Mathematics	4	3	50	50	100	3
26UEMA64			Astronomy						
26UAEC61	V	AEC - II	Design Thinking	2	3	50	50	100	2
26U5EA61	V	Common	Extension Activity	-				100	1
Total				**30**				**800**	**26**
Grand Total				**180**				**4800**	**144**

Internship (minimum of 30 hours): The students should submit certificate of attendance from the industry stating the nature of work done, duration and role played along with report (minimum of 20 pages) at the end of V semester for external evaluation.

Industrial Visit/ Field Visit : A report based on the observation and learning outcome to be submitted (minimum of 10 pages) along with suitable evidences at the end of V semester for external evaluation.

Knowledge Updation Activity :A report to be submitted (minimum of 10 pages) based on the study made along with the completion certificate stating the work done (MOOC/NPTEL) at the end of V semester for external evaluation.

Internship/Industrial Visit/Field Visit/Knowledge Updation Activity: Internal –50 Marks, External – 50 Marks

Project: Group Project report should be submitted for external evaluation. Internal – 50 Marks, External – 50 Marks

Extension Activity (NSS/ NCC/ YRC/ RRC/ Games and Sports/ Youth Welfare Activities Outreach Programmes/Migration Awareness in the Tamil Nadu Education System): Individual report should be submitted at the end of VI semester for external evaluation.
External – 100 Marks

Ability Enhancement Compulsory Course: Empowered Vocational English and Design Thinking subjects is given to students.

Internal Marks – 50 Marks, External – 50 Marks

Semester-1

Semester–1									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours.	**Max Marks**			
						CIA	**ESE**	**Total**	
26U1TL11	I	Language- I	Tamil–I	5	3	50	50	100	3
26U1HD11	I		Hindi –I						
26U1MY11	I		Malayalam–I						
26U1FR11	I		French – I						
26U2EN11	II	Language- II	English–I	5	3	50	50	100	3
26UCMA11	III	Core- I	Algebra & Trigonometry	4	3	50	50	100	4
26UCMA12	III	Core -II	Differential Calculus	4	3	50	50	100	4
26UEMA1A	III	EC - I	Programming Language C	4	3	50	50	100	3
26UEMA1B			Allied Physics II						
26UEMA1C			Allied Chemistry II						
26UEMA1AP1	III	EC II	Programming Language C Practical	4	3	50	50	100	2
26UEMA1BP1			Allied Physics II Practical						
26UEMA1CP1			Allied Chemistry II Practical						
26UFMA11	IV	FC	Essential Mathematics Skills	2	3	50	50	100	2
26UNMA11	IV	NME - I	Fundamentals Of Statistics – I	2	3	50	50	100	2
Total				**30**				**800**	**23**

FIRST YEAR – SEMESTER – I

CORE I- ALGEBRA & TRIGONOMETRY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA11	**4**	0	0	I	**4**	**4**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand and solve different types of algebraic equations.
LO2	Apply methods to find and analyze roots of equations.
LO3	Use binomial, exponential, and logarithmic series in problems.
LO4	Expand and simplify trigonometric expressions using standard identities.
LO5	Understand relationships between circular and hyperbolic functions.

Prerequisites:

Unit	Contents	No. of Hours
I	Reciprocal Equations – Standard form–Increasing or decreasing the roots of a given equation– Removal of terms– Related problems.	**12**
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.	**12**
III	Summation of Series: Binomial – Exponential– Logarithmic series (Theorems without proof) – Approximations – Related problems.	**12**
IV	Expansions of sin $n\theta$, cos $n\theta$ in powers of sin θ, cos θ - Expansion of tan $n\theta$ in terms of tan θ, Expansions of cos nθ, sin nθ, cos mθ sin nθ–Expansions of tan($\theta 1 + \theta 2 + \cdots + \theta n$) –related problems.	**12**
V	Hyperbolic functions – Relation between circular and hyperbolic functions Inverse hyperbolic functions, Logarithm of complex quantities–Related problems.	**12**
TOTAL		**60**

CO	**Course Outcomes**
CO1	Identify and solve reciprocal equations using suitable techniques.
CO2	Determine the sum of powers of the roots of a given equation.
CO3	Calculate the sums of binomial, exponential, and logarithmic series.
CO4	Express powers and multiples of trigonometric functions in terms of sine and cosine.
CO5	Analyze the relationship between circular functions and hyperbolic functions.

Textbooks

➢	T.K.Manicavachagom Pillay, T.Natarajan and KS.Ganapathy, Algebra VolI, S.Viswanathan (Printers & Publishers)Pvt.Ltd., 2017.

➢	S.Narayanan and T.K.Manicavachagom Pillay, Trigonometry, S.Viswanathan (Printers & Publishers) Pvt.Ltd.,2009.
Reference Books	
1.	W.S. Burnstine and A.W.Panton, Theory of equations.
2.	David C.Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3.	G.B.Thomas and R.L.Finney, Calculus, 9thEd.,Pearson Education,Delhi, 2005.
4.	C.V. Durell and A.Robson, Advanced Trigonometry, Courier Corporation, 2003.
5.	J.Stewart, L.Redlin and S.Watson, Algebra and Trigonometry, Cengage Learning,2012.
6.	Calculus and Analytical Geometry, G.B.Thomas and R.L.Finny, Pearson Publication, 9thEdition, 2010.

CO/PO & PSO	**POs**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**2**	**1**
CO2	**2**	**1**	**3**	**1**	**2**	**2**	**3**	**2**	**1**
CO3	**3**	**1**	**3**	**1**	**3**	**2**	**3**	**2**	**1**
CO4	**3**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO5	**3**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
Weightage of course contributed to each PSO	**14**	**5**	**15**	**9**	**14**	**13**	**15**	**10**	**5**

CORE II - DIFFERENTIAL CALCULUS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA12	**4**	0	0	I	**4**	**4**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand basic and higher-order differentiation techniques.
LO2	Apply partial differentiation to solve multivariable problems.
LO3	Find maxima and minima of functions of two variables.
LO4	Determine envelopes of families of curves.
LO5	Study curvature, evolutes, and involutes of curves.

Prerequisites:

Unit	Contents	No. of Hours
I	Successive Differentiation: Introduction (Review of basic concepts) – The nth derivative – Standard results – Trigonometrical transformation – Formation of equations involving derivatives. (Chapter 3: Sections - 1.1 to 1.6)	**12**
II	Partial Differentiation: Partial derivatives – Successive partial derivatives – Function of a function rule – Total differential coefficient –(Chapter 8: Sections - 1.1 to 1.5)	**12**
III	Partial Differentiation (Continued): Homogeneous functions – Partial derivatives of a function of two variables – Maxima and Minima of two variables- Small Corrections-increment and differentials (Chapter 8: Sections - 1.6, 1.7, 2.1, 2.2,4 and 5)	**12**
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 to1.4)	**12**
V	Curvature: Definition of Curvature – Circle, Radius and Centre of Curvature- - Evolutes and Involutes – Radius of Curvature in Polar co-ordinates-p-r equations, pedal equation of a curve (Chapter 10: Sections - 2.1 to 2.6)	**12**
	TOTAL	**60**

CO	Course Outcomes
CO1	Compute the n^{th} *derivative,* formulate differential equations involving derivatives, and apply Leibniz's theorem to solve problems.
CO2	Find the partial derivative and total derivative coefficient
CO3	Analyze and determine the maxima and minima of functions of two variables.

CO4	Derive the envelope of a given family of curves.
CO5	Determine the evolute and involute of curves and compute the radius of curvature using polar coordinates.
Textbooks	
➢	S.Narayanan and T K.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 &I), Springer-Verlag, New York, Inc., 1989.
2.	T. Apostol, Calculus, Volumes I 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, PearsonEducation,2010.
6.	M.J. Strauss, G.L. Bradley and K.J. Smith, Calculus, 3rdEd., Dorling Kindersley (India)P.Ltd. (Pearson Education),Delhi,2007.

CO/PO/PSO	**POs**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**2**	**1**
CO2	**2**	**1**	**3**	**3**	**2**	**3**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO4	**3**	**2**	**3**	**2**	**1**	**3**	**3**	**2**	**1**
CO5	**3**	**2**	**3**	**2**	**1**	**3**	**3**	**2**	**1**
Weightage of course contributed to each PSO	**14**	**8**	**15**	**12**	**10**	**15**	**15**	**10**	**5**

ELECTIVE COURSE I -PROGRAMMING LANGUAGE C

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA11	4	-	0	I	3	4	50	50	100

Learning Objectives

LO1	Understand basic structure and syntax of C programming.
LO2	Use operators and control statements effectively.
LO3	Work with arrays and strings in C programs.
LO4	Develop programs using functions and modular approach.
LO5	Solve basic computational problems using C programming.

Prerequisites:

Unit	Contents	No. of Hours
I	Introduction – Character set – C Tokens –Keywords and Identifiers – Constants – Variables – Data types. (Chapter2:Sections-2.1to2.7)	**12**
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 (Chapters3and4:Sections-3.1to3.9,3.12,4.2to4.5)	**12**
III	Decision making and branching: Statements: IF, IF … ELSE, Nesting of IF … ELSE, ELSE IF Ladder and Switch statements – The ?:operator – The GOTO statement – Decision making and looping: The WHILE, DO and FOR statements –Jumps in loops. (Chapters 5& 6: Sections-5.3 to5.9, 6.2to 6.5)	**12**
IV	Array: One dimensional and two-dimensional arrays– Declaration, Initialization of arrays – Multidimensional arrays Character arrays and Strings: Declaring and initializing string variables – Reading and writing of strings – String handling functions. (Chapters7 & 8: Sections7.1to7.7,8.1to 8.8)	**12**
V	User defined functions: Definition of function –Return values and their types – Function calls – Function declaration – Category of functions – Nesting of functions – Recursion. (Chapter9:Sections9.5to 9.9,9.15, 9.16)	**12**
TOTAL		**60**

CO	Course Outcomes
CO1	Identify the keywords, constants and variables
CO2	Know different operators and their uses
CO3	Use suitable statements and looping
CO4	Know one, two and multi-dimensional arrays and the use of string variables
CO5	Know user defined functions and how to apply these functions in programme.
Textbooks	
➢	E.Balaguruswamy- Programming in ANSIC–Tata Mc Graw Hill Publishing company limited – III Edition,2017.
Reference Books	
1.	C.Reema Thareja, ProgramminginC-OxfordUniversityPress,2018.
2.	Ramasamyet.al.-Programming in C-Scetech Publication (INDIA) Pvt. Ltd. II Edition, 2015.
3.	Ashok N. Kamathane-Programming with Ansi and Turbo C Dorling Kindersley (India) Pvt. Ltd., 2009.

CO/PO/PSO	Pos						PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO2	**2**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO4	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO5	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
Weightage of course contributed to each PSO	**14**	**10**	**15**	**10**	**5**	**5**	**15**	**10**	**5**

ELECTIVE COURSE II - PROGRAMMING LANGUAGE C - LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMAP1	**0**	**-**	**4**	I	**2**	**4**	**50**	**50**	**100**

Learning Objectives

LO1	Understand basic structure and syntax of C programming.
LO2	Use operators and control statements effectively.
LO3	Work with arrays and strings in C programs.
LO4	Develop programs using functions and modular approach.
LO5	Solve basic computational problems using C programming.

Prerequisites:

Contents

1. Program to print the even numbers from 1 to 100.

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 $V=P\ 1+r\ n$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 between1 and100 and also should account the number of sets 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.

9. Develop a modular interactive program using functions that reads the value of three sides of a

triangleanddisplayseitheritsareaoritsperimeteraspertherequestoftheuser.Giventhethree sides a,b and c, perimeter is$a+b+c$ and area is $s(s-a)(s-b)(s-c)$where $s=(a+b+c)/2$.

10. Developyourownfunctionsforperformingfollowingoperationsinstrings.

a) Copying one string to another

b) Comparing two stings

c) Adding a string to the end of another string

Write a program to test your functions.

CO	Course Outcomes
CO1	Identify the keywords, constants and variables
CO2	Know different operators and their uses
CO3	Use suitable statements and looping
CO4	Know one, two and multi-dimensional arrays and the use of string variables
CO5	Know user defined functions and how to apply these functions in programme.
Textbooks	
➢	E.Balaguruswamy- Programming in ANSIC–Tata Mc Graw Hill Publishing company limited –III Edition,2017.
Reference Books	
4.	C.Reema Thareja, ProgramminginC-OxfordUniversityPress,2018.
5.	Ramasamyet.al.-Programming in C-Scetech Publication (INDIA) Pvt. Ltd. II Edition, 2015.
6.	Ashok N. Kamathane-Programming with Ansi and Turbo C Dorling Kindersley (India) Pvt. Ltd., 2009.

	Pos						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO2	**2**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO4	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO5	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
Weightage of course contributed to each PSO	**14**	**10**	**15**	**10**	**5**	**5**	**15**	**10**	**5**

FOUNDATION COURSE FC- ESSENTIAL MATHEMATICS SKILLS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UFMA11	2	0	0	I	2	2	50	50	100

Learning Objectives	
LO1	Understand basic algebraic formulas and binomial theorem.
LO2	Solve problems on sequences, series, permutations, and combinations.
LO3	Apply trigonometric identities and transformations.
LO4	Learn basic differentiation and integration techniques.
LO5	Solve simple problems using limits and applications of calculus.

Unit	Contents	No. of Hours
I	Algebra: Binomial theorem, General term, middle term, problems based on these concepts, Particular cases of Binomial theorem.	6
II	Sequences and series (Progressions). Fundamental principle of counting. Factorial n.	6
III	Fundamentals principle of counting, Factorials, Permutations and combinations, Derivation of formulae and their connections, simple applications, combinations with repetitions, arrangements with in groups, formation of groups.	6
IV	Trigonometry: Introduction to trigonometric ratios, proof of sin(A+B), cos(A+B), tan(A+B) formulae, multiple and sub multiple angles, sin(2A), cos(2A), tan(2A)etc., transformations sum into product and product into sum formulae, inverse trigonometric functions, inverse trigonometric functions, sine rule and cosine rule.	6
V	Calculus: Limits, standard formulae and problems, differentiation, first principle, uvrule,/$v$rule, methods of differentiation, application of derivatives, integration – product rule and substitution method.	6
	TOTAL	30

CO	Course Outcomes
CO1	Prove the binomial theorem and apply it to find the expansions of any $x + yn$ and 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	Explain various trigonometric ratios and find them for different angles, including sum of the

	angles, multiple and submultiple angles, etc. Also, they can solve the problems using the transformations.
CO5	Find the limit and derivative of a function at a point, the definite and indefinite integral of a function. Find the points of min/max of a function.
Textbooks	
➢	NCERT class XI and XII text books.
➢	Any State Board Mathematics text books of class XI and XI
➢	Seymour Lipschutz and Marc Lipson Schaum's Outline of Linear Algebra, Sixth Edition Paperback – 2, December 2017
➢	Elliott Mendelson, Schaum's Outline of Calculus, Seventh Edition 7th Edition, Kindle Edition

CO/PO/PSO	**POs**						**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**
CO1	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
CO2	**2**	**1**	**1**	**2**	**2**	**1**	**2**	**1**
CO3	**2**	**1**	**1**	**2**	**2**	**1**	**2**	**1**
CO4	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**
CO5	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**
Weightage of course contributed to each PSO	**7**	**5**	**5**	**7**	**7**	**5**	**9**	**5**

NON MAJOR ELECTIVE I - FUNDAMENTALS OF STATISTICS – I

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UNMA11	**2**	**0**	**0**	**I**	**2**	**2**	**50**	**50**	**100**

Learning Objectives		
LO1	Represent data using charts and diagrams.	
LO2	Calculate mean, median, and mode.	
LO3	Measure data dispersion using variance and standard deviation.	
LO4	Understand correlation and rank correlation concepts.	
LO5	Develop simple regression equations for prediction.	
Unit	Contents	**No. of Hours**
I	Classification of datas – Bar Diagram – Pie chart.	**6**
II	Measures of central tendency: Mean, median, mode (with frequency).	**6**
III	Measures of dispersion: Range – standard deviation, Variance – Quartile deviation.	**6**
IV	Correlation – Rank correlation (Problems only)	**6**
V	Regression equations (Problems only)	**6**
	TOTAL	**30**

CO	**Course Outcomes**
CO1	Classify and organize statistical data and represent it using appropriate graphical methods such as Bar Diagrams and Pie Charts.
CO2	Compute and interpret measures of central tendency including Mean, Median, and Mode for individual and frequency distributions.
CO3	Evaluate variability in data using measures of dispersion such as Range, Variance, Standard Deviation, and Quartile Deviation.
CO4	Solve numerical problems related to Correlation, including Rank Correlation, and interpret the strength and direction of relationships between variables.
CO5	Construct and solve Regression Equations for given datasets and use them for prediction and decision-making purposes.

Textbooks	
1	Dr. S. Arumugam, A.Thangapandi Issac- Statistics, New Gamma Publishing House, Palayamkottai. (2016)

Reference Books	
1	S. P. Gupta - Elementary Statistical Methods, Sultan Chand & Sons,2017).
2	T. Veerarajan Fundamentals of mathematical Statistics, Yes Dee Publishing Pvt,Ltd..(2017)

CO/PO/PSO	POs						PSOs	
	3	2	2	3	2	2	1	2
CO1	2	3	2	3	2	2	1	1
CO2	2	3	2	2	3	1	2	1
CO3	1	2	2	1	3	2	2	1
CO4	2	2	2	1	3	3	2	1
CO5	3	2	2	3	2	2	2	1
Weightage of course contributed to each PSO	10	12	10	10	13	10	9	5

ALLIED MATHEMATICS I- ALGEBRA AND DIFFERENTIAL EQUATIONS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA11	**4**	**0**	**0**	**I**	**3**	**4**	**50**	**50**	**100**

Learning Objectives		
LO1	Develop the ability to construct, interpret, and solve algebraic equations systematically	
LO2	Gain proficiency in numerical techniques for solving equations with accuracy and efficiency.	
LO3	Build strong foundations in linear algebra for applications in chemistry, physics, and computing..	
LO4	Acquire skills to model and solve real-world problems using both ODE and PDE.	
LO5	Use Laplace techniques effectively in solving engineering and physics problems	
Unit	Contents	**No. of Hours**
I	Theory of Equations – Formation of Equations – Reciprocal equation.	**12**
II	Transformation of Equations- Approximate Solutions to Equations-Newton's Method- Horner's Method	**12**
III	Matrices–Rank of a Matrix-Characteristic equation of a matrix –Eigen values and Eigen vectors – Cayley Hamilton theorem and simple Problems.	**12**
IV	Differential equation of first order but of higher degree – Equations solvable for p,x–Partial differential equations–formations– solutions –Standard form $Pp+Qq=R$.	**12**
V	Laplace transformation- Inverse Laplace transform	**12**
	TOTAL	**60**

CO	**Course Outcomes**
CO1	Form the equation, and Categorize and find solutions of reciprocal equations
CO2	Discover approximate solution to equations by Horner's method
CO3	Find Eigen values and Eigen vectors for given square matrix and find inverse by applying Cayley-Hamilton theorem
CO4	Detect solution of differential equations and partial differential equations
CO5	Find Laplace transformation and inverse Laplace transformation for a given function

Textbooks	
1	Dr.S.Arumugam and A. Thangapandi Isaac–Allied Mathematics Paper I, New Gamma Publishing House,2012.

Reference Books	
1	S. Narayanan.S and T.K. Manikavachagom Pillay -Differential Equations and its applications, S.Viswanathan Printers Pvt.Ltd,2006.
2	T.Veerarajan- Algebra and Trigonometry-Yes Dee Publishing Pvt.Ltd., 2009.

CO/PO/PSO	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	1	3	3	3	2	1
CLO2	2	1	3	1	2	2	3	2	1
CLO3	3	1	3	1	3	3	3	2	1
CLO4	3	1	3	1	3	3	3	2	1
CLO5	3	1	3	1	1	1	3	2	1
Weightage of course contributed to each PSO	14	5	15	5	12	12	15	10	5

Semester-2

Semester–2									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
26U1TL21	I	Language-I	Tamil–II	5	3	50	50	100	3
26U1HD21	I		Hindi –II						
26U1MY21	I		Malayalam–II						
26U1FR21	I		French – II						
26U2EN21	II	Language-II	English–II	5	3	50	50	100	3
26UCMA21	III	Core-III	Analytical Geometry (Two & Three Dimensions)	4	3	50	50	100	4
26UCMA22	III	Core IV	Integral Calculus	4	3	50	50	100	4
26UEMA2A	III	EC - III	Programming In C++ With Practical	4	3	50	50	100	3
26UEMA2B			Allied Physics II with Practical						
26UEMA2C			Allied Chemistry II with Practical						
26UEMA2AP2	III	EC IV	Programming Language C Practical	4	3	50	50	100	2
26UEMA2BP2			Allied Physics II Practical						
26UEMA2CP2			Allied Chemistry II Practical						
26USMA21	IV	SEC - I	LaTeX	2	3	50	50	100	2
26UNMA21	IV	NME - II	Fundamentals Of Statistics – II	2	3	50	50	100	2
			Total	**30**				**800**	**23**

SECOND YEAR – SEMESTER – II

CORE COURSE III - ANALYTICAL GEOMETRY (TWO & THREE DIMENSIONS)

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA21	**4**	0	**0**	II	**4**	**4**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand basic concepts of coordinate geometry in two and three dimensions.
LO2	Identify and solve problems involving poles, polars, and conjugate lines.
LO3	Derive and use polar equations of straight lines and circles.
LO4	Analyze geometrical relationships between lines and planes in 3D space.
LO5	Apply sphere equations to solve geometric problems in space.

Prerequisites:

Unit	Contents	No. of Hours
I	Pole, Polar- conjugate points and conjugate lines – diameters – conjugate diameters of an ellipse –Semi diameters –Conjugate diameters of hyperbola – Related problems only. (Book 1: Chapters: 9 and 10)	**12**
II	Polar coordinates: General polar equation of straight line –Polar equation of a circle given diameter, Equation of a straight line, circle, conic - Equation of chord, tangent, normal. (Book 2: Chapter 9: Sections - 1 to 3, 5 to 10,12).	**12**
III	System of Planes – Length of the perpendicular–Orthogonal projection. (Book 3: Chapter 2: Sections - 1 to 11)	**12**
IV	Representation of line– Angle between a line and a plane – coplanar lines– Shortest distance between two skew lines– Length of the perpendicular. (Book 3: Chapter 3: Sections - 1 to 7).	**12**
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 orthogonality. (Book 3: Chapter 4: Sections - 1to7)	**12**
TOTAL		**60**

CO	Course Outcomes
CO1	Determine the pole and polar of conics, and find diameters and conjugate diameters of ellipses and hyperbolas.
CO2	Obtain the polar equations of straight lines and circles, and derive the equations of chords, tangents, and normals.
CO3	Explain the system of planes in detail.
CO4	Explain the system of straight lines in detail.
CO5	Explain the system of spheres in detail.
Textbooks	
1.	P. R. Mittal and V. Malini, Analytical Geometry & Trigonometry, Margam Publications, 2018.
2.	T.K. Manicavachagom Pillay and T. Natarajan, Analytical Geometry (PartI - Twodimensions), 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	Robert J.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, Cengage 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.

CO/PO/PSO	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	2	2	2	1	3	2	3	2	1
CO2	2	2	2	1	3	2	3	2	1
CO3	3	2	2	1	2	2	3	2	1
CO4	3	2	3	1	2	2	3	2	1
CO5	3	2	3	1	3	2	3	2	1
Weightage of course contributed to each PSO	13	10	12	5	13	10	15	10	5

CORE IV – INTEGRAL CALCULUS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA22	**4**	0	**0**	II	**4**	**4**	**50**	**50**	**100**

Learning Objectives

LO1	Understand basic integration techniques and reduction formulae.
LO2	Evaluate double and triple integrals in different coordinate systems.
LO3	Apply multiple integrals to find area, volume, and surface area.
LO4	Learn and use Beta and Gamma functions in integration problems.
LO5	Solve real-world problems using integral calculus concepts.

Prerequisites:

Unit	Contents	No. of Hours
I	Reduction formulae – Types, integration of product of powers of algebraic and trigonometric functions, integration of product of powers of algebraic and logarithmic functions–. (Chapter 1: Sections -13 to 14)	**12**
II	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)	**12**
III	Triple integrals –Applications of multiple integrals – Areas of curved surfaces–Change of variables–Jacobian. (Chapter 5: Sections - 4, 5.1 to 5.4, 7; Chapter 6: Sections - 1, 2)	**12**
IV	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)	**12**
V	Geometrical Applications of Integral calculus: Area– Length of a curve – Area of surface of revolution. (Chapter 2: Sections -1.1 to 1.4, 4, 5)	**12**
	TOTAL	**60**

CO	Course Outcomes
CO1	Compute integrals of algebraic, trigonometric, and logarithmic functions and derive reduction formulae.
CO2	Calculate double and triple integrals, including problems involving change of order of integration.
CO3	Apply multiple integrals to determine areas of curved surfaces and volumes of solids of revolution.

CO4	Describe Beta and Gamma functions and apply them in evaluating integrals.
CO5	Interpret and solve problems related to the geometrical applications of integral calculus.
Textbooks	
1.	S.Narayanan and T.K.Manicavachagom Pillay, Calculus VolII, 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 FourierSeries, Springer Undergraduate Mathematics Series, 2nd Edition, 2001.

CO/PO/PSO	**POs**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**2**	**2**	**3**	**3**	**2**	**1**
CO2	**3**	**1**	**3**	**2**	**2**	**2**	**3**	**2**	**1**
CO3	**3**	**1**	**3**	**2**	**3**	**2**	**3**	**2**	**1**
CO4	**3**	**1**	**3**	**2**	**3**	**2**	**3**	**2**	**1**
CO5	**3**	**1**	**3**	**2**	**2**	**1**	**3**	**2**	**1**
Weightage of course contributed to each PSO	**15**	**5**	**15**	**10**	**12**	**10**	**15**	**10**	**5**

ELECTIVECOURSE III– PROGRAMMING IN C++

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA21	4	0	0	II	3	4	50	50	100

Learning Objectives		
LO1	Understand basic concepts and structure of C++ programming.	
LO2	Write programs using functions and control structures.	
LO3	Use constructors and destructors in object-oriented programming.	
LO4	Apply operator overloading in simple programs.	
LO5	Implement inheritance concepts in C++ programs.	
Unit	**Contents**	**No. of Hours**
I	Introduction, Tokens, Keywords, Identifiers and constants, Basic data types, User defined data types, storage classes, Derived data types, Symbolic constants.	12
II	Introduction, The main function, function prototyping, Call by reference, Return by references, Inline functions, Default arguments, constant Arguments, Recursion, Function overloading, Friend and virtual functions, Math library functions, C structures Revisited, Specifying a class, Defining member functions, A 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	12
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.	12
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	12
V	Introduction, Defining Derived classes, Single inheritance, Making a	12

	private member inheritable, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance.	
TOTAL		**60**
CO	**Course Outcomes**	
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.	
Textbooks		
➢	E. Balagurusamy, Object Oriented Programming with C++, Tata Mc Graw Hill Education Private Limited, New Delhi (Fifth Print 2012).	
Reference Books		
1.	Reema Thareja, Object Oriented Programming with C++, Oxford University Press(January 2018)	

CO/PO/PSO	**POs**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO2	**2**	**1**	**3**	**1**	**1**	**1**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO4	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO5	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
Weightage of course contributed to each PSO	**14**	**8**	**15**	**9**	**5**	**5**	**15**	**10**	**5**

ELECTIVECOURSE IV– PROGRAMMING IN C++ LAB

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMAP2	0	0	4	II	2	4	50	50	100

Learning Objectives	
LO1	Understand basic concepts and structure of C++ programming.
LO2	Write programs using functions and control structures.
LO3	Use constructors and destructors in object-oriented programming.
LO4	Apply operator overloading in simple programs.
LO5	Implement inheritance concepts in C++ programs.

List of Practical's:

1. Program to print the following output using for loops

1
22
333
4444
55555
……

2. Program to calculate the variance and standard deviation of N numbers.

Variance = $\frac{1}{N}\sum_1^N(x_i - \overline{x}^2)$

Standard Deviation = $\sqrt{\frac{1}{N}\sum_1^N(x_i - \overline{x}^2)}$ where $\bar{x} = \sum_1^N x_i$

3. Write a program to read a matrix of size m by from the key board and display the same on the screen using functions.

4. Write a function power power () to raise a number m to a power n. The function takes a double value for m and int value for n and returns the result correctly: Use a default value of 2 for n to make the function to Calculate Squares when this argument is Omitted. Write a main that gets the values of m and n from the user to test the function.

5. Write a class to represent a vector (a series of float values) Include member function to perform the following tasks:

a)To create the vector b)to modify the value of a given element

c) To multiply by a Scalar value d) To display the vector in the form (10, 20, 30,...)

Write a program to test your class.

6. Create two classes DM and DB to Store the value of distances. DM Stores distances in meters and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add One object of DM with another object of DB. Use a friend function to carry out the additions operation, The object that Stores the results may be a DM object or DB object, depending on the units in which the results are required. The display should be in the format of Feet and inches or meters and Centimeters depending on the object on display.

7. Define a class String that Could work as a user-defined String type. Include constructors that will enable us to create an uninitialized StringS1;//String with length 0 and also to initialize an object with a String Constant at the time of constant at the time of creation like string S2

("Well done!"); Include a function

That adds two strings to make a third string, Write a complete program to test your class to see that it does the following tasks:

a) Create uninitialized string objects

b) Create object with string constants

c) Concatenate two strings properly

d) Displays desired String object

8. Create a class FLOAT that contains one float data member. Overload all the four arithmetic operators So that they operate on the objects of FLOAT.

9. Define a class string. Write a program to compare two strings by using overload==operator.

TOTAL	**60**

CO	**Course Outcomes**
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.

Textbooks

➢	E. Balagurusamy, Object Oriented Programming with C++, Tata Mc Graw Hill Education Private Limited, New Delhi (Fifth Print 2012).

Reference Books

1.	Reema Thareja, Object Oriented Programming with C++, Oxford University Press(January 2018)

CO/PO/PSO	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	1	1	3	2	1
CO2	2	1	3	1	1	1	3	2	1
CO3	3	2	3	2	1	1	3	2	1
CO4	3	2	3	2	1	1	3	2	1
CO5	3	2	3	2	1	1	3	2	1
Weightage of course contributed to each PSO	14	8	15	9	5	5	15	10	5

SKILL ENCHANCED COURSE SEC I – LaTeX

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USMA21	2	0	0	II	2	2	50	50	100

Learning Objectives	
LO1	Learn to create and format documents using LaTeX.
LO2	Use basic text typing and formatting commands in LaTeX.
LO3	Apply font styles, sections, and page formatting techniques.
LO4	Create lists, tables, and structured document environments.
LO5	Write mathematical expressions using LaTeX syntax.

Unit	Contents	No. of Hours
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)	6
II	Typing Text: The keyboard, Word Sentences and paragraphs, commands and environments, Symbols not on the keyboard (Quotation marks, Dashes, Special Characters – only), Comments and footnotes. (Chapter 5: Sections - 5.1, 5.2, 5.3.15.4.1, 5.4.2, 5.4.4, 5.5)	6
III	Typing Text: Changing Font Characteristics, Lines paragraphs and pages. (Chapter 5: Sections - 5.6, 5.7)	6
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)	6
V	Typing Math: Math environments, Spacing Rules, Equations, Basic Constructs, Delimiters, Operators, Math accents (Chapter 7: Sections - 7.1 to 7.7)	6

TOTAL		30
CO	**Course Outcomes**	
CO1	Clarify to type text and anatomy of an article	
CO2	Illustrate the different comments and footnotes	
CO3	Elucidate the changing of font characteristic	
CO4	Describe the different text environments	
CO5	Recognize the spacing rules and operators	
Textbooks		
➢	George Gratzer, More Math into LaTeX, 4th Edition, Springer,2007.	
Reference Books		
1.	Helmut Kopka and Patric W.Daly, A guide to LaTeX, Fourth edition, Addison-Wesley.	
2.	David R. Wilkins, Getting started with LaTeX, Second Edition.	

CO/PO/PSO	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	1	1	1	3	2	1
CO2	2	1	3	1	1	1	3	2	1
CO3	3	1	3	1	1	1	3	2	1
CO4	3	1	3	1	1	1	3	2	1
CO5	3	1	3	1	1	1	3	2	1
Weightage of course contributed to each PSO	14	5	15	5	5	5	15	10	5

ALLIED II –VECTOR CALCULUS AND FOURIER SERIES

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA22	4	0	0	II	3	4	50	50	100

Learning Objectives	
LO1	Understand vector differentiation concepts like gradient, divergence, and curl.
LO2	Evaluate multiple integrals and apply Jacobian concepts.
LO3	Compute line, surface, and volume integrals.
LO4	Apply Green's, Stokes', and Divergence theorems to problems.
LO5	Develop Fourier series for periodic and non-periodic functions.

Unit	Contents	No. of Hours
I	Vector differentiation –Gradient–Divergence and curl.	12
II	Evaluation of double and triple integrals-Jacobians- Properties of Jacobians-Problems on Jacobians.	12
III	Vector integration–Line, surface and volume integrals.	12
IV	Green's, Stoke's and Divergence theorems (without proof) – Simple problems.	12
V	Fourier series–Even and odd functions.	12
	TOTAL	60

CO	Course Outcomes
CO1	Differentiate vector functions and compute the gradient, divergence, and curl of vector fields.
CO2	Evaluate and apply double and triple integrals to solve problems.
CO3	Compute and interpret line, surface, and volume integrals.
CO4	Apply and verify the theorems of Gauss, Stokes, and Green in vector calculus.
CO5	Analyze and construct Fourier series for even and odd functions, including half-range Fourier series.

Textbooks

- S.Arumugamand A. Thangapandi Isaac, Allied Mathematics Paper-II, New Gamma Publishing House, Palayamkottai, 2012.
- T.K.Manicavachagom Pillay, Calculus (VolII), 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 (4th Edition), Pearson Education, Boston, 2012.
3.	Murray Spiegel, Vector analysis, Schaum Publishing Company, NewYork, 2009.

CO/PO/PSO	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	1	1	1	3	2	1
CO2	2	1	3	1	1	1	3	2	1
CO3	3	1	3	1	1	1	3	2	1
CO4	3	1	3	1	1	1	3	2	1
CO5	3	1	3	1	1	1	3	2	1
Weightage of course contributed to each PSO	14	5	15	5	5	5	15	10	5

NME II - FUNDAMENTALS OF STATISTICS – II

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UNMA21	2	0	0	II	2	2	50	50	100

Learning Objectives	
LO1	Understand the theory of attributes and their applications.
LO2	Compute weighted index numbers and consumer price index.
LO3	Analyze time series data and identify trends.
LO4	Apply curve fitting techniques for statistical data.
LO5	Interpret statistical data using index numbers and trend analysis.

Unit	Contents	No. of Hours
I	Theory of attributes – two attributes.	6
II	Index number - weighted index number.	6
III	Consumer Price index number - conversion of index number.	6
IV	Time series - measurement of trends.	6
V	Curve fitting – Straight line – Parabola - Exponential curve.	6
TOTAL		30

CO	Course Outcomes
CO1	Apply the Theory of Two Attributes to analyze association and consistency of data.
CO2	Compute Weighted Index Numbers using standard methods.
CO3	Construct and convert Consumer Price Index Numbers..
CO4	Measure trends in Time Series data.
CO5	Fit Straight Line, Parabolic, and Exponential Curves to statistical data

Textbooks

- Dr. S. Arumugam, A.Thangapandi Issac- Statistics, New Gamma Publishing House, Palayamkottai (2016)

Reference Books

1. S. P. Gupta - Elementary Statistical Methods, Sultan Chand & Sons, 2017).
2. T. Veerarajan Fundamentals of mathematical Statistics, Yes Dee Publishing Pvt. Ltd. Edition . (2017)

CO/PO/PSO	POs						PSOs	
	1	2	3	4	5	6	1	2
CO1	1	1	1	1	1	1	1	1
CO2	2	1	1	2	2	1	2	1
CO3	2	1	1	2	2	1	2	1
CO4	1	1	1	1	1	1	2	1
CO5	1	1	1	1	1	1	2	1
Weightage of course contributed to each PSO	7	5	5	7	7	5	9	5

Semester-3

Semester–3									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
26U1TL31	I	Language–I	Tamil–III	5	3	50	50	100	3
26U1HD31	I		Hindi –III						
26U1MY31	I		Malayalam– III						
26U1FR31	I		French – III						
26U2EN31	II	Language–II	English–III	5	3	50	50	100	3
26UCMA31	III	Core– V	Vector Calculus And Its Applications	5	3	50	50	100	4
26UCMA32	III	Core –VI	Differential Equations And Applications	5	3	50	50	100	4
26UEMA31	III	EC - III	Statistics I	4	3	50	50	100	3
26UEMA32			Difference Equations						
26USMA31	IV	SEC - II	Computational Mathematics	2	3	50	50	100	2
26USMA32	IV	SEC – III	Mathematics For Competitive Examination I	2	3	50	50	100	2
26UEVS31	IV	Common	Environmental Studies	2	50	50	50	100	2
Total				**30**				**800**	**23**

SECOND YEAR – SEMESTER – III

CORE V –VECTOR CALCULUS AND ITS APPLICATIONS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA31	**5**	0	0	III	**4**	**5**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand basic vector functions and their properties.
LO2	Differentiate vector-valued functions.
LO3	Compute gradient, divergence, and curl of vector fields.
LO4	Evaluate line, surface, and volume integrals.
LO5	Apply vector calculus theorems to solve problems.

Prerequisites:

Unit	Contents	No. of Hours
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 -1.1to1.5)	**15**
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 -2.1to2.7)	**15**
III	Laplacian operator, Vector identities -Line integral-Work Done by a Force Field- simple problems. (Chapter 2:Section -2.8 and Chapter3:Sections - 3.1 to 3.4)	**15**
IV	Surface integral-Volume integral –Change of Variables in Multiple Integrals -Applications. (Chapter 3:Sections - 3.5,3.6)	**15**
V	Gauss Divergence Theorem, Stoke's Theorem, Green's Theorem in two dimensions – Applications to real life situations. (Chapter 4:Sections - 4.1to4.5)	**15**
TOTAL		**75**

CO	Course Outcomes
CO1	Compute gradient, divergence and curl of vector fields.
CO2	Analyze properties of vector fields such as solenoidal and irrotational fields.

CO3	Evaluate line, surface and volume integrals.
CO4	Apply Green's, Gauss and Stokes' Theorems to solve problems.
CO5	Interpret vector calculus concepts in physical and engineering applications.
Textbooks	
1	P. Duraipandian and Laxmi Duraipandian, Vector Analysis, Emerald Publishers, 2005.
Reference Books	
1.	J.C.Susan, Vector Calculus, (4thEdition) Pearson Education, Boston, 2012.
2.	A.Gorguis, Vector Calculus for College Students, Xilbius Corporation, 2014.
3.	J.E.Marsden and A.Tromba, Vector Calculus, (5thEdition), W.H.Freeman, NewYork, 1988.

CO/PO/PSO	**Pos**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**2**	**3**	**1**	**3**	**2**	**3**	**2**	**1**
CO2	**3**	**2**	**3**	**1**	**2**	**3**	**3**	**2**	**1**
CO3	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**1**
CO4	**3**	**3**	**3**	**3**	**1**	**1**	**3**	**3**	**1**
CO5	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**1**
Weightage of course contributed to each PSO	**15**	**13**	**15**	**11**	**9**	**11**	**15**	**13**	**5**

CORE VI –DIFFERENTIAL EQUATIONS AND APPLICATIONS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA32	**5**	0	0	III	**4**	**5**	**50**	**50**	**100**

Learning Objectives	
LO1	Identify different types of differential equations.
LO2	Solve first-order differential equations using standard methods.
LO3	Solve second-order linear differential equations.
LO4	Form partial differential equations from given conditions.
LO5	Apply differential equations to real-life problems.

Prerequisites:

Unit	Contents	No. of Hours
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 - 1to 6)	**15**
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 3andChapter 5: Sections - 1to4)	**15**
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 – Fermat and Bernoulli – Simple electric circuits.(Chapter 8: Sections -1 to 3 and Chapter3: Sections-2 to 6)	**15**
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)	**15**
V	Special methods–Standard forms. (Chapter 12: Sections-5.1 to 5.5)	**15**
	TOTAL	**75**

CO	**Course Outcomes**
CO1	Determine solutions of homogeneous equations, non-homogeneous equations of degree one in

	two variables, solve Bernoulli's equations 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.
Textbooks	
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.	Sneddon, Elements of Partial Differential Equations, McGraw- Hill, International Edition, 1967.
3.	G. F. Simmons, Differential equations with applications and historical notes, 2nd Ed, Tata McGraw 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 andAnalysis,Wiley,2010.
6.	M. Braun, Differential Equations and their Applications. (3rdEdition), Springer- Verlag, New York, 1983.
7.	S. Arumugam, A. Thangapandi Isaac and A. Somasundaram, Differential Equations and Applications, Yes Dee Publishing, 2020.
8.	V. Sundrapandian, Ordinary and Partial Differential Equations, Tata Mc Graw Hill Education Pvt. Ltd. NewDelhi, 2013.

CO/PO/PSO	**Pos**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**2**	**1**	**2**	**3**	**2**	**1**
CO2	**3**	**1**	**3**	**2**	**1**	**3**	**3**	**2**	**1**
CO3	**3**	**1**	**3**	**2**	**1**	**2**	**3**	**3**	**1**
CO4	**3**	**1**	**3**	**2**	**2**	**2**	**3**	**3**	**1**
CO5	**3**	**1**	**3**	**2**	**2**	**1**	**3**	**3**	**1**
Weightage of course contributed to each PSO	**15**	**5**	**15**	**10**	**7**	**10**	**15**	**13**	**5**

ELECTIVE V –STATISTICS I

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA31	**4**	0	0	III	**3**	**4**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand basic statistical concepts and measures.
LO2	Compute dispersion, skewness, and kurtosis.
LO3	Calculate correlation and regression values.
LO4	Analyze relationships using statistical methods.
LO5	Construct and interpret index numbers.

Prerequisites:

Unit	Contents	No. of Hours
I	Dispersion–Measures of Dispersion–Coefficients of Dispersion – Moments – Skewness – Kurtosis. (Book1-Chapter2: Sections -2.12to 2.17)	**12**
II	Correlation – Scatter Diagram – Karl Pearson's coefficient of correlation – Probable error of Correlation Coefficient – Rank Correlation. (Book1 -Chapter 10:Sections-10.2 to10.4, 10.6, 10.7)	**12**
III	Curve Fitting and Regression: Linear Regression–Curve linear Regression – Regression Curve. (Book1-Chapter11: Sections -11.2to 11.4)	**12**
IV	Theory of Attributes: Notations and Terminology – Classes and Class Frequency – Consistency of Data – Independence of Attributes – Association of Attributes. (Book1-Chapter13: Sections -13.2to 13.6)	**12**
V	Index Numbers – Consumer Price Index Numbers –Conversion of Chain Base Index Number into Fixed Base Index and conversely. (Book2-Chapter9: Sections -9.1to 9.3)	**12**
TOTAL		**60**

CO	Course Outcomes
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
Textbooks	
➢	S. G. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand& Sons, New Delhi, 2021.
➢	S. Arumugam and A. Thangapandi Isaac, Statistics, New Gamma Publishing House, 2016.
Reference Books	
➢	P. R. Vittal, Mathematical Statistics, Margham Publications, 2004.
➢	D.C. Sacheti and V. K. Kapoor, Statistics, Sultan Chand & Sons, New Delhi, 2017

CO/PO/PSO	**POs**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO2	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**1**
CO4	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**3**	**1**
CO5	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**3**	**1**
Weightage of course contributed to each PSO	**15**	**10**	**15**	**10**	**7**	**5**	**15**	**13**	**5**

ELECTIVE V –DIFFERENCE EQUATIONS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA32	4	0	0	III	3	4	50	50	100

Learning Objectives	
LO1	Understand basic concepts of difference operators.
LO2	Solve first-order linear difference equations.
LO3	Solve higher-order linear difference equations.
LO4	Apply difference equations to simple models.
LO5	Analyze stability of difference equation systems.

Prerequisites:

Unit	Contents	No. of Hours
I	The Difference Calculus: The Difference operator–Summation–Generating functions and approximate summation. (Chapter 2:Sections - 2.1 to 2.3)	12
II	Linear Difference Equations: First order equations–General results for linear equations – Solving linear equations. (Chapter3:Sections-3.1to3.3)	12
III	Linear Difference Equations: Applications–Equations with variable coefficients – Nonlinear equations that can be linearized. (Chapter3:Sections-3.4to3.6)	12
IV	Stability Theory: Initial value problems for linear systems – Stability of linear systems, Phase plane Analysis for Linear Systems (Chapter 4: Sections - 4.1, 4.2,4.3)	12
V	Stability Theory: Fundamental Matrices and Floquet Theory, stability of nonlinear system, chaotic behavior (Chapter 4: Sections - 4.4-4.7)	12
TOTAL		60

CO	Course Outcomes
CO1	Know how to use difference operator
CO2	Solve first order difference equation and linear equations
CO3	Solve equation with variable coefficients
CO4	Solve the initial value problem for linear systems

CO5	Solve the fundamental matrices
Textbooks	
➢	W. G. Kelley and A. C. Peterson, Difference Equations,2nd Edition, Academic Press, NewYork, 2012
Reference Books	
1.	R. P. Agarwal, "Difference Equations and Inequalities", 2nd Edition, Marcel Dekker, NewYork, 2000.
2.	S. N. Elaydi, "An Introduction to Difference Equations", 3rdEdition, Springer, India, 2008.
3.	R. E. Mickens, "Difference Equations", 3rd Edition, CRC Press, 2015.

CO/PO/PSO	**Pos**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO3	**3**	**2**	**3**	**2**	**1**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO5	**3**	**2**	**3**	**2**	**1**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**10**	**15**	**10**	**5**	**7**	**15**	**15**	**10**

SKILL ENHANCEMENT COURSE II –COMPUTATIONAL MATHEMATICS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USMA32	2	0	0	III	2	2	50	50	100

Learning Objectives	
LO1	Understand numerical methods for solving equations.
LO2	Solve algebraic equations using iterative methods.
LO3	Solve systems of linear equations numerically.
LO4	Apply numerical techniques for real-world problems.
LO5	Compute numerical solutions of partial differential equations.

Prerequisites:

Unit	Contents	No. of Hours
I	Algebraic and Transcendental Equations: Errors in Numerical Computation – Iteration method – Regula Falsie method. (Chapter3:Sections-3.1,3.2,3.4)	6
II	Algebraic and Transcendental Equations: Bisection method– Newton-Raphson method – Horner's method. (Chapter3:Sections -3.3,3.5,3.6)	6
III	Simultaneous Equations: Simultaneous equations – Back substitution – Gauss Elimination method – Gauss-Jordan Elimination method – Calculation of inverse of a matrix- crout's Method. (Chapter 4: Sections - 4.1 to 4.6)	6
IV	Simultaneous equations: Iterative Methods – Gauss Jacobi iteration method – Gauss-Seidel Iteration method – Relaxation method – Newton-Raphson method for simultaneous equations. (Chapter4: Sections-4.7to4.10)	6
V	Numerical Solutions of Partial Differential Equations: Classification of partial differential equations of second order – Finite Difference Approximations to Derivatives – Laplace equation. (Chapter 11: Sections - 11.0 to 11.3)	6
	TOTAL	30

CO	Course Outcomes
CO1	Explain the roots of algebraic equations using methods such as the Iteration Method and Regula Falsi Method.
CO2	Identify the real root of an equation through the Bisection Method, Newton-Raphson Method, and Horner's Method.
CO3	Solve systems of simultaneous equations using the Substitution and Elimination Methods.

CO4	Solve systems of simultaneous equations using the Iteration Method.
CO5	Compute numerical solutions for Partial Differential Equations (PDEs).
Textbooks	
➢	S. Arumugam, A. Thangapandi Isaac and A. Somasundaram, Numerical Methods, Scitech, 2017.
Reference Books	
1.	S. S. Sastry, Introductory Methods of Numerical Analysis, Fourth Edition, PHI Learning Private Limited, New Delhi-1, 2009.
1.	Pallab Ghosh, Numerical Methods with Computer Programs in C++, Prentice Hall India Pvt. Ltd., New Delhi, 2009.
3.	T. Veerarajan and T. Ramachandran, Numerical Methods with Programs in C, Second Edition, McGraw Hill Education Pvt. Ltd, New Delhi, 2006.

CO/PO/PSO	**Pos**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**3**	**2**	**3**	**3**	**1**	**3**	**3**	**2**
CO2	**2**	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**2**
CO4	**2**	**3**	**3**	**2**	**3**	**1**	**3**	**3**	**2**
CO5	**2**	**3**	**3**	**3**	**2**	**1**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**12**	**15**	**14**	**15**	**14**	**5**	**15**	**15**	**10**

SKILL ENHANCEMENT COURSE III - MATHEMATICS FOR COMPETETIVE EXAMINATION I

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USMA31	**2**	0	0	III	**2**	**2**	**50**	**50**	**100**

Learning Objectives	
LO1	Solve simplification and number system problems quickly.
LO2	Apply ratio, proportion, and percentage concepts.
LO3	Solve profit, loss, and discount problems.
LO4	Analyze coding, decoding, and logical reasoning problems.
LO5	Improve speed and accuracy in aptitude calculations.

Prerequisites:

Unit	Contents	No. of Hours
I	Simplification– Averages – LCM – HCF.	**6**
II	Ratio and Proportion, Coding and Decoding	**6**
III	Profit and Loss- Clock	**6**
IV	Profit and Loss-Discount and Marked Price – Successive Discounts	**6**
V	Divisibility Rules-Problems on Numbers	**6**
	TOTAL	**30**

CO	Course Outcomes
CO1	Solve simplification and average problems quickly and accurately.
CO2	Apply number theory concepts to solve aptitude-based number problems.
CO3	Analyze and solve profit, loss and discount problems.
CO4	Solve ratio, proportion and variation-based problems effectively.
CO5	Compute percentage, partnership and interest-based problems and interpret basic data.

Textbooks

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

Reference Books

1. R.S. Agarwal-Objective arithmetic, Published by S. Chand & Co Ltd.,2018

CO/PO/PSO	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	1	2	3	3	2	1
CO2	2	1	3	1	3	2	3	2	1
CO3	3	1	3	1	2	2	3	2	1
CO4	3	1	3	1	3	3	3	2	1
CO5	3	1	3	1	2	3	3	2	1
Weightage of course contributed to each PSO	14	5	15	5	12	13	15	10	5

COMMON - ENVIRONMENTAL STUDIES

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEVS31	2	0	0	III	2	2	50	50	100

Learning Objectives

LO1	To study the multidisciplinary nature of environmental studies, including the scope, importance, and sustainable management of natural resources such as forests, water, minerals, food, energy, and land.
LO2	To understand different types of ecosystems, energy flow, ecological succession, food chains, food webs, and ecological pyramids.
LO3	To examine the levels of biodiversity, its distribution in India and globally, threats to biodiversity, and conservation strategies including in-situ and ex-situ methods.
LO4	To identify causes, effects, and control measures of various types of pollution, and to understand solid waste management and disaster management techniques.
LO5	To analyze social and environmental issues such as climate change, global warming, and population growth, along with environmental protection laws and sustainable development practices.

Prerequisites:

Unit	Contents	No. of Hours
I	THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES Definition, scope and importance Natural resources and associated problems: a) Forest resources: Use and over-exploitation, deforestation, timber extraction, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, dams-benefits and problems, water conservation and watershed management. c) Mineral resources: Use and exploitation, environmental effects. d) Food resources: World food problems, changes, effects of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewables lion renewable energy sources, alternate energy sources. f) Land resources: Land as a resource, land degradation, man-induced landslides, soil erosion and desertification.	**6**
II	ECOSYSTEMS a) Forest Ecosystem b) Grassland Ecosystem c) Desert ecosystem d)	**6**

	Aquatic Ecosystem (Ponds, rivers, oceans, estuaries) Energy flow in the ecosystem Ecological succession Food Chains, Food Webs and Ecological Pyramids.	
III	BIODIVERSITY AND ITS CONSERVATION Introduction Definition: Genetic, species and ecosystem diversity. Biogeographically classification of India ,Values of Biodiversity, Biodiversity at global, national and local levels India as a mega-diversity nation, Hot-Spots of biodiversity Threats to biodiversity Endangered and endemic species of India , Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity	**6**
IV	ENVIRONMENTAL POLLUTION Definition- Causes, effects and control measures of:- a) Air Pollution b) Water Pollution c) Soil Pollution d) Marine Pollution e) Noise Pollution f) Thermal Pollution Solid Waste Management, Disaster Management: Floods, earthquake, cyclone and landslides.	**6**
V	SOCIAL ISSUES AND THE ENVIRONMENT Climatic change, global warming, acid rain, ozone depletion. Wasteland reclamation Consumerism and Waste products, use and through plastics Environment Protection Act Air (Prevention and Control of Pollution) Act Water (Prevention and Control of Pollution) Act Wildlife Protection Act Forest Conservation Act Population Explosion - Family Welfare Programme Human Rights	**6**
TOTAL		**30**

CO	**Course Outcomes**
CO1	Students will be able to explain the scope and importance of environmental studies and analyze the use, over-exploitation, and conservation of natural resources.
CO2	Students will be able to describe ecosystem types, energy flow, ecological succession, and relationships such as food chains, food webs, and ecological pyramids.
CO3	Students will be able to assess biodiversity at different levels, identify threats, and explain conservation methods including in-situ and ex-situ approaches.
CO4	Students will be able to identify various types of pollution, analyze their causes and effects, and suggest control measures along with waste and disaster management practices.
CO5	Students will be able to evaluate major environmental issues such as climate change and population growth, and understand environmental protection laws and sustainable practices.

Reference Books

1	G.S. Vijayalakshmi, A.G. Murugesan and N. Sukumaran. 2006. Basics of Environmental Science, Manonmaniam Sundaranar University Publications, Tirunelveli , pp.160.
2	Agarwal. K.C. 2001. Environmental Biology, Nidi Publications Limited, Bikaner
3	A.K.De. 1999. Environmental Chemistry, Wiley Eastern Limited, India.
4	Jadhav,H. and Bhosale, V.M.1995. Environmental Protection and Laws, Himalaya Publishing House, Delhi. pp284
5	Odum, E.P.1971. Fundamentals of Ecology, W.B.Saunders Co., USA. pp.574.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**2**	**2**	**2**
CO2	**2**	**3**	**2**	**2**	**2**	**2**
CO3	**2**	**3**	**3**	**3**	**2**	**2**
CO4	**2**	**3**	**2**	**2**	**2**	**2**
CO5	**3**	**3**	**2**	**2**	**2**	**2**
Weightage of course contributed to each PSO	**12**	**14**	**11**	**11**	**10**	**10**

Semester-4

Semester–4									
Course Code	**Part**	**Course category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
26U1TL41	I	Language– I	Tamil–IV	5	3	50	50	100	3
26U1HD41	I		Hindi –IV						
26U1MY41	I		Malayalam–IV						
26U1FR41	I		French – IV						
26U2EN41	II	Language– II	English–IV	5	3	50	50	100	3
26UCMA41	III	Core– VII	Sequence and Series	5	3	50	50	100	4
26UCMA42	III	Core –VIII	Fourier Series and Integral Transforms	5	3	50	50	100	4
26UEMA41	III	EC – VI	Statistics II	4	3	50	50	100	3
26UEMA42			Numerical Methods						
26USMA41	III	SEC –IV	GeoGebra	2	3	50	50	100	2
26USMA42	IV	SEC - V	Mathematics for Competitive Examination II	2	3	50	50	100	2
26UVBE41	V	Common	Value Based Education	2	3	50	50	100	2
			Total	**30**				**800**	**23**

SECOND YEAR – SEMESTER – IV
CORE VII–SEQUCNCES AND SERIES

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA41	**5**	0	0	IV	**4**	**5**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand the concept of sequences and their types.
LO2	Identify convergent and divergent sequences.
LO3	Apply limit laws to sequences and series.
LO4	Test convergence of infinite series using standard tests.
LO5	Analyze absolute and conditional convergence of series.

Prerequisites:

Unit	Contents	No. of Hours
I	Sequences - Bounded sequences - Monotonic Sequences – Convergent Sequences –Divergent and Oscillating Sequences – The Algebra of limits. (Chapter3:Sections- 3.1 to 3.7)	**15**
II	Behavior of Monotonic Sequences – Some theorem on limit - Subsequences – Limit points – Cauchy sequences. (Chapter3:Sections- 3.8 to 3.12)	**15**
III	Series of positive terms: Infinite series–Comparison test. (Chapter2:Sections - 4.1, 4.2)	**15**
IV	Kummer's test–Root test–Integral Test. (Chapter4:Sections-4.3 to 4.5)	**15**
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)	**15**
	TOTAL	**75**

CO	Course Outcomes
CO1	Explain Sequence and Subsequence of real numbers and to find the limit of sequence to test for convergent, divergent and bounded sequences
CO2	Know the behaviour of monotonic sequences and the Cauchy sequence
CO3	Explain series and to verify convergent of series by using comparison test
CO4	Understand Kummer's test and Ratio test.
CO5	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.

Textbooks	
➢	S. Arumugam, A. Thangapandi Isaac and A. Somasundaram, Sequence and Series, Yes Dee Publications, 2021.
Reference Books	
7.	Richard R.Goldberg, "Methods of Real Analysis": Oxford and IBH Publishing, 2020
8.	Ethan D.Bloch, "The Real Numbers and Real Analysis", Springer, 2011.
9.	G. M. Fikhtengol'ts, "The Fundamentals of Mathematical Analysis", Vol I.Pergamon Press, New York, 1965
10.	T.M. Apostol, "Calculus (Vol.I)", John Wiley and Sons (Asia)P. Ltd., 2002. 5. R. G. Bartle and D. R Sherbert, "Introduction to Real Analysis", John Wiley and Sons (Asia) P. Ltd., 2000.
11.	E.Fischer, "Intermediate Real Analysis", Springer Verlag, 1983.
12.	T.M. Apostol, "Calculus (Vol.I)", John Wiley and Sons (Asia)P. Ltd., 2002.
13.	. K. A. Ross, "Elementary Analysis - The Theory of Calculus Series" -Undergraduate Texts in Mathematics, Springer Verlag, 2003.

CO/PO/PSO	**Pos**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**1**
CO2	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**1**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**1**
CO5	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**1**
Weightage of course contributed to each PSO	**15**	**15**	**12**	**15**	**10**	**10**	**15**	**10**	**5**

CORE VIII–FOURIER SERIES AND INTEGRAL TRANSFORMS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA42	**5**	0	0	IV	**4**	**5**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand the concept of Fourier series representation.
LO2	Compute Fourier coefficients for periodic functions.
LO3	Develop half-range and complex Fourier series.
LO4	Apply Fourier transforms to simple functions.
LO5	Solve differential equations using Laplace transforms.

Prerequisites:

Unit	Contents	No. of Hours
I	Fourier Series–Definition – Fourier coefficients and Fourier series for a given periodic function with period 2π and $2l$,odd and even functions. (Book 1 - Chapter 1: Sections - 1.4 to 1.8)	**15**
II	Half range Fourier series – Parseval‟s theorem – Root-Mean square value of a function – Harmonic analysis – Complex form of Fourier series. (Book 1 - Chapter 1: Sections - 1.9 to 1.12)	**15**
III	Fourier Transforms – Fourier Integral theorem – Fourier sine and cosine transforms – Properties of Fourier transform – Parsavel‟s Identity. (Book 1 - Chapter 2: Sections - 2.2 to 2.6))	**15**
IV	Laplace Transforms – Definition – Results – Linearity property -Laplace transform of periodic functions – Some general Theorems – Evaluation of certain integrals. (Book 2 - Chapter 9:Sections -1 to 5)	**15**
V	The Inverse Transform – Results –Linearity property- Solving ordinary differential equations with constant coefficients, simultaneous linear differential equations and differential equations with variable coefficients by Laplace Transform. (Book 2 - Chapter 9:Sections -6 to 10)	**15**
	TOTAL	**75**

CO	**Course Outcomes**
CO1	Compute the Fourier coefficients and construct the Fourier series of a given periodic function.
CO2	Develop half-range Fourier series and express functions in the complex form of Fourier

	series.
CO3	Evaluate the Fourier transform of a given function and analyze its fundamental properties.
CO4	Determine the Laplace transform of periodic functions and apply it to evaluate definite integrals.
CO5	Compute the inverse Laplace transform and apply Laplace transform techniques to solve differential equations.
Textbooks	
➢	T. Veerarajan, Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2001.
➢	S. Narayananand T.K. Manicavachagom Pillay, Differential equations and its application,S. Viswananthan Printers Pvt. Ltd., 2012
Reference Books	
1.	M.K. Venkataraman and Manorama Sridhar, Vector Calculus and Fourier Series, The National Publishing Company, Chennai-1, 2002.
2.	J. Ray Hanna, Fourier Series, Transforms and Boundary value Problems, Dover Publications, NewYork,2008.
3.	P. R. Mittal, Differential Equations, Fourier and Laplace Transforms, Probability, Margham Publications, Chennai, 2012.
4.	S. Arumugam A. Thangapandi Issac, Trigonometry and Fourier Series

CO/PO/PSO	**Pos**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**1**	**1**	**1**	**3**	**2**	**1**
CO2	**3**	**1**	**3**	**2**	**1**	**1**	**3**	**2**	**1**
CO3	**3**	**1**	**3**	**1**	**1**	**1**	**3**	**3**	**1**
CO4	**3**	**1**	**3**	**2**	**2**	**1**	**3**	**3**	**1**
CO5	**3**	**1**	**3**	**2**	**2**	**1**	**3**	**3**	**1**
Weightage of course contributed to each PSO	**15**	**5**	**15**	**8**	**7**	**5**	**15**	**13**	**5**

ELECTIVE COURSE VI – STATISTICS II

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA41	**4**	0	0	IV	**3**	**4**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand random variables and probability distributions.
LO2	Compute expectation, variance, and covariance.
LO3	Use moment generating functions and characteristic functions.
LO4	Apply binomial and Poisson distributions in problems.
LO5	Analyze normal and uniform distributions.

Prerequisites:

Unit	Contents	No. of Hours
I	Random variables and Distribution functions: Introduction – Distribution functions–Discrete random variable (One dimensional) – Probability mass function and Distribution function– Continuous random variable (one dimensional)–Probability density function–Various measure of central tendency – Continuous distribution function – Problems. (Chapter5: Sections-5.1 to 5.4)	**12**
II	Mathematical Expectation: Introduction– Mathematical Expectation– Expected value of function of Random variable – Properties – Variance – Properties – Covariance – Problems. (Chapter 6: Sections - 6.1 to 6.6)	**12**
III	Generating functions and Law of large numbers: Moment Generating functions – Cumulants – Characteristic function – Properties – Problems.(excluding some important theorems). (Chapter 7: Sections - 7.1 to 7.3.)	**12**
IV	Special Discrete Probability Distributions: Binomial Distribution – Poisson Distribution – Properties and Problems. (Chapter 8: Sections - 8.4, 8.5)	**12**
V	Some Continuous Probability Distributions: Normal distribution – Uniform distribution– Properties and Problems. (excluding area property, error function, importance and log normal distribution) (Chapter 9: Sections - 9.2.1-9.2.10,9.2.149.2.11 9.8)	**12**
TOTAL		**60**

CO	**Course Outcomes**

CO1	Describe Random variables, Probability mass function, Probability density function, and Distribution functions.
CO2	Enumerate Expectation, Variance and Covariance
CO3	Gain knowledge about Moment Generating functions and Characteristic functions
CO4	Special Discrete Probability Distributions: Binomial Distribution – Poisson Distribution – Properties and Problems. (Chapter 8: Sections - 8.4, 8.5)
CO5	Some Continuous Probability Distributions: Normal distribution – Uniform distribution– Properties and Problems. (excluding area property, error function, importance and log normal distribution) (Chapter 9: Sections - 9.2.1-9.2.10,9.2.149.2.11 9.8)
Textbooks	
➢	S. C. Gupta S. C. and V. K. Kapoor V.K, Fundamentals of Mathematical Statistics, 12thEdition, Sultan Chand &Sons, New Delhi, 2021.
Reference Books	
1.	S. C. Gupta and V. K. Kapoor, Elements of Mathematical Statistics, 3rdEdition, Sultan Chand &Sons, New Delhi, 2001.
2.	P. R. Vittal, Mathematical Statistics, Margham Publications, Chennai, 2020.
3.	S. Arumugam and A. Thangapandi Isaac, Statistics, New Gamma Publication, 2016.

CO/PO/PSO	**POs**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**2**	**3**	**2**	**3**	**1**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**2**	**3**	**1**	**3**	**3**	**2**
CO3	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**3**	**2**
CO5	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**10**	**15**	**10**	**12**	**5**	**15**	**15**	**10**

ELECTIVE COURSE VI- NUMERICAL METHODS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA42	**4**	0	0	IV	**3**	**4**	**50**	**50**	**100**

Learning Objectives

LO1	Solve equations using numerical approximation methods.
LO2	Apply interpolation techniques for data estimation.
LO3	Use numerical differentiation and integration methods.
LO4	Solve differential equations using numerical algorithms.
LO5	Analyze errors in numerical computations.

Prerequisites:

Unit	Contents	No. of Hours
I	Finite Differences: Difference Operators – Other Difference Operators – Error propagation in a difference table. (Chapter 6: Sections - 6.1 to 6.3)	**12**
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-Error in Interpolation. (Chapter 7: Sections - 7.1 to 7.5) [Except Bessel's and Laplace Everett's formulae in 7.2]	**12**
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)	**12**
IV	Numerical Solutions of Ordinary Differential Equations: Taylor's Series Method – Picard's method – Euler's method – Runge-Kutta method-Modified Euler's Method. (Chapter 10: 10.1 to 10.4)	**12**
V	Numerical Solutions of Ordinary Differential Equations: Predictor Corrector method – Milne's Method – Adams-Bashforth method-Error Analysis of Predictor–Corrector Methods. (Chapter 10: Sections – 10.5 to 10.7)	**12**
	TOTAL	**60**

CO	Course Outcomes
CO1	Solve algebraic and transcendental equations using numerical techniques.
CO2	Construct interpolation polynomials and apply finite difference methods.

CO3	Apply numerical methods for differentiation and integration.
CO4	Solve ordinary differential equations using numerical schemes such as Euler and Runge–Kutta methods
CO5	Solve systems of linear equations using direct and iterative numerical methods
Textbooks	
➢	S 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.	Pallab Ghosh, 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, Second Edition, Mc Graw Hill Education Pvt. Ltd, New Delhi, 2006.

CO/PO/PSO	**Pos**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**1**
CO2	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**1**
CO3	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**1**
CO4	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**1**
CO5	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**1**
Weightage of course contributed to each PSO	**15**	**10**	**15**	**10**	**5**	**5**	**15**	**15**	**5**

SKILL ENHANCEMENT COURSE IV - GEOGEBRA

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USMA41	**2**	0	0	IV	**2**	**2**	**50**	**50**	**100**

Learning Objectives	
LO1	Install and use GeoGebra software effectively.
LO2	Construct basic geometric figures using tools.
LO3	Apply algebraic commands in GeoGebra.
LO4	Create and edit mathematical visualizations.
LO5	Integrate graphs and spreadsheets for analysis.

Prerequisites:

Unit	Contents	No. of Hours
I	Installation and Introduction of GeoGebra - Drawing versus Geometric Construction. (Chapters: 1 and 2)	**6**
II	Practice Block I – Basic Algebraic Input, Commands and Functions. (Chapters: 3 and 4)	**6**
III	Export of Pictures to the Clipboard – Practice Block II – Inserting Pictures into the Graphics View. (Chapters:5, 6 and 7)	**6**
IV	Inserting Text into the Graphics View – Practice Block III. (Chapters: 8 and 9)	**6**
V	Combining Spreadsheet View & Graphics View - Creating Static Instructional Materials – Creating Dynamic Worksheets, Practice Block IV(Chapters: 10-13)	**6**
TOTAL		**30**

CO	Course Outcomes
CO1	Install the GeoGebra application and construct geometric figures.
CO2	Understand and use the commands and functions available in GeoGebra.
CO3	Export images to the clipboard and insert them into the Graphics View.
CO4	Add text within the Graphics View.
CO5	Integrate the Spreadsheet View with the Graphics View.

Textbooks

➢	Judith and Markus Hohenwarter, Introduction to GeoGebra, 2011.

Reference Books

1.	Steve Phelps, An Introduction to GeoGebra, 2011.

CO/PO/PSO	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	1	2	1	3	2	1
CO2	2	1	3	1	2	1	3	2	1
CO3	3	1	3	1	2	1	3	2	1
CO4	3	1	3	1	2	1	3	2	1
CO5	3	1	3	1	2	1	3	2	1
Weightage of course contributed to each PSO	14	5	15	5	10	5	15	10	5

SKILL ENHANCEMENT COURSE V– MATHEMATICS FOR COMPETETIVE EXAMINATION II

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USMA42	**2**	0	0	IV	**2**	**2**	**50**	**50**	**100**

Learning Objectives	
LO1	Solve problems on chain rule applications.
LO2	Apply time and work concepts in real problems.
LO3	Solve pipe and cistern problems efficiently.
LO4	Analyze time, speed, and distance problems.
LO5	Solve simple and compound interest problems.

Prerequisites:

Unit	Contents	No. of Hours
I	Chain Rule.	**6**
II	Time and work	**6**
III	Pipes and Cistern.	**6**
IV	Time and Distance	**6**
V	Simple interest and Compound interest.	**6**
	TOTAL	**30**

CO	Course Outcomes
CO1	Explain chain rule.
CO2	Explain Time and work
CO3	Explain Pipes and Cistern
CO4	Find Time and Distance
CO5	Find Simple interest and Compound interest.

Textbooks

➢	R.S.Agarwal-Objective Arithmetic, Published by S.Chand & Co, Ltd., Edition (2018).

Reference Books

1.	Rajesh Verma- Fasttrack Objective arithmetic, Arihant Publications (India) Limited. Fourth Edition 1st January 2018.
2.	R.S.Aggarwal, Arithmetic Subjective and objective, Published by S.Chand and Co. Ltd. Revised Edition.1stApril2017.

CO/PO/PSO	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	1	2	3	3	2	1
CO2	2	1	3	1	3	2	3	2	1
CO3	3	1	3	1	2	3	3	2	1
CO4	3	1	3	1	2	3	3	2	1
CO5	3	1	3	1	3	3	3	2	1
Weightage of course contributed to each PSO	14	5	15	5	12	14	15	10	5

COMMON - VALUE BASED EDUCATION

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UVBE41	2	0	0	IV	2	2	50	50	100

Learning Objectives	
LO1	To provide basic knowledge of the Indian Constitution and its framework.
LO2	To understand fundamental rights, duties, and directive principles.
LO3	To create awareness about human rights and their protection mechanisms.
LO4	To develop analytical skills regarding constitutional and human rights issues.
LO5	To promote values of equality, justice, and democracy among students.

Prerequisites:

Unit	Contents	No. of Hours
I	**Introduction to Indian Constitution** **Introduction**: Meaning and importance of Constitution - Historical background of Indian Constitution - Making of the Constitution (Constituent Assembly) - Salient features of Indian Constitution - Preamble – Meaning, Objectives and Values.	6
II	**Fundamental Rights and Duties** Fundamental Rights – Types and significance - Right to Equality, Freedom, Religion, Cultural & Educational Rights - Right to Constitutional Remedies - Fundamental Duties – Meaning and importance.	6
III	**Directive Principles of State Policy** Meaning and objectives - Classification of Directive Principles - Relationship between Fundamental Rights and DPSP - Role in governance and welfare state.	6
IV	**Human Rights – Concepts and Development** Meaning and definition of Human Rights - Evolution of Human Rights - Universal Declaration of Human Rights (UDHR) - Types of Human Rights – Civil, Political, Economic, Social & Cultural	6
V	**Human Rights in India** Human Rights Protection Act, 1993 - National Human Rights Commission (NHRC) – Structure and functions - Role of NGOs in Human Rights protection - Issues: Women, Children, Minorities & Environment - Contemporary Human Rights challenges in India.	6
	TOTAL	30

CO	Course Outcomes
CO1	Explain the structure and features of the Indian Constitution.
CO2	Identify and interpret Fundamental Rights and Duties.

CO3	Analyze the role of Directive Principles in governance.
CO4	Understand the concept and importance of Human Rights.
CO5	To create a congenial climate in the organization
Textbooks	
➢	Durga Das Basu – *Introduction to the Constitution of India*
Reference Books	
1	V.N. Shukla – *Constitution of India*
2	M. Laxmikanth – *Indian Polity*
3	Upendra Baxi – *The Future of Human Rights*
4	H.O. Agarwal – *Human Rights*
5	P.M. Bakshi – *The Constitution of India*

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**2**	**2**	**3**
CO2	**3**	**2**	**2**	**2**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**
CO4	**3**	**2**	**2**	**2**	**2**	**3**
CO5	**3**	**3**	**2**	**2**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**12**	**11**	**11**	**12**	**12**

Semester-5

Semester – 5									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in hrs.	**Max Marks**			
						CIA	**ESE**	**Total**	
26UCMA51	III	Core-IX	Abstract Algebra	5	3	50	50	100	4
26UCMA52	III	Core -X	Real Analysis	5	3	50	50	100	4
26UCMA53	III	Core -XI	Mathematical Modelling	5	3	50	50	100	4
26UCMA54	III	Core -XII	Number Theory	5	3	50	50	100	4
26UCMA55	III	Core -XIII	Operations Research I	4	3	50	50	100	4
26UEMA53	III	Elective- VII	Discrete mathematics	4	3	50	50	100	3
26UEMA54			Combinatorial Mathematics						
26UEMA55			Fuzzy Sets And Applications						
26UFIK51	IV	Internship	Internship/Industrial Visit/Field Visit/Knowledge Updation Activity	-	3	50	50	100	1
26UAEC51	IV	AEC - I	Empowered Vocational English	2	3	50	50	100	2
Total				**30**				**800**	**26**

THIRD YEAR – SEMESTER V

CORE XI –ABSTRACT ALGEBRA

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA51	**5**	0	0	V	**4**	**5**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand group theory concepts including subgroups and cyclic groups.
LO2	Apply Lagrange's theorem and study cosets in groups.
LO3	Analyze homomorphisms and isomorphisms of algebraic structures.
LO4	Study ring theory including ideals and subrings.
LO5	Construct quotient rings and analyze integral domains.

Prerequisites:

Unit	Contents	No. of Hours
I	Groups: Definition and Examples – Properties – Permutation Groups – Subgroups – Cyclic Groups. (Chapter 3: Sections-3.1, 3.2, 3.4 to 3.6)	**15**
II	Order of an element – Cosets and Lagrange's Theorem – Normal subgroups and Quotient groups. (Chapter3:Sections-3.7to3.9)	**15**
III	Isomorphism – Cayley's Theorem– Homomorphisms - Fundamental Theorem. (Chapter 3 : Sections-3.10 and 3.11)	**15**
IV	Rings: Definition and examples –Properties –Isomorphism of Ring- Types of rings – Characteristic of a ring – Subrings – Ideals. (Chapter4:Section-4.1, 4.2 to 4.7)	**15**
V	Quotient Rings – Maximal and Prime Ideals – Homomorphism of Ring - The field of quotients of an Integral Domain. (Chapter4: Section-4.3, 4.8 to 4.11)	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Explain groups, subgroups and cyclic groups
CO2	Explain about cosets, normal subgroup and quotient groups and to apply Lagrange's theorem for a given finite group has a subgroup
CO3	Apply Cayley's theorem to problems and to know and verify the functions for homomorphism and automorphism properties
CO4	Explain rings, properties, different types of rings, Ideals and examine their structure
CO5	Know the quotient ring and to discuss about the field of quotient of an integral domain.

Textbooks

➢	S.Arumugam and A. Thangapandi Isaac, Modern Algebra, Scitech Publications, 2014.
Reference Books	
1.	I.N.Herstein, Topics in 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.

CO/PO/PSO	**POs**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**3**	**2**	**3**	**1**	**2**	**3**	**3**	**1**
CO2	**3**	**3**	**2**	**3**	**1**	**1**	**3**	**3**	**1**
CO3	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**1**
CO4	**3**	**3**	**2**	**3**	**1**	**1**	**3**	**3**	**1**
CO5	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**1**
Weightage of course contributed to each PSO	**15**	**15**	**10**	**15**	**7**	**8**	**15**	**15**	**5**

CORE X– REAL ANALYSIS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA52	**5**	0	0	V	**4**	**5**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand metric spaces and their basic properties.
LO2	Analyze convergence, completeness, and limit points in metric spaces.
LO3	Study continuity and uniform continuity of functions.
LO4	Understand connectedness and contraction mapping theorem.
LO5	Analyze compactness and its relation to continuity.

Prerequisites:

Unit	Contents	No. of Hours
I	Metric spaces: Definition and Examples – Bounded sets – Open ball– Open sets – Subspaces– Interior of a set. (Chapter 2:Section - 2.1to 2.6)	**15**
II	Closed sets– Closure– Limit point– Dense set– Complete metric space: Completeness –Cantor's intersection theorem– Baire's Category theorem. (Chapter 2:Sections - 2.7to 2.10 and Chapter 3: Sections – 3.1 and 3.2)	**15**
III	Continuity: Continuity –Homeomorphism–Uniform Continuity – Discontinuous functions on *R*. (Chapter 4: Sections- 4.1 to 4.4)	**15**
IV	Connectedness: Definition and Examples –Connected subsets of *R*– Connectedness and continuity- Contraction mapping theorem. (Chapter 5: Sections-5.1 to 5.3)	**15**
V	Compactness: Compact metric spaces–Compact subsets of R– Equivalent characterizations for compactness–Compactness and Continuity. Point wise convergence and Uniform convergence. (Chapter 6:Sections- 6.1 to 6.4) (Chapter 7:Sections- 7.1 to 7.2)	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Explain the concepts of bounded, open and close 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
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
Textbooks	
➢	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 Mc Graw 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.

CO/PO/PSO	**POs**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**3**	**1**	**3**	**1**	**2**	**3**	**1**	**1**
CO2	**3**	**3**	**1**	**3**	**1**	**2**	**3**	**1**	**1**
CO3	**3**	**3**	**1**	**3**	**1**	**2**	**3**	**1**	**1**
CO4	**3**	**3**	**1**	**3**	**1**	**2**	**3**	**1**	**1**
CO5	**3**	**3**	**1**	**3**	**1**	**2**	**3**	**1**	**1**
Weightage of course contributed to each PSO	**15**	**15**	**5**	**15**	**5**	**10**	**15**	**5**	**5**

CORE XI – MATHEMATICAL MODELLING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA53	**5**	0	0	V	**4**	**5**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand principles and characteristics of mathematical models.
LO2	Develop models using differential equations for real-world systems.
LO3	Apply system-based models like predator-prey and competition models.
LO4	Use difference equations in economic and actuarial models.
LO5	Analyze real-life problems using mathematical modelling techniques.

Prerequisites:

Unit	Contents	No. of Hours
I	Mathematical Modelling: Simple situations requiring mathematical modelling, characteristics of mathematical models. (Chapter1:Sections -1.1 and 1.4)	**15**
II	Mathematical Modelling through differential equations: Linear Growth and Decay Models. Non-Linear growth and decay models, Compartment models-Simple Harmonic motion-Motion under Gravity in a Resisting Medium- Motion of a Rocket. (Chapter2:Sections -2.1to2.4, 2.5.1, 2.5.2 and 2.5.3)	**15**
III	Mathematical Modelling, through a system of Ordinary differential equations of first order: Prey-predator models, Competition models, Model with removal and model with immigrations. (Chapter3: Sections -3.1.1, 3.1.2, 3.2.6)	**15**
IV	Introduction to different equations. (Chapter5: Sections 5.1, 5.2.1 to 5.2.4)	**15**
V	Mathematical Modelling through difference equations: Harrods Model, cob web model application to Actuarial Science (Chapter5: Sections - 5.3.1,5.3.2, 5.3.4)	**15**
TOTAL		**75**

CO	Course Outcomes
CO1	Explain simple situations requiring mathematical modelling and determine the characteristics of such models.
CO2	Develop mathematical models using differential equations to represent linear growth and decay processes
CO3	Formulate and analyze systems of first-order ordinary differential equations to discuss models related to epidemics and medicine.

CO4	Explain the theory and applications of difference equations in detail.
CO5	Construct and analyze mathematical models using difference equations.
Textbooks	
➢	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 Mc Graw 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.

CO/PO/PSO	**POs**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**
CO2	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**
CO3	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**
CO4	**3**	**2**	**2**	**2**	**3**	**1**	**2**	**3**	**2**
CO5	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**
Weightage of course contributed to each PSO	**11**	**14**	**14**	**14**	**11**	**9**	**10**	**15**	**10**

CORE XII –NUMBER THEORY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA54	**5**	0	0	V	**4**	**5**	**50**	**50**	**100**

Learning Objectives	
LO1	Apply mathematical induction and binomial theorem in number problems.
LO2	Use Euclidean algorithm to find GCD and solve Diophantine equations.
LO3	Understand prime numbers and fundamental theorem of arithmetic.
LO4	Solve congruence problems using modular arithmetic.
LO5	Apply Fermat's and Wilson's theorems in number theory problems.

Prerequisites:

Unit	Contents	No. of Hours
I	Mathematical induction– The Binomial Theorem– Early Number Theory.	**15**
II	Division Algorithm–GCD–Euclidean Algorithm– The Diophantine Equation $ax + by = c$.	**15**
III	The fundamental Theorem of Arithmetic – The Sieve of Eratosthenes– The Gold bach conjecture.	**15**
IV	Binary and Decimal representation of integers – Linear congruence and The Chinese Remainder Theorem.	**15**
V	Fermat's Theorem – Wilson's Theorem–The Fermat Kraitchik Factorization Method.	**15**
TOTAL		**75**

CO	**Course Outcomes**
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 bach Conjecture
CO4	Summarize the basic properties of congruences and to apply Chinese Remainder Theorem
CO5	Elaborate Fermat's Theorem, Wilson's Theorem and to apply Kraitchik Factorization Method.

Textbooks

- 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. Klima, 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.

CO/PO/PSO	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	2	3	2	3	3	3	2	3	2
CO2	2	2	3	3	3	3	2	3	2
CO3	3	3	2	3	3	3	2	3	2
CO4	2	3	3	3	3	2	2	3	2
CO5	3	3	3	2	3	2	2	3	2
Weightage of course contributed to each PSO	12	14	13	14	15	13	10	15	10

CORE COURSE XIII –OPERATIONS RESEARCH I

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA51	**4**	0	0	V	**4**	**4**	**50**	**50**	**100**

Learning Objectives	
LO1	Formulate linear programming problems mathematically.
LO2	Solve LPP using graphical and simplex methods.
LO3	Understand duality and apply dual simplex method.
LO4	Solve transportation problems using optimization techniques.
LO5	Solve assignment problems including special cases.

Prerequisites:

Unit	Contents	No. of Hours
I	Linear Programming: Linear Programming Problem: Formulating a problem as linear programming model – Examples of LP model formulation – General LPP – Canonical and Standard forms of LPP – Terminology for the solution of LPP - Graphical solution. (Chapter 2: Sections - 2.1, 2.5 to 2.9 and Chapter 3: Section - 3.1)	**12**
II	Solving LPP: The computational procedure – Simplex Algorithm – Two-Phase method and Big-M method – (Chapter 3: Sections - 3.3 to 3.5)	**12**
III	Duality in LP: General Primal-Dual pair – Formulating a Dual problem – Properties of Dual problem – Complementary slackness Theorem-Duality and Simplex method – Dual Simplex method. (Chapter 5: Sections - 5.2 to 5.5,5.6, 5.8)	**12**
IV	Transportation Problem (TP): General structure of a TP – Existence of solution in TP – Duality in TP – Degeneracy in TP – Solution of a TP – Method for finding IBFS – North-West Corner method, Least Cost method, Vogel's Approximation Method – Optimality test – Stepping stone method – MODI. (Chapter 7: Sections - 7.1 to 7.10)	**12**
V	Assignment Problem (AP): Formulation of an AP – Assumptions in AP – Methods of solving an AP (Hungarian method) – Special case in AP (Unbalanced AP & Maximization case in AP) – Dual of the AP-Travelling Salesman Problem. (Chapter 8: Sections - 8.1 to 8.4 and 8.6, 8.7)	**12**
TOTAL		**60**

CO	**Course Outcomes**

CO1	Define a Linear Programming Problem and solve it using the graphical method.
CO2	Solve Linear Programming Problems using the Simplex, Two-Phase, and Big-M methods.
CO3	Interpret the concept of duality, distinguish between primal and dual problems, and solve LPP using the Dual Simplex method
CO4	**:** Determine the optimal solution for Transportation Problems using appropriate methods.
CO5	Determine the optimal solution for Assignment Problems using suitable techniques
Textbooks	
➢	Kanti Swarup, P. K. Gupta and Man Mohan, Operations Research, [20thRevisedEdition], Sultan Chand & Sons, New Delhi, 2022
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.

CO/PO/PSO	**Pos**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**2**	**3**	**3**	**2**	**1**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**3**	**2**	**1**	**3**	**3**	**3**
CO3	**3**	**2**	**3**	**3**	**2**	**1**	**3**	**3**	**3**
CO4	**3**	**2**	**3**	**3**	**2**	**1**	**3**	**3**	**3**
CO5	**3**	**2**	**3**	**3**	**2**	**1**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**10**	**15**	**15**	**10**	**5**	**15**	**15**	**15**

ELECTIVE COURSE VII –DISCRETE MATHEMATICS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA52	**4**	0	0	V	**3**	**4**	**50**	**50**	**100**

Learning Objectives	
LO1	Use propositional logic and truth tables in reasoning.
LO2	Apply rules of inference in logical problem solving.
LO3	Understand predicates and quantifiers in logic systems.
LO4	Analyze relations, functions, and partial orderings.
LO5	Study lattices and Boolean algebra structures.

Prerequisites:

Unit	Contents	No. of Hours
I	Mathematical logic: Statements and Notations – Connectives– Negation – Conjunction –Disjunction –Statement formulas and truth table – Conditional and Biconditional –Well- formed formulas– Tautologies- Equivalence of Formulas. (Chapter1: Sections- 1.1,1.2.1to1.2.4,1.2.6to1.2.9)	**12**
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. (Chapter1: Sections- 1.3.1to1.3.5,1.4.1,1.4.2)	**12**
III	The Predicate calculus–Predicates –The Statement function, Variables and quantifiers–Predicate formulas–Free and bound variables – The Universe of discourse –Inference theory of the predicate calculus – Valid formulas and Equivalence – Some valid formulas over finite Universes – Special valid formulas involving quantifiers. (Chapter1: Sections -1.5.1to1.5.5 and 1.6.1 to 1.6.3)	**12**
IV	Relations and Ordering–Relations –Properties of Binary relations in a set– Equivalence relations- Comparability relations-Partial ordering– Partially ordered set: Representation and Associated terminology - Functions: Definition and Introduction–Composition of functions– Inverse functions. (Chapter2: Sections - 2.3.1, 2.3.2, 2.3.5, 2.3.6, 2.3.8, 2.3.9, 2.4.1 to2.4.3)	**12**
V	Lattices as partially ordered sets: Definition and examples– Some properties of Lattices–Sub lattices, Direct product and Homomorphism – Boolean algebra: Definition and examples. (Chapter 4: Sections -4.1.1,4.1.2,4.1.4,4.2.1)	**12**
	TOTAL	**60**

CO	Course Outcomes
CO1	Interpret and construct mathematical logic statements using appropriate notations
CO2	Analyze decision problems to determine whether a given statement is a tautology, contradiction,

	or satisfiable within a finite number of steps.
CO3	Apply predicate logic and explain the theory of inference in predicate calculus.
CO4	Define and analyze relations, orderings, and various types of functions
CO5	Define lattices and examine their fundamental properties.
Textbooks	
➢	J. P. Tremblay, R. Manohar, Discrete Mathematical structures with Applications to Computer Science, Tata Mc Graw hill, 2001.
Reference Books	
1.	M. K. Sen and B. C. Charraborthy, Introduction to Discrete Mathematics, Arunabha Sen Books & Allied Pvt. Ltd, Kolkatta.
2.	P Kenneth H.Rosen, Discrete Mathematics and Its Applications, Fourth Edition.

CO/PO/PSO	**POs**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO3	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO5	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**10**	**15**	**10**	**5**	**5**	**15**	**15**	**10**

ELECTIVE COURSE VII– COMBINATORIAL MATHEMATICS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA53	**4**	0	0	V	**3**	**4**	**50**	**50**	**100**

Learning Objectives	
LO1	Apply counting principles in combinatorial problems.
LO2	Solve permutation and combination problems efficiently.
LO3	Formulate recurrence relations for counting problems.
LO4	Use inclusion-exclusion principle in combinatorics.
LO5	Apply combinatorial methods in discrete structures.

Prerequisites:

Unit	Contents	No. of Hours
I	Selections and Binomial coefficients–Permutations–Ordered selections–unordered selections–Miscellaneous Problems. (Chapter1:Sections - 1.1to 1.4)	**12**
II	Parings Problems: Pairings within a set–Pairing between sets-Derangements – Principle of Counting by Double Counting (Chapter2:Sections -2.1 and 2.2)	**12**
III	Recurrence–Fibonacci-type relations using generating functions– Miscellaneous methods. (Chapter 3:Sections - 3.1 to 3.4)	**12**
IV	The Inclusion-Exclusion Principles –Applications of Inclusion–Exclusion in Counting Problems - Rook Polynomial-. (Chapter 4:Sections- 4.1to4 .3)	**12**
V	Block designs– Square block designs-Applications of Block Designs in Statistics. (Chapter 5:Sections- 5.1, 5.2)	**12**
TOTAL		**60**

CO	**Course Outcomes**
CO1	Apply fundamental counting principles to solve combinatorial problems.
CO2	Prove and use combinatorial identities involving binomial and multinomial coefficients.
CO3	Formulate and solve recurrence relations arising in discrete problems.
CO4	Use generating functions to solve counting and partition problems.
CO5	Apply combinatorial techniques in graph theory and discrete mathematical structures.

Textbooks

➢	Ian Andersen, A First Course in Combinatorial Mathematics, Clarendon Press, Oxford, 1989.

Reference Books

1.	Ralph P.Grimaldi, Discrete and Combinatorial Mathematics
2.	An Applied Introduction, V Edition, Pearson, 2004.

CO/PO/PSO	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	3	2	3	2	2	1	3	3	2
CO2	3	2	3	2	2	1	3	3	2
CO3	3	2	3	2	2	1	3	3	2
CO4	3	2	3	2	2	1	3	3	2
CO5	3	2	3	2	2	1	3	3	2
Weightage of course contributed to each PSO	15	10	15	10	10	5	15	15	10

ELECTIVE COURSE VII–FUZZY SETS AND APPLICATIONS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA54	**4**	0	0	V	**3**	**4**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand fuzzy sets and membership functions.
LO2	Compare fuzzy sets with crisp sets.
LO3	Perform operations on fuzzy sets and relations.
LO4	Apply fuzzy arithmetic in mathematical problems.
LO5	Use fuzzy logic in decision-making models.

Prerequisites:

Unit	Contents	No. of Hours
I	From Crisp sets to Fuzzy sets: Crisp Sets – Fuzzy Sets – Basic Types – Basic Concepts – Characteristics and Significance of Paradigm Shift-Fuzzy Set Representation Theorem. (Chapter1: Sections - 1.1 to 1.5)	**12**
II	Fuzzy sets verses Crisp sets: Additional properties of α-cuts – Representations of Fuzzy sets – Extension principle of Fuzzy sets-Decomposition Theorem. (Chapter 2: Sections - 2.1 to 2.3)	**12**
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)	**12**
IV	Fuzzy Arithmetic: Fuzzy Numbers – Linguistic Variables – Arithmetic Operations on Intervals – Arithmetic Operations on Fuzzy Numbers - Lattice of Fuzzy numbers - Fuzzy Equations. (Chapter4: Sections - 4.1 to 4.6)	**12**
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)	**12**
TOTAL		**60**

CO	**Course Outcomes**
CO1	Explain fuzzy sets, membership functions and their operations.
CO2	Analyze fuzzy relations and compute compositions..
CO3	Apply fuzzy logic and inference techniques to reasoning problems.

CO4	Perform fuzzy arithmetic operations and analyze fuzzy numbers.
CO5	Apply fuzzy set theory to decision-making and optimization problems.
Textbooks	
➢	George J.Klir and Bo Yuan, Fuzzy sets and Fuzzy Logic Theory Applications, Prentice Hall of India, New Delhi, 2002.
Reference Books	
1.	George J. Klirand Tina A. Folger, Fuzzy sets, Uncertainty and Information, Prentice Hall of India, New Delhi, 2003.
2.	S.Nanda and N.R.Das, Fuzzy Mathematical Concepts, Narosa PublishingHouse, 2012.

CO/PO/PSO	**POs**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO3	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO5	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**10**	**15**	**10**	**6**	**6**	**15**	**15**	**10**

ABILITY ENHANCEMENT COURSE I – EMPOWERED VOCATIONAL ENGLISH

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UAEC51	2	0	0	V	2	2	50	50	100

Learning Objectives	
LO1	To build self- assurance in students by mastering interpersonal, team- management, and leadership abilities.
LO2	To equip aspiring learners with skills that transforms them into effective young managers.
LO3	To sharpen communication proficiency for professional and workplace contexts.
LO4	To foster strategic thinking and problem- solving through advanced writing & presentation techniques.
LO5	To develop etiquette and corporate- ready competencies for modern business environments

Prerequisites:

Unit	Contents	No. of Hours
I	Communication Skills , Current English Usage , Aptitude and Attitude , Team Building and Leadership , Psychological Tests , Effective Resume Writing	6
II	Précis Writing, Essay Writing, Goal Setting ,Conflict Management, Appearing for an Interview , Myths regarding Group Discussion	6
III	Debates, Presentation for Small and Large Groups , Prioritization ,Time Management ,Stress Interview , Prerequisites of a Group Discussion	6
IV	Marketing and Business Presentations, Report Writing , Cross- Cultural Communication, Lateral Thinking, Qualities of a Candidate for an Interview, Generating Ideas for Discussion	6
V	Telephone Etiquette, Email Etiquette, Concepts of Leadership, Insights from Great Leaders, Mock Interview, Mock Group Discussion	6
TOTAL		30

CO	Course Outcomes
CO1	Students will demonstrate strong interpersonal and leadership skills in team settings.
CO2	Learners will apply effective communication strategies in current English usage.
CO3	Graduates will craft professional résumés and master interview- ready writing styles.
CO4	Participants will manage conflicts, set goals, and deliver impactful presentations.
CO5	Individuals will exhibit polished telephone & email etiquette alongside refined leadership insights

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	2
CO2	2	3	2	2	2	2
CO3	2	3	3	3	2	2
CO4	2	3	2	2	2	2
CO5	3	3	2	2	2	2
Weightage of course contributed to each PSO	12	14	11	11	10	10

Semester-6

Semester–6									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours / Week**	**Examination**				**Credits**
					Duration in hrs.	**Max Marks**			
						CIA	**ESE**	**Total**	
26UCMA61	III	Core– XIV	Linear Algebra	5	3	50	50	100	4
26UCMA62	III	Core - XV	Complex Analysis	5	3	50	50	100	4
26UCMA63	III	Core - XVI	Mechanics	5	3	50	50	100	4
26UCMA64		Core – XVII	Project	5	3	50	50	100	5
26UEMA61	III	Elective- VII	Operations Research-II	4	3	50	50	100	3
26UEMA62			Graph Theory						
26UEMA63		Elective- VIII	Financial Mathematics	4	3	50	50	100	3
26UEMA64			Astronomy						
26UAEC61	V	AEC - II	Design Thinking	2	3	50	50	100	2
26U5EA61	V	Common	Extension Activity	-				100	1
Total				**30**				**800**	**26**
Grand Total				**180**				**4800**	**144**

THIRD YEAR – SEMESTER VI

CORE XIV – LINEAR ALGEBRA

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA61	**5**	0	0	VI	**4**	**5**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand vector spaces, subspaces, and their fundamental properties.
LO2	Analyze linear independence, span, basis, and dimension of vector spaces.
LO3	Study linear transformations and their matrix representations, including rank–nullity concepts.
LO4	Apply inner product spaces, orthogonality, and Gram–Schmidt process in problem solving.
LO5	Compute eigenvalues, eigenvectors, and reduce quadratic forms to diagonal form.

Prerequisites:

Unit	Contents	No. of Hours
I	Vector Spaces: Definition and examples– Subspaces– Linear Transformations– Fundamental theorem of homomorphism. (Chapter 5: Sections - 5.1 to 5.3)	**15**
II	Span of a set– Linear Dependence and Independence– Basis and Dimension. (Chapter 5: Sections - 5.4 to 5.6)	**15**
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)	**15**
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)	**15**
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)	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Acquire detailed knowledge of vector spaces and subspaces.
CO2	Explain the concepts of linear dependence, linear independence, basis, and dimension of a vector space.
CO3	Explain linear transformations and their matrix representation, understand inner product spaces and norms, and apply the Gram–Schmidt orthogonalization process.
CO4	Apply elementary transformations to find the rank of a matrix and solve systems of simultaneous linear equations.

CO5	Find eigenvalues and eigenvectors and understand quadratic forms.
Textbooks	
➢	S. Arumugam and A. Thangapandi Isaac, Modern Algebra, Scitech Publications, 2014.
Reference Books	
1.	I. N. Herstein, Topics in Algebra, Wiley Eastern Ltd. Second Edition, 2006.
2.	John B.Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
3.	N. S. Gopala krishnan, University Algebra, New Age International Publications, Wiley Eastern Ltd.
4.	Joseph A Gallian, Contemporary Abstract Algebra, 4thEdition, Narosa, 1999.

CO/PO/PSO	**Pos**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**1**
CO3	**3**	**3**	**2**	**3**	**1**	**2**	**3**	**3**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**1**
CO5	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**1**
Weightage of course contributed to each PSO	**15**	**15**	**13**	**15**	**8**	**10**	**15**	**15**	**5**

CORE XV– COMPLEX ANALYSIS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA62	**5**	**0**	0	VI	**4**	**5**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand analytic functions, limits, continuity, and differentiability of complex functions.
LO2	Analyze conformal mappings, bilinear transformations, and their properties
LO3	Apply Cauchy's theorem, integral formula, and related results in complex integration
LO4	Expand functions using Taylor and Laurent series and study convergence of complex series
LO5	Evaluate integrals using residue theorem and determine singularities and residues

Prerequisites:

Unit	Contents	No. of Hours
I	Functions of a Complex variable –Limits –Theorem on limits – Continuity – Differentiability– Cauchy Riemann equations – Polar coordinates– Analytic functions– Harmonic functions-Conformal Mapping.(Chapter2:Sections - 2.1 to 2.9)	**15**
II	Elementary Transformation – Bilinear Transformation – Cross Ratio – Fixed Points. (Chapter 3:Sections –3.1 to 3.4)	**15**
III	Complex Integration: Definite Integral – Cauchy' s Theorem– Cauchy integral formula – Higher Derivatives. (Chapter 6: Sections - 6.1 to 6.4)	**15**
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)	**15**
V	Residues– Cauchy Residue theorem –Residue at infinity– Evaluation of Definite Integrals. (Chapter 8:Sections -8.1 to 8.3)	**15**
	TOTAL	**75**

CO	**Course Outcomes**
CO1	Explain analytic functions, their continuity and differentiability, and verify harmonic functions using analyticity conditions.
CO2	Explain conformal mappings and linear transformations, and determine fixed points of transformations
CO3	Explain integration of complex functions over simply and multiply connected domains, and derive Cauchy's Integral Formula, Liouville's Theorem, the Fundamental Theorem of Algebra, and the Maximum Modulus Principle.
CO4	Analyze convergence of sequences and series and derive Taylor and Laurent series expansions.
CO5	Determine zeros of analytic functions, compute residues at singular points, and evaluate definite integrals using residue theory

Textbooks	
➢	Arumugam, S., Thangapandi Isaac, A., & Soma sundaram, A. (2014). *Complex Analysis*. SciTech Publications
Reference Books	
1.	Brown, J. W., & Churchill, R. V. (2009). *Complex Variables and Applications* (7th ed.). McGraw-Hill International Edition
2.	Gamelin, T. W. (2008). *Complex Analysis*. Springer-Verlag.
3.	Bak, J., & Newman, D. J. (1997). *Complex Analysis* (2nd ed.). Undergraduate Texts in Mathematics. Springer-Verlag, New York
4.	Silverman, R. A. (1972). *Introductory Complex Analysis*. Dover Publications
5.	Ponnusamy, S., & Silverman, H. (2006). *Complex Variables with Applications*. Birkhäuser.

CO/PO/PSO	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	1	2	3	2	3	1	1	2	3
CO2	3	3	3	2	1	1	3	3	2
CO3	3	3	3	2	1	1	3	3	2
CO4	3	3	3	2	1	1	3	3	2
CO5	3	3	3	2	1	1	3	3	2
Weightage of course contributed to each PSO	13	14	15	10	7	5	13	14	11

CORE XVI– MECHANICS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA63	**5**	0	0	VI	**4**	**5**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand Newton's laws, equilibrium, rigid body mechanics, and work–energy principles.
LO2	Analyze projectile motion, simple harmonic motion, and orbital motion.
LO3	Analyze work, energy, power, and simple harmonic motion in mechanical systems.
LO4	Study projectile motion and solve problems involving motion under gravity
LO5	Understand central force motion and orbital motion using physical laws

Prerequisites:

Unit	Contents	No. of Hours
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.	**15**
II	Forces on a Rigid Body: Moment of a Force – General motion of a body – Equivalent systems of forces- Parallel Forces –Reduction of coplanar forces into a force and couple – Problems involving frictional forces	**15**
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	**15**
IV	Projectiles: Forces on a projectile–Projectile projected on an inclined plane.	**15**
V	Central Orbits: General orbits–Central orbit	**15**
	TOTAL	**75**

CO	**Course Outcomes**
CO1	Explain resultant force, force components, coplanar force systems, like and unlike parallel forces, particle equilibrium, and limiting equilibrium on an inclined surface.
CO2	Describe the moment of a force and a couple with suitable examples, explain parallel force systems and forces acting on a triangular body, and solve numerical problems involving friction.
CO3	Explain the concepts of work, energy, and power, analyze rectilinear motion under variable forces, and describe Simple Harmonic Motion with its geometric interpretation.
CO4	Describe projectile motion, impulse, collision, and the laws of impact; demonstrate that a projectile follows a parabolic path, and solve problems involving direct and oblique impacts of smooth elastic spheres
CO5	Explain central force motion, describe conic sections as central orbits, and work out related central-orbit problems

Textbooks

➢	Duraipandian, P., Duraipandian, L., & Jayapragasam, M. (2007). *Mechanics*. S. Chand & Company Ltd
Reference Books	
1.	Ruina, A., & Pratap, R. (2014). *Introduction to Statics and Dynamics*. Oxford University Press.
2.	Loney, S. L. (1904). *The Elements of Statics and Dynamics*. Cambridge University Press.
3.	Meriam, J. L., Kraige, L. G., & Bolton, J. N. (2015). *Engineering Mechanics: Dynamics* (8th ed.). Wiley & Sons Pvt. Ltd., New York
4.	Silverman, R. A. (1972). *Introductory Complex Analysis*. Dover Publications
5.	Dhiman, A. K., Dhinam, P., & Kulshreshtha, D. (2015). *Engineering Mechanics(Statics and Dynamics)*. McGraw Hill Education (India) Private Limited, New Delhi.

CO/PO/PSO	**POs**						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO3	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
CO5	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**10**	**15**	**10**	**5**	**5**	**15**	**15**	**10**

CORE XVII - PROJECT WITH VIVA-VOCE

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCMA64	**0**	0	5	VI	**5**	**5**	**50**	**50**	**100**
Learning Objectives									
Encourage students to gain an in-depth understanding of a particular topic and develop an orientation toward 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.

ELECTIVE VIII–OPERATIONS RESEARCH-II

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA61	**4**	0	0	VI	**3**	**4**	**50**	**50**	**100**

Learning Objectives

LO1	Apply operations research techniques including scheduling, CPM/PERT, and game theory.
LO2	Analyze queuing and inventory models for decision-making and optimization.
LO3	Apply game theory concepts to solve two-person zero-sum games.
LO4	Analyze queuing models and evaluate system performance measures
LO5	Apply inventory models to determine optimal ordering and cost minimization

Prerequisites:

Unit	Contents	No. of Hours
I	Operations Scheduling: Problem of Sequencing –Basic in Sequencing – Gantt Chart –Single Processor Scheduling-SPT, DD and Moore procedure – Flow Shop Scheduling – Two-machine, Three Machine and k-Machine – Processing of Two jobs through m machines. (Chapter 10: Sections - 10.1 to 10.8)	**12**
II	Scheduling Techniques: Basic components of Network – Logical Sequencing – Rules of Network construction – Network Scheduling– CPM – PERT. (Chapter 13: Sections - 13.1 to 13.10)	**12**
III	Decision 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 × 2Games–Dominance Property-Games against Passivity-Limitations and Extensions(Chapter 19: Sections - 19.10, 19.11)	**12**
IV	Queuing Theory: Queuing system – Deterministic, Characteristic and Probability Distributions in Queuing system – Classification Queuing models – Probabilistic Queuing models – Poisson-Exponential Models–$(M/M/1) : (N/FCFS)$ (Chapter 20: Sections -20.1 to 20.8)	**12**
V	Inventory Management: Types of Inventory–Inventory Decisions– Costs associated with Inventories – EOQ Models – EOQ and Quantity discount – EOQ and price breaks. (Chapter 22: Sections - 22.1, 22.3, 22.5, 22.8 to 22.11)	**12**
TOTAL		**60**

CO	Course Outcomes
CO1	Understand sequencing problems and solve job–machine scheduling problems
CO2	Develop network schedules using PERT/CPM and explain the rules of network construction.
CO3	Interpret games and strategies and solve two-person zero-sum games using mixed strategies and the dominance principle.
CO4	Explain and classify queuing models, such as (M/M/1): (N/FCFS)and (M/M/1):(∞/FCFS).
CO5	Analyze and solve inventory control problems.
Textbooks	
➢	Swarup, K., Gupta, P. K., & Mohan, M. (2022). *Operations Research* (20th Revised ed.). Sultan Chand & Sons, New Delhi.
Reference Books	
1.	Gupta, P. K., & Hira, D. S. (2020). *Operations Research*. Sultan Chand & Sons,New Delhi.
2.	Gupta, P. K., & Mohan, M. (2014). *Problems in Operations Research* (9th ed.). Sultan Chand & Sons, New Delhi
3.	Kalavathy, S. (2012). *Operations Research* (4th ed.).Vikas Publishing House, Chennai.

CO/PO/PSO	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	3	2	3	3	2	1	3	3	3
CO2	3	2	3	3	2	1	3	3	3
CO3	3	2	3	3	2	1	3	3	3
CO4	3	2	3	3	2	1	3	3	3
CO5	3	2	3	3	2	1	3	3	3
Weightage of course contributed to each PSO	15	10	15	15	10	5	15	15	15

ELECTIVE COURSE VIII –GRAPH THEORY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA62	**4**	0	0	VI	**3**	**4**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand basic graph theory concepts including graphs, paths, circuits, trees, connectivity, and Euler/Hamiltonian properties.
LO2	Apply graph representations, coloring, matchings, planar graphs, and related problems such as the Four Color Problem.
LO3	Represent graphs using matrices like adjacency and incidence matrices.S
LO4	Study planar graphs and determine chromatic number and coloring properties.
LO5	Apply graph theory concepts to matchings, coverings, and digraphs.

Prerequisites:

Unit	Contents	No. of Hours
I	Introduction – Application of Graphs – Finite and Infinite graphs – Incidence and degree – Isolated vertex, Pendent vertex and Null graph – Isomorphism – Subgraphs – Walks, Paths and Circuits – Connected Graphs – Disconnected Graphs and Components. (Chapter 1:Sections - 1.1 to 1.5 and Chapter 2: Sections 2.1, 2.2, 2.4, 2.5)	**12**
II	Euler graphs –Operations on Graphs – More on Euler graphs – Hamiltonian Paths and Circuits – Trees – Some properties on Trees – Pendent vertices in a Tree – Distance and Centers in a Tree (Chapter 2:Sections - 2.6 to2.9 and Chapter 3:Sections -3.1 to3.4,)	**12**
III	Incidence Matrix – Circuit Matrix – Fundamental Circuit Matrix and Rank of B – Path Matrix – Adjacency Matrix. (Chapter 7:Sections - 7.1, 7.3, 7.4, 7.8, 7.9)	**12**
IV	Planar Graphs – Kuratowski's Two Graphs – Euler's formula – Chromatic Number – Chromatic Partitioning – Chromatic Polynomial. (Chapter 5:Sections - 5.2 to 5.4 and Chapter 8: Sections - 8.1to8.3)	**12**
V	Matchings – Coverings – Four Color Problem – Definition – Some types of Digraphs – Directed Paths and Connectedness – Euler Digraphs. (Chapter 8:Sections - 8.4 to 8.6; Chapter 9: Sections - 9.1, 9.2, 9.4, 9.5)	**12**
TOTAL		**60**

CO	Course Outcomes
CO1	Understand the concepts of graphs, subgraphs, walks, paths, cycles, connected and disconnected graphs.
CO2	Explain Eulerian graphs, Hamiltonian paths, and properties of trees.
CO3	Represent graphs using matrix representations such as incidence and adjacency matrices.
CO4	Understand planar graphs and determine the chromatic number and chromatic polynomial of a graph.

CO5	Explain matchings and describe directed graphs and Euler digraphs.
Textbooks	
1	Deo, N. (1974). *Graph Theory with Applications to Engineering and Computer Science*. Prentice Hall of India, New Delhi.
Reference Books	
1	Harary, F. (2001). *Graph Theory*. Narosa Publishing House Pvt. Ltd., New Delhi.
2	Arumugam, S., & Ramachandran, S. (2001). *Invitation to Graph Theory*. SciTech Publications, Chennai.
3	Rajagopalan, S. P., & Sattanathan, R. (Year not specified). *Graph Theory*. Margham Publications, Chennai.
4	Pant, N., & Faruqi, S. (2017). *Graph Theory*. CBS Publishers.

CO/PO/PSO	**Pos**						**PSOs**		
	3	**2**	**3**	**2**	**2**	**1**	**3**	**3**	**2**
CO1	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**3**	**2**
CO3	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**3**	**2**
CO5	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**10**	**15**	**10**	**10**	**5**	**15**	**15**	**10**

ELECTIVE COURSE IX –FINANCIAL MATHEMATICS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA63	**4**	0	0	VI	**3**	**4**	50	50	**100**

Learning Objectives	
LO1	Understand investments, financial instruments, risk–return, CAPM, and financial ratios.
LO2	Analyze life insurance, annuities, and property & casualty insurance models.
LO3	Evaluate risk and return using financial models like CAPM.
LO4	Apply actuarial concepts in life annuities and insurance models.
LO5	Understand property and casualty insurance and their mathematical modeling

Prerequisites:

Unit	Contents	No. of Hours
I	Mathematics of Investment: Stocks – Bonds – Mutual funds. (Chapter 5: Section- 1- 1.1 to 1.6, Section 2- 2.1 to 2.6 and Section 3 - 3.1 to 3.4)	**12**
II	Mathematics of Investment: Options –Cost of Capital and Ratio. (Chapter 5: Section- 4: 4.1 to 4.4 and section 5: 5.1 to 5.3)	**12**
III	Mathematics of Return and Risk: Measuring Return and Risk – The Capital Asset Pricing Model. (Chapter 6: Section-1: 1.1 to 1.5 and section-2: 2.1 to 2.4)	**12**
IV	Mathematics of Insurance: Life Annuities – Life Insurance. (Chapter 7:Sections - 1, 2.1 to 2.8)	**12**
V	Mathematics of Insurance: Life Insurance – Property and Casualty Insurance. (Chapter 7: Sections - 2.9 to 2.14, 3)	**12**
TOTAL		**60**

CO	**Course Outcomes**
CO1	Understand the concepts of stocks, bonds, and mutual funds.
CO2	Understand options, cost of capital, and financial ratios.
CO3	Measure and analyze the return and risk of investments.
CO4	Understand the principles of life annuities and life insurance.
CO5	Explain property and casualty insurance concepts.

Textbooks

1. Alhabeeb, M. J. (2012). *Mathematical Finance*. John Wiley & Sons, Inc.

Reference Books

1. Gupta, S. P., & Jain, S. K. (2022). *Financial Mathematics*. Sahitya Bhawan Publications.
2. Jaiswal, B., & Shimpi, L. S. (2020). *Financial Mathematics*. New Royal Book Company.
3. Capinski, M., & Zastawniak, T. (2010). *Mathematics for Finance: An Introduction to Financial Engineering*. Springer.

CO/PO/PSO	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	3	2	3	2	2	1	3	3	2
CO2	3	2	3	2	2	1	3	3	2
CO3	3	2	3	2	2	1	3	3	2
CO4	3	2	3	2	2	1	3	3	2
CO5	3	2	3	2	2	1	3	3	2
Weightage of course contributed to each PSO	15	10	15	10	10	5	15	15	10

ELECTIVE COURSE IX – ASTRONOMY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEMA64	**4**	0	0	VI	**3**	**4**	**50**	**50**	**100**

Learning Objectives	
LO1	Understand spherical triangles and apply fundamental formulas to solve right spherical triangles and navigation problems and conversion between coordinate systems.
LO2	Analyze astronomical phenomena such as refraction, twilight, atmospheric extinction, and length of day and determine distances of planets and stars.
LO3	Apply Kepler's laws, anomalies, and Newton's law of gravitation to study orbital motion and orbital elements.
LO4	Determine distances using parallax methods in astronomy.
LO5	Apply Kepler's laws and Newton's law to study planetary motion.

Prerequisites:

Unit	Contents	No. of Hours
I	Spherical Trigonometry: Spherical Triangle – Fundamental Formula of Spherical Trigonometry – Sine Formula – Cosine Formula – Four Parts Formula – Napier's Formula (without proof) – Simple Problems, Solution of Right Spherical Triangles – Applications in Navigation	**12**
II	The Celestial Sphere**:** Celestial Coordinates – Diurnal Motion – Rising and Setting of a Star – Sidereal Time – Circumpolar Stars – Morning and Evening Stars, Conversion between Different Coordinate Systems – Equation of Time	**12**
III	Earth: Length of a Day – Refraction – Tangent Formula – Cassini's Formula – Effects of Refraction, Twilight – Atmospheric Extinction	**12**
IV	Geocentric Parallax – Effects – Heliocentric Parallax – Effects, Determination of Distance of Planets – Stellar Parallax	**12**
V	Kepler's Laws – Verification of Kepler's Laws – True Anomaly – Mean Anomaly – Eccentric Anomaly – Relation between them, Newton's Law of Gravitation – Orbital Elements	**12**
TOTAL		**60**

CO	Course Outcomes
CO1	Explain celestial coordinate systems and planetary motion using mathematical principles.
CO2	Describe the structure and dynamics of the solar system.
CO3	Classify stars and explain stellar evolution concepts.
CO4	Analyse galaxy structures and cosmological theories of the universe.
CO5	Understand space exploration technologies and their applications.

Textbooks

1. Kumaravelu, S., & Susheela Kumaravelu, (2005). *Astronomy for Degree Classes*. Rainbow Printers, Nagercoil.

Reference Books

1. Ramachandran, G. V. (1965). *Astronomy*. Mission Press, Palayamkottai.
2. Fraknoi, A., Morrison, D., & Wolff, S. C. (2012). *Introduction to Astronomy*. Open Stax.

CO/PO/PSO	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	3	2	3	2	2	1	3	3	2
CO2	3	2	3	2	2	1	3	3	2
CO3	3	2	3	2	2	1	3	3	2
CO4	3	2	3	2	2	1	3	3	2
CO5	3	2	3	2	2	1	3	3	2
Weightage of course contributed to each PSO	15	10	15	10	10	5	15	15	10

ABILITY ENHANCEMENT COURSE II – DESIGN THINKING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UAEC 61	**2**	0	0	VI	**2**	**2**	**50**	**50**	**100**

Learning Objectives	
LO1	To recall and describe the key concepts, stages, and principles of Design Thinking.
LO2	To explain the importance of empathy, ideation, and prototyping in solving user-entered problems.
LO3	To apply Design Thinking methods such as brainstorming, empathy mapping, and SCAMPER to real-world problems.
LO4	To analyze user needs and problem statements using observation and structured frameworks.
LO5	To design innovative solutions and develop prototypes based on insights gained through the Design Thinking process.

Prerequisites:

Unit	Contents	No. of Hours
I	**Introduction to Design Thinking** Introduction to Design Thinking, Essential Design Thinking Skills, Core Principles of Design Thinking, Foundations of Design Thinking, Building an Effective Design Thinking Team, Discussion of Problems from IT sector.	**6**
II	**Design Thinking Phases** Stages of Design Thinking, Role of observation in understanding product and process challenges, Preparation of AEIOU and other canvases with defined problem statement, Exploring Design Thinking innovations, Understanding the Role of Design Thinking in Product and Process Innovation, Double Diamond model and its applications.	**6**
III	**Design Thinking Techniques** Understanding, listening and Empathizing Techniques, Exploring observation methods, Utilizing a structured, open-ended approach for effective communication, Ideation Labs, Brainstorming techniques for idea generation, Applying innovation to foster creativity, Application of SCAMPER technique to support Problem Statement	**6**
IV	**Prototyping Methods** Methods and Tools for Design Thinking Practice; Empathize: Ask five why questions, Empathy map, storytelling, critical items diagram, mind map, journey map; Ideate: Brainstorming, 2x2 matrix, Need-Approach-Benefit-Competition (NABC) Methods; Prototype: Exploration map, Minimum	**6**

	Viable Product (MVP), Feasibility Testing, Viability Testing, A/B Testing, Sustainability Verification, Collect Feedback, Iterate and Improve, PDC canvas versioning	
V	**Case Studies** Quick-Commerce Applications – Food and Grocery Delivery (eg. Swiggy, Instamart), Uber, OLA, Rapido, E-Commerce Applications – Online Shopping (eg. Amazon), Online Publishing (eg. Canva), Online Ticket Booking (eg. BookMyShow), Fintech apps (eg. Google Pay, Razorpay etc.)	**6**
TOTAL		**30**

CO	**Course Outcomes**
CO1	Understand the fundamental principles and importance of Design Thinking in fostering innovation, ethics and its relevance.
CO2	Apply systematic problem identification, problem framing, articulation, and problem-solving approaches in the context of Design Thinking
CO3	Analyze and evaluate different tools and methodologies used in Design Thinking, such as observation, ethnographic research and mind mapping to gain insights into users' needs
CO4	Develop and refine product concepts by preparing product development canvases (PDC) that consider product experience, functions, features, and sustainable development of the components
CO5	Create a final working prototype for projects with limitations, documenting the functionality and features, viability, sustainability, scalability, cost and resource utilization for the product

Open-source software and websites	
➢	Google Workspace: Docs, Sheets and Slides
➢	Google Jamboard
➢	Mind-mapping tools: Wisemapping, Freeplane, Semantik

Reference Books	
➢	Soni, Pavan. Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving. Penguin Random House India Private Limited, 2020
➢	Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins e-books (2009)
➢	Liedtka, Jeanne, Randy Salzman, and Daisy Azer. Design thinking for the greater good: Innovation in the social sector. Columbia University Press, 2019

Suggested MOOC Courses

➢	B. K. Chakravarthy, Design Technology and Innovation, SWAYAM NPTEL (Online)
➢	B. K. Chakravarthy, Innovation by Design, SWAYAM NPTEL (Online)
➢	Nina Sabnani, Understanding Design, SWAYAM NPTEL (Online)
Note: Activities are to be performed in a team size of 3-4 students. Report is to be prepared based on these activities	
➢	Brainstorm and explore various problems in IT field. Select an appropriate problem, draft a Problem Statement and get it approved for performing further activities.
➢	Design AEIOU canvas
➢	Design Empathy map

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	3
CO2	3	2	2	2	3	2
CO3	3	3	3	3	2	2
CO4	3	2	2	2	2	3
CO5	3	3	2	2	3	2
Weightage of course contributed to each PSO	15	12	11	11	12	12