

DEPARTMENT OF MATHEMATICS

COURSE STRUCTURE & SYLLABI (For the students admitted from year 2023-2024 onwards)

Programme : B.Sc. Mathematics



JAMAL MOHAMED COLLEGE (AUTONOMOUS)
Accredited with A++ Grade by NAAC (4th Cycle) with CGPA 3.69 out of 4.0
(Affiliated to Bharathidasan University)
TIRUCHIRAPPALLI – 620 020

B.SC. MATHEMATICS

Sem	Course Code	Part	Course Category	Course Title	Ins. Hrs/ Week	Credit	Marks		Total
							CIA	ESE	
I	23U1LT1/LA1/LF1 /LH1/LU1	I	Language - I		6	3	25	75	100
	23UCN1LE1	II	English - I	English for Communication - I	6	3	25	75	100
	23UMA1CC1	III	Core - I	Calculus with SageMath	5	5	25	75	100
	23UMA1CC2		Core - II	Analytical Geometry with Geogebra	3	3	25	75	100
	23UPH1AC1		Allied - I	Fundamentals of Physics	5	4	25	75	100
	23UPH1AC2P		Allied - II	Properties of Matter - Practical	3	2	20	80	100
	23UCN1AE1	IV	AECC - I	Value Education	2	2	-	100	100
	Total				30	22			700
II	23U2LT2/LA2/LF2 /LH2/LU2	I	Language - II		6	3	25	75	100
	23UCN2LE2	II	English - II	English for Communication - II	6	3	25	75	100
	23UMA2CC3P	III	Core - III	Python Programming - Practical	5	5	20	80	100
	23UMA2CC4		Core - IV	Classical algebra with MATLAB	4	4	25	75	100
	23UPH2AC3		Allied - III	Essentials of Physics	4	4	25	75	100
	23UPH2AC4P		Allied - IV	Optical, Thermal and Electricity - Practical	3	2	20	80	100
	23UCN2SS	IV	Soft Skills Development	Soft Skills Development	2	2	-	100	100
	23UCN2CO	V	Community Outreach	JAMCROP	-	@	-	-	@
	23U2BT1 / 23U2AT1		Basic Tamil - I / Advanced Tamil - I	எழுத்தும் இலக்கியமும் அறிமுகம் - I / தமிழ் இலக்கியமும் வரலாறும் - I	-	-	-	100 #	-
	@Only grades will be given Total				30	23			700
III	23U3LT3/LA3/LF3 /LH3/LU3	I	Language - III		6	3	25	75	100
	23UCN3LE3	II	English - III	English for Communication - III	6	3	25	75	100
	23UMA3CC5	III	Core - V	ODE and Laplace Transform with Scilab	4	4	25	75	100
	23UMA3CC6		Core – VI	Vector Calculus and Trigonometry with Scilab	3	3	25	75	100
	23UMA3AC5:1		Allied - V	Mathematical Statistics - I with R	4	4	25	75	100
	23UMA3AC6:1		Allied - VI	Mathematical Statistics - II with R	3	2	25	75	100
	23UMA3GE1	IV	Generic Elective - I		2	2	-	100	100
	23UCN3AE2		AECC - II	Environmental Studies	2	2	-	100	100
	Total				30	23			800
IV	23U4LT4/LA4/LF4 /LH4/LU4	I	Language - IV		6	3	25	75	100
	23UCN4LE4	II	English - IV	English for Communication - IV	6	3	25	75	100
	23UMA4CC7	III	Core - VII	Advanced Calculus	5	5	25	75	100
	23UMA4CC8		Core - VIII	PDE and Fourier series with Maple	3	3	25	75	100
	23UMA4AC7:1		Allied - VII	Statistics for Data Science with R	4	4	25	75	100
	23UMA4AC8P:1		Allied - VIII	Statistical lab using SPSS - Practical	4	2	20	80	100
	23UMA4GE2	IV	Generic Elective - II		2	2	-	100	100
	23UCN4EL		Experiential Learning	Field Visit / Case Study / Survey	-	2	-	100	100
	23UCN4EA	V	Extension Activities	NCC, NSS, etc.	-	1	-	-	-
23U4BT2 / 23U4AT2		Basic Tamil - II / Advanced Tamil - II	எழுத்தும் இலக்கியமும் அறிமுகம் - II / தமிழ் இலக்கியமும் வரலாறும் - II	-	-	-	100 #	-	
	Total				30	25			800
V	23UMA5CC9	III	Core - IX	Mechanics	6	6	25	75	100
	23UMA5CC10		Core - X	Modern Algebra	5	5	25	75	100
	23UMA5CC11		Core - XI	Real Analysis	5	5	25	75	100
	23UMA5CC12		Core - XII	Numerical Methods with Mathematica	5	5	25	75	100
	23UMA5DE1A/B	IV	Discipline Specific Elective - I		5	4	25	75	100
	23UMA5SE1P		Skill Enhancement Course - I	Latex - Practical	2	1	-	100	100
	23UMA5SE2P		Skill Enhancement Course - II	App Development - Practical	2	1	-	100	100
	23UMA5EC1	V	Extra Credit Course - I*	Online Course	-	*	-	-	-
	Total				30	27			700
VI	23UMA6CC13	III	Core - XIII	Linear Algebra	6	6	25	75	100
	23UMA6CC14		Core - XIV	Complex Analysis	6	6	25	75	100
	23UMA6CC15		Core - XV	Number Theory	5	5	25	75	100
	23UMA6PW		Project Work	Group Project	3	2	-	100	100
	23UMA6DE2A/B		Discipline Specific Elective - II		5	4	25	75	100
	23UMA6DE3A/B		Discipline Specific Elective - III		4	4	25	75	100
	23UCN6AE3	IV	AECC - III	Gender Studies	1	1	-	100	100
	23UMA6EC2	V	Extra Credit Course - II*	Online Course	-	*	-	-	-
	23UMA6ECA		Extra Credit Course for all**	Online Course	-	**	-	-	-
	23UCN6ECA1		Extra Credit Course for all*	Entrepreneurship Development	-	+	-	-	-
	* Programme Specific Online Course for Advanced Learners ** Any Online Course for Enhancing Additional Skills + Course for Enhancing Entrepreneurial Skills Total				30	28			700
Grand Total						148			4400

GENERIC ELECTIVE COURSES

Semester	Course Code	Course Title
III	23UMA3GE1	Mathematics for Competitive Examination - I
IV	23UMA4GE2	Mathematics for Competitive Examination - II

Self-Study Course – Basic and Advanced Tamil

(Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

Semester	Course Code	Course Title
II	23U2BT1	Basic Tamil – I (எழுத்தும் இலக்கியமும் அறிமுகம் - I)
	23U2AT1	Advanced Tamil – I (தமிழ் இலக்கியமும் வரலாறும் - I)
IV	23U4BT2	Basic Tamil – II (எழுத்தும் இலக்கியமும் அறிமுகம் - II)
	23U4AT2	Advanced Tamil – II (தமிழ் இலக்கியமும் வரலாறும் - II)

Mandatory

Basic Tamil Course - I and II are offered for the students who have not studied Tamil Language in their schools and college.

Advanced Tamil Course - I and II are offered for those who have studied Tamil Language in their schools but have opted for other languages under Part - I.

DISCIPLINE SPECIFIC ELECTIVES

Semester	Course Code	Course Title
V	23UMA5DE1A	Graph Theory
	23UMA5DE1B	Control Theory
VI	23UMA6DE2A	Operations Research
	23UMA6DE2B	Discrete Mathematics
	23UMA6DE3A	Astronomy
	23UMA6DE3B	Vedic Mathematics

ALLIED MATHEMATICS FOR B.Sc. COMPUTER SCIENCE

Sem	Course Code	Part	Course	Course Title	Ins. Hrs/ Week	Credit	Marks		Total
							CIA	ESE	
I	23UMA1AC1	III	Allied - I	Linear Algebra and Differential Equations	4	3	25	75	100
	23UMA1AC2		Allied - II	Numerical Methods with Octave	4	3	25	75	100
			Total		8	6			200
II	23UMA2AC3	III	Allied - III	Operations Research	4	3	25	75	100
	23UMA2AC4		Allied - IV	Statistics	3	3	25	75	100
			Total		7	6			200
			Grand Total			12			400

ALLIED MATHEMATICS FOR B.Sc. PHYSICS

Sem	Course Code	Part	Course	Course Title	Ins. Hrs/ Week	Credit	Marks		Total
							CIA	ESE	
III	23UMA3AC5:2	III	Allied - V	Calculus	4	3	25	75	100
	23UMA3AC6:2		Allied - VI	Algebra and Trigonometry	3	3	25	75	100
			Total		7	6			200
IV	23UMA4AC7:2	III	Allied - VII	Differential Equations	4	3	25	75	100
	23UMA4AC8:2		Allied - VIII	Vector Calculus and Fourier series	4	3	25	75	100
			Total		8	6			200
			Grand Total			12			400

ALLIED MATHEMATICS FOR B.Sc. CHEMISTRY

Sem	Course Code	Part	Course	Course Title	Ins. Hrs/ Week	Credit	Marks		Total
							CIA	ESE	
III	23UMA3AC5:3	III	Allied - V	Calculus	4	3	25	75	100
	23UMA3AC6:3		Allied - VI	Algebra and Trigonometry	3	3	25	75	100
	Total				7	6			200
IV	23UMA4AC7:3	III	Allied - VII	Differential Equations	4	3	25	75	100
	23UMA4AC8:3		Allied - VIII	Statistics and Vector Calculus	4	3	25	75	100
	Total				8	6			200
Grand Total						12			400

ALLIED MATHEMATICS FOR B.Sc. ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Sem	Course Code	Course Category	Course Title	Ins. Hrs/ Week	Credit	Marks		Total
						CIA	ESE	
I	24UMA1AC1:4	Allied - I	Calculus	4	3	25	75	100
	24UMA1AC2:4	Allied - II	Linear Algebra	4	3	25	75	100
	Total			7	6			200
II	24UMA2AC3:4	Allied - III	Discrete Mathematics	4	4	25	75	100
	24UMA2AC4:4	Allied - IV	Statistics and Numerical Methods	3	3	25	75	100
	Total			8	6			200
Grand Total					12			400

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UMA1CC1	CORE - I	5	5	25	75	100
Course Title Calculus with SageMath							

SYLLABUS		
Unit	Contents	Hours
I	Successive Differentiation: The nth derivatives of Standard result - Trigonometrical transformation of functions - * Formation of equations involving derivatives * - Leibnitz formula for the nth derivative of a product - Related problems.	15
II	*Homogeneous functions* - Partial derivatives of a function of two functions - Maxima and Minima of function of two variables - Lagrange's Method of undetermined Multipliers.	15
III	Curvature: Circle, Radius and Centre of Curvature - Cartesian Formula for the Radius of Curvature - Coordinates of the Centre of Curvature.	15
IV	Evolute and Involute - Radius of Curvature when the curve is given in Polar Co-ordinates. Multiple Integrals – Evaluation - Illustrative Examples.	15
V	Double Integrals in Polar coordinates - Change the order of Integration - Triple Integrals – Examples.	15
VI	Current Trends (For CIA only) – Contemporary developments related to calculus during the semester concerned.	

..... Self Study

Text Books:			
1. T.B-1 T.K.Manicavachagom Pillay and Others, Calculus Volume-I, S. Viswanathan Publishers Pvt. Ltd. (2019).			
2. T.B-2 T.K.Manicavachagom Pillay and Others, Calculus Volume-II, S. Viswanathan Publishers Pvt. Ltd. (2019).			
UNIT I	Chapter III	Sections 1, 2	T.B- 1
UNIT II	Chapter VIII	Sections 1.6, 1.7, 4, 5	T.B- 1
UNIT III	Chapter X	Sections 2.1 – 2.4	T.B- 1
UNIT IV	Chapter X	Sections 2.5, 2.6	T.B- 1
	Chapter V	Sections 1,2	T.B- 2
UNIT V	Chapter V	Sections 3, 4	T.B-2
Reference Books:			
1. S. Arumugam and A. Thangapandi Isaac, Calculus, New Gamma Publishing House (2008).			
2. Devi Prasad, Advanced Calculus, Prentice Hall of India Learning Pvt. Ltd. (2009).			
Web Resources:			
1. https://www.youtube.com/watch?v=KijGLjxKlsY			
2. https://www.analyzemath.com/calculus/multivariable/maxima_minima.html			
3. https://www.youtube.com/watch?v=Cb2E0bznd-w			
4. https://www.youtube.com/watch?v=Cb2E0bznd-w			

➤ **Digital Demonstration using SageMath**

1. Find n^{th} derivative using SageMath.

<https://ask.sagemath.org/question/30330/derivative-of-order-varm-returns-0/>

2. Find maxima and minima using SageMath.

https://doc.sagemath.org/html/en/reference/functions/sage/functions/min_max.html

3. Find radius of curvature using SageMath.

https://doc.sagemath.org/html/en/reference/riemannian_geometry/sage/geometry/riemannian_manifolds/parametrized_surface3d.html

5. Evaluate multiple integral using SageMath.

<https://ask.sagemath.org/question/7636/double-integral/>

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	remember the fundamental concepts of Differentiation, integration, curvature and evolute	K1
CO2	understand and translate integrals of physical problems	K2
CO3	apply and solve physical problems using evolute and involute	K3
CO4	analyse different types curves using radius of curvature	K4
CO5	evaluate physical problems using multiple integrals	K5

Relationship Matrix: -

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	1	3	1	3	1	2	1	2.1
CO2	3	3	3	1	3	1	3	3	2	1	2.3
CO3	3	2	3	2	3	1	3	3	2	1	2.3
CO4	3	3	3	2	3	1	2	3	2	1	2.3
CO5	3	3	3	1	3	1	3	2	2	1	2.2
Mean Overall Score											2.24
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators: -

Dr. M. Mohammed Jabarulla

Mrs. A. Thagasin Banu

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UMA1CC2	CORE - II	3	3	25	75	100
Course Title Analytical Geometry with Geogebra							

SYLLABUS		
Unit	Contents	Hours
I	Direction cosines- Direction ratios- General equation of the plane- Intercept form- *Normal form*- Angle between two planes.	9
II	Length of the perpendicular- Equation of the planes bisecting the angle between two planes- Straight line as the intersection of two planes - Symmetrical form.	9
III	Equation of a straight line passing through two given points- Condition for a line to be parallel to a plane – Coplanar lines – Shortest distance between two skew lines.	9
IV	Equation of a sphere - Finding centre and radius – Length of the tangent plane to a sphere.	9
V	Equation of a circle on a sphere – Intersection of two spheres – Tangent plane to a sphere.	9

..... Self Study

Text Books:		
1.T.K.Manicavachagom Pillay, T. Narayanan, Analytical Geometry, Part II – 3 Dimensions, S. Viswananthan Publishers Pvt Ltd.(Reprint June2021).		
2. Geogebra Manual – The Official Manual of Geogebra Research.shu.ac.uk/geogebra/GIF – Guides/official Geogebra manual.pdf(2011).		
UNIT I Chapter I	Sections 7, 8 Chapter II Sections 1, 2, 3, 7	T.B- 1
UNIT II Chapter II	Sections 10, 11 Chapter III Sections 1, 2, 3	T.B- 1
UNIT III Chapter III	Sections 4, 5, 7 & 8	T.B- 1
UNIT IV Chapter IV	Sections 2-5	T.B- 1
UNIT V Chapter IV	Sections 6-8	T.B- 1
Reference Books:		
1. 1. Shanti Narayanan, Analytical Solid Geometry, S.Chand& Company Ltd, New Delhi(2007).		
2. M.L. Khanna, Solid Geometry, Jai Prakash Nath& co, Educational Publishers, 25th Edition (2005).		
3.P.R.VITAL ,Analytical Geometry 2D and 3D ,Pearson Publication (2013)		
Digital Demonstration using Geogebra		
1) Relation between Cartesian Coordinates and Polar Coordinates : https://www.youtube.com/watch?v=Oh2DefOhcA&ab		
2) Equation of a plane in Normal form: https://www.youtube.com/watch?v=2sZKZHyaQJ8&ab https://www.youtube.com/watch?v=AEZq5uLhbIU&ab		
3) Equation of a Straight Line in Symmetrical Form: https://www.youtube.com/watch?v=AlAReyCFskU&ab		
4) The Equation of a Sphere with centre at (a, b, c) and radius r: https://www.youtube.com/watch?v=WhYX0T_UqBQ&ab		
5) Equation of a Cone with a given Vertex and a given guiding curve: https://www.youtube.com/watch?v=XQi6ul9-nJo&a		
6) https://youtu.be/OwNru3Znsfk		
7) https://youtu.be/_MgBCc0z8N8		
8) https://youtu.be/zYtAgCiUA7c		
9. https://youtu.be/ysagRAwySEg		

Web Resource:
1. Tangent, Normal : https://nptel.ac.in/courses/111/104/111104095/

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	recall and classify geometric shapes using correct mathematical language. Draw and label figures based on verbal descriptions.	K1
CO2	understand various equations of Planes, Straight Line, Sphere, Cone, and Cylinder.	K2
CO3	apply theorems involving vertical angles, complementary angles, supplementary angles, transversals, internal angle measure in triangles, circles and tangent lines to circles and applying geometric concepts to solve problems.	K3
CO4	classify and discuss about a circle on a sphere with examples.	K4
CO5	determine the intersection of two sphere and tangent plane to a sphere with problems.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	2	1	3	3	3	2	2	2.3
CO2	2	3	3	2	1	3	3	2	2	2	2.3
CO3	2	2	2	1	1	2	2	3	2	2	1.9
CO4	3	2	2	2	1	2	2	3	2	2	2.1
CO5	2	2	1	1	1	2	2	2	2	2	1.7
Mean Overall Score											2.06
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. U. Abuthahir
Mrs. J. Sarthaj Banu

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UPH1AC1	Allied – I	5	4	25	75	100
Course Title		FUNDAMENTALS OF PHYSICS					

SYLLABUS		
Unit	Contents	Hours
I	Elasticity: Hooke's law – Young's modulus, Rigidity modulus & Bulk modulus – Expression for bending moment - determination of Young's modulus by non-uniform bending (Pin and Microscope) - surface tension:- definition –determination of surface tension by drop weight method –Viscosity: co-efficient of viscosity –determination of co-efficient of viscosity by burette method (variable pressure head) – *comparison of viscosities*	15
II	Mechanics: Newton's law of gravitation –Kepler's laws of planetary motion–gravitation constant-determination of 'G' by Boy's method- friction- laws of friction – centre of gravity - centre of gravity of solid cone and solid hemisphere – meta center – meta centric height – *determination of the metacentric height of a ship*	15
III	Sound: Simple harmonic motion (SHM) –equation of simple harmonic motion – composition of two SHM's in a straight line – composition of two SHM's at right angles to each other – Lissajou's figures (Basic concept only) –ultrasonic – properties – production by piezo-electric method- *applications of ultrasonics*– reverberation and reverberation time-conditions for a good auditorium	15
IV	Heat: Newton's law of cooling -determination of specific heat capacity of a liquid by cooling – thermal conductivity – co-efficient of thermal conductivity – determination of thermal conductivity of a bad conductor by Lee's disc method – solar constant – * determination of solar constant by Angstrom's Pyrheliometer*-temperature of the sun	15
V	Diffusion and Osmosis: Diffusion: Diffusion of liquids – Graham's laws of diffusion in liquids –*Ficks' law of diffusion* – analogy between liquid diffusion and heat conduction – experimental determination of coefficient of diffusion. Osmosis: osmosis and osmotic pressure – laws of osmotic pressure -experimental determination of osmotic pressure (Berkeley and Hartley method)	15

..... Self Study

Text Book(s):
1. R. Murugesan, Properties of matter, S.Chand& Co, reprint (2022) Unit – I: Sec: 1.1,1.2,1.15.1.21, 3.1, 3.17, 2.1, 2.5, 2.7 Unit – III: 11.1 , 11.2, 12.1,12.2, 12.4, 11.9, 11.10,11.16, 11.17, 11.21 Unit – II: Sec: 6.1-6.3, 22.1-22.3, 20.1- 20.3 2. R. Murugesan, Properties of matter, S.Chand& Co, 4th Edition, 2005 Unit – V: Sec: 2.21, 8.1- 8.28 3. Brijlal&Subramaniam, Heat & thermodynamics, S.Chand Publications, 7th Edition, 2008. Unit – IV: Sec: 4.1- 5.5

Reference Book(s):
1. BrijLal&Subramaniam, Properties of Matter, S.Chand Publications, 4th edition, 2008. 2. MathurD.S, Elements of Properties of Matter ,Eleventh edition, Shyamlal Charitable Trust, New Delhi, 1993.
Web Resource(s):
1. https://www.askiitians.com/physics/mechanics/surface-tension.aspx 2. https://www.esaral.com/oscillations-class-11-simple-harmonic-motion-notes 3. https://www.adda247.com/teaching-jobs-exam/heat-and-temperature/

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	understand the basic principles of certain physical properties of the materials around us	K2
CO2	Applications of different constants associated with different materials	K3
CO3	analyze viscosity, surface tension, diffusion, osmosis, properties of liquid	K4
CO4	analyze the centre of gravity of various objects	K4
CO5	interpret the physical properties of new materials	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	2	3	3	3	2	2	2.5
CO2	3	3	3	2	2	3	2	1	1	2	2.2
CO3	3	1	3	1	3	2	2	2	2	3	2.2
CO4	3	3	2	3	2	3	3	3	1	3	2.6
CO5	1	3	2	2	2	2	3	3	2	2	2.2
Mean Overall Score											2.34
Correlation											MEDIUM

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. C. Hariharan

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UPH1AC2P	ALLIED –II	3	2	20	80	100
Course Title		PROPERTIES OF MATTER – PRACTICAL					

List of Experiments:

1. Young's Modulus – Non Uniform bending (Scale & Telescope)
2. Surface tension and interfacial surface tension by drop weight method.
3. Potentiometer – Low range voltmeter calibration
4. Air wedge – Thickness of a thin wire.
5. Comparison of viscosities by capillary flow method.
6. AND, OR and NOT logic gates using discrete components.

Books for reference:
1. M.N. Srinivasan, S. Balasubramaniyan, R. Ranganathan, A text book of Practical Physics, S.Chand & Sons, reprint 2010.
2. C.C. Ouseph, U.J. Rao & V. Vijayendran, Practical physics and electronics, S. Viswanathan, Pvt, Ltd, First edition, 2007.

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the basic principles of properties of matter and understand the concepts of bending behaviour beams	K2
CO2	Make practical skills essential for experimentation.	K3
CO3	Apply experimental approaches to correlate with physics theory to develop practical understanding.	K3
CO4	Analyze themselves the concept of heat, optics and acoustics	K4
CO5	evaluate the ideas required for their higher studies	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	2	2	1	2	2	2	2.2
CO2	2	3	2	3	2	2	2	2	3	2	2.3
CO3	2	2	2	3	3	2	3	3	2	2	2.4
CO4	2	1	2	2	2	2	2	3	2	2	2.0
CO5	2	3	3	2	3	3	2	1	2	2	2.3
Mean Overall Score											2.22
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S. Abbas Manthiri

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23UMA2CC3P	CORE - III	5	5	20	80	100
Course Title		Python Programming - Practical					

SYLLABUS		
Unit	Contents	Hours
I	Getting started with Python – Variables – Printing – *Input and Output*.	15
II	For loops - If statements – Conditional Operators - elif	15
III	*Numbers* – Math Operators – Random Numbers – Math functions - Modules and functions.	15
IV	Strings – Concatenation and repetition – the in operator- indexing – slices – looping – String methods	15
V	Lists – List methods - Tuples	15

..... Self Study

List of Programs
1. To evaluate simple expressions 2. To Find the square root 3. To calculate the Area of the triangle 4. To Solve quadratic equation 5. To Swap 2 variables
6. To Check if a number is odd or even 7. To find the largest among three numbers 8. To find the factorial of a given number 9. To print the Fibonacci sequence 10. To find the sum of natural numbers
11. To make a simple calculator 12. To find factors of a given number 13. To find HCF and GCD 14. To convert decimal into other number systems 15. To display calendar
16. To sort words in alphabetical order 17. To demonstrate slice operation 18. To check whether a string is palindrome or not 19. To reverse a string 20. Program that uses different string methods like upper, lower, split, join, count, replace and find on string object.
21. To create python list 22. To multiply two matrices 23. Program using list methods. 24. To understand different types of tuples 25. Program using tuple methods.

Text Book:		
Brian Heinold, A Practical Introduction to Python Programming, Creative Commons Attribution, 2012.		
UNIT I	Chapter I	Sections 1.1 – 1.8
UNIT II	Chapter II	Sections 2.1- 2.5,
	Chapter IV	Sections 4.1-4.5
UNIT III	Chapter III	Sections 3.1- 3.5,
	Chapter XIII	Sections 13.1- 13.5
UNIT IV	Chapter VI	Sections 6.1 – 6.8
UNIT V	Chapter VII	Sections 7.1 – 7.7,
	Chapter VIII	Sections 8.1 – 8.7
Reference Books:		
1. Chun, J. Wesley, CORE Python Programming, 2 nd Edition, Pearson, 2007 Reprint 2010.		
2. Varadha Rajkumar K, Marlapalli Krishna and Jaya Prakash S., Basic Python Programming for Beginners, BlueRose Publishers, 2021.		
Web Resources:		
1. Jeffrey Elkner, Chris Meyers Allen Downey, Learning with Python, Dreamtech Press, 2015. http://www.foo.be/docs-free/thinkCSpy.pdf		
2. ReemaThareja, Python programming using problem solving approach, Oxford University Press, 2017. https://india.oup.com/productPage/5591038/7421214/9780199489497		

Course Outcomes		
Upon successful completion of this course, the student will be able to:-		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	remember the fundamental concepts of variables and operators	K1
CO2	understand decision making and looping	K2
CO3	apply functions in the programming	K3
CO4	analyse different types of string operations	K4
CO5	evaluate list and tuples in the programming	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	1	3	2	3	1	2	3	2.4
CO2	3	3	3	1	3	3	3	3	2	3	2.7
CO3	3	2	3	2	3	3	3	3	2	3	2.7
CO4	3	3	3	2	3	3	2	3	2	3	2.7
CO5	3	3	3	1	3	2	3	2	2	3	2.5
Mean Overall Score											2.6
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators: -

Dr. M. Mohammed Jabarulla

Dr. S. Shajitha Begum

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23UMA2CC4	CORE - IV	4	4	25	75	100
Course Title Classical Algebra with MATLAB							

SYLLABUS		
Unit	Contents	Hours
I	Inequalities - Triangle inequalities - Arithmetic, Geometric and Harmonic means.	12
II	Cauchy - Schwarz inequality - Some more inequalities and related problems.	12
III	Relation between the roots and coefficients of equations - Symmetric function of the roots - Sum of the powers of the roots of an equation.	12
IV	Transformation of equation - *Roots with sign changed*, Roots Multiplied by a given number, *Reciprocal roots* - Reciprocal equation - Diminishing, Increasing the roots of a given equation by a given quantity.	12
V	Descarte's rule of signs – Newton's method of divisors – Horner's method.	12

..... Self Study

Text Books:			
1. S. Arumugam and A. Thangapandi Isaac, Sequences and series, New Gamma Publishing House (2012).			
2. T.K. Manicavachagom Pillai, T. Natarajan, and K.S. Ganapathy, Algebra, Volume-I, S.Viswanathan Publishers, Pvt. Ltd. (2012).			
UNIT I	Chapter II	Sections 2.1-2.3	T.B- 1
UNIT II	Chapter II	Sections 2.4-2.6	T.B- 1
UNIT III	Chapter VI	Sections 11-13	T.B- 2
UNIT IV	Chapter VI	Sections 15, 16, 17	T.B- 2
UNIT V	Chapter VI	Sections 24, 29.4, 30	T.B- 2
Reference Books:			
1. S. Arumugam, A. Thangapandi Isaac, Algebra (Theory of Equations, Inequalities and Theory of numbers), New Gamma Publishing House (2006)			
2. T.K. Manicavachagom Pillai, T. Natarajan, and K.S. Ganapathy, Algebra, Volume- II, S.Viswanathan Publishers, Pvt. Ltd. (2008).			
3. S. Arumugam, A. Thangapandi Isaac, Theory of Equations and Trigonometry, New Gamma Publishing House (2006)			
Web Resources:			
1. https://www.mathworks.com/matlabcentral/answers/116618-solving-inequalitis-in-matlab			
2. https://www.mathworks.com/help/matlab/math/roots-of-polynomials.html			
3. https://www.math-only-math.com/relation-between-roots-and-coefficients-of-a-quadratic-equation.html			

Practical(s)
○ To find Arithmetic, Geometric and Harmonic Means using MATLAB ○ To check validation of some important inequalities using MATLAB ○ To find the roots of algebraic equations using MATLAB

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	remember the properties of inequality and types of algebraic equations.	K1
CO2	understand some important inequalities and relate the roots and co-efficients of equation.	K2
CO3	apply the concepts of inequality and algebraic equation to solve real world problems.	K3
CO4	analyse the various types of inequalities and the structure of algebraic equations.	K4
CO5	determine the roots of equation using MATLAB	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	1	3	2	1	3	3	2	3	2	2.2
CO2	3	2	3	3	2	2	3	3	2	2	2.5
CO3	3	3	3	3	2	3	3	3	3	2	2.8
CO4	3	2	3	3	2	3	3	3	3	3	2.8
CO5	2	3	2	2	1	2	3	3	3	3	2.4
Mean Overall Score											2.54
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. S. Mohamed Yusuff Ansari.

Mrs. A. Thagasin Banu

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23UPH2AC3	ALLIED – III	4	4	25	75	100
Course Title		ESSENTIALS OF PHYSICS					

SYLLABUS		
Unit	Contents	Hours
I	OPTICS Spherical Aberration in a lens – Methods of minimizing Spherical Aberration – Interference– Air-wedge – Thickness of a thin wire (Theory and Experiment) – Newton’s rings – Radius of curvature of the lens-Diffraction-Determination of wavelength of light using grating- *Polarization* –Specific Rotatory Power- Laurent’s Half Shade Polarimeter	12
II	ELECTRICITY Coulomb’s law – Gauss law - Principle of capacitor –Energy stored in a charged capacitor – Loss of energy due to sharing of charges – *Kirchhoff’s laws* – Application of Kirchhoff’s laws to Wheatstone bridge – Carey Foster bridge – Determination of specific resistance – Potentiometer - Calibration of low range voltmeter and ammeter	12
III	ATOMIC AND NUCLEAR PHYSICS Vector atom model – Quantum numbers – Coupling schemes – The Pauli’s Exclusion Principle – Zeeman Effect – Experimental arrangement for normal Zeeman effect – Liquid drop model –Construction and working of an Ionization chamber and Geiger Muller Counter – *Nuclear fission* – Energy released in fission –Nuclear fusion	12
IV	ELECTRONICS Formation of P-N Junction Diode – Forward and Reverse biasing of a Junction diode – V-I Characteristics of a Junction Diode – *Junction diode as bridge rectifier* – Zener diode – V-I Characteristics of a Zener Diode – Construction and Working of a transistor – Characteristics of a transistor in Common Emitter (CE) and Common Base (CB) configurations	12
V	NUMBER SYSTEMS AND LOGIC CIRCUITS Conversion between Decimal, Binary, Octal and Hexadecimal number systems – *The basic logic gates (AND, OR, NOT) using discrete components – NAND and NOR as universal gates – The Exclusive OR gate* – Laws of Boolean algebra – De-Morgan’s theorems – Half Adder– Full Adder	12

..... Self Study

Text Books:	
1.	R. Murugesan, KiruthigaSivaprasath, Optics and Spectroscopy, S. Chand & Company PVT. Ltd, New Delhi, Reprint, 2016. Unit–I: Section 1.16 – 1.7, 2.1, 2.7-2.9, 3.17, 4.19, 4.20 Unit – VI: Section 5.3 – 5.6
2.	R. Murugesan, Electricity and Magnetism, S. Chand & Company PVT. Ltd, New Delhi, Tenth Edition, 2017. Unit–II: Section 1.2, 2.2, 4.1, 4.9, 4.11, 6.6 – 6.8 Unit –III: Section 4.12 – 4.23, 17.10, 18.3, 18.6, 22.1, 22.6 – 22.6.1 Unit –IV: Section 33.1 – 33.2.1, 33.5.3, 34.1, 35.1 – 35.3 Unit – V: Section 41.1 – 41.15
3.	N. Subrahmanyam, Brijlal and M.N. Avadhanulu, A Textbook of Optics, S. Chand & Company PVT. Ltd, New Delhi, Twenty Fourth Edition, 2015. Unit – VI: Section 22.8, 22.14 – 22.19
Reference Books :	
1.	Arthur Beiser, Concepts of Modern Physics, McGraw Hill, Fifth edition, 2002.
2.	V.K.Mehta, Rohit Mehta, Principles of Electronics, S.Chand Publications, Reprint 2016
Web Resources:	
1.	https://www.classcentral.com/course/edx-electricity-and-magnetism-part-1-3032
2.	https://www.electronics-tutorials.ws/
3.	https://www.nuclear-power.net/nuclear-power/reactor-physics/atomic-nuclear-physics/

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the basic principles and contemporary concepts on various fields on physics like optics, electrostatics, atomic and nuclear physics	K1
CO2	Understand the basic ideas of geometric optics	K2
CO3	Construct digital circuits for simple real world problems	K3
CO4	List the applications of electronics in modern gadgets	K4
CO5	Explain the fundamental concepts of electricity	K5

Relationship Matrix

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	1	3	2	2	3	1	2	3	2.1
CO2	2	3	1	2	3	2	3	2	3	2	2.3
CO3	2	3	2	3	1	1	3	2	1	3	2.1
CO4	3	2	3	1	1	3	2	2	2	3	2.2
CO5	3	2	3	3	2	3	2	2	3	1	2.4
Mean Overall Score											2.22
Correlation											MEDIUM

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. S. Shek Dhavud

Dr.P. Revathi

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23UPH2AC4P	ALLIED-IV	3	2	20	80	100
Course Title		OPTICAL, THERMAL AND ELECTRICITY - PRACTICAL					

List of Experiments:

1. Young's modulus – Cantilever depression method
2. Potentiometer – Ammeter calibration.
3. Compound Pendulum: Determination of the radius of Gyration
4. Comparison of radii: Capillary flow method.
5. Sonometer – Verification of transverse laws of vibration (I & II Law)
6. Meter bridge resistance.
7. Verification of De Morgan's theorems using ICs.
8. Determination of the resistance of a material using post office box.

Books for Reference:

1. M.N. Srinivasan, S. Balasubramaniyan, R. Ranganathan, A text book of Practical Physics, S.Chand&Sons, reprint 2010.
2. C.C. Ouseph, U.J. Rao & V. Vijayendran, Practical physics and electronics, S. Viswanathan, Pvt,Ltd, First edition, 2007.

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the basic principles of properties of matter and underlying the concepts of bending behaviour beams	K2
CO2	Make practical skills essential for experimentation.	K3
CO3	Apply experimental approaches to correlate with physics theory to develop practical understanding.	K3
CO4	Analyze the concepts of heat and acoustics and understood the measurements of some physical quantities through heat and electricity experiments	K4
CO5	evaluate the circuit construction in the electronics	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	2	2	1	2	2	2	2.2
CO2	2	3	2	3	2	2	2	2	3	2	2.3
CO3	2	2	2	3	3	2	3	3	2	2	2.4
CO4	2	1	2	2	2	2	2	3	2	2	2.0
CO5	2	3	3	2	3	3	2	1	2	2	2.3
Mean Overall Score											2.22
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Mr. S. Mohamed Ibrahim Sulaiman Sait

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UMA3CC5	CORE – V	4	4	25	75	100
Course Title		ODE AND LAPLACE TRANSFORMS WITH SCILAB					

SYLLABUS		
Unit	Contents	Hours
I	Linear equation – Bernoulli's equation – Exact differential equations: Sufficient condition for exact differential equations – Practical rule for solving an exact differential equations – Rules for finding integrating factor.	12
II	Equations of the first order but of higher degree: Equations solvable for dy/dx - Equations solvable for y - *Equations solvable for x * – Clairaut's form – Equations that do not contain x explicitly - Equations that do not contain y explicitly - Homogeneous equations in x and y .	12
III	Linear Equations with constant coefficients - The operator D - Complementary function of a linear equation with constant coefficients – Particular integrals - General method of finding PI - Special methods for finding PI - Linear equations with variable coefficients.	12
IV	Laplace transforms – Sufficient condition for the existence of the Laplace transforms – Properties of Laplace transforms – Laplace transforms of periodic function – Some general theorems – *Evaluation of integrals*.	12
V	The inverse Laplace transforms -Inverse transforms of functions – Related problems. Application of Laplace transforms - Solution of ODE with constant coefficients – Solution of Systems of Differential equations - Solution of differential equations with variable coefficients.	12

..... Self Study

Text Book(s):		
S. Narayanan and T. K. Manicavachagom Pillay, Differential Equation and its Application, Viswanathan Publishers Pvt. Ltd., Ninth edition (2006)		
UNIT I	Chapter II	Sections 4, 5, 6.1 – 6.5
UNIT II	Chapter IV	Sections 1 – 4
UNIT III	Chapter V	Sections 1 – 5
UNIT IV	Chapter IX	Sections 1 - 5
UNIT V	Chapter IX	Sections 6 - 11
Reference Book(s):		
1. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Co. (2010). 2. M.L. Khanna, Differential Equations, Jai Prakash Nath and Co. (2004). 3. Murray R. Spiegel, Schaum's Outline of Theory and Problems of Laplace Transforms, McGraw Hill, (1965).		
Web Resource(s):		
1. https://www.youtube.com/watch?v=IFpT-Ptmkyg 2. https://youtu.be/tpVoFcIEKHI 3. https://youtu.be/tg_QM9b1bdA 4. https://youtu.be/ogC78S3FY8Q 5. https://youtu.be/YiZiB7mG0_Q		

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Retrieve the elementary ordinary differential equations.	K1
CO2	Interpret the concept of solving differential equations.	K2
CO3	Apply Laplace transforms to solve ordinary differential equations	K3
CO4	Discuss various formulae for Laplace and inverse Laplace transforms.	K4
CO5	Evaluate the linear differential equation with constant & variable coefficients	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	3	3	3	3	2	3	2.8
CO2	3	2	3	3	3	3	3	3	1	3	2.7
CO3	3	1	3	3	3	3	3	1	2	2	2.4
CO4	3	3	3	2	1	3	3	3	2	2	2.5
CO5	2	3	3	3	3	2	3	1	3	3	2.6
Mean Overall Score											2.6
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

1. Dr. U. Abuthahir
2. Dr. K.S. Kanzul Fathima

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UMA3CC6	Core – VI	3	3	25	75	100
Course Title		VECTOR CALCULUS AND TRIGONOMETRY WITH SCILAB					

SYLLABUS		
Unit	Contents	Hours
I	Introduction – Gradient – Divergent – *Curl* – Formulae involving ∇ - operators involving ∇ twice.	9
II	Line, Surface and Volume integrals – Theorem of Gauss (Statement only) – simple problems.	9
III	Green's Theorem (in space) (Statement only) - Stokes Theorem (Statement only) - Green's Theorem (in plane) (Statement only) – simple problems.	9
IV	Expansion of $\sin n\theta$, $\cos n\theta$, and $\tan n\theta$ - Powers of sines and cosines of θ in terms of functions of multiples of θ .	9
V	Hyperbolic functions: Relations between Hyperbolic functions – Inverse hyperbolic functions	9

..... Self Study

Text Book(s):				
1. S. Narayanan and T.K. Manicavachagom Pillay, Vector Algebra and Analysis, S. Viswanathan Publishers, Pvt. Ltd., (1995)				
2. S. Narayanan and T.K. Manicavachagom Pillay, Trigonometry, S. Viswanathan Publishers, Pvt. Ltd., 2006.				
UNIT I	Chapter IV	Sections 7 - 12	T.B- 1	
UNIT II	Chapter VI	Sections 1 - 6	T.B- 1	
UNIT III	Chapter VI	Sections 7 - 10	T.B- 1	
UNIT IV	Chapter III	Sections 1-2, 4	T.B- 2	
UNIT V	Chapter IV	Sections 1,2	T.B- 2	
Reference Book(s):				
1. Vector Analysis, Schaum's outline series, Murray R. Spiegel., Seymour Lipschutz, Dennis Spellman, Second Edition, McGraw Hill Book Company, 2009.				
2. P.K.Mittal, Trigonometry, Vrinda Publications(P) Ltd., 2007				
Web Resource(s):				
1. https://users.scilab.narkive.com/CBGtibfE/scilab-queries-about-vector-and-complex-numbers				
2. https://help.scilab.org/sinh				
3. https://help.scilab.org/acosh				
4. https://help.scilab.org/docs/2023.1.0/en_US/log.html				
5. https://help.scilab.org/docs/2023.1.0/en_US/section_99038107015b1d789de50bf92f154a85.html				
6. https://help.scilab.org/docs/2023.1.0/en_US/cosh.html				

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Relate and study of hyperbolic functions with examples	K1
CO2	Acquire more knowledge on line, surface and volume integrals	K2
CO3	Demonstrate and discuss the expansion of trigonometric multiple functions	K3
CO4	Apply domain knowledge for vector integration	K4
CO5	Remember the double integral and application to area with examples	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	3	3	3	3	3	2	2.7
CO2	3	2	2	3	3	3	3	3	3	2	2.7
CO3	3	2	2	2	2	3	3	3	3	3	2.6
CO4	3	2	2	3	2	3	3	3	2	2	2.5
CO5	3	3	3	2	2	3	3	3	2	2	2.6
Mean Overall Score											2.62
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

1. Dr. H. Sheik Mujibur Rahman
2. Mrs. M. Affrose Begum

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UMA3AC5:1	Allied - V	4	4	25	75	100
Course Title		MATHEMATICAL STATISTICS - I WITH R					

SYLLABUS		
Unit	Contents	Hours
I	Arithmetic Mean; *Weighted mean*; Median; Mode; Geometric Mean; Harmonic Mean- Simple Problems	12
II	Measures of Dispersion; Range; Quartile Deviation; Mean Deviation; Standard Deviation and Root mean square Deviation- Simple problems	12
III	Coefficient of Dispersion; Coefficient of variation; Moments; Pearson's β and γ Co-efficients- Simple problems	12
IV	Theory of probability- Introduction; Classical probability; empirical probability; Axiomatic approach to probability; Laws of Addition of Probabilities; Laws of Multiplication of Compound Probability; Independent Events; Pairwise Independent Events; Baye's theorem- simple problems.	12
V	Random variable; Distribution function; Properties of Distribution function; Discrete random variable; Probability mass function; Discrete distribution function; Continuous random variable; Probability density function; Joint probability mass function and marginal and conditional probability function; Joint probability distribution function; Joint density function, Marginal density function; Independent random variables; The conditional distribution function and conditional probability density function – Simple problems.	12

..... Self Study

Text Book(s):		
S.C.Gupta & V.K.Kapoor, Elements of Mathematical Statistics, Sultan Chand publication, Third Edition, Reprint 2019.		
UNIT I	Chapter 2	Sections 2.5, 2.5.3, 2.6, 2.7, 2.8, 2.9
UNIT II	Chapter 3	Sections 3.3, 3.4, 3.5, 3.6, 3.7
UNIT III	Chapter 3	Sections 3.8, 3.8.1, 3.9, 3.10
UNIT IV	Chapter 4	Sections 4.1, 4.3.1, 4.3.2, 4.5, 4.6.2, 4.7, 4.7.2, 4.7.3, 4.8
UNIT V	Chapter 5	Sections 5.1-5.4.1, 5.5.1-5.5.5
Reference Book(s):		
1. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons Publication, Twelfth Edition (2023).		
2. P.R.Vittal, Mathematical Statistics, Margham Publishers, Chennai, Reprint 2009.		
Web Resource(s):		
1. https://onlinecourses.swayam2.ac.in/cec23_mg14/preview		
2. https://onlinecourses.swayam2.ac.in/cec23_ma08/preview		
3. https://onlinecourses.nptel.ac.in/noc23_ma77/preview		
4. https://onlinecourses.nptel.ac.in/noc23_ma83/preview		

Digital Demonstration using R

Topic	Web Link
Arithmetic Mean	https://www.r-tutor.com/elementary-statistics/numerical-measures/mean
Median	https://www.r-tutor.com/elementary-statistics/numerical-measures/median
Range	https://www.r-tutor.com/elementary-statistics/numerical-measures/range
Quartiles	https://www.r-tutor.com/elementary-statistics/numerical-measures/quartile
Standard Deviation	https://www.r-tutor.com/elementary-statistics/numerical-measures/standard-deviation

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the basic concept of measures of central tendencies with examples.	K1
CO2	Calculate the measures of dispersion and coefficient of variation.	K2
CO3	Determine the Coefficient of Dispersion and Coefficient of variation.	K3
CO4	Explain classical probability and examine Baye's theorem.	K4
CO5	Evaluate the distribution function and probability density function.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	1	3	3	3	3	3	3	3	3	2.8
CO2	3	1	3	3	3	3	3	3	3	3	2.8
CO3	3	1	3	3	3	3	3	3	3	3	2.8
CO4	3	1	3	3	3	3	3	3	3	3	2.8
CO5	3	1	3	3	3	3	3	3	3	3	2.8
Mean Overall Score											2.8
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

1. Dr. A. Prasanna
2. Dr. M.A. Rifayathali
3. Mrs. S. Sharmila Banu

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UMA3AC6:1	Allied - VI	3	2	25	75	100
Course Title		MATHEMATICAL STATISTICS - II WITH R					

SYLLABUS		
Unit	Contents	Hours
I	Mathematical Expectation; Addition theorem of Expectation; Multiplication theorem of Expectation; Co-variance; Moment Generating Function; Cumulants– Simple problems.	9
II	Theoretical discrete distribution – Binomial distribution; Moments of Binomial distribution; Recurrence relation for the Moments of Binomial distribution; Moment generating Function of Binomial distribution- Simple Problems.	9
III	Poisson distribution; Moments of the Poisson distribution; Recurrence relation for the Moments of the Poisson distribution; Moment generating function of Poisson distribution- Simple Problems.	9
IV	Theoretical continuous distribution - Rectangular (or) Uniform distribution; Normal distribution; M.G.F. of Normal distribution; Cumulant generating Function of Normal distribution; Moments of Normal distributions - Simple Problems.	9
V	Curve fitting; Fitting of a Straight Line; Fitting of second Degree Parabola; * Fitting of Polynomial of Kth Degree* –Change of Origin - Simple problems.	9

..... Self Study

Text Book(s):		
S.C.Gupta & V.K.Kapoor, Elements of Mathematical Statistics, Sultan Chand publication, Third Edition, Reprint 2019.		
UNIT I	Chapter 6	Sections 6.1–6.4, 6.9, 6.10
UNIT II	Chapter 7	Sections 7.2, 7.2.1, 7.2.2, 7.2.6
UNIT III	Chapter 7	Sections 7.3.1, 7.3.2, 7.3.4, 7.3.5
UNIT IV	Chapter 8	Sections 8.1, 8.2, 8.2.5, 8.2.6, 8.2.7
UNIT V	Chapter 9	Sections 9.1 – 9.1.4
Reference Book(s):		
1. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons Publication, Twelfth Edition (2023).		
2. P.R.Vittal, Mathematical Statistics, Margham Publishers, Chennai, Reprint 2009.		
Web Resource(s):		
1. https://onlinecourses.nptel.ac.in/noc23_ma77/preview		
2. https://onlinecourses.swayam2.ac.in/cec23_mg14/preview		
3. https://onlinecourses.swayam2.ac.in/cec23_ma08/preview		

Digital Demonstration using R

Topic	Web Link
Binomial Distribution	https://www.r-tutor.com/elementary-statistics/probability-distributions/binomial-distribution
Poisson Distribution	https://www.r-tutor.com/elementary-statistics/probability-distributions/poisson-distribution
Uniform Distribution	https://www.r-tutor.com/elementary-statistics/probability-distributions/continuous-uniform-distribution
Normal Distribution	https://www.r-tutor.com/elementary-statistics/probability-distributions/normal-distribution

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Define mathematical expectation and moment generating function with examples.	K1
CO2	Explain Binomial distribution.	K2
CO3	Explain Poisson distribution.	K3
CO4	Explain the concepts of continuous distribution.	K4
CO5	Compare Fitting of a Straight Line and Fitting of second Degree Parabola.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	1	3	3	3	3	3	3	3	3	2.8
CO2	3	1	3	3	3	3	3	3	3	3	2.8
CO3	3	1	3	3	3	3	3	3	3	3	2.8
CO4	3	1	3	3	3	3	3	3	3	3	2.8
CO5	3	1	3	3	3	3	3	3	3	3	2.8
Mean Overall Score											2.8
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

1. Dr. A. Prasanna
2. Dr. M.A. Rifayathali
3. Mrs. S. Sharmila Banu

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UMA3GE1	Generic Elective – I	2	2	-	100	100
Course Title		MATHEMATICS FOR COMPETITIVE EXAMINATION - I					

SYLLABUS		
Unit	Contents	Hours
I	Numbers – H.C.F and L.C.M of Numbers	6
II	Decimal Fractions - Simplification	6
III	Square roots and Cube roots – *Average* – Surds and Indices	6
IV	*Percentage* – Profit and Loss - Ratio and Proportion	6
V	Partnership – Chain Rule – *Alligation or Mixture*	6

..... Self Study

Text Book(s):	
Dr. R.S. Aggarwal, Quantitative Aptitude, S. Chand and Company Ltd, (2022).	
UNIT I	Chapters 1 & 2
UNIT II	Chapters 3 & 4
UNIT III	Chapters 5, 6 & 9
UNIT IV	Chapters 11, 12 & 13
UNIT V	Chapters 14, 15 & 21
Reference Book(s):	
1. R. V. Praveen, Quantitative Aptitude and Reasoning, PHI Private Limited, (2012).	
2. Edgar Thorpe, Course in Mental Ability and Quantitative Aptitude, 3rd Edition, Mc Graw Hill Education, (2012).	
Web Resource(s):	
1. https://www.youtube.com/watch?v=xyyejJYeILM	
2. https://www.youtube.com/watch?v=eOqurZ2JkrQ	
3. https://www.youtube.com/watch?v=OKSJDDAyqP0	

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Find LCM and HCF of numbers	K1
CO2	Illustrate the problems on square and cubic roots, surds and indices.	K2
CO3	Solve the problem based on percentage, chain rule, ratio and proportion	K3
CO4	Simplify the fractions and expressions	K4
CO5	Determine the profit and loss in business transactions	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	2	3	3	2	3	2	2.6
CO2	2	1	2	3	2	3	3	3	3	2	2.4
CO3	3	1	2	3	2	3	2	3	2	2	2.3
CO4	2	3	2	2	2	3	2	3	3	3	2.5
CO5	3	3	2	2	2	3	3	3	3	3	2.7
Mean Overall Score											2.5
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

1. Dr. U. Abuthahir
2. Dr. C. Gurubaran

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UMA4CC7	Core – VII	5	5	25	75	100
Course Title		ADVANCED CALCULUS					

SYLLABUS		
Unit	Contents	Hours
I	Sets and elements – *Operations on sets* – Functions – Real valued functions – Equivalence – Countability – Real numbers – Least upper bounds	15
II	Definition of a sequence and subsequence – Limit of a sequence – Convergent sequences – Divergent sequences – Bounded sequences – Monotone sequences – Operations on convergent sequences – Operations on divergent sequences.	15
III	Limit superior and limit inferior – Cauchy sequences. Convergent and divergent series of Real Numbers; Series with non-negative numbers; Alternating series; Conditional convergence and absolute convergence.	15
IV	Tests for absolute convergence; Series whose terms form a non-increasing sequence. Limit of a function on a real line; Metric spaces; Limits in metric spaces.	15
V	Improper integrals of the first kind - integral test for series - improper integrals of the second kind -convergence , divergence and absolute convergence of the improper integrals.	15

..... Self Study

Text Book(s):		
Richard R. Goldberg, Methods of Real Analysis, (Oxford and IBH Publishing Co.), 1970.		
UNIT I	Chapter I	Sections 1.1 - 1.7
UNIT II	Chapter II	Sections 2.1 – 2.8
UNIT III	Chapter II	Sections 2.9, 2.10
	Chapter III	Sections 3.1 – 3.4
UNIT IV	Chapter III	Sections 3.6, 3.7
	Chapter IV	Sections 4.1, 4.2, 4.3
UNIT V	Chapter VII	Sections 7.9, 7.10
Reference Book(s):		
1. Principles of Real analysis, Third Edition, Walter Rudin, Mc-Graw Hill international edition, 1976.		
2. Elements of Real Analysis, Shanti Narayan, M.D. Raisinghania, S. Chand & Company Ltd., Twelfth Revised Edition, 2011.		
3. Real analysis, Volume I, K. Chandrasekhara Rao, K.S Narayan, S. Viswanathan Printers & Publishers Pvt. Ltd., 2008.		
4. Sequence and Series, S. Arumugam, Issac, New Gamma Publishing House, 1993		
Web Resource(s):		
1. https://youtu.be/sgsJAAtRLGq4?si=VBn3TjqQ9neF8s-		
2. https://youtu.be/lfZGtjSWcQs?si=O7wJr94tUxyrFjc5		
3. https://youtu.be/VNoHcFoawTg?si=mpz3aTsB0Nz5M90I		
4. https://youtu.be/MHDUCp4OAcg?si=uWwwKo6TiTd4SS5d		
5. https://youtu.be/ND9cEdfCFr0?si=wYBMleSYiXHiz-Rq		

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall and discuss the basic concepts of sets, elements and functions with examples.	K1
CO2	Explain the sequences and series of R with the examples	K2
CO3	Identify convergent and divergent series of real numbers.	K3
CO4	Examine the Limit of a function on a real line with examples	K4
CO5	Discuss the convergence and divergence of the improper integrals.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	1	3	3	1	3	3	2	3	2.5
CO2	3	3	2	3	3	3	1	3	3	2	2.6
CO3	2	2	3	3	1	3	3	3	1	3	2.4
CO4	3	3	3	3	3	1	2	3	3	2	2.6
CO5	1	3	3	2	3	3	3	1	3	3	2.5
Mean Overall Score											2.52
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

1. Mr. S. Masoothu
2. Mrs. A.Reigana Begum

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UMA4CC8	CORE – VIII	3	3	25	75	100
Course Title		PDE AND FOURIER SERIES WITH MAPLE					

SYLLABUS		
Unit	Contents	Hours
I	Partial Differential Equations: Elimination of arbitrary constants-Elimination of arbitrary functions –Different integrals of PDE – Solution of PDE in some simple cases- Lagrange’s method of solving the linear equation.	9
II	Standard types of first order PDE I, II, III and IV (Clairaut’s form) –Equations reducible to the standard forms-Charpit’s method.	9
III	Partial Differential equations of higher orders: A simple case of the linear PDE with constant coefficients- The general homogeneous linear equation-The homogeneous equations with constant coefficients-Solution of homogeneous equation $f(D, D')z = 0$ second method- Case of the auxiliary equation having repeated roots, The particular integral.	9
IV	Fourier series: Definition of Fourier series -Finding Fourier expansion of a periodic function with period 2π -*Odd and Even functions*.	9
V	Half range Fourier series –Development in cosine and sine series-Change of interval.	9

..... Self Study

Text Book(s):				
1. T.K Manicavachagom Pillay and S. Narayanan, Calculus Volume - III, S. Viswanathan Publishers Pvt., Ltd. (2019).				
2. Dr. M.K. Venkataraman, Engineering Mathematics Volume-III B, The National Publishing Company, 13th edition, (1998).				
UNIT I	Chapter 4	Sections 1 –4and 6	TB- 1	
UNIT II	Chapter 4	Sections 5,7	TB- 1	
UNIT III	Chapter II	Sections 13-19	T.B-2	
UNIT IV	Chapter 6	Sections 1, 2, 3	T.B-1	
UNIT V	Chapter 6	Sections 4,5,6	T.B-1	
Reference Book(s):				
1. M.D. Raisinghanian, Ordinary and Partial Differential Equations, S. Chand & Co. (2010).				
2. M.L. Khanna, Differential Equations, Jai Prakash Nath and Co. (2004).				
Web Resource(s):				
1. https://youtu.be/TDrFoSSQeW0?si=e3V8nupFil9CQPzs				
2. https://youtu.be/htnyQcA3Vks?si=3dPR1rN-8FhHM3bo				
3. https://youtu.be/cWPkZAaXGmA?si=eX8FVesgc7k44DL_				
4. https://youtu.be/wjQtgncIvoo?si=fEq-2THgn2sA9IOL				
5. https://youtu.be/praNtRezlkw?si=eC3ENewH8uZ3T8m5				
6. https://youtu.be/KPdvl9dl50?si=YmuJeJJCFf_3xfjg				
7. https://youtu.be/dtS4gNarS18?si=SfNerKDSHN5GWnOT				
8. https://youtu.be/Cb3HpOf2V1g?si=P5XW3AzZxgYPqQFI				
9. https://youtu.be/WzX27dVz96c?si=tAWrTER1-hQLEOTo				

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the basic concepts in Partial Differential Equation of first order and Classification of integrals	K1
CO2	Classify Standard types of first order PDE I, II, III and IV (Clairaut's form)	K2
CO3	Develop the half range Fourier series and change of intervals by illustrating some examples.	K3
CO4	Analyze the function using the concept of Fourier series and find the Fourier co-efficients for different functions.	K4
CO5	Evaluate the Partial Differential equations of higher orders.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	1	3	3	3	3	3	2	1	2.5
CO2	3	2	2	3	3	3	2	3	2	3	2.6
CO3	3	2	2	3	2	3	3	2	2	2	2.4
CO4	3	2	3	2	2	3	3	2	3	2	2.6
CO5	3	2	2	3	3	2	3	2	2	3	2.5
Mean Overall Score											2.5
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

1. Dr. S. Mohamed Yusuff Ansari
2. Dr. K.S. Kanzul Fathima

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UMA4AC7:1	Allied – VII	4	4	25	75	100
Course Title		STATISTICS FOR DATA SCIENCE WITH R					

SYLLABUS		
Unit	Contents	Hours
I	Most Plausible Solution of a system of Linear Equations; Conversion of Data to Linear Form - Simple problems	12
II	Karl Pearson coefficient of correlation; Rank Correlation; Regression; Lines of regression- Simple problems	12
III	Chi-Square variate; Applications of Chi-square distribution; Chi-square test as a test for population variance; Chi-square test of goodness of fit; Independence of attributes- Simple problems.	12
IV	Student's 't' definition; *Application of t-distribution*; Test for single mean; t-Test for difference of means; t-Test for testing significance of an observed sample correlation Coefficient- Simple problems.	12
V	F-Statistic definition; Applications of F-distribution; F-test for equality of population variance- Simple problems.	12

..... Self Study

Text Book(s):		
S.C.Gupta & V.K.Kapoor, Elements of Mathematical Statistics, Sultan Chand publication, Third Edition, Reprint 2019.		
UNIT I	Chapter 9	Sections 9.2 – 9.3
UNIT II	Chapter 10	Sections 10.3, 10.6, 10.7, 10.7.1
UNIT III	Chapter 13	Sections 13.1, 13.5 - 13.5.3
UNIT IV	Chapter 14	Sections 14.2, 14.2.5- 14.2.8
UNIT V	Chapter 14	Sections 14.3, 14.3.1, 14.3.2
Reference Book(s):		
1. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons Publication, Twelfth Edition (2023).		
2. P.R.Vittal, Mathematical Statistics, Margham Publishers, Chennai, Reprint 2009.		
Web Resource(s):		
1. https://onlinecourses.swayam2.ac.in/cec23_ma08/preview		
2. https://onlinecourses.nptel.ac.in/noc23_ma83/preview		
3. https://onlinecourses.swayam2.ac.in/cec23_mg14/preview		

Digital Demonstration using R

Topic	Web Link
Correlation Co-efficient	https://www.r-tutor.com/elementary-statistics/numerical-measures/correlation-coefficient
Chi-square distribution	https://www.r-tutor.com/elementary-statistics/probability-distributions/chi-squared-distribution
Chi-square test	https://www.r-tutor.com/elementary-statistics/goodness-fit/chi-squared-test-independence
Student's 't' distribution	https://www.r-tutor.com/elementary-statistics/probability-distributions/student-t-distribution
F distribution	https://www.r-tutor.com/elementary-statistics/probability-distributions/f-distribution

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Find the Most Plausible Solution of a system of Linear Equations.	K1
CO2	Explain the concepts of correlation and regression coefficients with examples.	K2
CO3	Explain χ^2 – distribution and χ^2 -test for populations.	K3
CO4	Explain the concept of Students t-distribution with examples.	K4
CO5	Evaluate the application of F-distribution.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	1	3	3	3	3	3	3	3	3	2.8
CO2	3	1	3	3	3	3	3	3	3	3	2.8
CO3	3	1	3	3	3	3	3	3	3	3	2.8
CO4	3	1	3	3	3	3	3	3	3	3	2.8
CO5	3	1	3	3	3	3	3	3	3	3	2.8
Mean Overall Score											2.8
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

1. Dr. A. Prasanna
2. Dr. M.A. Rifayathali
3. Mrs. S. Sharmila Banu

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UMA4AC8P:1	Allied – VIII	4	2	20	80	100
Course Title		STATISTICAL LAB USING SPSS – PRACTICAL					

SYLLABUS		
Unit	Contents	Hours
I	Data handling: open SPSS data file – save – import from other data source – data entry – labeling for dummy numbers - recode into same variable – recode in to different variable – transpose of data – insert variables and cases – merge variables and cases.	12
II	Data handling: Split – select cases – compute total scores – table looks – Changing column - font style and sizes	12
III	Diagrammatic representation: Simple Bar diagram – Multiple bar diagram – Sub-divided Bar diagram - Percentage diagram - Pie Diagram – Frequency Table – Histogram – Scatter diagram – Box plot.	12
IV	Descriptive Statistics: Mean, Median, Mode, SD- Skewness- Kurtosis. Correlation – Karl Pearson’s and Spearman’s Rank Correlation , Regression analysis: Simple and Multiple Regression Analysis [Enter and stepwise methods]	12
V	Testing of Hypothesis: Parametric – One sample – Two sample Independent t – test – Paired t – test. Non – parametric: One sample KS test- Mann-Whitney U test – Wilcoxon Signed Rank test - Kruskal Wallis test – Friedman test- Chi- square test. Analysis of variance: One way and Two way ANOVA.	12

..... Self Study

Text Book(s):
1. SPSS for You - A. Rajathi & P. Chandran – MJP Publications, Chennai, 2019 2. SPSS in Simple Steps, Pandya Kiran, Bulsari Smruti, Sinha Sanjay, Dreamtech press, New Delhi, 2012
Reference Book(s):
1. Data analysis using SPSS for windows, Jeremy J. Foster, Sage publications, London, New edition. Versions 8-10, 2001 2. SPSS for windows Step by Step, George Darren and Mallery Paul, Dorling Kindersley Publishing Pvt Ltd, Noida, UP, 2011
Web Resource(s):
1. Data handling: https://youtu.be/uw-UToPCzao?list=PLVI_iGT5ZuRmXlbuwMKi04R6Oe1G3De8G 2. Data handling: https://youtu.be/gyzTW08IceU?list=PLVI_iGT5ZuRmXlbuwMKi04R6Oe1G3De8G 3. Diagrammatic representation: https://youtu.be/MIak5nI78qM?list=PLVI_iGT5ZuRmXlbuwMKi04R6Oe1G3De8G 4. Descriptive Statistics: https://youtu.be/aOZ56S4YSeY?list=PLVI_iGT5ZuRmXlbuwMKi04R6Oe1G3De8G 5. Testing of Hypothesis: https://youtu.be/C2Qa5d9ij0Y?list=PLVI_iGT5ZuRmXlbuwMKi04R6Oe1G3De8G

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Perform a wide range of data management tasks in SPSS application.	K1
CO2	Perform data checking and create simple tables and charts.	K2
CO3	Perform database management tasks, descriptive statistics and graphics, and basic inferential statistics for comparisons and correlations.	K3
CO4	Understand the basic workings of SPSS, and perform basic statistical analyses.	K4
CO5	Perform advanced analysis in SPSS	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	3	3	3	3	3	2	2.7
CO2	3	2	2	3	3	3	3	3	3	2	2.7
CO3	3	2	2	2	2	3	3	3	3	3	2.6
CO4	3	2	2	3	2	3	3	3	2	2	2.5
CO5	3	3	3	2	2	3	3	3	2	2	2.6
Mean Overall Score											2.62
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

1. Dr. R. Jahir Hussain
2. Mrs. S. Sharmila Banu

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UMA4GE2	Generic Elective – II	2	2	-	100	100
Course Title		MATHEMATICS FOR COMPETITIVE EXAMINATION - II					

SYLLABUS		
Unit	Contents	Hours
I	Pipes and Cisterns – Time and Work	6
II	Time and Distance – Boats and Streams – *Problems on Trains*	6
III	Simple Interest – Compound Interest	6
IV	Area – Volume and Surface Area	6
V	Calendar – *Clocks* – Permutation and Combination	6

..... Self Study

Text Book(s):
Dr. R.S. Aggarwal, Quantitative Aptitude, S. Chand and Company Ltd, (2022).
UNIT I Chapters 16 & 17 UNIT II Chapters 18, 19 & 20 UNIT III Chapters 22 & 23 UNIT IV Chapters 24 & 25 UNIT V Chapters 27, 28 & 30
Reference Book(s):
1. R. V. Praveen, Quantitative Aptitude and Reasoning, PHI Private Limited, (2012). 2. Edgar Thorpe, Course in Mental Ability and Quantitative Aptitude, 3rd Edition, Mc Graw Hill Education, (2012).
Web Resource(s):
1. https://www.youtube.com/watch?v=78b4Jn4rw44 2. https://www.youtube.com/watch?v=edEvlh0tqzk 3. https://www.youtube.com/watch?v=ETiRE7N7pEI 4. https://www.youtube.com/watch?v=2rp_-h6PnFo

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Find area, volume and surface area of solids	K1
CO2	Illustrate the problems simple and compound interest	K2
CO3	Solve the problem based on Pipes and Cisterns & Time and Work	K3
CO4	Examine the date and time in Calendar and clocks respectively	K4
CO5	Determine the speed and time taken of boats and trains	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	3	2	3	3	2.8
CO2	2	2	2	3	2	3	3	3	3	2	2.5
CO3	3	1	2	3	2	3	2	3	2	2	2.3
CO4	2	2	2	2	2	3	2	1	3	3	2.2
CO5	3	3	2	2	2	3	3	2	3	1	2.4
Mean Overall Score											2.44
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

1. Dr. U. Abuthahir
2. Dr. C. Gurubaran

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UMA5CC9	Core - IX	6	6	25	75	100
Course Title		Mechanics					

SYLLABUS		
Unit	Contents	Hours
I	Force: Newton's Laws of motion – Resultant of two forces on a particle - Equilibrium of a particle: Equilibrium of a particle under three forces.	18
II	Forces on a rigid body: Moment of force - Parallel forces – Forces along the sides of a triangle - Couples – *Resultant of several coplanar forces*. Equilibrium of a rigid body under three coplanar forces – Cotangent formulae.	18
III	Types of forces - A specific reduction of forces: Problems involving frictional forces – Hanging Strings: Equilibrium of a uniform homogeneous string– *Suspension bridge*.	18
IV	Kinematics: Velocity – Projectiles - Forces on projectile –Projectile projected on an inclined plane.	18
V	Impact: Impact of sphere –Impact of two smooth spheres – Impact of a smooth sphere on a plane – Direct Impact of a smooth sphere on a plane - Oblique Impact of two smooth spheres.	18

..... Self Study

Text Book:		
P. Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasam, Mechanics, S. Chand & Company Ltd, 2018.		
UNIT I	Chapter 2	Sections 2.1.1, 2.2
	Chapter 3	Sections 3.1
UNIT II	Chapter 4	Sections 4.1,4.4 - 4.7 (Except 4.7.1, 4.7.2), 4.9
UNIT III	Chapter 2	Sections 2.1.2
	Chapter 5	Sections 5.2 (Except 5.2.1)
	Chapter 9	Sections 9.1, 9.2
UNIT IV	Chapter 1	Sections 1.2
	Chapter 13	Sections 13.1 & 13.2
UNIT V	Chapter 14	Sections 14.2 to 14.5
Reference Books:		
1. A. Ruina and R. Pratap, Introduction to Statics and Dynamics, Oxford University Press, 2014		
2. M.K.Venkataraman, Statics, Agasthiyar Publications, 2002.		
3. M.K.Venkataraman, Dynamics, Agasthiyar Publications, 2002.		
Web Resources:		
1. https://www.youtube.com/watch?v=V5MY96rdh3Q&list=PLpPH3ew3j225VZyZe2_zF4FOiqJAO6jet		
2. https://www.youtube.com/watch?v=1tc_jUs5_YU&list=PLpPH3ew3j225FlYl7WR82x2WBkdC3IFKV		

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	identify the mechanics theory of equilibrium for an object.	K1
CO2	calculate and apply the concepts of moment of a couple to determine their effects on objects.	K3, K4
CO3	understand the mechanics of strings in tension, particularly in systems involving hanging objects and able to solve problems related to tension in strings and the equilibrium of systems with hanging masses.	K2, K3
CO4	analyse and measure the motion of projectiles, including the determination of trajectories, range, maximum height, and time of flight and apply kinematic equations and principles to solve problems involving projectile motion.	K4, K5
CO5	analyse and solve problems related to the impact and collisions of spheres, including elastic and inelastic collisions and understand concepts such as conservation of momentum and energy and apply them to determine the outcomes of collisions between spherical objects.	K2, K4

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	3	3	3	3	2.7
CO2	3	2	3	2	1	3	3	3	3	3	2.6
CO3	3	3	3	2	2	3	3	3	3	3	2.8
CO4	3	2	3	3	1	3	3	3	3	3	2.7
CO5	3	3	3	3	1	3	3	3	3	3	2.8
Mean Overall Score											2.72
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator

Dr. S. Mohamed Yusuff Ansari

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UMA5CC10	Core - X	5	5	25	75	100
Course Title		Modern Algebra					

SYLLABUS		
Unit	Contents	Hours
I	Group Theory: Definition of a Group –Some Examples of Groups-Some Preliminary Lemmas- Subgroups –A Counting Principle – Normal Subgroups and Quotient Groups	15
II	Homomorphisms – Automorphisms – Cayley’s Theorem – Permutation Groups.	15
III	Ring Theory: Definition and Examples of Rings – Some Special Classes of Rings – *Homomorphisms*.	15
IV	Ideals and Quotient Rings - More Ideals and Quotient Rings – The Field of Quotients of an Integral Domain.	15
V	Euclidean Rings - A Particular Euclidean Ring – Polynomial Rings – Polynomials over the Rational Field.	15

..... Self Study

Text Book:		
I.N. Herstein, Topics in Algebra, Wiley India Adaptation Publication, Second Edition, 2022.		
Unit I	Chapter 2	Sections 2.1 – 2.6
Unit II	Chapter 2	Sections 2.7 – 2.10
Unit III	Chapter 3	Sections 3.1 – 3.3
Unit IV	Chapter 3	Sections 3.4 – 3.6
Unit V	Chapter 3	Sections 3.7 – 3.10
Reference Books:		
1. Joseph A. Gallian, Contemporary Abstract Algebra, Cengage India Pvt. Ltd., 2019.		
2. S.G. Venkatachalapathy, Modern Algebra, Maragham Publications, 2003.		
3. S. Arumugam, T. Issac, Modern Algebra, Scitech Publications India Pvt. Ltd., 2015.		
Web Resources:		
1. https://nptel.ac.in/courses/111/106/111106137/		
2. https://youtu.be/RNtgeBc3wyg		
3. https://youtu.be/fchJe96mXXQ		
4. https://youtu.be/ZCX49Jd3A38		
5. https://youtu.be/FXbnrsv4Z3g		

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	remember the concepts of sets, functions and binary operations.	K1
CO2	understand the algebraic structures of groups and rings.	K2
CO3	apply the concepts of groups and rings in some of its special characterizations.	K3
CO4	analyse the concepts of homomorphisms, isomorphisms and automorphisms of different algebraic structures.	K4
CO5	interpret with different examples for the groups, rings and its special characterizations.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	3	2	3	3	3	3	3	2.8
CO2	3	2	2	3	3	3	3	3	3	3	2.8
CO3	3	2	2	3	2	3	3	3	3	3	2.7
CO4	3	2	2	3	1	3	3	3	2	2	2.4
CO5	3	2	1	2	1	3	3	2	2	2	2.1
Mean Overall Score											2.56
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:

Dr. N. Mohamed Thoiyab

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UMA5CC11	Core - XI	5	5	25	75	100
Course Title		Real Analysis					

SYLLABUS		
Unit	Contents	Hours
I	Functions continuous at a point on the real line – Reformulation – Functions continuous on a metric space – *Open sets*	15
II	*Closed sets* – Discontinuous functions on the real line – More about open sets – Connected sets – Bounded sets and totally bounded sets.	15
III	Complete metric spaces – Compact metric spaces – Continuous functions on a compact metric spaces – Continuity of inverse functions – Uniform continuity.	15
IV	Sets of measure zero – Definition of the Riemann integral – Existence of the Riemann integral – Properties of Riemann integral.	15
V	Derivatives – Rolle's theorem – Law of mean – Fundamental theorems of calculus	15

..... Self Study

Text Book:			
Richard R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co., Reprint 2019.			
UNIT I	Chapter – V	Sections	5.1 –5.4
UNIT II	Chapter – V	Sections	5.5 and 5.6
	Chapter – VI	Sections	6.1 - 6.3
UNIT III	Chapter – VI	Sections	6.4 – 6.8
UNIT IV	Chapter – VII	Sections	7.1 – 7.4
UNIT V	Chapter - VII	Sections	7.5 and 7.8
Reference Books:			
1. Principles of Real Analysis, Third edition, Walter Rudin, Mc-Graw Hill international edition, 1976.			
2. Elements of Real Analysis, Shanti Narayan, M.D. Raisinghania, S. Chand & Company Ltd., Twelfth Revised Edition, 2011.			
3. Modern Analysis, S. Arumugam, Issac, New Gamma Publishing House, 2012.			
Web Resources:			
1. https://youtu.be/8Uf8cRh57k8			
2. https://youtu.be/fVzOEX6Stzc			
3. https://youtu.be/lK3h9NSH-DI			

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	demonstrate an understanding of the functions continuous on a metric space.	K1
CO2	discuss the discontinuous on the real line.	K2
CO3	give the definition of concepts related to metric space such as uniformly continuity, compactness and completeness.	K3
CO4	define and recognize the Riemann integral.	K4
CO5	give the essence of the proof of fundamental theorem of calculus.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	1	2	3	1	3	3	3	2.4
CO2	3	2	3	3	3	3	3	3	1	3	2.7
CO3	3	3	3	3	1	2	3	3	3	1	2.5
CO4	3	3	1	3	3	3	3	3	1	2	2.5
CO5	3	1	3	2	3	3	3	1	3	2	2.4
Mean Overall Score											2.5
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:**Mr. S. Masoothu**

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UMA5CC12	Core - XII	5	5	25	75	100
Course Title		Numerical Methods with Mathematica					

SYLLABUS		
Unit	Contents	Hours
I	Solution of Algebraic and Transcendental equation – Bisection Method - *Iteration Method* - Method of false position - Newton-Raphson Method.	15
II	Interpolation: Finite differences – Forward differences - *Backward differences* - Central differences - Symbolic relations - Newton's formula for interpolation. Interpolation with unevenly spaced points – Lagrange's interpolation formula.	15
III	Numerical differentiation and integration – Numerical differentiation (Excluding cubic spline Method), Maximum and Minimum values of a tabulated function - Numerical integration -Trapezoidal Rule - Simpson's Rule.	15
IV	Matrices and linear system of equation: Gaussian Elimination Method - Method of Factorization - Iterative Method – Gauss Jacobi- Gauss Jordan - Gauss Seidel Methods.	15
V	Numerical solution of ordinary differential equations – Solution by Taylor series - Picard's method of successive approximations - Euler method - *Modified Euler Method*- Runge–Kutta Methods of second order and fourth order.	15

*..... * Self Study

Text Book:		
S.S. Sastry, Introductory Methods of Numerical Analysis, Fourth Edition, 2009.		
UNIT I	Chapter 2	Sections 2.1-2.5
UNIT II	Chapter 3	Sections 3.3, 3.6, 3.9.1
UNIT III	Chapter 5	Sections 5.1, 5.2 (Excluding 5.2.1 and 5.2.2), 5.4, 5.4.1, 5.4.2
UNIT IV	Chapter 6	Sections 6.3.2-6.3.4, 6.4
UNIT V	Chapter 7	Sections 7.2 - 7.4, 7.4.2, 7.5.
Reference Books:		
1. F.B. Hildebrand, Introduction to Numerical analysis, Second edition, Tata McgrawHill, 1987.		
2. A. Singaravelu, Numerical Methods, Meenachi Agency, 2000.		
Web Resources:		
1. https://youtu.be/o9MUMIWA5IE?si=bBKnpPy-rnXDVB0v		
2. https://youtu.be/5W9CP4JERSM?si=1fMWZ1x1xTNUt0I		
3. https://youtu.be/oTN7hGoSPMw?si=v7fy-n3vSe1cXpbW		
4. https://youtu.be/loZXC_29nIY?si=GBKSa_ySdzJd1h6		

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	demonstrate an understanding of the method of false position and bisection method using Mathematica	K1
CO2	discuss the central differences and interpolation with unevenly spaced points	K2
CO3	give the definition of maximum and minimum values of a tabulated function	K3
CO4	define matrices and linear system of equation	K4
CO5	give the essence of the proof Picard's method of successive approximations	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	1	2	3	2	3	3	3	2.5
CO2	3	2	3	3	3	3	3	3	1	3	2.7
CO3	3	3	3	3	1	2	3	3	3	1	2.5
CO4	3	3	1	3	3	3	3	3	1	2	2.5
CO5	3	1	3	2	3	3	3	2	3	2	2.5
Mean Overall Score											2.6
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:

Dr. P. Muruganantham

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UMA5DE1A	Discipline Specific Elective - I	5	4	25	75	100
Course Title		Graph Theory					

SYLLABUS		
Unit	Contents	Hours
I	Graph – *Applications of Graphs* – Finite and Infinite graphs – Incidence and Degree – Isolated vertex, Pendant vertex and Null graphs. Paths and Circuits: Isomorphism – Sub-graphs – Walks, Paths and Circuits – Connected and disconnected graphs – Euler graphs.	15
II	Operations on Graphs – More on Euler Graphs – Hamiltonian Paths and Circuits - Trees and Fundamental Circuits: Trees – Properties of Trees – Pendant vertices in a Tree – Distance and Centers in a Tree.	15
III	Spanning Trees – Fundamental circuits - Cut sets and Cut vertices: Cut sets – Properties of a Cut set – All Cut sets in a graph - Fundamental Circuits and Cut sets – Connectivity and Separability.	15
IV	Planar and Dual graphs: Planar graphs – Kuratowski's two graphs – Representation of a Planar graph – Detection of Planarity – Geometric Dual.	15
V	Matrix Representation of graphs: Incidence Matrix – Circuit matrix – Fundamental Circuit matrix and Rank of Circuit matrix – *Cut set matrix* – Relationship among A_f , B_f and C_f – Path matrix– Adjacency matrix.	15
VI	Current Trends (For CIA only) Applications of Graphs: Graphs in Markov Process – Graphs in Computer Programming	

..... Self Study

Text Book:		
Narsingh Deo, Graph theory with application to Engineering and Computer Science, PHI Learning Private Limited, New Delhi, 2012.		
UNIT I	Chapter 1	Sections 1.1 – 1.5
	Chapter 2	Sections 2.1, 2.2, 2.4 – 2.6
UNIT II	Chapter 2	Sections 2.7 – 2.9
	Chapter 3	Sections 3.1 – 3.4
UNIT III	Chapter 3	Sections 3.7, 3.8
	Chapter 4	Sections 4.1 – 4.5
UNIT IV	Chapter 5	Sections 5.2 – 5.6
UNIT V	Chapter 7	Sections 7.1, 7.3, 7.4, 7.6 – 7.9
Reference Books:		
1. V.R. Kulli, College Graph Theory, Viswa International Publications, Gulbarga, India (2012). 2. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, Tata McGraw Hill Higher Education Private Limited, New Delhi, Eight reprint (2012). 3. Frank Harary, Graph Theory, Narosa Publishing House, New Delhi (Reprint 2001).		
Web Resources:		
1. https://archive.nptel.ac.in/courses/111/106/111106102/ 2. https://archive.nptel.ac.in/courses/106/104/106104170/ 3. http://www.ndl.gov.in/he_document/nptel/nptel/courses_106_103_106103205_video_lec12 4. https://www.youtube.com/results?search_query=nptel+graph+theory 5. https://www.youtube.com/channel/UCfm1RidSZpKnqhaBhjLcalg/videos		

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	demonstrate and discuss about graphs and its applications	K1
CO2	apply domain knowledge in operations on graphs with illustrations	K2
CO3	analyse spanning trees and prove the properties of cut sets	K3
CO4	determine the fundamental circuits and cut sets	K4
CO5	discuss the concepts of incidence matrix, circuit matrix and fundamental circuit matrix	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	1	2	3	1	3	3	3	2.4
CO2	3	2	3	3	3	3	3	3	1	3	2.7
CO3	3	3	3	3	1	2	3	3	3	1	2.5
CO4	3	3	1	3	3	3	3	3	1	2	2.5
CO5	3	1	3	2	3	3	3	1	3	2	2.4
Mean Overall Score											2.5
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:

Dr. H. Sheik Mujibur Rahman

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UMA5DE1B	Discipline Specific Elective - I	5	4	25	75	100
Course Title		Control Theory					

SYLLABUS		
Unit	Contents	Hours
I	Basic Results of Differential Equation – Fixed Point Method – Banach Fixed point theorem – Brouwer fixed point theorem – Leray-Schauder theorem.	15
II	Observability- Linear System – Results of simple theorems and propositions – non - Linear Systems - Results of simple theorems and propositions.	15
III	Controllability- Linear System – Results of simple theorems and propositions – non - Linear Systems – Controllability with prescribed Controls - Results of simple theorems and propositions.	15
IV	Stability – Linear Systems – Perturbed Linear Systems – Gronwall's Inequality - non - Linear Systems - Results of simple theorems and propositions.	15
V	Linear time varying systems - Linear time invariant systems – Results of simple theorems and propositions - non - Linear Systems - Results of simple theorems and propositions.	15

..... Self Study

Text Book:		
K. Balachandran , J.P. Dauer, Elements of Control Theory, Narosa Publishing House, 2 nd Edition, 2001.		
UNIT I	Chapter 1	Sections 1.2 – 1.3
UNIT II	Chapter 2	Sections 2.1 – 2.2
UNIT III	Chapter 3	Sections 3.1 – 3.4
UNIT IV	Chapter 4	Sections 4.1 – 4.3
UNIT V	Chapter 6	Sections 6.1 – 6.3
Reference Books:		
1. Jerzy Zabczyk, Mathematical Control Theory, Birkhäuser Cham, 2020		
2. W.L.Brogan, Modern Control Theory, Prentice Hall International Inc, 2019.		
Web Resources:		
1. https://www.youtube.com/watch?v=bfI53iDMStQ&list=PLi0SF0xUQtTq3PpCQvg8EbGVZxapTcFS2		
2. https://www.youtube.com/watch?v=vKgbYRw21xA		
3. https://www.youtube.com/watch?v=ySfs8YVMY7Q&list=PLw5b-jhi9cCD_YQgijiHnodoD0G91lu4c		

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	remember the fundamental concepts of differentiation, fixed point method	K1
CO2	understand linear and non-linear systems	K2
CO3	apply and prove basic results of theorems and propositions	K3
CO4	analyse different linear and non-linear systems	K4
CO5	evaluate linear and non-linear system of time varying systems	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	1	3	1	3	1	1	2.1
CO2	3	3	1	3	3	1	3	1	3	2	2.3
CO3	3	2	3	2	3	3	1	3	1	2	2.3
CO4	3	2	1	3	2	3	3	2	3	1	2.3
CO5	3	1	3	1	3	1	3	2	2	3	2.2
Mean Overall Score											2.24
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:

Dr. T. Shiek Pareeth

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UMA5SE1P	Skill Enhancement Course - I	2	1	-	100	100
Course Title		LATEX - Practical					

SYLLABUS

List of Practical

1. i) To typeset some vague mathematical formulae.
ii) To typeset the system of equations and the corresponding matrix form.
2. To prepare a multi table.
3. To create a floating picture.
4. To prepare Page alignments, Page Style, the footnote and endnote.
5. To typeset theorem, lemma, proposition and corollary.
6. To prepare chapters, sections, subsections, table of contents, list of figures, list of tables
in a book.
7. To prepare bibliography and bibliography database in book.
8. To prepare title, acknowledgement, declare certificates, abstract, keyword in report.
9. To prepare front page of report and book.
10. To prepare a model conduct certificate.

Text Book:

George Grätzer, Practical LATEX, Springer International Publishing Switzerland, First Edition, 2014.

Reference Books:

1. Frank Mittelbach and Michel Goossens The LaTeX Companion, Addison-Wesley Series, Second Edition, 2004.
2. Stefan Kottwitz, LaTeX Beginner's Guide, Packt Publishing Ltd., First Edition 2011.
3. E. Krisnan, Latex Tutorials: A Primer, Indian TEX Users Group, Tiruvandrum, 2003.

Web Resources:

1. <https://www.youtube.com/playlist?list=PLHXZ9OQGMqxcWWkx2DMnQmj5os2X5ZR73>
2. <https://www.youtube.com/watch?v=p5Yr0dkrKG8>
3. <https://www.youtube.com/watch?v=SoDv0qhyysQ>

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	remember the m.s. word font, font size, alignment and page setup.	K1
CO2	understand the latex software to prepare a document / book.	K2
CO3	applying the latex software to type the vague mathematical equations in a book.	K3
CO4	analyse the various packages using in latex.	K4
CO5	know how to prepare an article / a book.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	3	3	3	2	2.8
CO2	3	2	3	2	3	3	3	2	3	3	2.7
CO3	3	3	2	3	3	3	3	3	2	3	2.8
CO4	3	3	3	3	2	3	3	3	3	2	2.8
CO5	3	2	3	3	2	3	3	2	3	3	2.7
Mean Overall Score											2.76
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:

Dr. A. Mohamed Ismayil

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UMA5SE2P	Skill Enhancement Course - II	2	1	-	100	100
Course Title		App Development - Practical					

SYLLABUS

1. Develop an application for Simple Counter.
2. Develop an application to display your personal details using GUI Components.
3. Develop a Simple Calculator that uses radio buttons and text view.
4. Develop an application that uses Intent and Activity.
5. Develop an application that uses Dialog Boxes.
6. Develop an application to display a Splash Screen.
7. Develop an application that uses Layout Managers.
8. Develop an application that uses different types of Menus.
9. Develop an application that uses Local File Storage.
10. Develop an application for Simple Animation.

Reference Books:

1. Dr. John T Mesia Dhas, Dr. S. Naveen Kumar, Mr. D. Surendra, Android Applications Development Practical Approach, Self-Published by Dr. John T Mesia Dhas, Copyright@ 2021, India.
2. WeiMeng Lee, Beginning Android Application Development, Wrox Publications (John Wiley, New York), 2012.
3. Ed Burnette, “Hello Android: Introducing Google's Mobile Development Platform”, 3rd edition, The Pragmatic Publishers, 2010.
4. Reto Meier, Professional Android 4 Application Development, Wrox Publications (John Wiley, New York), 2012.

Web Resources:

1. <https://www.ijaeast.com/AAD%20-%20Book.pdf>
2. https://www.tutorialspoint.com/mobile_development_tutorials.htm
3. [https://www.tutorialspoint.com/Android/Android – Home](https://www.tutorialspoint.com/Android/Android_Home)

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	understand the concepts of counters and dialogs	K2
CO2	develop a simple calculator using radio buttons.	K3
CO3	analyze the concepts of layout managers.	K4
CO4	determine the concepts of simple animation .	K5
CO5	construct an application using local file storage.	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	3	2	3	3	3	3	2.8
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	2	3	2	3	2	3	3	3	2.7
CO4	3	3	3	3	3	2	3	3	3	3	2.9
CO5	3	2	3	3	3	3	3	3	3	3	2.9
Mean Overall Score											2.86
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:
Dr. K.S. Kanzul Fathima.

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
V	23UMA5EC1	Extra Credit Course – I*	-	*	-	-	-
Course Title		Online Course					

* Programme Specific Online Course for Advanced Learners.

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UMA6CC13	Core - XIII	6	6	25	75	100
Course Title		Linear Algebra					

SYLLABUS		
Unit	Contents	Hours
I	Vector spaces- subspaces- sum of subspaces- Quotient spaces- homomorphism of vector spaces- linear span- *linear dependence and independence*.	18
II	Linear transformations – algebra of linear transformations – matrix of a linear transformation.	18
III	Dual spaces- transpose of a linear transformations.	18
IV	Characteristic polynomials - Characteristic polynomial of a linear operator – *minimal polynomials* – diagonalizable operators.	18
V	Inner product spaces – norm of a vector – orthogonality – orthonormal set.	18

..... Self Study

Text Book:	
Vijay K. Khanna and S. K. Bhambri, A course in Abstract Algebra, 5th Edition, Vikas Publishing house Pvt. Ltd., 2016.	
Unit I	Chapter 10 up to Linear dependence and independence.
Unit II	Chapter 11 up to matrix of a linear transformation
Unit III	Chapter 11 remaining topic
Unit IV	Chapter 12 up to diagonalizable operators.
Unit V	Chapter 13 up to orthonormal set
Reference Books:	
1. V. Krishnamurthy, V.P. Mainra, I.L. Arora, Introduction to Linear Algebra, Affiliated East-west Press Pvt. Ltd., 2000.	
2. Lipschutz, Seymour, Lipson, Marc, Schaum's Outline of Linear Algebra, Sixth Edition, McGraw Hill Professional, 2018.	
3. Gilbert Strang, Introduction to Linear Algebra, Sixth Edition, Wellesley Cambridge Press, 2023.	
Web Resources:	
1. https://nptel.ac.in/courses/111/106/111106051/	
2. https://youtu.be/BxYHt2FlmqM	
3. https://youtu.be/FL9ANdNTQus	
4. https://youtu.be/9pqhfDyzbhw	
5. https://youtu.be/H9p0-hlseh0	

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	recall the concepts in vector space, linear span, linear dependence and independence	K1
CO2	classify the concepts in linear transformations with examples.	K2
CO3	solve dual spaces with examples	K3
CO4	deduct the characteristic values by using Cayley Hamilton theorem	K4
CO5	determine an orthonormal basis for an inner product space by using the Gram-Schmidt process	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	3	3	2	1	2	2	3	3	2.3
CO2	3	2	3	3	3	3	3	2	2	2	2.6
CO3	3	3	3	3	1	1	3	3	2	3	2.5
CO4	3	3	1	3	3	2	3	2	2	3	2.3
CO5	3	3	1	3	2	3	3	3	3	3	2.7
Mean Overall Score											2.48
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:

Dr. U. Abuthahir

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UMA6CC14	Core-XIV	6	6	25	75	100
Course Title		Complex Analysis					

SYLLABUS		
Unit	Contents	Hours
I	Continuous functions – Differentiability – Cauchy – Riemann equations – Analytic functions- Harmonic functions.	18
II	Conformal Mapping – Elementary transformations – Bilinear transformations – Cross ratio – Fixed points of Bilinear Transformation	18
III	Definite integral – Cauchy's Theorem – Cauchy's integral formula- *Higher derivatives*.	18
IV	Taylor's series – Laurent's series – Zeroes of Analytic functions- Singularities	18
V	Residues – Cauchy's Residue Theorem- Evaluation of definite integrals.	18

** Self Study

Text Book:		
S. Arumugam, A. Thangapandi Isaac and A. Somasundaram, Complex Analysis, New Scitech Publications (India) Pvt. Ltd. 2015.		
UNIT I	Chapter II	Sections 2.4 – 2.8
UNIT II	Chapter II	Sections 2.9 & Chapter III Sections 3.1 – 3.4
UNIT III	Chapter VI	Sections 6.1 – 6.4
UNIT IV	Chapter VII	Sections 7.1 – 7.4
UNIT V	Chapter VIII	Sections 8.1 – 8.3
Reference Books:		
1. J.N. Sharma, Functions of a Complex variable, Krishna Prakasan Media (P) Ltd, 13 th Edition, 1996-97.		
2. T.K. Manicavachagom Pillay, Complex Analysis, S.Viswanathan Publishers Pvt. Ltd., 1994.		
Web Resources:		
1. https://www.youtube.com/watch?v=pXch7JJgiBo		
2. https://youtu.be/XvLnHIPsWqY?si=OWLe7E54Oj020Ei4		
3. https://youtu.be/ZQCtNuIr55k?si=nSU7LvCe38fu2r4x		
4. https://youtu.be/_mjZJYcER_Q?si=VZRPpjaf4ggIQatx		
5. https://youtu.be/9YuJxGomb_4?si=AN9L0i1fKS-UzR1J		

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	analyse complex functions, including their limits, continuity and differentiable with examples.	K1
CO2	understand and apply the concepts of complex mappings and transformations.	K2
CO3	evaluate complex integrals using contour integration, including applications of Cauchy's theorem and Cauchy's integral formula.	K3
CO4	understand and apply the theory of complex series, including Taylor and Laurent's series.	K4
CO5	use residue calculus to evaluate complex integrals and solve problems involving singularities.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	1	3	3	2	2	3	2	3	3	2.5
CO2	3	3	3	2	2	3	3	3	2	3	2.7
CO3	2	3	2	3	3	3	1	2	3	1	2.3
CO4	3	3	3	3	3	2	3	3	3	3	2.9
CO5	2	2	3	3	2	3	3	3	1	3	2.5
Mean Overall Score											2.58
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:
M. S. Afya Farhana

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UMA6CC15	Core-XV	5	5	25	75	100
Course Title		Number Theory					

SYLLABUS		
Unit	Contents	Hours
I	Divisibility Theory in the integers: The Division Algorithm- *The Greatest Common Divisor*-The Euclidean Algorithm-The Diophantine Equation $ax+by=c$.	15
II	Primes and Their Distribution: The Fundamental theorem of Arithmetic- The Sieve of Eratosthenes- *The Goldbach Conjecture*	15
III	The Theory of Congruences -Basic Properties of Congruence -Linear Congruences and The Chinese Remainder Theorem-Fermat's Little Theorem and Pseudoprimes - Wilson's Theorem.	15
IV	Number Theoretic Functions: The Sum and Number of Divisors-The Mobius Inversion Formula- The Greatest Integer Function.	15
V	Euler's generalization of Fermat's Theorem: Euler's Phi-function- Euler's Theorem-Some properties of the Phi-function	15

** Self Study

Text Book:

David M. Burton, Elementary Number Theory, Seventh Edition, Tata McGraw Hill, 2023.

UNIT I	Chapter 2	Sections 2.2-2.5
UNIT II	Chapter 3	Sections 3.1-3.3
UNIT III	Chapter 4	Sections 4.2, 4.4
	Chapter 5	Sections 5.2, 5.3
UNIT IV	Chapter 6	Sections 6.1-6.3
UNIT V	Chapter 7	Sections 7.2-7.4

Reference Books:

1. G. H. Hardy, An Introduction to the Theory of Numbers, Oxford University Press; 6th edition, 2008.
2. Joseph Silverman, A Friendly Introduction to Number Theory, Pearson Education; Fourth edition, 2019.
3. Kumaravelu S., Susheela Kumaravelu, Elements of Number Theory, S.K.V Publishers, Nagercoil, 2002.

Web Resources:

1. <https://youtube.com/playlist?list=PLmxCweM-UENwd0YFTrzSwvHaOiV3R9mZ&si=dPHWTJLz7gVrxXme>
2. <https://youtube.com/playlist?list=PLBlnK6fEyqRjjeHdm0cwu6E-nhhEluuVA&si=onlSE5ddSuRF982Q>
3. https://youtube.com/playlist?list=PLlj41Lsfa1mZ4OYASMq5D_EYtW27ZgQI3&si=6YVILqDFHQOXeUMF

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	gain knowledge and understanding the topics including, but not limited to divisibility, prime numbers, congruences and Diophantine equations.	K1
CO2	learn methods and techniques used in Euclidean algorithm.	K2
CO3	understand the meaning and role of different conjectures in number theory.	K3
CO4	apply the theory of congruences for solving problems in number theory.	K4
CO5	solve problems with the help of number theoretic functions.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	1	3	3	2	2	3	2	3	3	2.5
CO2	3	3	3	2	2	3	3	3	2	3	2.7
CO3	2	3	2	3	3	3	1	2	3	1	2.3
CO4	3	3	3	3	3	2	3	3	3	3	2.9
CO5	2	2	3	3	2	3	3	3	1	3	2.5
Mean Overall Score											2.58
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:
S. Sharmila Banu

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UMA6PW	Project Work	3	2	-	100	100
Course Title		Group Project					

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UMA6DE2A	Discipline Specific Elective - II	5	4	25	75	100
Course Title		Operations Research					

SYLLABUS		
Unit	Contents	Hours
I	Introduction - Linear Programming Problem – Mathematical Formulation of LPP – Graphical Solution Method – Some Exceptional Cases – Canonical and Standard forms of LPP – Basic Solution – Basic Feasible and Infeasible Solution – Degenerate Solution - Simplex Algorithm.	15
II	Use of Artificial Variables – Two Phase Method and Big-M Method. Introduction – General Primal Dual Pair – Formulating a Dual Problem – *Primal-Dual Pair in matrix form*.	15
III	Introduction – LP formulation of the Transportation Problem – Finding an Initial Basic Feasible Solution using North West Corner Rule, *Least Cost Entry Method* and VAM – MODI Method – Assignment Problem – Hungarian method	15
IV	Games and Strategy : Introduction – Two-person zero –sum games – *Some Basic terms – The maxmin –minmax principle* – Games without saddle points – mixed strategies – Graphic solution of 2 x n and m x 2 games.	15
V	Introduction – *Network: Basic Components, Logical Sequencing* - Rules of Network Constructions – Critical Path Analysis – Probability consideration in PERT - Distinction between CPM and PERT	15

..... Self Study

Text Book:		
Kanti Swarup, P.K. Gupta and Man Mohan, Operations Research, Sultan Chand and Sons Publishers, New Delhi, 19 th edition, 2017.		
UNIT I	: Chapter 2	Sections 2.1 – 2.4
	Chapter 3	Sections 3.2 - 3.5
	Chapter 4	Sections 4.1- 4.3
UNIT II	: Chapter 4	Sections 4.4
	Chapter 5	Sections 5.1 - 5.4, 5.7
UNIT III	: Chapter 10	Sections 10.1, 10.2, 10.9, 10.13
	Chapter 11	Sections 11.1 - 11.3
UNIT IV	: Chapter 17	Sections: 17.1 – 17.6
UNIT V	: Chapter 25	Sections 25.1 - 25.4, 25.6 - 25.8
Reference Books:		
1. Sharma, S.D., Operations Research, Kedar Nath Ram Nath & Co, 15 th Edition, 2010.		
2. B.S.Goel and S.K.Mittal , Operations Research, Pragathi Prakashan Publishers, Meerut, 16 th Edition, 1999.		
3. Hamdy A. Taha., Operations Research An Introduction, Pearson Publication, 10th Edition, 2017.		
Web Resources:		
1. https://nptel.ac.in/courses/111/107/111107128/		
2. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=25		
3. https://onlinecourses.swayam2.ac.in/cec21_ma13/unit?unit=6&lesson=7		

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	demonstrate and study of operations research and graphical solution method illustrate the examples.	K1
CO2	classification and study of artificial variables and two phase method and analyse the dual simplex method with illustrate the examples.	K2
CO3	interpret the concept of game theory with illustrate the examples.	K3
CO4	illustrate the transportation problem and assignment problems with examples.	K4
CO5	construct the network and plan execution with examples.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	2	3	2	3	3	3	2.7
CO2	3	2	3	3	3	3	3	3	2	3	2.8
CO3	3	3	3	3	2	2	3	3	3	2	2.7
CO4	3	3	2	3	3	3	3	3	2	2	2.7
CO5	3	2	3	2	3	3	3	2	3	2	2.6
Mean Overall Score											2.7
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:

Dr. M. Mohamed Althaf

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UMA6DE2B	Discipline Specific Elective -II	5	4	25	75	100
Course Title		Discrete Mathematics					

SYLLABUS		
Unit	Contents	Hours
I	Logic: Propositions and logical operations - Logical Connectives and Compound Statements – Quantifiers – Conditional statements - Mathematical induction – Mathematical statements – *Logic and Problem Solving*.	15
II	Counting: Permutations – Combinations - Pigeonhole principle – The extended pigeonhole Principle – Elements of probability – Sample Spaces – Events – Assigning Probabilities to Events - *Equally Likely Outcomes* – Recurrence Relations.	15
III	Relations and Digraphs: Relations and Digraphs – Sets Arising from Relations – The Matrix of a Relation – The Digraph of a Relation – Paths in Relations and Digraphs - Properties of Relations – Reflexive and Irreflexive Relations – Symmetric, Asymmetric and Antisymmetric Relations – Transitive Relations – *Equivalence Relations* – *Equivalence Relations and Partitions* – Operations on Relations – Composition – Transitive Closure and Warshall's Algorithm – Transitive Closure – Warshall's Algorithm	15
IV	Order relations and structures: Partially ordered sets – Hasse Diagrams – Topological Sorting – *Isomorphism*- Extremal elements of partially ordered sets – Lattices – Isomorphic Lattices - Properties of Lattices - Special types of lattices - Finite Boolean Algebras – Functions on Boolean Algebras – Boolean Polynomials.	15
V	Languages and Finite-State Machines: Languages – Grammars – Representations of Special Grammars and Languages – BNF Notation – Syntax Diagrams – Regular Grammars and Regular Expressions - Finite-State Machines – *Machine Congruence and Quotient Machines*.	15

** Self Study

Text Book:		
Kolman, Busby and Ross, Discrete Mathematical Structures, P HI learning private ltd, New Delhi, sixth edition, 2009.		
UNIT I	Chapter II	Sections 2.1, 2.2, 2.4 – 2.6.
UNIT II	Chapter III	Sections 3.1 – 3.5.
UNIT III	Chapter IV	Sections 4.2 – 4.5, 4.7, 4. 8.
UNIT IV	Chapter VI	Sections 6.1 – 6.5
UNIT V	Chapter X	Sections 10.1 – 10.3
Reference Books:		
1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, Thirty-Ninth Reprint, 2011.		
2. Rakesh Dube, Adesh Pandey and Ritu Gupta, Discrete Structures and Automata Theory, Narosa Publishing House, 2000.		

Web Resources:

1. Propositional Logic:

<https://www.geeksforgeeks.org/proposition-logic/>

2. Predicate Logic:

<https://www.geeksforgeeks.org/mathematic-logic-predicates-quantifiers/>

3. Relations and their Properties:

<https://www.geeksforgeeks.org/relation-in-maths/>

4. Counting Techniques and Pigeonhole Principle:

<https://www.geeksforgeeks.org/discrete-mathematics-the-pigeonhole-principle/>

5. Hasse Diagrams:

<https://www.geeksforgeeks.org/discrete-mathematics-hasse-diagrams/>**Course Outcomes**

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

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	recognize mathematical reasoning in order to read, comprehend, and construct mathematical arguments which serves as the foundation for the subsequent discussions of methods of proof.	K1
CO2	understand to count or enumerate objects which begin with the basic techniques of counting. they will be able to perform combinatorial analysis to solve counting problems and analyse algorithms, not on applying formulae.	K2
CO3	apply properties of relations and to identify equivalence and partial order relations, sketch relations.	K3
CO4	analyse Boolean functions and simplify expression using the properties of Boolean algebra.	K4
CO5	evaluate the use finite-state machines to model computer operations.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	2	3	3	2	3	3	2.7
CO2	3	2	3	2	2	3	3	3	3	3	2.7
CO3	3	3	2	2	3	3	3	3	2	3	2.7
CO4	3	2	3	2	2	3	3	3	2	2	2.5
CO5	2	3	2	2	2	3	3	3	2	2	2.4
Mean Overall Score											2.6
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:**A. Fathima Begam**

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UMA6DE3A	Discipline Specific Elective -III	4	4	25	75	100
Course Title		Astronomy					

SYLLABUS		
Unit	Contents	Hours
I	Formula for spherical Trigonometry – Celestial Sphere – Diurnal motion.	12
II	Dip of Horizon – Twilight – Refraction – Astronomical refraction – Tangent and Cassini's formula for refraction.	12
III	Kepler's laws of planetary motion –Newton's deductions from Kepler's laws – Time – Equation of time – Analytical expression for the equation of time.	12
IV	*Calendar*-Conversion of Time-Heliocentric Parallax	12
V	Moon –Phase of Moon - Eclipses – Lunar Eclips – Solar Eclips	12

..... Self Study

Text Book:			
Kumaravelu and Susheela Kumaravelu, Astronomy, Revised and enlarged edition, 2013.			
UNIT-I	Chapter I	Sections	21 – 23, 25
	Chapter II	Sections	39 - 63, 66-68 , 69 – 79 , 80 – 83.
UNIT-II	Chapter III	Sections	106 -116
	Chapter IV	Sections	117 – 130
UNIT-III	Chapter VI	Sections	146, 153
	Chapter VII	Sections	166 – 170
UNIT-IV	Chapter VII	Sections	175-178, 180-184
	Chapter VIII	Sections	190-194
UNIT-V	Chapter XII	Sections	229 -241
	Chapter XIII	Sections	256 – 263, 267 – 270
Reference Books:			
1. Introduction to Astronomy and Cosmology by Ian Morison, A John Wiley and Sons Limited Publications, 2008.			
2. W.M. Smart, Textbook on Spherical Astronomy, Cambridge University Press, 1999.			
3. Barlow, Elementary Mathematical Astronomy, Barlow Prentice-Hall, 1983.			
Web Resources:			
1. https://www.nsf.gov/news/classroom/astronomy.jsp			
2. https://onlinecourses.swayam2.ac.in/arp19_ap87/preview			

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	recall and discuss the basic concepts of spherical trigonometry	K1
CO2	explain the refraction with the examples	K2
CO3	identify time and seasons	K3
CO4	examine the heliocentric parallax	K4
CO5	discuss the solar eclipses and lunar eclipses	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	1	3	3	1	3	3	2	3	2.5
CO2	3	3	2	3	3	3	1	3	3	2	2.6
CO3	2	2	3	3	1	3	3	3	1	3	2.4
CO4	3	3	3	3	3	1	2	3	3	2	2.6
CO5	1	3	3	2	3	3	3	1	3	3	2.5
Mean Overall Score											2.52
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:

Dr. M.A. Rifayathali

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UMA6DE3B	Discipline Specific Elective -III	4	4	25	75	100
Course Title		Vedic Mathematics					

SYLLABUS		
Unit	Contents	Hours
I	Addition – addition using zero ending numbers – addition of algebraic expression. Subtraction – subtraction using “Ekadhikena Poorvena” – subtraction using “Ekanyunena Poorvena” – subtraction of polynomials - Multiplication – multiplication using “Nikhilum” sutra - multiplication using “Urdhva Triyagbhyam”	12
II	Division – division using “Nikhilum” sutra - division using “Paravartya Yojayet” – division of polynomials - Divisibility – Positive Osculators - Negative Osculators Square and Square root – square using Yavadunam Method – square using “Ekadhikena Poorvena” – square root	12
III	Cube and Cube roots – cube using Yavadunam Method – cube using “Anurupyena” method – cube root - Decimals – operation on decimals – conversion into decimals – addition of decimals – *subtraction of decimals* – multiplication of decimals Factorization – simple quadratic equation – homogeneous quadratic equation – complex quadratic non homogenous polynomials – cubic polynomials	12
IV	Highest common factor - *Simple equation* - Quadratic equation	12
V	Cubic equation – solving cubic equation using “Purna and Paravartya” – special types of cubic equations - Biquadratic equation - Simultaneous Equation – Solving for X – Solving Y	12

..... Self Study

Text Book:
Pandit Ramnandan Shashtri, For Competitive Exams Vedic Mathematics MADE EASY Arihanth Publication (I) Pvt. Ltd, Meerut. 2011.
Unit I Chapter 1, 2, 3
Unit II Chapter 4, 5, 6
Unit III Chapter 7, 8, 9
Unit IV Chapter 10, 11, 12
Unit V Chapter 13, 14, 15
Reference Books:
1. Rajesh Kumar Thakur, Speed Mathematics Do It Quick, Do It Right! Rupa Publication Pvt. Ltd, 2022
2. Dhaval Bathia, Vedic Mathematics The Problem Solver, Maple Press Private Limited Edition, 2020
Web Resources:
1. https://www.youtube.com/watch?v=0UL8P-mpRfU
2. https://www.youtube.com/watch?v=S7G1uAK6c-s
3. https://www.youtube.com/watch?v=8WS-O1XA7_o

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	recall the basic concepts of addition, subtraction, and multiplication with easy tricks.	K1
CO2	understand the deep insight concept of normal solving using Vedic mathematics.	K2
CO3	apply the mathematical idea of using the Vedic mathematics concepts.	K3
CO4	analyse the difference between normal calculation and Vedic mathematics calculation.	K4
CO5	estimate the mathematical problem in the entrance examination easily and fast.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	1	3	3	3	1	3	2	3	2.5
CO2	3	3	2	3	3	3	1	3	3	2	2.6
CO3	2	2	3	2	2	3	3	2	2	3	2.4
CO4	3	3	3	3	2	2	2	3	3	2	2.6
CO5	1	3	3	2	3	3	3	1	3	3	2.5
Mean Overall Score											2.52
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator:
Dr. A. Prasanna

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UMA6EC2	Extra Credit Course – II*	-	*	-	-	-
Course Title		Online Course					

* Programme Specific Online Course for Advanced Learners.

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
VI	23UMAECA	Extra Credit Course for all **	-	**	-	-	-
Course Title		Online Course					

** Any Online Course for Enhancing Additional Skills

Allied Mathematics for B.Sc. Computer Science

Allied Mathematics for B.Sc. Physics

Allied Mathematics for B.Sc. Chemistry

**Allied Mathematics for B.Sc. Artificial Intelligence & Machine
Learning**

Allied Mathematics for B.Sc. Computer Science

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UMA1AC1	Allied - I	4	3	25	75	100
Course Title		Linear Algebra and Differential Equations					

SYLLABUS		
Unit	Contents	Hours
I	Matrices- *Special types of matrices*- Scalar multiplication of a matrix- Equality of matrices, Addition of matrices- Subtraction- Symmetric matrix-Skew symmetric matrix-Hermitian and skew Hermitian matrices- Multiplication of matrices- Inverse matrix- Orthogonal matrices (Problems only).	12
II	Solution of simultaneous equations-Rank of a matrix- Eigen values and Eigen vectors-*Cayley Hamilton theorem*. (Problems only)	12
III	Differential equations of the first order with higher degree – Equations solvable for p- Equations Solvable for y – *Equations Solvable for x* - Clairaut's form. (Problems only)	12
IV	*Linear Differential Equations with constant coefficients * - Particular integral – Special method of finding P.I. – Derivation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Different integrals of First Order P.D.E. (Problems only)	12
V	Standard type of first order partial differential equations I, II, III and IV (Clairaut's form) - *Lagrange's equations*. (Problems only).	12

..... Self Study

Text Books:		
1. T.K. Manicavachagom Pillay, T. Natarajan and K.S. Ganapathy, Algebra Volume-II, Ananda Book Depot, Chennai (2019) 2. S. Narayanan, T.K. Manicavachagom Pillay, Calculus Volume-III, S. Viswanathan Publishers Pvt. Ltd. (2012).		
UNIT I	Chapter 2 Sections 1-9	T.B-1
UNIT II	Chapter 2 Sections 10-13, 16	T.B-1
UNIT III	Chapter 1 Sections 5.1–5.4, 6.1, 6.2	T.B-2
UNIT IV	Chapter 2 Sections 1–4 Chapter 3 Sections 1–3	T.B-2
UNIT V	Chapter 4 Sections 5.1-5.4, 6	T.B- 2
Reference Books:		
1. P. Kandasamy and K. Thilagavathy, Allied Mathematics, S. Chand & Company Ltd, New Delhi (2010). 2. A. Abdul Rasheed, Allied Mathematics, Vijay Nicole Imprints private limited, Chennai (2008). 3. S. Arumugam and A. Thangapandi Isaac, Ancillary Mathematics, New Gamma Publishing house (2002).		
Web Resources:		
1.	https://nptel.ac.in/courses/111/107/111107111/	
2.	https://nptel.ac.in/courses/111/102/111102133/	

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	recognize and recall the basic concept of matrices and first order differential equations with examples.	K1
CO2	compute the operations on matrices and solving differential equations related problems.	K2
CO3	apply the concepts of matrices for solving system of equations, Eigen values and Eigen vectors.	K3
CO4	analyse the impact of an applications of mathematical concepts in computer science using matrices and differential equations.	K4
CO5	evaluate the general solution of ordinary and partial differential equations	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	3	1	3	3	2	3	2	2.5
CO2	3	3	2	2	1	2	3	2	3	2	2.3
CO3	3	3	2	2	1	3	2	3	3	2	2.4
CO4	3	2	3	3	2	3	3	3	2	2	2.6
CO5	2	2	2	3	1	2	2	2	3	2	2.1
Mean Overall Score											2.38
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. M.A. Rifayathali
Mrs. A. Fathima Begam

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23UMA1AC2	Allied – II	4	3	25	75	100
Course Title							
Numerical Methods with Octave							

SYLLABUS		
Unit	Contents	Hours
I	Solution of Algebraic equations by the bisection method – The iteration method – * Newton-Raphson Method *.	12
II	Finite Differences: Forward differences – Backward difference. Interpolation: Gregory-Newton forward interpolation formula for equal intervals - *Gregory-Newton backward interpolation formula for equal intervals* – Related Problems.	12
III	Exact solutions to a set of linear equations using Gauss Elimination method and Gauss – Jordan Method – Inversion of a matrix using Gauss – *Elimination method*.	12
IV	Numerical Integration: Trapezoidal Rule – Simpson's 1/3 rule - *Simpson's 3/8 rule*.	12
V	Numerical Solution of Ordinary Differential Equations: Numerical solutions to an Ordinary Differential Equation by Euler's Method – Improved Euler Method – * Modified Euler Method *– Runge-Kutta's second order and fourth order method.	12

Note: Theoretical proof not expected.

..... Self Study

Text Book:		
P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company Ltd(2010).		
UNIT I	Chapter 3	Sections 3.1, 3.2 and 3.4
UNIT II	Chapter 5	Sections 5.1
	Chapter 6	Sections 6.2 and 6.3
UNIT III	Chapter 4	Sections 4.1, 4.2 and 4.3
UNIT IV	Chapter 9	Sections 9.9, 9.13 and 9.14.
UNIT V	Chapter 11	Sections 11.9 – 11.13.
Reference Books:		
1. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Learning Private Limited, Fourth Edition (2009).		
2. F.B. Hildebrand, Introduction to Numerical analysis, Second edition, Tata McgrawHill (1987)		
3. A. Singaravelu, Numerical Methods, Meenachi Agency (2000)		
Web Resources:		
1. https://nptel.ac.in/courses/111107105		
2. https://nptel.ac.in/courses/127106019		

Digital Demonstration using OCTAVE

<https://www.digimat.in/nptel/courses/video/113101072/L29.html>

<https://www.youtube.com/watch?v=4jD7GPt1x2U> - The bisection method

<https://www.youtube.com/watch?v=gAmhUrX5Byk> - Newton-Raphson Method

<https://www.youtube.com/watch?v=XYWEIxY6Qkw> - Euler's Method

<https://www.youtube.com/watch?v=02nBrrLlheQ> - Runge-Kutta's Method

<https://www.youtube.com/watch?v=lFPW0cTXhyk> - Simpson's Rule

<https://www.youtube.com/watch?v=bwqccQRG1R4> - Trapezoidal Rule

<https://www.youtube.com/watch?v=EcM3tbLhosU> - Gauss – Jordan Method

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Remember the common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.	K1
CO2	Demonstrate understanding numerical methods for various mathematical problems	K2
CO3	Apply numerical methods to obtain approximate solutions to mathematical problems.	K3
CO4	Analyse mathematical problems to determine the suitable numerical techniques.	K4
CO5	Evaluate the numerical solution of ordinary differential equations.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	1	3	3	3	1	3	2.5
CO2	2	2	3	2	1	3	3	3	1	3	2.3
CO3	2	3	3	1	1	3	3	2	1	2	2.1
CO4	3	2	2	1	1	3	3	3	1	2	2.1
CO5	3	2	2	2	1	3	3	2	1	2	2.1
Mean Overall Score											2.22
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators: Dr. V. Krishnan & Mrs. A. Fathima Begam

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	define the features of operations research with applications and limitations with practical examples.	K1
CO2	illustrate LPP by Graphical and Simplex methods.	K2
CO3	construct the Basic feasible solution of Transportation problem by different methods.	K3
CO4	analyse the optimum solution for Assignment problems with illustrations.	K4
CO5	determine Network scheduling and demonstrate critical path analysis with examples.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	2	2	3	2.8
CO2	3	3	3	3	3	3	3	3	3	2	2.9
CO3	3	3	3	3	3	3	2	3	2	3	2.8
CO4	3	3	3	3	3	3	2	3	2	2	2.7
CO5	3	3	3	3	3	3	3	2	2	3	2.8
Mean Overall Score											2.8
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. M. Mohamed Althaf

Mrs. Z. Sirajunisha

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23UMA2AC4	Allied - IV	3	3	25	75	100
Course Title		Statistics					

SYLLABUS		
Unit	Contents	Hours
I	Arithmetic Mean-Properties of Arithmetic Mean-Weighted Mean-Median. Merits and Demerits of Mean, *Median*.	9
II	Mode- Geometric Mean- Harmonic Mean. Graphical Location of the Partition values. Merits and Demerits of Mode, Geometric Mean and * Harmonic Mean*.	9
III	Dispersion-Characteristics for Ideal Measure of Dispersion-Measures of Dispersion -Range- Q.D- M.D- S.D, Coefficient of Dispersion -*Coefficient of Variation*-	9
IV	Correlation–Types of Correlation–Scatter Diagram–Karl-Pearson’s Coefficient of *Correlation Spearman’s Rank Correlation*.	9
V	Regression- Linear -Properties of correlation and regression coefficients. (Numerical Problems only)	9

..... Self Study

Text Book:		
S.C. Gupta & V.K. Kapoor, Elements of Mathematical Statistics, Sultan Chand and Sons, Third Edition, Reprint 2010.		
UNIT I	Chapter 2	Sections 2.3–2.6
UNIT II	Chapter 2	Sections 2.7 –2.9.1 & 2.11.1
UNIT III	Chapter 3	Sections 3.1–3.7, 3.7.3, 3.8
UNIT IV	Chapter 10	Section 10.1 to 10.3, 10.6
UNIT V	Chapter 10	Section 10.7
Reference Books:		
1. S.C. Gupta and V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan Chand and Sons Publication, 11 th Edition, 2013.		
2. Murray R. Spiegel, John Jschiller, R. Alu Srinivasan, Probability and statistics, 3 rd Edition, Schaum’s Outline series, 2010.		
3. P.R. Vittal, Business Mathematics and Statistics, Margham Publications, 2021		
Web Resources:		
MOOC learning:		
1.	https://nptel.ac.in/courses/110107114 (Introduction – Objectives- Diagrams and Graphs) (Lectures by Prof. Mukesh Kumar Barua, Dept. of Management Studies, IIT Roorkee)	
2.	https://www.syncfusion.com/ebooks/statistics/descriptive-statistics (Measures of central tendency and dispersion)	
3.	https://www.youtube.com/watch?v=cOuUsZ9yNyk (Diagrammatic and graphical)	
4.	https://www.youtube.be/XrGM00ANzaE (Measures of central tendency)	
5.	https://www.youtu.be/O48XefedSWs (S.D)	
6.	https://www.youtu.be/5TJ52gAizOI (M.D)	
7.	https://www.youtu.be/C1gidiCxQ2s (Q.D)	
8.	https://www.youtu.be/iJcO1ZzX-Qo (correlation)	
9.	https://www.youtu.be/pT8M17HUh8c (Regression)	

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	demonstrate the basic concepts about collection and representation of data with practical examples.	K1
CO2	identify the methods for different type of Mean and discuss its merits and demerits.	K2
CO3	examine and understanding of the concepts of Median and Mode with examples.	K3
CO4	determine the measures of dispersions and their coefficients.	K4
CO5	evaluate the direction of linear relationship between two variables, correlation and Regression.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	3	1	3	3	3	3	3	2.6
CO2	3	3	3	3	1	3	2	3	3	3	2.7
CO3	3	3	3	2	0	3	3	3	3	2	2.5
CO4	3	3	3	2	0	3	3	3	3	2	2.5
CO5	3	3	3	2	0	3	3	2	2	2	2.3
Mean Overall Score											2.52
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators: Dr. T. Shiek Pareeth & Mrs. Z. Sirajunisha

Allied Mathematics for B.Sc. Physics

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UMA3AC5:2	Allied – V	4	3	25	75	100
Course Title		CALCULUS (For Physics)					

SYLLABUS		
Unit	Contents	Hours
I	Higher Derivatives: The nth derivative - Standard results - Trigonometrical transformations - Formation of equations involving derivatives - Leibnitz formula for the nth derivative of a product (Statement only) - Related problems.	12
II	Jacobian – Curvature: Circle, radius and centre of curvature – Cartesian formula for the Radius of Curvature – The Coordinates of the Center of Curvature	12
III	Properties of definite integrals – Integration by parts - Reduction formulae $\int x^n e^{ax}$, $\int \sin^n x$, $\int \cos^n x$, and $\int \sin^m x \cos^n x$ - Related problems.	12
IV	Multiple Integral: Definition of the double integral – Evaluation of the double integral – *Application of multiple integrals*	12
V	Volume of solids of revolution – volumes of solids as double integrals – Volume as a triple integral - *Areas of curved Surface*	12

..... Self Study

Text Book(s):			
1. S. Narayanan, R. Hanumantha Rao and T.K. Manicavachagom Pillay, Ancillary Mathematics Volume - I, S. Viswanathan Publishers Pvt. Ltd Revised Edition (2007).			
2. S. Narayanan, R. Hanumantha Rao and T.K. Manicavachagom Pillay, Ancillary Mathematics Volume - II, S. Viswanathan Publishers Pvt. Ltd Revised Edition (2007).			
UNIT I	Chapter VI	Sections 6.1	T.B.1
UNIT II	Chapter VI	Sections 6.2, 6.4	T.B.1
UNIT III	Chapter 1	Sections 11, 12, 13.1-13.5	T.B.2
UNIT IV	Chapter 3	Sections 2.1, 2.2 & 4.1	T.B.2
UNIT V	Chapter 3	Sections 3, 5.1 – 5.4	T.B.2
Reference Book(s):			
1. T.K. Manicavachagom Pillay and Others, Calculus Volume-I, S. Viswanathan Publishers Pvt. Ltd. (2004).			
2. T.K. Manicavachagom Pillay and Others, Calculus Volume-II, S. Viswanathan Publishers Pvt. Ltd. (2004).			
Web Resource(s):			
1. https://nptel.ac.in/courses/111104092			
2. https://nptel.ac.in/courses/111105122			

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall and illustrate the examples of Multiple Integrals.	K1
CO2	Demonstrate and discuss Jacobian – Curvature with examples.	K2
CO3	Apply domain knowledge for Integration by parts - Reduction formulae	K3
CO4	Examine methods for Higher Derivatives with illustrate the examples.	K4
CO5	Study of Application of multiple integrals with suitable examples.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	1	3	3	1	3	3	3	2	2.5
CO2	3	1	3	1	3	3	2	3	3	1	2.3
CO3	3	3	1	3	3	3	3	3	3	3	2.8
CO4	1	3	3	1	3	3	3	1	3	2	2.3
CO5	3	3	1	3	1	3	1	3	2	3	2.3
Mean Overall Score											2.4
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. P. Muruganatham
Mr. T. Rabeeh Ahamed

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UMA3AC6:2	Allied – VI	3	3	25	75	100
Course Title		ALGEBRA AND TRIGONOMETRY (For Physics)					

SYLLABUS		
Unit	Contents	Hours
I	Theory of equations: *Nature of roots* – Relation between the coefficients and the Roots of an algebraic equation – Transformation of equations – Reciprocal equations.	9
II	Matrices- *Special types of matrices*- Scalar multiplication of a matrix- Equality of matrices, Addition of matrices- Subtraction- Symmetric matrix-Skew symmetric matrix-Hermitian and skew Hermitian matrices- Multiplication of matrices (Problems only).	9
III	Matrices: *Various types of Matrices* - Rank of a Matrix - Eigen values and Eigen Vectors- Verification of Cayley-Hamilton theorem.	9
IV	Trigonometry: Expansions of $\cos n\theta$ and $\sin n\theta$ – Powers of sines and cosines of θ in Terms of functions of multiple of θ .	9
V	Hyperbolic functions – Simple Problems	9

..... Self Study

Text Book(s):				
1. S.Narayanan, R.Hanumantha Rao and T.K. Manicachagom Pillay, P. Kandaswamy, Ancillary Mathematics, Volume I, S. Viswanathan Publishers Pvt. Ltd. Revised Edition (2007).				
2.T.K. Manicavachagom Pillay, T. Natarajan and K.S. Ganapathy, Algebra Volume-II, Ananda Book Depot, Chennai (2019).				
UNIT I	Chapter 2	Sections 2.1– 2.4	TB-1	
UNIT II	Chapter 2	Sections 1-7	TB-2	
UNIT III	Chapter 3	Sections 3.1, 3.2, 3.4.	TB-1	
UNIT IV	Chapter 5	Sections 5.1, 5.2	TB-1	
UNIT V	Chapter 5	Section 5.4.	TB-1	
Reference Book(s):				
1. A. Abdul Rashid, Allied Mathematics, Vijay Nicole Publishing Company (2008).				
2. S. Arumugam and A. Thangapandi Isaac, Ancillary Mathematics, New Gamma Publishing house (2002).				
Web Resource(s):				
1. https://nptel.ac.in/courses/111107119				
2. https://www.digimat.in/nptel/courses/video/111107119/L01.html				

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand of common algebra and how they are used to obtain solutions of matrices then mathematical problems.	K1
CO2	Derive the Trigonometry Expansions of $\cos n\theta$ and $\sin n\theta$ – Powers of sines and cosines.	K2
CO3	Apply algebra and Trigonometry to obtain solutions to mathematical problems.	K3
CO4	Analyse mathematical problems to determine the suitable functions.	K4
CO5	Evaluate various Trigonometry functions and roots of algebraic equation, hyperbolic functions.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	1	3	3	3	2	3	2.6
CO2	2	3	3	3	1	3	3	3	1	3	2.5
CO3	3	1	3	3	1	3	1	3	3	3	2.4
CO4	3	2	3	2	1	1	2	3	3	3	2.3
CO5	2	3	1	3	1	3	3	3	3	3	2.5
Mean Overall Score											2.46
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. V. Krishnan
Mr. T. Rabeeh Ahamed

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UMA4AC7:2	Allied – VII	4	3	25	75	100
Course Title		DIFFERENTIAL EQUATIONS (For Physics)					

SYLLABUS		
Unit	Contents	Hours
I	Differential Equations of the first order: Definitions – Solution of Differential Equations – Formation of differential equations – Equations of the first order and the first degree – variable separable – Homogenous equations – *Non-homogenous equations of the first degree in x and y* – linear equation.	12
II	Linear Differential Equations with Constant Coefficients: The operator D and D^{-1} – Particular integral – Special methods of finding P.I – Equations reducible to the linear homogeneous equation.	12
III	Partial Differential Equations: Derivation of partial differential equations – Different integrals of partial differential equations – Solution of partial differential equation in some simple cases – *Some standard types of first order equations* – Lagrange's Equations.	12
IV	Laplace Transforms: Definitions – Laplace transform of periodic functions – Some General Theorems and problems.	12
V	The inverse transforms: Results under inverse transforms of functions – Solving ordinary differential equations with constant coefficients using Laplace transforms.	12

..... Self Study

Text Book(s):		
S. Narayanan and T.K. Manicavachagom Pillay, Calculus, Volume – III, S. Viswanathan Publishers Pvt. Ltd., Revised Edition (2019).		
UNIT I	Chapter I	Sections 1, 2.1 to 2.4
UNIT II	Chapter II	Sections 1 – 4, 9
UNIT III	Chapter IV	Sections 1 – 6
UNIT IV	Chapter V	Sections 1 - 5
UNIT V	Chapter V	Sections 6 - 8
Reference Book(s):		
1. S. Arumugam and A. Thangapandi Isaac, Calculus, New Gamma Publishing House (2008).		
2. A. Abdul Rashid, Allied Mathematics, Vijay Nicole Publication Company.		
Web Resource(s):		
1. https://www.classcentral.com/course/swayam-ordinary-and-partial-differential-equations-and-applications-17718		
2. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ma10/		
3. https://nptel.ac.in/courses/111/105/111105093/		

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Apply domain knowledge for solving first order linear differential equations.	K1
CO2	Discuss and solve the linear differential equations with constant coefficients with examples.	K2
CO3	Solve the partial differential equations and Lagrange's equations with the examples.	K3
CO4	Investigate Laplace transform of periodic functions and some general theorems with examples.	K4
CO5	Determine results under inverse transforms of functions with examples and solve differential equations with constant co-efficient	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	2	2	3	3	3	2	2	2.4
CO2	3	2	1	2	3	3	3	3	3	2	2.5
CO3	3	3	2	2	2	3	3	3	2	2	2.5
CO4	3	3	2	2	2	3	3	3	2	2	2.5
CO5	3	3	3	1	2	3	3	3	2	2	2.5
Mean Overall Score											2.48
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. U. Abuthahir
Dr. C. Gurubaran

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UMA4AC8:2	Allied – VIII	4	2	25	75	100
Course Title		VECTOR CALCULUS AND FOURIER SERIES (For Physics)					

SYLLABUS		
Unit	Contents	Hours
I	Fourier Series: Even and Odd Functions – Half Range Fourier Series – Development in Cosine series.	12
II	Development in Sine Series – Change of interval – Combination of series.	12
III	Vector Analysis: Level Surfaces – The vector differential operator – Gradient – Direction and Magnitude of gradient – Divergence and curl.	12
IV	Line integral – Theorem under Line integral – Volume integral – Surface integral.	12
V	Gauss Divergence Theorem (Statement only) – Stokes Theorem (Statement only) - Simple problems.	12

Text Book(s):		
S. Narayanan, R. Hanumantha Rao and T.K.Manikavachagompillay, P. Kandasamy, Ancillary Mathematics, Volume – II, S.Viswanathan publishers Pvt. Ltd., Revised Edition (2007).		
UNIT I	Chapter - 2	Sections 1 to 4, 5.1
UNIT II	Chapter - 2	Sections 5.2, 6, 7
UNIT III	Chapter - 8	Sections 15 to 20
UNIT IV	Chapter - 8	Sections 1 to 5
UNIT V	Chapter - 8	Sections 6 and 9
Reference Book(s):		
1. S. Arumugam and A. Thangapandi Isaac, Calculus, New Gamma Publishing House (2008). 2. A. H. Siddiqi & P.H. Manchanda, A first course in Differential Equations with applications, Macmillan Publishers India Limited, 2006.		
Web Resource(s):		
1. https://nptel.ac.in/courses/111105122 2. https://nptel.ac.in/courses/111101164		

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Relate and study the Vector differential operator	K1
CO2	Acquire more knowledge on line, volume and surface integral	K2
CO3	Demonstrate and discuss the Half range Fourier series	K3
CO4	Apply domain knowledge for the sine and cosine series in change of interval	K4
CO5	Remember the concept of vector and operators with examples	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	3	3	2	3	3	2	2	2.4
CO2	3	2	2	3	3	3	2	3	2	2	2.5
CO3	3	3	2	3	3	3	2	3	3	3	2.5
CO4	3	3	1	2	3	3	3	3	1	3	2.5
CO5	1	3	3	2	3	3	2	2	3	3	2.5
Mean Overall Score											2.58
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. H. Sheik Mujibur Rahman
Mr. T. Rabeeh Ahamed

Allied Mathematics for B.Sc. Chemistry

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UMA3AC5:3	Allied – V	4	3	25	75	100
Course Title		CALCULUS (For Chemistry)					

SYLLABUS		
Unit	Contents	Hours
I	Successive Differentiation – The n^{th} derivatives of Standard result – Trigonometrical transformation of functions - * Formation of equations involving derivatives* - Leibnitz formula for the n^{th} derivative of a product (Statement only) - Related problems.	12
II	Partial Differentiation – Successive partial derivatives – Function of function rule - *Total differential coefficient and special case* – implicit functions - Homogeneous functions - Partial derivatives of a function of two functions.	12
III	Properties of definite integrals – Integration by parts - Reduction formulae $\int x^n e^{ax}$, $\int \sin^n x$, $\int \cos^n x$, and $\int \sin^m x \cos^n x$ - Related problems.	12
IV	Curvature: Circle, Radius and Center of Curvature - Cartesian Formula for the Radius of Curvature - Coordinates of the Center of Curvature.	12
V	Evolute and Involute – Radius of curvature when the curve is given in polar co-ordinates – p-r equation – pedal equation of a curve.	12

..... Self Study

Text Book(s):			
T. K. Manicavachagom Pillay and Others, Calculus Volume-I, S. Viswanathan Publishers Pvt. Ltd. (2004).			
only,	UNIT I	Chapter III	Sections 1.1 – 1.6, 2.1, 2.2 (Section 2.1: statement only Section 2.2: problems only)
	UNIT II	Chapter V	Sections 1.2, 1.3, 1.5(Section 1.2 and 1.3: Theorems statement only, Section 1.5: Working Rules and problems only)
		Chapter VIII	Sections 4, 5
	UNIT III	Chapter VIII	Sections 1.1 – 1.7
	UNIT IV	Chapter X	Sections 2.1 – 2.4
	UNIT V	Chapter X	Sections 2.5 – 2.8
Reference Book(s):			
1. A. Abdul Rasheed, Allied Mathematics, Tata McGraw Hill Education (2006)			
2. S. Arumugam and A. Thangapandi Isaac, Calculus, New Gamma Publishing House (2008).			
Web Resource(s):			
1. https://nptel.ac.in/courses/111104092			
2. https://nptel.ac.in/courses/111105122			

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Find the n^{th} derivatives of a function and apply the Leibnitz's theorem for finding n^{th} derivative of product of two functions.	K1
CO2	Explain the concept of curvature of a curve and to find the radius and center of curvature of a given curve.	K2
CO3	Solve maxima and minima for a function of one, two variables.	K3
CO4	Understand the concept of evolute, involute and to find radius of curvature using polar co-ordinates and forming pedal equation of a curve.	K4
CO5	Discuss the partial derivatives of a function of functions depending on two independent variables and to understand the concepts of homogeneous function, Euler's theorem, total differentiation and implicit functions.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	3	3	3	3	3	3	2	2.8
CO2	3	1	3	3	3	3	1	3	1	3	2.4
CO3	3	3	1	3	2	3	3	1	3	3	2.5
CO4	3	3	3	1	3	3	3	3	3	3	2.8
CO5	3	1	3	3	3	1	3	3	1	3	2.4
Mean Overall Score											2.58
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. P. Muruganatham
Mr. T. Rabeeh Ahamed

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23UMA3AC6:3	Allied – VI	3	3	25	75	100
Course Title		ALGEBRA AND TRIGONOMETRY (For Chemistry)					

SYLLABUS		
Unit	Contents	Hours
I	Theory of equations: *Nature of roots* – Relation between the coefficients and the Roots of an algebraic equation – Transformation of equations – Reciprocal equations.	9
II	Matrices- *Special types of matrices*- Scalar multiplication of a matrix- Equality of matrices, Addition of matrices- Subtraction- Symmetric matrix-Skew symmetric matrix-Hermitian and skew Hermitian matrices- Multiplication of matrices (Problems only).	9
III	Matrices: *Various types of Matrices* - Rank of a Matrix - Eigen values and Eigen Vectors- Verification of Cayley-Hamilton theorem.	9
IV	Trigonometry: Expansions of $\cos n\theta$ and $\sin n\theta$ – Powers of sines and cosines of θ in Terms of functions of multiple of θ .	9
V	Hyperbolic functions – Simple Problems	9

..... Self Study

Text Book(s):				
1. S.Narayanan, R.Hanumantha Rao and T.K. Manicachagom Pillay, P. Kandaswamy, Ancillary Mathematics, Volume I, S. Viswanathan Publishers Pvt. Ltd. Revised Edition (2007).				
2.T.K. Manicavachagom Pillay, T. Natarajan and K.S. Ganapathy, Algebra Volume-II, Ananda Book Depot, Chennai (2019).				
UNIT I	Chapter 2	Sections 2.1– 2.4	TB-1	
UNIT II	Chapter 2	Sections 1-7	TB-2	
UNIT III	Chapter 3	Sections 3.1, 3.2, 3.4.	TB-1	
UNIT IV	Chapter 5	Sections 5.1, 5.2	TB-1	
UNIT V	Chapter 5	Section 5.4.	TB-1	
Reference Book(s):				
1. A. Abdul Rashid, Allied Mathematics, Vijay Nicole Publishing Company (2008).				
2. S. Arumugam and A. Thangapandi Isaac, Ancillary Mathematics, New Gamma Publishing house (2002).				
Web Resource(s):				
1. https://nptel.ac.in/courses/111107119				
2. https://www.digimat.in/nptel/courses/video/111107119/L01.html				

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand of common algebra and how they are used to obtain solutions of matrices then mathematical problems.	K1
CO2	Derive the Trigonometry Expansions of $\cos n\theta$ and $\sin n\theta$ – Powers of sines and cosines.	K2
CO3	Apply algebra and Trigonometry to obtain solutions to mathematical problems.	K3
CO4	Analyse mathematical problems to determine the suitable functions.	K4
CO5	Evaluate various Trigonometry functions and roots of algebraic equation, hyperbolic functions.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	1	3	3	3	2	3	2.6
CO2	2	3	3	3	1	3	3	3	1	3	2.5
CO3	3	1	3	3	1	3	1	3	3	3	2.4
CO4	3	2	3	2	1	1	2	3	3	3	2.3
CO5	2	3	1	3	1	3	3	3	3	3	2.5
Mean Overall Score											2.46
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. V. Krishnan

Mr. T. Rabeeh Ahamed

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UMA4AC7:3	Allied – VII	4	3	25	75	100
Course Title		DIFFERENTIAL EQUATIONS (For Chemistry)					

SYLLABUS		
Unit	Contents	Hours
I	Linear equation – Bernoulli's equation – Exact differential equations.	12
II	Equations of the first order but of higher degree - Equations solvable for dy/dx Equations solvable for y - *Equations solvable for x * – Clairaut's form – Equations that do not contain x explicitly - Equations that do not contain y explicitly - Homogeneous equations in x and y .	12
III	Linear Equations with constant coefficients - The operator D - Complementary function of a linear equation with constant coefficients –Particular integrals.	12
IV	Linear equations with variable coefficients – Equations reducible to the linear equations –Variation of parameters.	12
V	Partial Differential Equations of the first order - Classification of integrals - Derivation of PDE by elimination of constants and functions - Lagrange's method of solving the linear equation -Special methods -Standard forms I, II, *III and IV (Clairant's form) *	12

..... Self Study

Text Book(s):		
S. Narayanan and T. K. Manicavachagom Pillay, Differential Equation and its Application, S. Viswanathan Publishers Pvt. Ltd., Ninth edition (2006).		
UNIT I	Chapter II	Sections 4, 5, 6.1 –6.4
UNIT II	Chapter IV	Sections 1 – 4
UNIT III	Chapter V	Sections 1 – 4
UNIT IV	Chapter V	Sections 5 and 6
	Chapter VIII	Section 4
UNIT V	Chapter XII	Sections 1 – 5
Reference Book(s):		
1. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Co. (2010). 2. M.L. Khanna, Differential Equations, Jai Prakash Nath and Co. (2004).		
Web Resource(s):		
1. https://nptel.ac.in/courses/111/105/111105093/ 2. https://nptel.ac.in/courses/111/107/111107111/ 3. https://nptel.ac.in/courses/122/107/122107037/		

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the concept of differential equations.	K1
CO2	Classify the different forms of differential equations	K2
CO3	Solve the linear differential equations with constant coefficients and particular integrals	K3
CO4	Simplify the differential equations with variable coefficients	K4
CO5	Evaluate the partial differential equation by Lagrange's method	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	2	3	3	3	2	2	2.5
CO2	3	2	1	1	2	3	3	3	3	2	2.3
CO3	3	3	2	2	2	3	3	3	2	2	2.5
CO4	3	2	2	2	2	3	3	3	2	2	2.4
CO5	3	3	2	2	2	3	3	2	2	2	2.4
Mean Overall Score											2.42
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. U. Abuthahir
Dr. C. Gurubaran

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23UMA4AC8:3	Allied – VIII	4	3	25	75	100
Course Title		STATISTICS AND VECTOR CALCULUS (For Chemistry)					

SYLLABUS		
Unit	Contents	Hours
I	Measures of central tendency- Arithmetic Mean - Properties of Arithmetic Mean - Weighted mean – Median- *Merits and Demerits of Mean, Median*.	12
II	Mode - Geometric mean - Harmonic mean. Graphical Location of the Partition values. *Merits and Demerits of Mode, Geometric Mean and Harmonic Mean*.	12
III	Dispersion-characteristics for ideal measure of dispersion - Measures of Dispersion - Range - Q.D - M.D - S.D, coefficient of dispersion - *Coefficient of variation* - Simple problems.	12
IV	Correlation – Bivariate distribution, correlation – scatter diagram – Karl- Pearson’s coefficient of correlation – Rank correlation- Regression - Properties of correlation and regression coefficients. (Numerical Problems only)	12
V	Vector Calculus: The vector differential operator – Gradient - Direction and Magnitude of gradient - Divergence and curl - Related problems.	12

..... Self Study

Text Book(s):			
1. S.C.Gupta & V.K.Kapoor, Elements of Mathematical Statistics, Sultan Chand and Sons, Third Edition, Reprint 2010.			
2. S.Narayanan, R.Hanumantha Rao , T.K. Manicachagom Pillay and P. Kandasamy, Ancillary Mathematics, Volume II, S. Viswanathan Publishers Pvt. Ltd. Revised Edition (2008).			
UNIT I	Chapter 2	Sections 2.3 - 2.6	TB-1
UNIT II	Chapter 2	Sections 2.7-2.9.1, 2.11.1	TB-1
UNIT III	Chapter 3	Sections 3.1-3.7, 3.7.3, 3.8	TB-1
UNIT IV	Chapter 10	Sections 10.1 to 10.3, 10.6, 10.7	TB-1
UNIT V	Chapter 8	Sections 16-20	TB-2
Reference Book(s):			
1. Murray R. Spiegel, John Jschiller, R. Alu Srinivasan, Probability and Statistics, Third Edition, Schaum’s Outline Series (2010).			
2. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons Publication, Eleventh Edition (2013).			
3. M.L, Khanna, Vector calculus, Jai Prakash Nath and Co., Eighth Edition (1986).			
Web Resource(s):			
1. https://nptel.ac.in/courses/111/106/111106112/			
2. https://nptel.ac.in/courses/111105122			

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Relate and study of vector differential operator with examples	K1
CO2	Acquire more knowledge on Measures of Central Tendency	K2
CO3	Demonstrate and discuss the Measures of Dispersion	K3
CO4	Apply domain knowledge for bivariate distributions with examples	K4
CO5	Remember the integration and its applications	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	3	3	3	2	3	2	3	2.7
CO2	3	2	2	3	3	3	3	3	3	2	2.7
CO3	3	1	2	2	2	2	3	3	3	3	2.4
CO4	3	2	3	2	2	3	3	2	3	2	2.5
CO5	1	3	3	2	2	2	3	3	3	3	2.5
Mean Overall Score											2.56
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. H. Sheik Mujibur Rahman

Dr. C. Gurubaran

Allied Mathematics for B.Sc. Artificial Intelligence & Machine Learning

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	24UMA1AC1:4	Allied - I	4	3	25	75	100
Course Title		CALCULUS					

SYLLABUS		
Unit	Contents	Hours
I	*Functions and their Graphs*-An Intuitive Introduction to Limits-Techniques for Finding Limits-A Precise Definition of a Limit-Continuous Functions-Tangent Lines and Rates of Change	12
II	The Derivative-Basic Rules of Differentiation-The Product and Quotient Rules-*The Role of the Derivative in the Real World*-Derivatives of Trigonometric Functions-The Chain Rule-Implicit Differentiation-Related Rates-Differentials and Linear Approximations	12
III	Indefinite Integrals-Integration by Substitution-Area-The Definite Integral-The Fundamental Theorem of Calculus- Areas Between Curves-Volumes: Disks, Washers, and Cross Sections-Volumes Using Cylindrical Shells-Arc Length and Areas of Surfaces of Revolution	12
IV	Functions of Two or More Variables-Limits and Continuity-Partial Derivatives-Differentials-The Chain Rule- Tangent Planes and Normal Lines-Extrema of Functions of Two Variables-Lagrange Multipliers	12
V	Double Integrals-Iterated Integrals-Double Integrals in Polar Coordinates-Applications of Double Integrals-Surface Area-Triple Integrals	12
VI	Current Trends *Extrema of Functions-The Mean Value Theorem-Increasing and Decreasing Functions and the First Derivative Test*	

..... Self Study

Text Book(s):
Soo T. Tan, Calculus, Brooks/Cole, Cengage Learning, USA, 2010 Chapter I : 0.2, 1.1-1.5 Chapter II: 2.1-2.9 Chapter III: 4.1-4.5, 5.1-5.4 Chapter IV: 13.1-13.5, 13.7-13.9 Chapter V: 14.1-14.6 Chapter VI: 3.1-3.3
Reference Book(s):
1. Thomas and Finney, Calculus and Analytic Geometry, Narosa Publishing House, New Delhi, 1998 2. Thomas. G. B., Hass. J, and Weir. MD., Thomas Calculus, 14 th Edition, Pearson India, 2018
Web Resource(s):
1. https://onlinecourses.nptel.ac.in/noc24_ma12/preview 2. https://onlinecourses.nptel.ac.in/noc24_ma33/preview

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the basic concept of functions and their graphs	K1
CO2	Calculate the limits and derivatives of a function	K2
CO3	Determine the areas between curves and surface area	K3
CO4	Explain the different methods of integration in solving practical problems	K4
CO5	Evaluate the areas, volumes and other practical problems using multiple integral ideas	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	1	3	3	3	3	3	3	3	3	2.8
CO2	3	1	3	3	3	3	3	3	3	3	2.8
CO3	3	1	3	3	3	3	3	3	3	3	2.8
CO4	3	1	3	3	3	3	3	3	3	3	2.8
CO5	3	1	3	3	3	3	3	3	3	3	2.8
Mean Overall Score											2.8
Correlation											High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. M.A. Rifayathali

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	24UMA1AC2:4	Allied - II	4	3	25	75	100
Course Title		Linear Algebra					

SYLLABUS		
Unit	Contents	Hours
I	Systems of Linear Equations-Row Reduction and Echelon Forms- * Solution Sets of Linear Systems*- Applications of Linear Systems-Introduction to Linear Transformations-*Matrix Operations-The Inverse of a Matrix*	12
II	Partitioned Matrices- Matrix Factorizations-Applications to Computer Graphics-Cramer's Rule-Volume, and Linear Transformations-Vector Spaces and Subspaces- Null Spaces, Column Spaces, and Linear Transformations	12
III	Linearly Independent Sets; Bases - Coordinate Systems- The Dimension of a Vector Space- Rank-Change of Basis- Eigenvectors and Eigenvalues - The Characteristic Equation.	12
IV	Diagonalization- Eigenvectors and Linear Transformations-Inner Product, Length, and Orthogonality-Orthogonal Sets-Orthogonal Projections-The Gram–Schmidt Process	12
V	Inner Product Spaces- Applications of Inner Product Spaces- Diagonalization of Symmetric Matrices- Quadratic Forms -The Singular Value Decomposition-Applications to Image Processing and Statistics.	12
VI	Current Trends (For CIA only): An introduction to the applications of linear and non-linear model in real life.	

..... Self Study

Text Book:
David C. Lay, Steven R. Lay, Judi J. McDonald, Linear Algebra and its Applications, Fifth Edition, Pearson Education, U.S.A, 2016.
UNIT I Chapter 1: Sections 1.1, 1.2, 1.5, 1.6, 1.8. Chapter 2: Sections 2.1, 2.2.
UNIT II Chapter 2: Sections 2.4, 2.5, 2.7. Chapter 3: Section 3.3. Chapter 4: Sections 4.1, 4.2.
UNIT III Chapter 4: Sections 4.3-4.7. Chapter 5: Sections 5.1, 5.2.
UNIT IV Chapter 5: Sections 5.3, 5.4 Chapter 6: Sections 6.1-6.4.
UNIT V Chapter 6: Sections 6.7, 6.8. Chapter 7: Sections 7.1, 7.2, 7.4, 7.5.
Reference Book:
Charu C. Aggarwal, Linear Algebra and Optimization for Machine Learning, Springer Nature Switzerland, 2020.
Web Resources:
1. https://youtu.be/nG_zOJCvmzw?si=v_Li8DLmovXzEF13
2. https://youtu.be/kZwSqZuBMGg?si=lhe9ZYhy6_06_x0z
3. https://youtu.be/JO9jNe6BemE?si=3ZhcSZcnhStmsqtK

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Remember the concept of matrices and operations on it.	K1
CO2	Understand the fundamental concepts of linear algebra relevant to AI and Machine Learning (ML)	K2
CO3	Apply linear algebra techniques to solve problems in AI and ML, such as solving linear systems and performing dimensionality reduction.	K3
CO4	Analyse data as vectors and matrices and find its singular value decomposition.	K4
CO5	Evaluate the matrix of a linear transformation and computing its eigenvalues and eigenvectors.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	3	3	3	3	3	2	2.7
CO2	3	2	2	3	3	3	3	3	3	2	2.7
CO3	3	2	2	2	2	3	3	3	3	3	2.6
CO4	3	2	2	3	2	3	3	3	2	2	2.5
CO5	3	3	3	2	2	3	3	3	2	2	2.6
Mean Overall Score											2.62
Correlation											High

Course Coordinator: Dr. N. Mohamed Thoiyab

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	24UMA2AC3:4	Allied - III	4	4	25	75	100
Course Title		DISCRETE MATHEMATICS					

SYLLABUS		
Unit	Contents	Hours
I	Mathematical Logic: Statements and notation – connectives – Negation – Conjunction – Disjunction – Statement formulas and truth tables – Conditional and Biconditional – well-formed formulas - Tautologies – Rules of inference.	12
II	Set theory: Basic concept of set theory – Notation – Inclusion and equality of sets – the power set – Some operations on sets – Venn diagrams – Cartesian products.	12
III	Algebraic Structures : Algebraic systems: Examples and general properties – Definition and examples – Some simple Algebraic systems and general properties – Semigroups and Monoids – Groups – definition and examples – subgroups and Homomorphism – Cosets and Lagrange's theorem – Normal subgroups.	12
IV	Lattices and Boolean Algebra: Lattices as partially ordered sets – Some properties of Lattices – Lattices as algebraic systems – Sub lattices – Direct product and Homomorphism – Some special Lattices – Boolean algebra – Sub algebra – Boolean Homomorphism.	12
V	Graph Theory : Basic concept of Graph theory – Basic definitions – Paths – Reachability and Connectedness – Matrix representation of Graphs – Trees.	12
VI	Current Trends (For CIA only): Developing C coding for simple real world application problems	

Text Book:
Tremblay J.P and Manohar. R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata Magraw Hill pub. Co. Ltd, 1997
Reference Book(s):
1. Liu C.L and Mohapatra “Elements of Discrete Mathematics” Tata Magraw Hill pub. Co. Ltd, reprint 2015 2. Grimaldi. R.P. “Discrete and Combinatorial Mathematics: An applied introduction”, 5 th Edition, Pearson Eductaion Asia, Delhi 2013.
Web Resource(s):
1. https://www.youtube.com/@4GSilverAcademy 2. https://www.youtube.com/@mathematicskala 3. https://www.youtube.com/@mathematicskala

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Remembering the concepts needed to test the logic of a program	K1
CO2	Have an understanding the concept of set theory	K2
CO3	Be aware of counting principles.	K3
CO4	Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.	K4
CO5	Be aware of a class of functions which transform a finite set into another set which relates to input and output functions in computer science	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	2	2	2	2	2	1	2.1
CO2	3	3	1	1	2	2	3	2	1	1	1.9
CO3	1	3	2	1	1	2	2	2	2	1	1.7
CO4	2	2	2	2	1	3	2	2	2	1	1.9
CO5	3	2	2	2	1	2	3	3	2	1	2.1
Mean Overall Score											1.94
Correlation											Medium

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. U. Abuthahir

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	24UMA2AC4:4	Allied - IV	3	3	25	75	100
Course Title		Statistics and Numerical Methods					

SYLLABUS		
Unit	Contents	Hours
I	Testing of Hypothesis: Basic Definitions – Test of Hypothesis (Large Sample Tests) – Test of significance of single mean - Test of significance of difference of two means – Test of significance of single proportion.	9
II	Test of Hypothesis (Small Sample Tests) – Test of significance of single mean - Test of significance of difference of two means – Chi-Square Test.	9
III	Design of Experiments: one way and two way classification – completely Randomized Design (CRD) – Randomized Block Design (RBD).	9
IV	Solution of algebraic and transcendental equation: Bisection Method – Method of false position – Iteration Method - Newton-Raphson Method.	9
V	Interpolation: finite differences – forward differences – backward differences – central differences. (Problems only)	9
VI	Current Trends (For CIA only): Formulate the system of linear equation of simple real world application problems.	

* * Self Study

Text Book(s):
1. N. Subramaniam, Probability and Statistics, first edition, SCM Publisher, Erode (2005) Unit – I: Chapter 4: Section 4.1 – 4.2 (Page No.: 291 – 324). Unit – II: Chapter 4: Section 4.3 (Page No.: 344 – 369), 4.5 (Page No.: 384 – 395). Unit – III: Chapter 5: Section 5.1 – 5.2 (Page No.: 408 – 444) 2. S. S. Sastry, Introductory Methods of Numerical Analysis, fourth edition, prentice Hall of india, New Delhi (2006) Unit – IV: Chapter 2: Section 2.2 – 2.5 (Page No.: 21 – 38) Unit – V: Chapter 3: Section 3.3.1 - 3.3.3 (Page No.: 65 – 78)
Reference Book(s):
1. Grewal, B.S., and Grewal, J.S., “Numerical Methods in Engineering and Science”, Khanna Publishers, 10 th Edition, New Delhi, 2015. 2. Johnson, R.A., Miller, I and Freund J., “Miller and Freund’s Probability and Statistics for Engineers”, Pearson Education, Asia, 8 th Edition, 2015.
Web Resource(s):
Testing of Hypothesis: https://www.youtube.com/watch?v=zJ8e_wAWUzE&pp=ygUac3RhdGlzdGljcyB0ZXN0IGh5cG90aGVzaXM%3D Design of Experiments: https://www.youtube.com/watch?v=k3lUo0XYG3E&pp=ygUgc3RhdGlzdGljcyBkZXNpZ24gb2YgZXhwZXJpbWVudHM%3D Numerical Methods: https://www.youtube.com/watch?v=jw4_1XLwBCQ&list=PLFw9SEeylu1Ve4Cym98bc_i4fuyQoTruJ

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Apply the concept of testing of hypothesis for small and large samples in real life problems	K1
CO2	Understand the logic and framework of the inference of hypothesis testing	K2
CO3	Apply the basic concepts of classification of design of experiments in the field of agriculture	K3
CO4	Solve the algebraic and transcendental equations with iteration methods	K4
CO5	Appreciate the numerical techniques in various intervals.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	3	3	3	2	3	3	3	3	2.7
CO2	2	2	2	3	2	3	2	3	2	3	2.4
CO3	2	2	3	3	3	2	3	3	3	3	2.7
CO4	2	2	2	3	2	2	3	3	2	3	2.4
CO5	2	2	2	3	2	2	3	2	3	3	2.4
Mean Overall Score											2.52
Correlation											High

Mean Overall Score = Sum of Mean Score of COs / Total Number of COs

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. M. Mohamed Althaf