SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS)

SALEM – 16

Reaccredited with 'B++' Grade by NAAC

Affiliated to Periyar University

Outcome Based Syllabus

PG & RESEARCH DEPARTMENT OF MATHEMATICS

B.Sc. MATHEMATICS

(For the students admitted in 2021-22)

B.Sc. MATHEMATICS

PROGRAMME OUTCOMES

PO1	To apply the knowledge of basic mathematics to obtain the solution for the complex mathematical problems
PO2	To identify, formulate and analyze mathematical problems in research
PO3	To acquire information and clear understanding in advanced areas of mathematics.
PO4	To create and analyze mathematical models for solving the problems in the emerging areas of societal and environmental contexts.
PO5	To apply mathematical knowledge in real life situations and in the context of scientific change via modern tools.
PO6	To communicate mathematical concepts effectively
PO7	To equip the students' career needs and to synthesize with the industry requirements
PO8	To inculcate the ethical responsibilities via mathematical concepts.
PO9	To enhance the ability of students to transfer ideas and develop team working skills.

SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS), SALEM – 16.
PG & RESEARCH DEPARTMENT OF MATHEMATICS
B.Sc.
PROGRAMME STRUCTURE UNDER CBCS
(For the students admitted in 2021-22)
Total Credits: 140 + Extra Credits (Maximum 28)
I SEMESTER

Part	Course	Course Title	Code	Hrs./ Week	Credits
I	Language - I	Tamil /Hindi / Sanskrit- I	21ULTC1/ 21ULHC1/ 21ULSC1	6	3
II	English – I	Communicative English I	21ULEC1	6	3
III	Core Course – I	Calculus I	21UMAC1	5	5
III	Core Course– II	Algebra	21UMAC2	5	5
III	Allied Course– I	Allied: Physics I	21UMAAC1	3	3
		Allied: Physics Practical	21UMAAQC	2	-
IV	Skill Based – I	Theory of Equations with Matlab – Practical	21UMASQC1	2	2
V	Society Connect	Group Project based on Society Connect	21USCAC	1	1
		Total		**30**	**22**
VI	Articulation and Idea Fixation Skills				
	Physical Fitness Practice – 35 hours per Semester				
	Advanced Diploma in Vedic Mathematics Level -1: Certificate Course 100 hours per year				

II SEMESTER

Part	Course	Course Title	Code	Hrs./ Week	Credits
I	Language – II	Tamil / Hindi / Sanskrit – II	21ULTC2/21ULHC2/ 21ULSC2	6	3
II	English – II	Communicative English II	21ULEC2	6	3
III	Core Course– III	Analytical Geometry and Trigonometry	21UMAC3	5	4
III	Core Course– IV	Analytical Solid Geometry	21UMAC4	4	4
III	Allied Course – II	Allied: Physics II	21UMAAC2	3	3
		Allied: Physics Practical	21UMAAQC	2	2+2
IV	Skill Based – II	Analytical Geometry with Geogebra- Practical	21UMASQC2	2	2
IV	Environmental Studies	Environmental Studies	21UEVSC	2	1
		Group Project based on Environmental Studies	21UEVSPC	-	1
		Total		**30**	**25**

VI	Articulation and Idea Fixation Skills – 1 Extra Credit
	Physical Fitness Practice – 35 hours per Semester – 1 Extra Credit
	Certificate Course in Yoga – 30 hours – 1 Extra Credit
	Advanced Diploma in Vedic Mathematics Level -1: Certificate Course 100 hours per year- 2 Extra Credits
	Extra credits are given for extra skills and courses qualified in MOOC/NPTEL

III SEMESTER

Part	Course	Course Title	Code	Hrs./ Week	Credits
I	Language - III	Tamil / Hindi / Sanskrit - III	21ULTC3/ 21ULHC3/ 21ULSC3	6	3
II	English – III	Communicative English III	21ULEC3	6	3
III	Core Course – VII	Calculus II	21UMAC5	4	4
III	Core Course – VIII	Vector Analysis and Theory of Numbers	21UMAC6	5	4
III	Allied Course – II	Allied: Mathematical Statistics I	21UMAAC3	5	5
IV	Skill Based – III	Data Analytics with R– Practical	21UMASQC3	2	2
IV	Non-Major Elective – I			2	2
		Total		**30**	**23**
VI	Extension Activity	Group Project based on Extension Activity			
	Life Skill Courses	Course I: Communication Skill			2 (Extra)
	Articulation and Idea Fixation Skills				
	Physical Fitness Practice – 35 hours per Semester				
	Advanced Diploma in Vedic Mathematics Level -2: Diploma Course 100 hours per year				
	Extra credits are given for extra skills and courses qualified in MOOC/NPTEL				

Non-Major Elective – I	Basic Mathematics	21UMANEC1

IV SEMESTER

Part	Course	Course Title	Code	Hrs./ Week	Credits
I	Tamil/Hindi/Sanskrit	Tamil / Hindi / Sanskrit - IV	21ULTC4/ 21ULHC4/ 21ULSC4	6	3
II	English	Communicative English IV	21ULEC4	6	3
III	Core Course – VII	Differential Equations and Laplace Transforms	21UMAC7	4	4
III	Elective – I	Operations Research/ Number Theory	21UMAEC1/ 21UMASEC1	5	4

III	Allied – II	Allied: Mathematical Statistics II	21UMAAC4	5	5
IV	Skill Based – IV	Optimization Techniques with Tora – Practical	21UMASQC4	2	2
IV	Non-Major Elective – II			2	2
		Total		**30**	**23**
VI	Extension Activity	Group Project based on Extension Activity			2 (Extra)
	Life Skill Courses	Course I: Professional Skills			2(Extra)
	Articulation and Idea Fixation Skills - 1 Extra Credit				
	Physical Fitness Practice – 35 hours per Semester – 1 Extra Credit				
	Advanced Diploma in Vedic Mathematics Level -2: Diploma Course 100 hours per year – 2 Extra Credits				
	Extra credits are given for extra skills and courses qualified in MOOC/NPTEL and societal oriented group projects				

Non-Major Elective – II	Mathematics for Competitive Examinations	21UMANEC2

V SEMESTER

Part	Course	Course Title	Code	Hrs./ Week	Credits
III	Core Course – VIII	Real Analysis I	21UMAC8	6	4
III	Core Course – IX	Complex Analysis I	21UMAC9	5	4
III	Core Course – X	Modern Algebra	21UMAC10	6	4
III	Core Course – XI	Mechanics	21UMAC11	5	5
III	Elective - II	Theory: BioMathematics (3 credits) Practical : BioMathematics (1 credit) / Data structures	21UMAEC2 21UMAEQC/ 21UMASEC2	5	4
IV	Non-Major Skill Based-I			2	2
IV	Value Education		21UVENC	1	-
		Total		**30**	**23**
VI	Extension Activity	Group Project based on Extension Activity			
	Life Skill Courses	Course III : Leadership Skills			2 (Extra)
	Articulation and Idea Fixation Skills				
	Physical Fitness Practice – 35 hours per Semester				
	Advanced Diploma in Vedic Mathematics Level -3: Advanced Diploma Course 100 hours per year				
	Internship Training – 1 Extra Credit				
	Extra credits are given for extra skills and courses qualified in MOOC/NPTEL				

Non-Major Skill Based-I	Industrial Mathematics with R Programming- Practical	21UMAQNSC1

VI SEMESTER

Part	Course	Course Title	Code	Hrs./Week		Credits	
III	Core Course – XVI	Real Analysis II	21UMAC12	6		4	
III	Core Course – XVII	Complex Analysis II	21UMAC13	5		4	
III	Core Course – XVIII	Linear Algebra	21UMAC14	6		4	
III	Core Course – XIX	Numerical methods	21UMAC15	5		4	
III	Elective – III	Project and Viva Voce	21UMAEPC/ 21UMASEC3	2 hrs. field visit	3 hrs. Project work	2 credits for field visit	2 credits for Project work
IV	Non-Major Skill Based-II			2		2	
IV	Value Education		21UVENC	1		2	
	Total			**30**		**24**	
VI	Extension Activity	Group Project based on Extension Activity				2 (Extra)	
	Life Skill Courses	Course IV: Universal Human Values				2 (Extra)	
	Articulation and Idea Fixation Skills – 1 Extra Credit						
	Physical Fitness Practice – 35 hours per Semester - - 1 Extra Credit						
	Advanced Diploma in Vedic Mathematics Level -3: Advanced Diploma Course 100 hours per year – 2 Extra Credits						
	Extra credits are given for extra skills and courses qualified in MOOC/NPTEL						

- ***Free and Open-Source Software (FOSS) – 2 Hours Per Semester***

Non-Major Skill Based-II	Mathematical Modeling with R Programming- Practical	21UMAQNSC2

ALLIED COURSES OFFERED TO OTHER MAJORS

SEMESTER	COURSE TITLE	CODE	HOURS/ WEEK	CREDITS
I	Allied Mathematics I (For I B.Sc. Statistics / I B.Sc. Computer Science)	22USTAC1/ 22UCSAC1	5	5
II	Allied Mathematics II (For I B.Sc. Statistics / I B.Sc. Computer Science)	22USTAC2/ 22UCSAC2	5	5
III	Allied Mathematics I (For II B.Sc. Physics / II B.Sc. Chemistry) Business Mathematics (For II B.Com)	21UPHAC3/ 21UCHAC3/ 21UCOAC3	5	5
IV	Allied Mathematics II (For II B.Sc. Physics / II B.Sc. Chemistry)	21UPHAC4/ 21UCHAC4	5	5

Programme Title: B.Sc. MATHEMATICS
Course Title : Calculus I
Course Code : 21UMAC1 **Hours/Week : 5**
Semester : I **Credits : 5**
Course Objectives:

1. To make the students familiarize with the successive differentiation and Higher order partialderivatives.
2. To develop the ability of obtaining Maxima and Minima of functions of 2 (or) 3 variables.
3. To discuss the concepts of Curvature, Radius of curvature and Evolutes

SYLLABUS

Unit – I :(Hours : 15)
Successive differentiation - nth derivatives, Leibnitz theorem (statement only) and applications.
Chapters 1 and 2

Unit – II :(Hours :15)
Partial derivative, Higher derivatives, Homogenous function, Total differential co-efficient, Implicit functions.
Chapter 3(Sections 1.1-1.3, 2.3, 2.4)

Unit – III :(Hours : 15)
Jacobians, Maxima and Minima of Functions of two variables, Necessary and sufficient conditions (without proof), Method of Lagrange's multipliers (no derivation) - simple problems only.
Chapter 3 (Sections 3-5)

Unit – IV :(Hours : 15)
Polar co-ordinates - Angle between Radius Vector and the Tangent, Angle of intersection of two curves, Length of perpendicular from the pole to the Tangent, Pedal Equation, Radius of curvature in Polar Co-ordinates, Radius of Curvature for pedal curve, Radius of curvature for polar tangential curve.
(Chapters 5 and 6)

Unit – V:(Hours : 15)
Curvature and Radius of Curvature - Cartesian Formula for Radius of Curvature, Parametric formula for Radius of Curvature, Centre of curvature, Chord of curvature, Evolutes.
(Chapters 6 and9)

Book for study:
P.R. Vittal and V. Malini - Calculus, Margham publications, Chennai - 17.
Books for Reference:

1. S. Narayanan and T. K. Manicavachagom Pillai, Calculus Volume I, S. Viswanathan (Printers and Publishers) Pvt Limited, Chennai-2011.
2. S. Arumugam and Isaac - Calculus, Volume INew Gamma Publishing House – 1991

Web Resources:

1. **http://www.math.wise.edu>free221**
2. **www.ma.huji.ac.il>iWeb>Teaching _files Note:** Questions to be taken only from the TextBook.

Course Outcomes (CO) : On completion of the course, students would be ableto

CO Number	CO Statement	Knowledge Level
1.	learn the notions of Differential Calculus	**K-1**
2.	understand the concepts of nth derivative, partial derivatives, Radius of curvature in polar co-ordinates and Cartesian Co-ordinates and evolutes	**K-2**
3.	apply the concepts of the course to solve the related problems	**K-3**
4.	analysethe applications of angle between the radius vector and the tangent,evolute of the curve	**K-4**
5.	evaluate radius of curvature in polar co-ordinates and Cartesian co-ordinates	**K-5**

K-1:Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create

Mapping of COs with POs :

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	L	S	M	S	S	S	S	S
CO2	S	L	S	M	S	S	S	S	S
CO3	S	L	S	M	S	S	S	S	S
CO4	S	L	S	M	S	S	S	S	S
CO5	S	L	S	M	S	S	S	S	S

S-Strong, M-Medium, L-Low

Programme Title: B.Sc. MATHEMATICS
Course Title: ALGEBRA
Course Code: 21UMAC2 **Hours / Week:5**
Semester: I **Credits:5**

Course Objectives

1. To gain knowledge about binomial series, exponential series, logarithmic series and matrices.
2. To develop the ability of solving different types of algebraic equations.
3. To develop the ability to reflect critically on the methods they have chosen to solve problems.

SYLLABUS

Unit - I (Hours: 15)

Binomial Series: Binomial theorem for a positive integral index - Binomial theorem for a rational index - Summation of Binomial series.

Exponential Series: Exponential series for all real values of x - Standard results for the exponential series - Logarithmic series.

Chapter 2 (Sections 1-3), Chapter 3 (Sections 1 & 2) & Chapter 4

Unit – II(Hours: 15)

Matrices: Condition for consistency - Characteristic equation of a matrix - Cayley - Hamilton theorem - Similarity of matrices – Diagonalizable matrix.

Chapter 6

Unit – III(Hours: 15)

Theory of equations: Rational integral equation of the n^{th} degree, Fundamental theorem in the theory of equations (without proof) – Relation between the roots and coefficients of an equation - Imaginary and Irrational roots - Symmetric functions of the roots of an equation in terms of its coefficients.

Chapter 7 (Sections 1-5)

Unit – IV(Hours: 15)

Reciprocal equations - Transformation of equation - Multiplication of roots by m-Diminishing the roots of an equation - Removal of a term.

Chapter 7 (Sections 6 -10)

Unit – V(Hours: 15)

Descartes' rule of signs – Descartes' rule of signs for negative roots of an equation - Horner's method for approximation of roots of a polynomial equation - Newton's method of evaluating a real root correct to given decimal places.

Chapter 7 (sections 11 – 14)

Book for Study:

Algebra, Analytical Geometry & Trigonometry by **Dr.P.R.Vittal** &**V.Malini**, Margham publications, Chennai - 17.

Books for Reference:

1. Algebra Volume I by **T.K. Manickavasagam Pillai** & others, S.V. Publications, 1985.
2. Algebra Volume II by **T.K. Manickavasagam Pillai** & others, Revised Edition, S.V. Publications, 1985.

Web Resources:

1. https://www.britannica.com/science/mathematics/Theory-of-equations
2. https://www.onlinemath4all.com/how-to-check-consistency-of-linear-equations-using-matrices.html
3. https://www.brainkart.com/article/Introduction-to-Binomial,-Exponential-and-Logarithmic-series_35107/

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn about series expansions, reciprocal equations and the results governing them.	**K-1**
2.	solve problems on matrices and problems involving Descartes' rule of signs, Horner's method	**K-2**
3.	apply the fundamental theorem of Algebra for solving problems in theory of equations	**K-3**
4.	diminish, increase and remove the roots of an equation and identify the relation between the roots and the coefficients of an equation	**K-4**
5.	examine consistency of system of equations, verify Cayley-Hamilton theorem and evaluate the roots using Newton's method.	**K-4 &K-5**

K-1:Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create

Mapping of COs with POs:

PO / CO	PO								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	L	S	S	M	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S
CO4	S	M	S	S	M	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S

S-Strong, M-Medium, L-Low

Programme Title:B.Sc. MATHEMATICS
Course Title : THEORY OF EQUATIONS WITH MATLAB
Course Code : 21UMASQC1 **Hours / Week:2**
Semester : I **Credits :2**

Course Objective:

To impart knowledge on solving problems on Theory of equations using computer with MATLAB.

SYLLABUS

Unit –I

Matrices, Determinants and Array Functions

Unit –II

Matrix Factorization and Gaussian Elimination

Unit –III

Eigen Values and Eigen Vectors

Unit –IV

Polynomial Factorization and Roots of the Polynomial

Unit –V

Horner's Method for approximation of roots of a polynomial equation andNewton's Method of evaluating a real root.

Book for Study:

RudraPratap-Getting started with MATLAB

Web Resources:

1. https://www.mathworks.com/help/symbolic/factor.html
2. https://www.mathworks.com/help/symbolic/horner.html
3. https://m.njit.edu/Undergraduate/Matlab/M111MATLAB2S08/

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	recall the fundamental operations in matrices and theory of equations	**K-1**
2.	understand and apply commands in MATLAB to solve problems in matrices and theory of equations.	**K-2,K-3**
3.	apply the acquired knowledge on MATLAB to find eigen values, eigen vectors , determinants and roots of polynomials..	**K-3**
4.	use MATLAB for polynomial factorization.	**K-3**
5.	make use of MATLAB for matrix factorization and Gaussian elimination .	**K-3**

K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analyse, K-5 Evaluate, K-6 Create

Mapping of COs with POs :

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	M	M	S	S	S	S	S	S
CO2	S	M	M	S	S	S	S	S	S
CO3	S	M	M	S	S	S	S	S	S
CO4	S	M	M	S	S	S	S	S	S
CO5	S	M	M	S	S	S	S	S	S

S - Strong, M - Medium, L - Low

Programme Title:B.Sc. MATHEMATICS
Course Title :ANALYTICAL GEOMETRY AND TRIGONOMETRY
Course Code : 21UMAC3 **Hours/Week:5**
Semester : II **Credits :4**

Course Objectives:
1. To discuss polar coordinates, Equations of straight line, Circle and Conic.
2. To gain knowledge about hyperbolic and inverse hyperbolic functions, Logarithm of Complex numbers, Gregory series and summation using telescopic method.
3. To discuss the above concepts with suitable examples.

SYLLABUS

Unit – I(Hours : 15)

Polar coordinates - Equations of straight line and circle.
Chapter 4 (Page 4.1 - 4.13)

Unit –II(Hours : 15)

Polar equation of a conic.
Chapter 4 (Page 4.14 - 4.47)

Trigonometry

Unit –III(Hours : 15)

Expansions of sin θ, cosθ, tan θinterms of θ - Expansions of Sinnθ, Cosnθ, tannθ - Expansions of sinnθ, cosnθ, tannθ - Hyperbolic and inverse hyperbolic functions.
Chapter 11 (Page 11.1 -11.60)

Unit – IV(Hours : 15)

Logarithm of a complex number, general value and principal value, Gregory series.
Chapter 11 (Page 11.61 - 11.85)

Unit –V(Hours : 15)

Summation of series, Sum of Sines (Cosines) of n angle in A.P, Summation using telescopic method ($V_n = U_n - U_{n-1}$) and the C+ iS method.
Chapter 11 (Page 11.86 - 11.123)

Books for study

1.Dr.P.R.Vittal and V.Malini - Calculus(for Unit I & II).
2. Dr.P.R.VittalandV.Malini Algebra - Analytical Geometry and Trigonometry (for Unit III, IV & V), Margham publications, Chennai - 17.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	owledge Level
1.	learn about the basic concepts on Analytical geometry and Trigonometry	**K-1**
2.	understand the concepts of polar equations of straight line, circle and conic, expansion of circular functions, hyperbolic functions and trigonometric series	**K-2**
3.	calculate summation of trigonometric series and solve problems on straight line, circle and conic	**K-3**
4.	examine the nature of straight line, circle and conic and prove trigonometric identities	**K-5,K-4**
5.	solve various problems using expansions of trigonometric functions, hyperbolic and inverse hyperbolic functions and logarithm of complex numbers	**K-3**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5:Evaluate; K-6 :Create.

Mapping of COs with POs:

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	M	S	S	L	S	M	S	S
CO2	S	M	S	S	L	S	M	S	S
CO3	S	M	S	S	L	S	M	S	S
CO4	S	M	S	S	L	S	M	S	S
CO5	S	M	S	S	L	S	M	S	S

S-Strong, M-Medium, L-Low

Programme Title: B.Sc. MATHEMATICS
Course Title : ANALYTICAL SOLID GEOMETRY
Course Code : 21UMAC4 **Hours/Week:4**
Semester : II **Credits :4**
Course Objectives:

1. To train in visualizing ideas in three dimensions.
2. To acquire practical knowledge about plane, straight line, spheres, cone, cylinder and conicoids in three dimensionals.
3. To develop the skill of solving problems related to plane, straight line, spheres, cone, cylinder and conicoids in three dimensionals.

SYLLABUS

Unit – I(Hours : 12)
Plane

First degree equation - Determination of a plane - Plane perpendicular to a given direction - Planes parallel to given lines and through given points - Equation $P + \lambda P' = 0$ - Second degree homogeneous equation - Co planarity of the lines through a point - Perpendicular to a plane - Position of points with reference to a plane - Bisector planes of the angles between two given planes - Volume of a tetrahedron.

Chapter 3 (Sections 3.1 - 3.12, Vector methods are to be excluded)

Unit – II(Hours : 12)
Straight Line

Equation of a straight line - Symmetrical form - Conditions for various situations of a line - Co planarity of the two lines.

Chapter 4 (Sections 4.1 & 4.2, Vector methods are to be excluded)

Unit – III(Hours : 12)
Straight Line (continued)

Angle between a plane and a line - Projection of a line - Image of a point in a plane - Projection and image of a line in a plane - Perpendicular drawn to a line - Shortest distance between two skew lines - Foot of the common perpendicular - Equations of the plane containing the shortest distance - Line intersection the given line - Lines of intersection of three planes - Equation of two given skew lines - Surface generated by the straight line.

Chapter 4 (Sections 4.3 - 4.11, Vector methods are to be excluded)

Unit – IV(Hours : 12)
Sphere

Equation of a sphere - Standard equation of a sphere - Results based on the properties of a sphere - Tangent plane to a sphere - Radical plane - Equation of a circle on a sphere - Equations $S+\lambda P =0$ and $S+ \lambda S'=0$.

Chapter 5 (Sections 5.1 - 5.8, Vector methods are to be excluded)

Unit – V(Hours : 12)

Cone, Cylinder and Conicoids

Cone - Equation of a Right circular cone - Cone whose vertex is at the origin - Cone with vertex at (α, β, γ)- Quadric Cone with Vertex at the origin - Intersection of a cone by a plane - Three mutually perpendicular generators - General Quadric Cone - Cylinder - Equation of a cylinder - Right circular cylinder - Quadric surfaces- Conicoids - Standard equations of central conicoids - Enveloping cone - Tangent Plane.

Chapter 6 (Sections 6.1 - 6.13, Vector methods are to be excluded)

Book for study:

Analytical Geometry-3D by **P. Duraipandian, Laxmi Duraipandian**, **D. Muhilan,** Emerald Publishers.

Books for Reference:

1. Analytical Solid Geometry by **Shanthi Narayanan** and **Mittal P.K**, 16th Edition S. Chand and Co., New Delhi.
2. Analytical Geometry 3 Dimensional by **P. Duraipandian** & others - edition.

Note: Questions to be taken only from the text book

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	assimilate the basic concepts of Analytical solid geometry	**K-1**
2.	understand the notions of Plane, Straight line, Sphere, Cone Cylinder and Conicoids and solve related problems	**K-2, K-3**
3.	inspect the properties of sphere, tangential sphere, general quadratic cone, quadratic surfaces	**K-4**
4.	obtain the conditions for various situations of a line, Co planarity of two lines and Surface generated by the straight line	**K-3**
5.	analyze the problems on Straight lines, Cone, Cylinder and Conicoids	**K-4**

K-1 : Recall, K-2 : Understand, K-3 : Apply, K-4 : Analyse, K-5 : Evaluate, K-6 : Create

Mapping of COs with POs :

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	-	S	S	M	S	S	S	S
CO2	S	-	S	S	M	S	S	S	S
CO3	S	-	S	S	M	S	S	S	S
CO4	S	-	S	S	M	S	S	S	S
CO5	S	-	S	S	M	S	S	S	S

S - Strong, M - Medium, L - Low

Programme Title : **B.Sc. MATHEMATICS**
Course Title : **SKILL BASED II–ANALYTICAL GEOMETRY WITH GEOGEBRA – PRACTICAL**
Course Code : **21UMASQC2** **Hours / Week: 2**
Semester : **II** **Credits: 2**

Course Objectives
1. To trace various conics and analyse certain properties of them using Geogebra
2. To construct three dimensional images and finding their key specifications using Geogebra.

SYLLABUS

Unit I:
Classification of Quadratic equations representing lines, Parabola, Ellipse and Hyperbola.

Unit II:
Tracing the conic when its equation is given.

Unit III:
Reflection property of Parabola, Reflection property of Ellipse, Reflection property of Hyperbola.

Unit IV:
Tracing Spheres, Tracing Cylindrical surfaces.

Unit V:
Graphing quadratic surfaces.

Books for Study (Manual):
1. "An Introduction to Geogebra" by Steve Phelps, Geogebra Institute of Ohio Madeira High School, University of Cincinnati
2. "Geogebra Manual, The official manual of Geogebra"

Web Resources:
1. https://www.geogebra.org/m/ZMXBaxRY
2. https://www.geogebra.org/m/DS6pbceB
3. https://www.geogebra.org/m/m6cz5fqR

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	know the basic concepts of lines, Parabola, Ellipse and Hyperbola.	**K-1**
2.	acquire knowledge about reflection property ofParabola, Ellipse and Hyperbola.	**K-2**
3.	trace the conic by using quadratic equations	**K-3**
4.	use Geogebra to trace Spheres and Cylindrical surfaces.	**K-3**
5.	apply Geogebra for Graphing quadratic surfaces	**K-3**

K-1:Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create

Mapping of COs with POs:

PO / CO	PO								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	L	S	M	M	S	S	S	S
CO2	S	L	S	M	M	S	S	S	S
CO3	S	M	S	S	M	S	S	S	S
CO4	S	M	M	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S

S - Strong, M - Medium, L - Low

Programme Title :B.Sc. COMPUTER SCIENCE
Course Title : ALLIED MATHEMATICS - I
Course Code : 21UCSAC1 **Hours / Week:5**
Semester : I **Credits :5**

Course Objectives:

1. To acquire knowledge about the rank of a matrix, characteristic roots and characteristic vectors.
2. To gain knowledge about the various concepts on matrices & theory of equations.
3. To acquire knowledge on solving problems by Numerical methods.

SYLLABUS

Unit - I (Hours : 15)

Matrices:

Rank of a matrix, Elementary transformation, Equivalent matrices, Finding the rank of a matrix using elementary transformations (up to third order - simple problems) Characteristic equation of a matrix, Characteristic vectors of a matrix, Cayley - Hamilton's theorem (Statement only), Verification of Cayley - Hamilton theorem. (Examples 3-16 are to be excluded)
Chapter 5 (Page No: 5.25 – 5.37, 5.50 – 5.54,5.61-5.75)

Unit – II(Hours :15)

Theory of Equations:

Relation between the roots and coefficients of an equation, Imaginary and irrational roots, Symmetric functions of the roots of an equation in terms of its coefficients (up to cubic equation) and reciprocal equations.
Chapter 6 (Page No: 6.2 – 6.37)

Unit – III(Hours : 16)

Transformation of equation (Definition only), Multiplication of roots by m (Definition only) Diminishing the roots of an equation, Removal of term, Descart's rule of signs, Descart's rule of signs for negative roots of an equation, Horner's method, Newton's method of evaluating a real root to given decimal places.
Chapter 6 (Page No: 6.38, 6.49 – 6.67)

Unit – IV(Hours : 14)

The solution of Numerical Algebraic and Transcendental equations - Bisection method - Method of Successive approximations – RegulaFalsi method - Newton's method.

Solution of Simultaneous Linear Algebraic Equations: Gauss-Elimination Method – Gauss-Jordan Elimination Method.
Chapter 3 (Page No: 69 - 98) (Example problems only)
Chapter 4 (Page No: 112 - 126) (Example problems only)

Unit – V(Hours : 15)

Numerical Differentiation and Numerical Integration: Newton's forward difference, Newton's backward difference formula to compute the derivative – Derivative using Stirling's formula - To find maxima and minima of the function given the tabular values - A general quadrature formula for equidistant ordinates - Trapezoidal rule - Simpson's one-third rule - Simpson's three-eighths rule. (Geometrical interpretation, Truncation error in Trapezoidal rule, Romberg's method – Weddle's rule and Truncation error in Simpson's rule are to be excluded)
Chapter 9 (Page No: 281 - 296, 300 - 320) (Example problems only - Examples 7 & 8 in Numerical Differentiation are excluded)

Books for study:

1. P.R.Vittal - Allied Mathematics**,** Margham Publications, Chennai (for Units I, II & III)
2. P.Kandasamy, K.Thilakavathy, K.Gunavathy -Numerical Methods,2003 Edition (for Units IV & V).

Book for Reference:

1. H.C. Saxena - Finite Differences and Numerical Analysis, S. Chand Publishers, 2005.
2. T.K. ManickavasagamPillai& others – Algebra, Volume I, S.V. Publications, 1985.

Web Resources:

1. https://books.googlea.co.in/books?id=4C4rDAAAQBAJ&pg=PR1&dq=allied+mathematics+and+numerical+method&hl=en&sa=X&ved=0ahUKEwiykt2fxorbAhVFeiskHcA7CSMQ6AEIJzAB#v=onepage&q=allied%20mathematics%20and%20numerical%20methods&f=false

2. https://www.sigc.edu>AlgebraandCalculus

Note: Questions to be taken only from the Text Books.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the concepts on Matrices ,Theory of equations and Numerical methods.	**K-1**
2.	use elementary transformation to find rank of a matrix , characteristic roots and corresponding characteristic vectors for a square matrix, apply Newton's and Horner's method to find a real root of polynomials.	**K-3**
3.	analysethe importance of real and complex polynomials and learn various methods of obtaining roots.	**K-4**
4.	understand the various methods to obtain numerical solution of algebraic and transcendental equations and simultaneous linear algebraic equations,various formula on Numerical differentiation and Numerical integration.	**K-2**
5.	apply the acquired knowledge to obtain numerical solution of algebraic and transcendental equations, simultaneous linear algebraic equations and differential equations.	**K-3**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Programme Title : B.Sc. STATISTICS
Course Title : ALLIED MATHEMATICS - I
Course Code : 21USTAC1 Hours / Week:5
Semester : I Credits :5

Course Objectives:

1. To acquire knowledge in theory of equations, Differential calculus and Differential equations.
2. To understand the method of solving algebraic equations using transformation of equation.
3. To promote problem solving ability in differential equations.

SYLLABUS

Unit – I (Hours : 15)

Theory of Equations

Relation between the roots and coefficients of an equation, Imaginary and irrational roots, Symmetric functions of the roots of an equation in terms of its coefficients (up to cubic equations) and Reciprocal equation.

Chapter 6 (Page No : 6.2 – 6.37)

Unit – II (Hours : 15)

Transformation of equation (Definition only), Multiplication of roots by m(Definition only), Diminishing the roots of an equation, Removal of a term, Descartes' rule of sign, Descartes rule of signs for negative roots of an equation, Horner's method, Newton's method of evaluating a real root correct to given decimal places.

Chapter 6 (Page.No : 6.38 - 6.67)

Unit – III (Hours : 15)

Differential Calculus

Angle between the radius vector and the tangent, Angle of intersection of two curves, Length of perpendicular from the pole to the Tangent, Pedal equation, Cartesian formula for radius of curvature, Parametric formula for radius of curvature.

Chapter 10 & 11(Page.No : 10.1 – 10.23, 11.1 – 11.22)

Unit – IV (Hours : 15)

Ordinary Differential Equations

Second order differential equations with constant coefficients, Finding particular integral for the function $f(x)e^{ax}$, cos*ax*, sin *ax*, sinh*ax*, cosh*ax*, x^m, $e^{ax}v$ where v is any function of x, Linear homogeneous equation and Variation of parameter.

Chapter 23 & 24 (Page No: 23.1 – 23.32, 24.1 – 24.23)

Unit – V (Hours : 15)

Partial Differential Equations

Elimination of arbitrary constants, Elimination of arbitrary functions, Definitions – complete solution, singular solutions, General solutions, Standard types, Lagrange's linear partial differential equations (Charpit's method to be excluded).

Chapter 26 (Page No: 26.1 – 26.40, 26.44 – 26.58)

Book for study:

P.R. Vittal - Allied Mathematics**,** Margham Publications, Chennai-17.

Book for Reference:

T.K.Manicavachagam Pillai, T.Natarajan& K.S. Ganapathy - Algebra Volume-I, S.Viswanathan Publishers, Pvt. Ltd, 2004.

Web Resources :

1. http://www.universityofcalicut.info/SDE/VI%20Sem.%20B.Sc%20Maths%20-%20Additional%20Course%20in%20lie%20of%20Project%20-Theory%20of%20equations%20&%20fuzzy%20set.pdf
2. https://sol.du.ac.in/pluginfile.php/4111/mod_resource/content/1/B.A.%20st%20m%204_1-7_.pdf

Note: Questions to be taken only from the Text Books.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the concepts of matrices, theory of equations, differential calculus, ordinary and partial differential equations	**K-1**
2.	analyse various methods to find roots of polynomial equation and inspect Horner's method and Newton's method to find approximate real roots	**K-4**
3.	understand the concept of angle between the radius vector and the tangent, radius of curvature, pedal equation and Descartes rule of signs and solve related problems	**K-2,K-3**
4.	solve specific types of ordinary and partial differential equations.	**K-3**
5.	analyse the method of Variation of parameters to solve ordinary differential equations, Lagrange's method to solve partial differential equations	**K-4**

K-1 Recall; K-2 Understand; K-3 Apply; K-4 Analyse; K-5 Evaluate; K-6 Create

Programme Title: B.Sc. COMPUTER SCIENCE
Course Title : ALLIED MATHEMATICS - II
Course Code : 21UCSAC2 **Hours / Week:5**
Semester : II **Credits :5**

Course Objectives:

1. To gain knowledge about the concepts of Mathematical logic, Set theory and Mathematical system known as Boolean Algebra.
2. To acquire knowledge about Linear Programming Problem and solving them using Graphical method and Simplex method.
3. To know about how to transport various quantities from various origins to different destinations with the minimum cost.

SYLLABUS

Unit – I(Hours : 15)

Mathematical Logic

Logical Statement or Proposition - Type of Propositions - The Propositional Calculus - The Negation of a Proposition - Disjunction - Conjunction - Tautologies and Contradictions - Logical Equivalence - The Algebra of Propositions - Conditional Propositions - Converse, Inverse and Contrapositive Propositions - The Negation of a Conditional Proposition - Biconditional Propositions - Arguments.

Chapter 1 Page No: 1-16

Unit – II(Hours : 15)

Set Theory

Sets - Set Designation - Null Sets and Unit Sets - Special Sets of Numbers - Universal Set - Subsets: Proper Subsets and Equal Sets - Set Operations - Union Operation - Properties of Union Operation - Intersection - Properties of Intersection Operation - Distributive Properties - Complementation - Relative Complement (or Difference of Sets) - Properties of Complement - Properties of Difference - Symmetric Difference.

Chapter 2 Page No: 17 - 35

Unit – III(Hours : 15)

Boolean Algebra

Introduction - Boolean Functions - Normal Form - Fundamental Forms of Boolean/ Functions.

Chapter 5 Page No: 112-132

Unit – IV(Hours : 16)

Graphical method of the solution of a LPP and General Linear Programming Problems - Simplex Method - General Linear Programming Problem - Canonical and Standard forms of LPP - The Simplex Method - The Simplex Algorithm.

Chapter 2 Page No: 2.15-2.32 (Example problems only)
Chapter 3 Page No: 3.1 - 3.26 (Example problems only)

Unit – V(Hours : 14)

Transportation Model : Introduction - Mathematical Formulation of a Transportation Problem - Methods for finding Initial Basic Feasible Solution - Transportation Algorithm (or) MODI Method (Test for Optimal)
(Balanced problems only)

Chapter 7 Page No: 7.1 - 7.25 (Example problems only)

Books for study:

1. B.S. Vatsa and SuchiVatsa - Discrete Mathematics**,** New Age International Publishers, New Delhi (for UNITS I, II & III)
2. V.Sundaresan, K.S. Ganapathy Subramanian and K. Ganesan - Resource Management Techniques (Operations Research)**,** A.R. Publications, SirkaliTaluk (for UNITS IV & V)

Books for Reference:

1. Kantiswarup, P.K. Gupta and Man Mohan - Operations Research, (9th Edition), Sultan-Chand Publications.
   2.M. Chandrasekaran, M. Umaparvathi. PHI Learning Private Ltd. 2010.

Web Resources :

1. http://www.maths.manchester.ac.uk/~avb/0n1_pdf/0N1_All.pdf
2. https://faculty.math.illinois.edu/~vddries/main.pdf
3. http://nptel.ac.in/courses/112106134/3

Note: Questions to be taken only from the text books

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	define mathematical logic and recognize the fundamental concepts of set operations, Boolean Algebraand LPP	**K-1**
2.	understand mathematical logic for expressions involving the logical connectives, properties of sets operations, fundamental forms of Boolean functions and graphical methods of LPP	**K-2**
3.	exercise problems in set theory and evaluate Boolean expressions	**K-3, K-5**
4.	explain the mathematical representation of LPP, simplex algorithm and transportation model	**K-2**
5.	solve problems using simplex method and transportation methods	**K-3**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Programme Title :B.Sc.STATISTICS
Course Title : ALLIED MATHEMATICS - II
Course Code : 21USTAC2 **Hours / Week:5**
Semester : II **Credits :5**

Course Objectives:

1. To acquire knowledge about the concepts in matrices, finite differences and differential calculus.
2. To gain knowledge about various concepts on roots of an equation.
3. To promote the problem solving skill applying the above concepts.

SYLLABUS

Unit - I (Hours : 15)

Characteristic equation of a matrix, Characteristic vectors of a matrix, Cayley-Hamilton theorem (statement only) and its applications.

Chapter 5 (Page No: 5.50 – 5.75 only, Examples 3-16 are to be excluded)

Unit – II(Hours : 15)

Trigonometry

Expansions of sin nθ, cos nθ, tan nθ (n being a positive integer), Expansions for $\cos^n\theta$ and $\sin^n\theta$ in terms of multiples of θ, Express cosnθ in terms of cosines of multiples of θ (n is a positive integer), Expansions of sin θ and cosθ in ascending powers of θ, Expansion of tan θ.

Chapter 14 (Page No: 14.1-14.30)

Unit –III(Hours : 16)

Integral Calculus

Multiple Integrals Evaluation of double integrals, Double integral in polar co-ordinates, Triple integrals, Change of order of integration.

Chapter 20 (Page No: 20.1 – 20.32)

Unit –IV(Hours : 15)

Laplace Transform

Definition, Laplace transform of elementary functions, Linearity property, Shifting property, Change of scale property, Laplace transform of derivatives, Laplace transform of integrals.(Periodic functions to be excluded).

Chapter 27 (Page No: 27.2 – 27.20)

Unit –V(Hours : 14)

Inverse Laplace transform, Solving differential equations using Laplace transform. (Simultaneous equations are to be excluded).

Chapter 27 (Page No: 27.24– 27.57)

(Section 5 : Examples 1-10, Exercise IV : 1-26 only)

Book for study:

P.R. Vittal - Allied Mathematics**,** Margham Publications, Chennai-17.

Books for Reference:

1. S. Narayanan and T.K. ManicavachagomPillay - Trigonometry, S. Viswanathan Publishers, Pvt. Ltd.,2009.
2. S. Narayanan and T. K. ManicavachagomPillay -Differential Equation and its Applications, S. Viswanathan Publishers Pvt Ltd, Ninth edition,2009.

Web Resources :

1. https://www.math.ucdavis.edu/~anne/WQ2007/mat67-Notes_on_Matrices.pdf
2. https://www.cms.waikato.ac.nz/~stokes/MATH102/trigOH.pdf
3. http://www.math.northwestern.edu/~scanez/courses/290/notes/lecture-notes-290-3.pdf
4. http://www.math.psu.edu/shen_w/250/NotesLaplace.pdf
5. https://services.math.duke.edu/~yh89/teaching/Math353_15Summer_I/LectureNotes/lecture13.pdf

Note: Questions to be taken only from the Text Book.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the concepts of characteristic equation, trigonometric expansions, multiple integrals and Laplace transforms	**K-1**
2.	understand different trigonometric expansions, applications of characteristic equations, Laplace transforms, inverse Laplace transforms and solve related problems	**K-2,K-3**
3.	inspect the limits of functions applying trigonometric expansions and values of multiple integrals using rules of integration	**K-3,K-4**
4.	interpret the properties of Laplace transforms and inverse Laplace transforms	**K-4**
5.	analyse the method of solving differential equations applying Laplace transforms, the method of finding inverse of a matrix using Cayley – Hamilton theorem	**K-3,K-4**

K-1 Recall; K-2 Understand; K-3 Apply; K-4 Analyse; K-5 Evaluate; K-6 Create

Programme Title: B.Sc. MATHEMATICS
Course Title :CALCULUS II
Course Code : 21UMAC5 Hours / Week:4
Semester : III Credits :4

Course Objectives

1. To acquire knowledge about Bernoulli's formula for integration by parts, Reduction formulae and Beta-Gamma functions.
2. To know the evaluation of multiple integrals and its applications.
3. To make the students to familiarize with the concepts of Fourier Series.

SYLLABUS

Unit –I(Hours: 12)

Bernoulli's formula for Integration by parts, Reduction formulae, Beta and Gamma functions, Properties.

(Chapter 11, 13)

Unit –II(Hours: 12)

Relations between Beta and Gamma functions, Evaluations of definite integrals using Beta and Gamma functions, Double Integrals, Double Integral in polar co-ordinates.

(Chapter 13, 17)

Unit – III(Hours: 12)

Triple Integrals, Change of order of Integration, Applications of Double and Triple Integrals to Area, Volume and Centroid.

(Chapter 17)

Unit – IV(Hours: 12)

Fourier Series : Fourier series expansions of periodic functions with period 2π, Fourier series for odd and even functions, Half range Fourier series.

(Chapter 22)

Unit –V(Hours: 12)

Fourier Transform – Fourier Sine and Cosine Transformations – Heat Flow Problems – Vibration of an Infinite String.

Books for study:

1. P.R.Vittal and V.Malini - Calculus, Margham publications, Chennai – 17(for Units I, II, III and IV).
2. P.R.Vittal - Allied Mathematics, Margham publications, Chennai- 17(for Unit IV).
3. https://nptel.ac.in/courses/111/103/111103021 (for Unit V)

Books for Reference:

1. S. Narayanan and T.K. ManicavavhagomPillai - Calculus (Volume II), S. Vishwanathan (Printers and Publishers) Pvt Limited, Chennai – 2011
2. Shanthi Narayan, Differential & Integral Calculus.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	recognize the concepts of Bernoulli's formula, Beta and Gamma functions, double and triple integrals, Fourier series and Fourier transforms	**K-1**
2.	understand relations between Beta and Gamma functions&double and triple integrals, basic properties of Fourier sine and cosine transforms and transformation of partial derivatives	**K-2**
3.	calculate trigonometric functions of sine and cosine and solve problems on vibration of an infinite string	**K-3**
4.	analyse the properties of integration, applications of double and triple integrals toarea, volume , centroid, Fourier series and Fourier Transforms	**K-4**
5.	evaluate Beta and Gamma functions, double and triple integrals and solve heat flow problems	**K-3, K-5**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Mapping of COs with POs:

PO / CO	PO								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	M	S	M	S	S	S	S	S
CO2	S	M	S	M	S	S	S	S	S
CO3	S	M	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S
CO5	S	M	S	S	S	S	S	S	S

Programme Title:B.Sc. MATHEMATICS
Course Title: VECTOR ANALYSIS AND THEORY OF NUMBERS
Course Code: 21UMAC6 **Hours / Week:5**
Semester: III **Credits:4**
Course Objectives:

1. To acquire the knowledge in divergence, curl and integration of vector point functions and number theory.
2. To understand the integral theorems in vector analysis
3. To analyse the evaluation of integrals.
4. To develop the ability in solving number theory problems.

SYLLABUS

Unit -I (Hours : 15)

Vector functions, Limit of a vector function, Derivative of a vector function, Partial derivatives of vector functions and Successive differentiation.

Chapter 1&https://nptel.ac.in/courses/111/105/111105122/

Unit -II(Hours : 15)

Vector Differentiation

Scalar and vector point functions,Level surfaces,Directional derivative of a scalar point functions, Gradient of a scalar point function,Summation notation for gradient, divergence and curl of a vector point function,Summation notation for divergence and curl , Laplacian differential operator and Examples.

Chapter 2

Unit -III(Hours : 15)

Vector Integration

Line integrals,Independence of path of integration,Conservative field and scalar potential,Line integral of a conservative vector,Surfaceintegrals,Volumeintegrals,Cylindrical and spherical polar coordinates and Examples.

Chapter 3

Unit -IV(Hours : 15)

Integral Theorems

Gauss' divergencetheorem,Integral theorems derived from the divergence theorem, Green's theorem in plane (without proof),Stokes' theorem, Integral theorems derived from Stokes' theorem, Operational meanings of $\nabla, \nabla., \nabla \times$ in terms of surface integrals and Examples.

Chapter 4

Unit -V (Hours : 15)

Prime number, Composite number ,decomposition of a composite number as a product of primes uniquely (without proof), Divisors of a given number N, Euler's function $\phi(N)$, formula for $\phi(N)$, Integral part of a real number, The highest power of a prime p contained in n!, The product of r consecutive integers is divisible by r! (without proof), Congruences, Numbers in arithmetical progression, Fermat's theorem(without proof), Generalisation of Fermat's theorem(without proof), Wilson's theorem(without proof).Simple problems.

Chapter 5 (Sections 1 - 9)

Books for Study:

1. P. Duraipandianand LaxmiDuraipandian- Vector Analysis ,Emerald publishers, Chennai (For Unit I, II , III&IV),.
2. Dr.P.R.Vittaland V. Malini - Algebra, Analytical geometry &Trigonometry ,Margham publications, Chennai - 17(For Unit V).

Web Source:

1.https://nptel.ac.in/courses/111/105/111105122/ (For Unit I)

Books for Reference:

1. P.R.Vittal and V. Malini - Vector Analysis ,Margham Publications, Chennai (For UnitsI,II , III& IV).
2. K.Viswanathan and S.Selvaraj - Vector Analysis , Emerald Publishers, Chennai(For Units I, II III& IV).
3.Kumaravelu and Susheela–Kumaravelu -Elements of Number Theory, Raja Sankar offset Printers, Sivakasi, 2002(For Unit V).

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the concepts of vector functions,vector differentiation and integration,integral theorems and number theory.	**K-1**
2.	understand the concepts of directional derivative and gradient of scalar point function, divergence and curl of a vector point function, line,surface and volume integrals, Euler's function,Integral part of a real number, the statements of Fermat's theorem and Wilson's theorem.	**K-2**
3.	apply the acquired knowledge to solve the problems on vector differentiation , vector integration and number theory.	**K-3**
4.	analyse the properties of congruences and verify Gaussdivergence theorem,Green's theorem and Stokes' theorem.'	**K-4,K-6**
5.	prove theresults in vector functions,vector differentiation and vector integration and also prove integral theorems.	**K-5**

K-1 :Recall, K-2 :Understand, K-3 :Apply, K-4 :Analyse, K-5 :Evaluate, K-6 :Create

Mapping of COs with POs :

S -

PO / CO	PO								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	-	M	L	L	S	S	S	S
CO2	S	-	M	L	L	S	S	S	S
CO3	S	-	M	L	L	S	S	S	S
CO4	S	-	M	L	L	S	S	S	S
CO5	S	-	M	L	L	S	S	S	S

Strong, M - Medium, L – Low

Programme Title: B.Sc. MATHEMATICS
Course Title : ALLIED- MATHEMATICAL STATISTICS - I
Course Code :21UMAAC3 **Hours / Week:5**
Semester :III **Credits:5**

Course Objectives:

1. To understand the concept of random variables, Marginal and Conditional Probability distributions.
2. To acquire knowledge about Expectation, Variance and Characteristicfunctions.
3. To gain knowledge about the correlation and regression coefficients and different types of distributions withexamples.

SYLLABUS

Unit – I (Hours : 15)

Random Variables: Definition, Discrete random Variable, Continuous random variable, Cumulative distribution, Two-dimensional random variable, Marginal probability distribution, Conditional probability distribution, Independent randomvariable.

Mathematical Expectation: Definition, Properties of expected values and examples.

Chapter 2 (Page No.: 2.1 -2.33)
Chapter 3 (Page No.: 3.1 -3.18)

Unit – II(Hours : 15)

Variance: Definition, properties of variance, Examples, Chebechev's inequality, examples

Moment and Moment generating function: Definition, Properties of moment generating functions and examples.

Chapter 4 (Page No.: 4.1 -4.25)
Chapter 5 (Page No.: 5.1 -5.17)

Unit – III(Hours : 15)

Characteristic Functions: Definition, Properties of characteristic function, Moments from the characteristic function, Inversion theorem, Probability generating function – Definition, Probability generating function of Binomial distribution and Poisson distribution, Additive Property, Relation between PGF and MGF and examples.

Cumulants:Definition, examples , Additive Property of Cumulants

Conditional Expectation: Definition, Theorems on conditional expectation and examples

Chapter 6 (Page No.: 6.1 - 6.46)
Chapter 7 (Page No.: 7.1 – 7.11)

Unit – IV(Hours :15)

Correlation: Definition, Rank correlation, Properties of correlation coefficient, Limitations,examples.

Regression: Derivation of regression lines, Properties of regression coefficients, examples.

Chapter 8 (Page No. : 8.2 Definition only, 8.20- 8.47)
Chapter 9 (Page No. : 9.1 - 9.24)

Unit – V(Hours : 15)

Binomial Distribution :Definition, Binomial frequency distribution and examples.

PoissonDistribution: Definition and examples of Poissondistribution.

NormalDistribution : Definition, standard normal probabilitydistribution and examples.

UniformDistribution : Definition andexamples

Chapter 12 (Page No. : 12.1 -12.16)
Chapter 13 (Page No. : 13.1 -13.12)

Chapter 16 (Page No. : 16.1, 16.13 - 16.27)
Chapter 22 (Page No.: 17.1 - 17.4)

Book for Study:
P.R.Vittal - Mathematical Statistics ,2004 - MaragathamPublishers.

Books for Reference:
S.C.Gupta and V.K.Kapoor - Fundamentals of Mathematical statistics , Sultan Chand and Sons, Pvt. Ltd.

Web Resources:
1. **www.iiserpue.ac.in>Sahoo_textbook**
2. **Spartan.ac.brocku.ca>~jvrbik>Statistics**
3. **www.maths.adelaide.edu.au>MSIII**

Note: Questions to be taken only from the Text Books.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	nowledge Level
1.	understand the concepts of Random variables,expectation, Variance Moments, Characteristic functions, Conditional expectation,correlation and regression, Binomial, Poisson,Normal and Uniform distributions	K-2
2.	apply Mathematical statistics in optimization problems appearing in Social sciences, Physical sciences, Life sciences and other disciplines.	K-3
3.	evaluate Mean,Variance and Moments for the distributions studied in the course using characteristic functions, MGF and PGF	K-5
4.	examine theproperties of expectation, variance correlation and regression solve the related problems	K-4, k-3
5.	solve the problems/ society connect problems using Binomial,Poisson,Normal and Uniform distributions	K-6

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Mapping of COs with POs :

PO / CO	PO								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	M	S	S	S	S	S	S	S
CO2	S	M	S	S	S	S	S	S	S
CO3	S	M	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S
CO5	S	M	S	S	S	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title: B.Sc. MATHEMATICS
Course Title: DATA ANALYTICS WITH R - PRACTICAL
Course Code: 21UMASQC3 **Hours / Week: 2**
Semester: III **Credits: 2**

Course Objectives
1. To familiarize the operations on vectors and matrices using R studio

2. To understand computations on Big Data analytics and correlation using R studio

SYLLABUS

UNIT - I

Getting started with R: Installation – Getting started with the R interface

R Nuts and Bolts – Entering Input – Evaluation – R objects – Numbers – creating vectors – Matrices – Lists – Factors – Missing values – Data frames –Names – Summary

UNIT – II

Getting Data In and Out of R

Reading and Writing Data – Reading Data Files with read.table() – Reading in Larger Datasets with read.table – Calculating Memory Requirements for R Objects

UNIT – III

Vectorized Operations

Vectorized Matrix Operations

Dates and Times

Dates in R - Times in R - Operations on Dates and Times

UNIT – IV

Coding Standards for R

Loop Functions

Looping on the Command Line - lapply() - sapply() - split() - Splitting a Data Frame – tapply - apply() - Col/Row Sums and Means - Other Ways to Apply - mapply() – Vectorizing a function

UNIT – V

Data Analysis Case Study: Changes in Fine Particle

Synopsis – Loading and Processing the Raw Data – Results

Book for Study

"R Programming for Data Science" by Roger D. Peng

Web Resource:
https://www.google.com/url?sa=t&source=web&rct=j&url=https://sites.calvin.edu/scofield/courses/m143/materials/RcmdsFromClass.pdf&ved=2ahUKEwjD9butqeTyAhU-7XMBHf7nDvcQFnoECAMQBg&usg=AOvVaw2cqS0mj02xNYei1l59OIq6

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	understand the operations on vectors using R	**K-2**
2.	interpret basic operations on matrices using R	**K-2**
3.	apply commands on data frames to understand various operations on it using R	**K-2 &K-3**
4.	solve Correlation problems with R	**K-3**
5.	analyse the operations on Big Data tables using R	**K-4**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Mapping of COs with POs:

PO / CO	PO								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	L	S	M	M	S	S	S	S
CO2	S	L	S	M	M	S	S	S	S
CO3	S	M	S	S	S	S	S	S	S
CO4	S	M	M	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title: B.A/B.Sc/B.COM
CourseTitle : NON MAJOR ELECTIVE -I
Course Code :21UMANEC1 **Hours / Week:2**
Semester :III **Credits :2**

Course Objectives:

1. To introduce the basic concepts ofmathematics.
2. To make the students to acquire knowledge on Geometry and solid and planefigures.
3. To initiate the students to find the volume and surface area ofsolids.

SYLLABUS

Unit –I(Hours : 6)
Operations on Numbers.
Section-I – Chapter 1 – Solved examples 1-32 only.(Page No. 1-9 only)

Unit –II(Hours : 6)
H.C.F. and L.C.M of Numbers.
Section-I – Chapter 2 (Page No. 30-45 only)

Unit –III(Hours : 6)
Percentage
Section-I – Chapter 10 – Solved examples 1-33 only.(Page No.208-214 only)

Unit –IV(Hours : 6)
Area
Section-I – Chapter 24 – Solved examples 1-32 only.(Page No. 499-505 only)

Unit – V(Hours : 6)
Volume and Surface Area
Section-I – Chapter 25 – Solved examples 1-34 only.(Page No. 549-555 only)

Book for Study:

Quantitative Aptitude for Competitive Examinations (Fully Solved) (Seventh Revised Edition) by **Dr. R. S. Aggarwal**, S.Chand& Company Pvt. Ltd.

Book for Reference:

Fast Track Objective Arithmetic by Rajesh Verma, Arihant Publications India Limited, New Delhi, Completely Revised Edition.

Web Resources:

1. http://ncert.nic.in/ncerts/l/iemh113.pdf
2. https://yoursmahboob.files.wordpress.com/2016/12/quantramandeepbook-1.pdf

Note: Questions to be taken only from the Text Book.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	recognise the notions of numbers, H.C.F and L.C.M percentage	**K-1**
2.	understand the concepts of area,volume and surface area	**K-2**
3.	use the acquire knowledge to solve the problems in numbers, H.C .F and L.C.M and percentage	**K-3**
4.	Calculate the area , volume and surface area for geometrical shapes and solid shapes	**K-3**
5.	Apply the concepts acquired to write the competitive examinations	**K-3**

K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analyse, K-5 Evaluate, K-6Create

Programme Title: B.Sc. MATHEMATICS
Course Title :DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS
Course Code :21UMAC7 Hours / Week:4
Semester: IV Credits :4

Course Objectives

1. To provide with a carrier and systematic way of solving a given ordinary and partial differential equations.
2. To know about Laplace transforms and its application to differential equations.

SYLLABUS

Unit-I(Hours : 12)

Differential equation of first order but not of first degree, Exact differential equation, Total differential equation Pdx + Qdy + Rdz = 0, Second order differential equations with constant coefficients P.I. for the polynomial and e^{ax} V, where V is X^n, cosmx, sinmx, (m and n are constants).

Chapter 1(section 3.1-3.3,4,5.1-5.5,6.1,6.2,7.1-7.3)

Chapter 2(section 1.1,1.2,2,3,4)

Chapter 3(Section 7.1-7.4)

Unit-II(Hours : 12)

Differential equations of second order with variable co-efficients, Variation of parameters, Partial differential Equations : Formation of P.D.E. by elimination of arbitary constants and functions, Solutions of P.D.E.

Chapter 2(section 8,8.1,8.2,9,10)

Chapter 4(section 1,2,2.1,2.2,3,4)

Unit –III(Hours : 12)

Standard Types : f(p,q) = 0, f(x,p,q) = 0; f(z,p,q) = 0, f(x,p) = g(y,q), Clairauts form, Lagrange's PDE : Pp + Qq = R, Charpit's method.

Chapter 4(section 1,2,2.1,2.2,3,4,5.1,5.2,5.3,5.4,6,6.1,7)

Unit – IV(Hours : 12)

Laplace Transforms, Inverse Laplace transform, Application of Laplace Transforms to differential equations, Simple problem - Solving simultaneous equations.

Chapter 5(section 1.1,1.2,2,3,4,5,6,7, 8,9,10,11,12)

Unit-V(Hours : 12)

Solution of Partial Differential Equations using Laplace Transform and Solution of Heat Equation and Wave Equation using Laplace Transform

Books for study:

1. S. Narayanan, T. K. Manicavachagam Pillay Differential Equations and Fourier Series and Fourier Transforms**,** Viswanathan (Printers and Publishers) Pvt. Ltd., 2004 (for Unit I to Unit IV).
2. https://nptel.ac.in/courses/111/105/111105123 (for Unit V)

Books for Reference:

1. Arumugam and Isaac, Differential Equation, New Gamma Publishing House, Palayamkottai, 2003
2. M.D. Raisinghania, Ordinary and partial Differential Equations, S. Chand & Co.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	recognize the fundamental concepts of ordinary, partial differential equations, exact, total differential equations, Clairauts form, Lagrange's method, Charpit's method, Laplace transforms, heat equation and wave equation	**K-1**
2.	solve ordinary and partial differential equations using standard techniques for exact, total differential equations and interpret the methods in solving second order linear differential equations with constant and variable coefficients, heat equation	**K-3**
3.	apply the acquire knowledge of standard types, Clairauts form, Lagrange's method and Charpit's method to solve problems on differential equations	**K-3**
4.	evaluate related problems onvariation of parameters, Laplace transforms and Inverse Laplace transforms	**K-5**
5.	analyse the applications of Laplace Transforms by differentiation and solve wave equation	**K-5**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Mapping of COs with POs:

PO / CO	PO								
	PO1	**PO 2**	**PO 3**	**PO 4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**
CO1	S	M	S	S	S	S	S	S	S
CO2	S	M	S	S	S	S	S	S	S
CO3	S	M	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S
CO5	S	M	S	S	S	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title:B.Sc. MATHEMATICS
Course Title :OPERATIONS RESEARCH
Course Code : 21UMAEC1 **Hours / Week:5**
Semester:IV **Credits :4**

Course Objectives:

1. To understand the concepts of solving Linear Programming Problem,Transportation and Assignment problems.
2. To develop the ability of solving the real world problem through Network Analysis.

SYLLABUS

Unit I(Hours:15)

Linear Programming Formulation and Graphical method of the solution of a L.P.P

Introduction, Requirements for employing LPP Technique, Mathematical Formulation of LPP&Graphical method of the solution of a L.P.P.

General Linear Programming Problems – Simplex Methods

General Linear Programming Problems, Canonical and Standard forms of LPP, The Simplex Method, The Simplex Algorithm, Artificial Variables Techniques, The Big M – Method&The Two Phase Method.

Chapter – 2- Sec: 2.1- 2.3 & 2.5(Page No: 2.1 – 2.28)

Chapter – 3- Sec: 3.1.1 - 3.1.4, 3.2, 3.2.1 & 3.2.2(Page No: 3.1 – 3.56)

Unit II (Hours:15)

Transportation Model

Introduction, Mathematical formulation of a Transportation Problem, Methods for finding initial basic feasible solution, Transportation Algorithm (or) MODI Method (modified distribution method) (Test for optimal solution),Degenerancy in Transportation problems and Unbalanced Transportation problems

Chapter – 7- Sec: 7.1- I, II , 7.2 - 7.4 (Page No: 7.1 – 7.47)

Unit III(Hours:15)

Assignment Problem

Introduction, Assignment Algorithm (or) Hungarian Method,Unbalanced Assignment Models& Travelling Salesman Problem.

Chapter – 8- Sec: 8.1, 8.5, 8.6 & 8.9 (Page No: 8.4 – 8.22, 8.33 – 8.49)

https://nptel.ac.in/courses/111/107/111107128/

UnitIV(Hours:15)

Scheduling by PERT and CPM

Introduction, Basic Terminologies, Rules for constructing a project network, Network Computations (Earliest completion time of a Project and Critical path), Floats, Programme Evaluation Review Technique : (PERT)& Basic differences between PERT and CPM.

Chapter – 15- Sec: 15.1 - 15.7(Page No: 15.1 – 15.46)

UnitV (Hours:15)

Game Theory

Introduction, Two person zero – Sum Games, The Maximin – Minimax Principle, Games without Saddle Points, Mixed Strategies, Dominance Property& Graphical Method for 2 x n or m x 2 games.

Chapter – 16- Sec: 16.1 - 16.4, 16.6 & 16.7 (Page No: 16.1 – 16.14, 16.20 – 16.39)

Book for Study:

1.Prof. V.Sundaresan,Prof. K.S. Ganapathy Subramanian, Prof. K. Ganesan -Resource Management Techniques,ARPublications,Chennai.

Books for Reference:

1Kantiswarup, P.K. Gupta and Man Mohan- Operations Research (9th Edition), Sultan-Chand Publications.

2.Taha H.A-Operations Research: An introduction, 7thedition, Pearson Prentice Hall,2002

Web Resource:

1.https://nptel.ac.in/courses/111/107/111107128

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the concepts of L.P.P, Transportation model, Assignment problem, Project scheduling and Game theory.	**K-1**
2.	formulate and analyse linear programming models of real life situations,construct a project network.	**K-4,K-6**
3.	understand simplex algorithm, transportation algorithm, assignmentalgorithm,CPM and PERT techniques and two person zero sum games.	**K-2**
4.	use acquired knowledge to solve problems on L.P.P, transportation model and assignment problems.	**K-3**
5.	apply CPM and PERT to solve problems on project scheduling and analyse graphical method to solve 2×n or m×2games.	**K-3,K-4**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Mapping of COs with POs :

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	M	S	S	S	S	S	S	S
CO2	S	M	S	S	S	S	S	S	S
CO3	S	M	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S
CO5	S	M	S	S	S	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title:B.Sc. MATHEMATICS
Course Title :NUMBER THEORY
Course Code : 21UMAESC1 **Hours / Week:5**
Semester: IV **Credits : 4**
Course Objectives:

1. To know about the basic concepts of numbertheory.
2. To get a complete grip of various concepts to present modern Mathematics in elementary terms.
3. To develop the skill of solving problems in numbertheory.

SYLLABUS

Number Theory

Unit-I(Hours :15)

Peano's Axiom - Mathematical Induction - The Binomial Theorem - Early Number Theory.

Unit-II(Hours :15)

Divisibility Theory in Integers - The Division Algorithm - The g.c.d. - Euclidean Algorithm - The Diophontine Equation ax + by =c.

Unit-III(Hours :15)

Primes and their Distributions - The fundamental theorem of Arithmetic - The Scive of Eratosthenes - The GullConjecture.

Unit–IV(Hours :15)

The Theory of Congruence - Basic Properties of Congruence - Special Divisibility test - Linear Congrence.

Unit–V(Hours :15)

Fermat's Theorem - Fermat's factorization method - The little theorem - Wilson's theorem.

Book for Study:

S.Kumaraveluand SusheelaKumaravelu - Elements of Number Theory, Nagercoil, 2002.

Books for Reference:

: G.H. Hardy, Edward M.Wright - An Introduction to the Theory of Numbers, Andrew Wiles, Roger Heath Brown and Joseph Silverman.

Web Resource :

http://www2.math.uu.se/~lal/kompendier.pdf

Note: Questions to be taken only from the text books

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	recall the basic concepts in number theory	**K-1**
2.	understand the concepts of divisibility theory in integers, the division algorithm, Euclidean algorithm and Diophontine equation ax + by =c	**K-2**
3.	solve the problems using the Fundamental theorem of arithmetic	**K-3**
4.	prove the properties of congruence and solve the related problems	**K-3, K-5**
5.	anlayse the Fermat's factorization method, the Little theorem & Wilson's theorem and acquire knowledge to apply them	**K-3, K-4**

K-1:Recall, K-2 :Understand, K-3 :Apply, K-4 :Analyse, K-5 :Evaluate, K-6 Create

Mapping of COs with POs and PSOs:

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	S	S	-	S	S	S	S	S
CO2	S	S	S	-	S	S	S	S	S
CO3	S	S	S	-	S	S	S	S	S
CO4	S	S	S	-	S	S	S	S	S
CO5	S	S	S	-	S	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title:B.Sc. MATHEMATICS
Course Title :ALLIED- MATHEMATICAL STATISTICS - II
CourseCode : 21UMAAC4 **Hours / Week:5**
Semester :IV **Credits:5**

Course Objectives:

1. To understand the concept of a Samplingdistribution.
2. To acquire knowledge about the Point Estimation and IntervalEstimation
3. To gain knowledge about the testing of significance for Large samples and Small samples

SYLLABUS

Unit – I (Hours : 15)

SamplingDistribution: Samplingdistribution,Samplingdistributionof$\overline{X}$,chi-square distribution, MGF of X^2- distribution, characteristic function of X^2, Additive property, Relation between moments.

Student t distribution, Moments of t distribution, limiting form of t-distribution and properties F – distribution, Moments of F-distribution.

Chapter 22 (Page No.: 22.1 - 22.40)

Unit – II(Hours : 15)

Estimation:

Point Estimation: Estimator and estimate, unbiased estimator, Examples, Efficiency, Cramer – Rao inequality, and Rao – Blackwell theorem, Method of maximum likelihood, Properties of ML estimators and Examples.

Interval Estimation: Confidence interval for the mean of the normal population,Confidence interval for the difference between the means, Confidence interval for Proportion,Confidence interval for the difference between two Proportions.

Chapter 23(Page No.: 23.1 – 23.25, 23.46 – 23.56, 23.62 – 23.66)

Unit – III (Hours : 15)

Large Samples: Population, Parameter and statistic, sampling distribution of mean, standard error of the mean, test of hypothesis, significance level, one tail test, two tail test, procedure for testing of hypothesis, procedure for one tail test, procedure two tail test, test for equality of two means.

Confidence interval: Confidence limits for the population mean, Population proportion and examples.

Test of Hypothesis: Null and alternate hypothesis, Critical region, power function, significance level of the test, Neymann Pearson lemma.

Chapter 24 (Page No. : 24.1 - 24.24, 24.44 – 24.54)

Chapter 29 (Page No. : 29.1 – 29.5)

Unit – IV(Hours : 15)

Small samples: t Test, uses of t – test, Properties of sampling distribution of t, Test for a specified Mean, Test of significance for the difference between two population means, confidence interval for small samples.

F – test, Procedure for equality of two population variances. Chapter 25 (Page No. :25.1 –25.30)

Chapter 26 (Page No. :26.1 –26.12)

Unit – V(Hours : 15)

Small samples:chi-square test, Additive property, Pearsons' statistic, uses of X^2- test, Test for independence of Attributes, Test for a specified Population Variance, Test of Indepencence of attributes.

Chapter 27 (Page No.:27.1 – 27.46)

Book for Study:

P.R.Vittal - Mathematical Statistics**,** 2004 - Margham Publications

Books for Reference:

S.C.Gupta and V.K. Kapoor-Fundamentals of Mathematical statistics , Sultan Chand and Sons, Pvt. Ltd.

Web Resources:

1. **www.iiserpue.ac.in>Sahoo_textbook**
2. **Spartan.ac.brocku.ca>~jvrbik>Statistics**
3. **www.maths.adelaide.edu.au>MSIII**

Note: Questions to be taken only from the Text Books.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the concepts of sampling distribution,estimation and Confidence Interval for mean,proportion and variance	**K-1**
2.	understand the notions of moments of chi-square,t, and F distribution and testing of hypothesis.	**K-3**
3.	estimate confidence interval for mean, proportion,variance and test the hypothesis for them and validate the claims	**K-3**
4.	analyse the properties of Maximum Likelihood estimators, chi-square t and F distributions and solve she related problems	**K-5**
5.	derive the distribution of chi-square,t and F distribution and defend its applications for small samples.	**K-5**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Mappings of CO with Pos:

PO / CO	PO								
	PO1	**PO 2**	**PO 3**	**PO 4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**
CO1	S	M	S	S	S	S	S	S	S
CO2	S	M	S	S	S	S	S	S	S
CO3	S	M	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S
CO5	S	M	S	S	S	S	S	S	S

S **- Strong, M - Medium, L – Low**

Programme Title:B.Sc. MATHEMATICS
Course Title :OPTIMIZATION TECHNIQUES WITH TORA-PRACTICAL
Course Code : 21UMASQC4 Hours / Week:2
Semester : IV Credits:2

Course Objective:

To impart knowledge on solving Operations Research problems using computer with TORA software.

SYLLABUS

Unit -I
Solving Linear Programming Problems – SimplexMethod
Unit –II
Solving Transportation Problems- North –West cornerrule,Least cost method, Vogel's approximation method, Test for optimal solution by Modimethod.
Unit –III
Solving Assignment Problem by Hungarianmethod.
Unit –IV
Solving Network Analysis Problems-CPM,PERT
Unit –V
Solving Game theoryproblems – Two person zero – SumGames, Graphical Method for 2 x n or m x 2games.

Book for Study:

Prof.V.Sundaresan, Prof. K.S. Ganapathy Subramanian and Prof. K. Ganesan -Resource Management Techniques(Operations Research),Fourth Revised Edition, A.R.Publications,Chennai.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	understand the basic concepts of TORA software	**K-2**
2.	interpret and apply commands in TORA to solve L.P.P and transportation problems .	**K-2,K-3**
3.	use TORA for solving problems on L.P.P and transportation problems	**K-3**
4.	make use of commands in TORA to solve problems on project scheduling by PERT and CPM and Game theory	**K-3**
5.	solve problems on project scheduling and Games & Strategies by using TORA	**K-3**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Mapping of COs with POs

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
1.	S	M	S	S	S	S	S	S	S
2.	S	M	S	S	S	S	S	S	S
3.	S	M	S	S	S	S	S	S	S
4.	S	M	S	S	S	S	S	S	S
5.	S	M	S	S	S	S	S	S	S

S - **Strong, M - Medium, L – Low**

Programme Title : B.A/B.Sc/B.COM
Course Title : NON MAJOR ELECTIVE II
CourseCode : 21UMANEC2 **Hours / Week:2**
Semester :IV **Credits:2**

Course Objectives:

1. To introduce the basic concepts ofMathematics.
2. To make them to find simple and compoundinterest.
3. To promote the problem solving ability to write the competitiveexaminations.

SYLLABUS

Unit – I(Hours : 6)
Averages, Problems on Numbers.
Section-I – Chapter 6 – Solved examples 1-15 only (Page No. 139-141), Chapter 7 - Solved examples 1-15 only (Page No.161-163).

Unit – II(Hours : 6)
Profit and Loss
Section-I – Chapter 11 – Solved examples 1-29 only (Page No.251-256).

Unit – III(Hours : 6)
Ratio and Proportion, Partnership
Section-I – Chapter 12 – Solved examples 1-7 only (Page No.294-296), Chapter 13 (Page No.311-325).

Unit – IV(Hours : 6)
Simple Interest, Compound Interest
Section-I – Chapter 21 – Solved
examples 1-12 only (445-447), Chapter 22 – Solved examples 1-15 only(466-470).

Unit – V(Hours : 6)
Odd Man Out and Series
Section-I – Chapter 35 (Page No.649-657).

Book for Study:
Dr. R. S. Aggarwal- Quantitative Aptitude for Competitive Examinations (Fully Solved) (Seventh Revised Edition), S. Chand & Company Pvt.Ltd.

Book for Reference:
AbhijitGuha - Quantitative Aptitude for All Competitive Examinations, McGraw Hill Education, Sixth edition.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	nowledge Level
1.	recognise the notions on numbers and averages	**K-1**
2.	understand the concepts of profit and loss, ratio and proportion,partnership,simple interest and compound interest	**K-2**
3.	apply the concepts obtained in the course to solve real life problems	**K-3**
4.	infer solutions about the partnership and rate of proportionality appropriately.	**K-4**
5.	analyse the problems on profit and loss and inspect the odd man out series.	**K-4**

K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analyse, K-5 Evaluate, K-6Create

Programme Title: B.COM
Course Title : ALLIED BUSINESS MATHEMATICS
Course Code : 21UCOAC3 Hours / Week:5
Semester : III Credits:5

Course Objectives:

1. To gain knowledge about Matrices and Determinants.
2. To acquire knowledge about the fundamental rules of Differentiation and integration.
3. To inculcate the application of derivatives and integration in business as a rate measures and in the field of Marginal analysis.
4. To acquire knowledge about Linear Programming Problem and solving of them.
5. To know about how to transport various quantities from various origins to different destinations with the minimum cost.

SYLLABUS

Unit -I(Hours : 17)

Definition of a matrix, Notation, Order of a matrix, Types of matrices, Matrix Operations-I, System of linear equations, Determinants, Evaluation (Method 2, Properties of determinants are to be excluded) Cramer's rule, (Product of determinants is to be excluded) Minor and Cofactor, Matrix operations-II.

(Page no.162-181, 184-188, 190-199 only)

Unit –II(Hours : 15)

Limit and Differentiation

Differentiation - Derivatives of standard functions from first principle (All the derivations and differentiation of parametric form are to be excluded), Successive differentiation, Uses of the derivative.

Chapter 6 (Page no: 267-286, 289-303 only)

Chapter 7 (Page no: 304-325 only)

Unit –III(Hours : 14)

Integration

Indefinite integrals, Standard forms, Determination of C, Definite integrals, Method of substitution, Method of partial fractions, Method of integration by parts, Uses in Economics.

Chapter 8 (Page no: 326-342, 346-352 only)

Unit –IV(Hours : 17)

Graphical method, A few important terms, Simplex method. (Simple problems involving slack variables only)

Chapter 9 (Page no: 366-401 only)

Unit – V(Hours : 12)

Transportation problems (Initial basic feasible solution only), Assignment problems (Simple problems only)

Books for Study:

1. PA. Navnitham - Business Mathematics**,** Jai Publishers. Trichy-21. (For Units I-IV).
2. Kantiswarup, P.K. Gupta and Man Mohan - Operations Research, Eighth Edition. (for Unit V).

Books for Reference:

1. Business Mathematics by Dharmapadam, Visvanathan .S Ltd Publications, 1991.
2. Resource Management Techniques by V.Sundaresan, AR Publications, 2015.

Web Resources:

1. http://ncert.nic.in/ncerts/l/lemh201.pdf
2. http://econweb.ucsd.edu/~jsobel/172aw02/notes8.pdf

Note: Questions to be taken only from the Text Books.

Course Outcomes (CO) : On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
1.	learn the basic concepts of matrix, types of matrix, differentiation, integration and LPP	**K-1**
2.	understand the concepts of determinants, Cramer's rule, inverse of matrix, successive differentiation , indefinite, definite integrals	**K-2**
3.	apply the acquire knowledge to solve problems on determinants, Cramer's rule, inverse of matrix, successive differentiation , indefinite, definite integrals	**K-3**
4.	analyse the uses of derivatives and uses of integration in economics and enhance the concepts of graphical method, simplex algorithm, transportation methods and assignment method	**K-4**
5.	solve the problems by using graphical method, simplex method, transportation methods and assignment method	**K-3**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Programme Title:B.Sc. PHYSICS
Course Title : ALLIED MATHEMATICS - I
Course Code : 21 UPHAC3 Hours / Week:5
Semester: III Credits:5

Course Objectives:

1. To acquire knowledge in Theory of equations, Differential calculus and Differential equations
2. To understand the method of solving algebraic equations using transformation of equation
3. To promote problem solving ability in differential equations.

SYLLABUS

Unit – I(Hours: 15)
Theory of Equations

Relation between the roots and coefficients of an equation, imaginary and irrational roots , Symmetric functions of the roots of an equation in terms of its coefficients(upto cubic equations), and Reciprocal equation.

Chapter 6 (Page. No.: 6.2 – 6.37)

Unit – II(Hours: 15)

Transformation of equation (Definition only), Multiplication of roots by m, Diminishing the roots of an equation, Removal of a term, Descartes' rule of sign, Descartes' rule of sign for negative roots of an equation, Horner's method, Newton's method of evaluating a real root correct to given decimal places.

Chapter 6 (Page.No : 6.49 – 6.67)

Unit – III(Hours: 15)
Differential Calculus

Angle between the radius vector and the tangent, Angle of intersection of two curves, length of perpendicular from the pole to the tangent, Pedal equation, Cartesian formula for radius of Curvature, Parametric formula for radius of curvature, Radius of curvature in Polar Coordinates, Radius curvature for pedal curve, Radius of curvature for polar tangential curve.

Chapter 10 & 11 (Page.No : 10.1 – 10.23, 11.1 – 11.33)

Unit – IV(Hours: 15)
Ordinary Differential Equations

Second order linear differential equations with constant coefficients, Finding particular integral for $(D)y = F(x)$ when the function $F(x) = e^{ax}$, $\cos ax$, $\sin ax$, $\sinh ax$, $\cosh ax$, x^m, $e^{ax}v$ where v is any function of x, Linear homogeneous equation and variation of parameters.

Chapter 23 & 24 (Page. No: 23.1 – 23.32, 24.1 – 24.23)

Unit – V(Hours: 15)
Partial Differential Equations

Elimination of arbitrary constants, Elimination of arbitrary functions, Definitions – Complete solution, Singular solutions, General solutions, Standard types : $F(p,q) = 0$, $F(z, p, q) = 0$, $f_1(x, p) = f_2(y, q)$ and Clairaut's form (simple problems only), Lagrange's linear partial differential equations.

Chapter 26 (Page.No : 26.1 – 26.40, 26.44 – 26.58)

Book for Study:

P.R. Vittal - Allied Mathematics, Margham Publications, Chennai – 17.

Book for Reference:

T.K.ManicavachagomPillai, T.Natarajan& K.S. Ganapathy - Algebra, Volume-I**,** S.Viswanathan Publishers, Pvt. Ltd, 2004.

Note: Questions to be taken only from the Text Books.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the concepts of matrices, theory of equations, differential calculus, ordinary and partial differential equations	**K-1**
2.	analyse various methods to find roots of polynomial equation and inspect Horner's method and Newton's method to find approximate real roots	**K-4**
3.	understand the concept of angle between the radius vector and the tangent, radius of curvature, pedal equation and Descartes rule of signs and solve related problems	**K-2,K-3**
4.	solve specific types of ordinary and partial differential equations.	**K-3**
5.	analyse the method of Variation of parameters to solve ordinary differential equations, Lagrange's method to solve partial differential equations	**K-4**

K-1 Recall; K-2 Understand; K-3 Apply; K-4 Analyse; K-5 Evaluate; K-6 Create

Programme Title:B.Sc. CHEMISTRY
Course Title : ALLIED MATHEMATICS - I
Course Code : 21UCHAC3 **Hours / Week:5**
Semester : III **Credits:5**

Course Objectives:
1. To acquire knowledge about the applications of elementary transformations and Cayley – Hamilton theorem.
2. To familiarize the methods of solving various equations using fundamental theorem of algebra.
3. To gain knowledge about different numerical methods and the notions of radius of curvature.

SYLLABUS

Unit –I(Hours : 15)
Matrices

Rank of a matrix, Elementary transformation, Equivalent matrices, Finding the rank of a matrix using elementary transformations (up to third order - simple problems) Characteristic equation of a matrix, Characteristic vectors of a matrix, Cayley - Hamilton's theorem (Statement only), Verification of Cayley - Hamilton theorem.
Chapter 5 (Page No: 5.25 – 5.37, 5.50 – 5.75)

Unit –II(Hours : 15)
Theory of Equations

Relation between the roots and coefficients of an equation, Imaginary and irrational roots, Symmetric functions of the roots of an equation in terms of its coefficients (up to cubic equation) and Reciprocal equations.
Chapter 6 (Page No: 6.2 – 6.37)

Unit –III(Hours : 15)

Transformation of equation (Definition only), Multiplication of roots by m (Definition only) Diminishing the roots of an equation, Removal of term, Descart's rule of signs, Descart's rule of signs for negative roots of an equation, Horner's method, Newton's method of evaluating a real root to given decimal places.
Chapter 6 (Page No: 6.38, 6.49 – 6.67)

Unit –IV(Hours : 15)
Finite Differences:

Finite Difference, Forward difference table, Newton's forward formula for interpolation, Newton's Backward difference formula, Binomial method, Lagrange's Formula.
Chapter 7(Page No: 7.2 - 7.29)

Unit –V(Hours : 15)
Polar Coordinates:

Angle between the radius vector and the tangent, Angle of intersection of two curves, Length of perpendicular from the pole to the tangent, Pedal equation.
Curvature and radius of curvature:

Cartesian formula for radius of curvature, Parametric formula for radius of curvature.
Chapter 10 (Page No: 10.1 – 10.23)
Chapter 11 (Page No: 11.1 – 11.22)

Book for Study:

P.R.Vittal - Allied Mathematics**,** Margham Publications, Chennai – 17.

Book for Reference:

P.Kandasamy and K.Thilagavathy – Allied Mathematics, S.Chand&Company Ltd, Ram Nagar, New Delhi-110 055

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the concepts of matrices, theory of equations, finite differences and differential calculus	**K-1**
2.	obtain rank of a matrix, characteristic roots and vectors and radius of curvature from pedal equation, verify Cayley – Hamilton theorem	**K-3, K-5**
3.	analyse various methods to find roots of polynomial equations using fundamental theorem of algebra, inspect Horner's method to find approximate real roots	**K-4**
4.	understand relations between roots and coefficients, Newton's method, Horner's method, Binomial method, Newton's interpolation formulae, the formula to find the angle between the radius vector and the tangent and solve related problems	**K-2,K-3**
5.	interpret elementary transformations, Cayley – Hamilton theorem, cartesian and parametric formulae to find radius of curvature and analyse their applications	**K-2,K-4**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Programme Title : B.Sc. PHYSICS/CHEMISTRY
Course Title : ALLIED MATHEMATICS - II
Course Code : 21UPHAC4/21UCHAC4 **Hours / Week:5**
Semester : IV **Credits:5**

Course Objectives:

1. To acquire the knowledge in Trigonometry, integral calculus, Fourier series and Laplace transform.
2. To understand the method of doing problems using the above concepts.
3. To analyse the different methods of solving differential equations using Laplace transform.

SYLLABUS

Unit – I(Hours : 16)

Trigonometry:

Expansions for sin nθ, cos nθ, tan nθ (n being a positive integer), Expansions for $cos^n\theta$, and $sin^n\theta$ in terms of multiple angle of θ, Express cos nθ in terms of cosines of multiples of θ (n being a positive integer), Expansions of sinθ and cosθ in ascending powers of θ, Expansion of tanθ, Hyperbolic functions, Inverse hyperbolic functions.
Chapter 14 (Page No : 14. 1 – 14. 60)

Unit – II(Hours : 15)

Integral Calculus

Multiple Integrals Evaluation of double integrals, Double integral in polar co-ordinates, Triple integrals, Change of order of integration, Applications of double integral in evaluating area only (Evaluation of volume, centroid and mass to be excluded).
Chapter 20 (Page No: 20.1 - 20.43) (In Exercise 5, only problems to 1 to 8)

Unit – III(Hours : 15)

Fourier Series

Definition, Finding Fourier series for a given periodic function with period 2π, Fourier series for odd and even functions, Half range Fourierseries.
Chapter 21 (Page No: 21.1 - 21.56)

Unit – IV(Hours : 15)

Laplace Transform

Definition, Laplace transform of elementary functions, Linearity property, Shifting property, Change of Scale property, Laplace transform of derivatives, Laplace transform of integrals, Periodic functions.
Chapter 27 (Page No: 27.2 - 27.23)

Unit – V(Hours : 14)

Inverse Laplace transform, Solving differential equations using Laplace transform. (Simultaneous equations are to be excluded).
Chapter 27 (Page No: 27.24 - 27.57)
(Section 5 : Examples 1-10, Exercise 4 : 1-26 only)

Book for Study:

P.R. Vittal - Allied Mathematics**,** Margham Publications, Chennai-1

Book for Reference:

S.Narayanan and T.K ManicavachagamPillay - Calculus-Volume III, **S.Viswanathan** (Printers and Publishers), Pvt., Ltd, 2011.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the notions of trigonometric functions, Hyperbolic functions, multiple integrals and Laplace transforms	**K-1**
2.	understand the expansions of trigonometric functions, inverse hyperbolic functions , change of order of integration, Fourier coefficients ,odd and even functions and solve related problems	**K-2,K-3**
3.	analyse the properties of integration to evaluate double and tiple integrals and Fourier series.	**K-4**
4.	interpret the properties of Laplace transform , inverse Laplace transform and solve the related problems.	**K-4**
5.	apply Laplace transform and inverse Laplace transform to solve the differential equations	**K-3**

K1-Recall ; K2-Understand; K3-Apply; K4-Analyse; k5-Evaluate; K6-Create.

Programme Title :**B.Sc. MATHEMATICS**
Course Title :**REAL ANALYSIS – I**
Course code :**21UMAC8** **Hours/Week:6**
Semester :**V** **Credits:4**

Course Objectives:

1. To introduce the fundamental material on sequences and series to the students who have studied elementary calculus.
2. To make them study about metric spaces.

SYLLABUS

Unit –I(Hours : 18)

Operations on sets – family of sets – indexing set – functions – axioms of choice – relations – equivalence relation – partial order – total order – maximal element – finite set – countable set – uncountable set – contours numbers- Real valued functions - Equivalence sets - Real numbers – greatest lower bound and least upper bound of a sets - Sequence and subsequence - Limit of a sequence.

Unit –II(Hours : 18)

Sequence of Real Numbers:

Convergent sequences - Divergent sequences - Bounded sequences - Monotone sequences - Operations on convergent sequences - Operations on divergent sequences.

Chapter 2 (Sections 2.3 to 2.8)

Unit –III(Hours : 18)

Limit superior and Limit Inferior - Cauchy sequences.

Series of Real Numbers:

Convergence and divergence - Series with non-negative terms - Alternating series.

Chapter 2 (Sections 2.9 & 2.10)

Chapter 3 (Sections 3.1 to 3.3)

Unit – IV(Hours : 18)

Conditional convergence and absolute convergence - Tests for absolute convergence - Series whose terms form a non increasing sequence - The class l^2.

Chapter 3 (Sections 3.4, 3.6, 3.7, 3.10)

Unit –V(Hours : 18)

Limits and Metric Spaces

Limit of a function on the real line - Metric spaces - Limits in metric spaces.

Continuous functions on metric spaces:

Functions continuous at a point on the real line - Reformulation - Functions continuous on a metric space.

Chapter 4 (Sections 4.1 to 4.3)

Chapter 5(Sections 5.1 to 5.3)

Books for study :

1. For Unit I https://nptel.ac.in/courses/111/106/111106053/
2. For Unit II to V: Richard R.Gold Berg, Methods of Real Analysis, Oxford & IBH. Publicatins CO.PVT.LTD.New delhi.

Books for Reference:

1. M.K. Singhal and Asha Rani Singhal, A First Course in Real Analysis, R. Chand & Co., June1997 Edition
2. Shanthi Narayan, A Course of Mathematical Analysis, S. Chand & Co., 1995.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	recall the notions of operations on sets, functions, relations and learn to define bounded sets, countable sets, cauchy sequence of real numbers, infinite series and metric spaces.	**K-1**
2.	understand the concepts of real numbers, lub and glb of sequences, absolute convergence of infinite series and continuous functions	**K-2**
3.	calculate the limit, limit superior and limit inferior of different types of sequences	**K-3**
4.	apply various tests for convergence and absolute convergence of an infinte series and solve problems on metric spaces	**K-3**
5.	analyse the properties of continuous functions and countable sets, Minkowski's theorem, the Schwarz inequality and Nested Interval theorem	**K-4, K-5**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Mapping of COs with POs:

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	M	S	L	-	S	S	S	S
CO2	S	M	S	L	-	S	S	S	S
CO3	S	M	S	L	-	S	S	S	S
CO4	S	M	S	L	-	S	S	S	S
CO5	S	M	S	L	-	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title : B.Sc. MATHEMATICS
Course Title : COMPLEX ANALYSIS I
Course code : 21UMAC9 Hours/Week:5
Semester : V Credits:4

Course Objectives

1. Toacquiretheknowledgeoflimit,continuity,differentiability,analyticityoffunctions of complex variable, contour integrals, transformations, conformal mappingsetc.
2. To understand the theorems in the contents and their applications to solveproblems.
3. To analyse the different type of transformations and contourintegrals.

SYLLABUS

Unit – I(Hours : 15)

Regionsinthecomplexplane-Functionsofacomplexvariable-Mappings-Mappings by the Exponential function - Limits - Theorems on Limits - Continuity - Derivatives - Differentiation Formulas - Cauchy Riemann Equations - Sufficient conditions for Differentiability - polar co-ordinates - Analytic Functions - HarmonicFunctions.

Conformal mapping : Application to steady temperature

Chapter 1 (section 11 only)
Chapter 2 (sections 12 - 16, 18 - 26)

Unit – II(Hours : 15)

Derivatives of functions w(t) - Definite integrals of functions w(t) - contours - contour Integrals - Some Examples - Examples with branch cuts - upper bounds for moduli of contour integrals - Antiderivatives - Proof of the theorem - Cauchy - Goursat - Theorem - Proof of the theorem - Simply and Multiply connected Domains.

Conformal mapping: Electro static potential

Chapter 4 (sections 37 to 49)

Unit – III(Hours : 15)

Cauchy Integral Formula - An Extension of the Cauchy integral formula - Some consequencesoftheextension-Liouville'sTheoremandtheFundamentalTheoremofAlgebra - Maximum modulus Principle.

Conformal mapping: Two dimensional fluid flow

Chapter 4 (sections 50 to 54)

Unit – IV(Hours : 15)

Mappings - Mappings by the Exponentialfunction- Linear Transformations - The transformation w = 1/z - Linear Fractional Transformations - An implicitform

Conformal mapping: Stream function

Chapter 2 (sections 13,14)
Chapter 8 (sections 90 to 94)

Unit – V(Hours : 15)

The Transformation w = sinz, w = cosz, w = sinhz, w = coshz - Mappings by z^2 and branches of $z^{½}$ - Conformal mappings - Preservation of Angles - Scale factors.

Chapter 8 (sections 96, 97)
Chapter 9 (sections 101, 102)

Books for study:

1. James Ward Brown and Ruel.V. Churchill - Complex variables and

Applications Eighth Edition, Mc Graw Hill, Inc. **(Units I toV)**

2. https://nptel.ac.in/courses/111/107/111107056/(**for Units I to IV**

Application) **Books for Reference:**

1. S.Arumugam,A.ThangapandiIsaacandA.Somasundaram-ComplexAnalysis**,**New Scitech Publications (India) Pvt Ltd,2002.
2. J. N. Sharma, Krishna Prakasan - Functions of Complex Variable – Thirteenth Edition Media(P) Ltd,1996-97.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	Learn the concepts of Functions of a complex variable, Mappings, Mappings by the Exponential function, limit, continuity, differentiability, analyticity of functions of complex variable, contour integrals, transformations and conformal mappings	**K-1**
2.	Understand the concepts of Cauchy - Riemann equations, derivatives of functions, Contour integration andCauchy's integralformula	**K-2**
3.	Apply the acquire knowledge of mappings, derivatives, contour integration, Cauchy integral formula, linear transformation, conformal mapping, Electro static potential and solve the related problems	**K-3**
4.	Analyze the properties of limits, derivations, continuity, analytic functions, harmonic functions , anti derivatives, simply and doubly connected domain, Some consequences of theextension, Applicationtosteadytemperature,Twodimensionalfluidflow and Stream function. .	**K-4**
5.	Prove CR Equation, Sufficient conditions for Differentiability , Anti derivative theorem, Cauchy Goursat Theorem, Liouville's Theorem and Maximum modulus Principle	**K-5**

K1-Recall ; K2-Understand; K3-Apply; K4-Analyse; k5-Evaluate; K6-Create.

Mapping of COs with POs :

CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	S	S	M	S	S	S	S	S
CO2	S	S	S	M	S	S	S	S	S
CO3	S	S	S	M	S	S	S	S	S
CO4	S	S	S	M	S	S	S	S	S
CO5	S	S	S	M	S	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title :B.Sc. MATHEMATICS
Course Title : MODERN ALGEBRA
Course code : 21UMAC10 **Hours/Week:6**
Semester : V **Credits:4**

Course Objectives

1. To acquire knowledge about various groups.
2. To gain knowledge about rings and special classes of rings.

SYLLABUS

Group Theory

Unit–I(Hours :18)

Subgroups, Cyclic groups, Cosets and Lagrange's theorem, Normal subgroups and Quotient groups.

Chapter 2 (Sections 2.4 - 2.7)

Unit–II(Hours :18)

Homomorphisms, Isomorphism theorems, Automorphisms, Permutation groups.

Chapter 2 (Sections 2.8 - 2.11)

Ring Theory

Unit–III(Hours :18)

Definition and examples, Properties, Special classes of rings, Subrings and subfields, Ideals and quotient rings, Homomorphisms.

Chapter 3 (Sections 3.1 - 3.6)

Unit–IV(Hours :18)

Maximal and prime ideals, The characteristic of an integral domain, The field of quotients of an integral domain. Euclidean rings - Definition and properties, Unique factorization theorem, Gaussian integers.

Chapters 3 & 4 (Sections 3.7 - 3.9, 4.1 - 4.3)

Unit–V(Hours :18)

Polynomial Rings

Polynomials over fields, Polynomials over the rational field, Polynomials over commutative rings.

Chapter 5 (Sections 5.1 - 5.3)

Book for study:

M.L. Santiago - Modern Algebra,Tata McGraw Hill Publishing Co. Ltd., NewDelhi.

Books for Reference :

1.I. N. HersteinTopics in Algebra - Second Edition, Wiley India Pvt. Ltd, New Delhi,2008.

2 . S. Arumugam, A. ThangapandiIsaac -Modern Algebra, New Gamma Publication House, Palayamkotti, 1997.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	recognize the concepts of various types of groups, subgroups, rings and fields	**K-1**
2.	understand the notions of structure preserving maps between groups and rings and inspect their applications	**K-2, K-4**
3.	explain the attributes of different sorts of groups, ideals and defend their applications	**K-2, K-5**
4.	interpret the concepts of integral domains, unique factorization domains, polynomial rings and assess their attributes	**K-2, K-5**
5.	analyse the properties of various subgroups, rings and solve related problems	**K-3, K-4**

K-1: Recall, K-2: Understand, K-3: Apply, K-4: Analyse, K-5: Evaluate, K-6: Create

Mapping of COs with POs :

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	S	S	S	M	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title :B.Sc. MATHEMATICS
Course Title :MECHANICS
Course code :21UMAC11 **Hours/Week:5**
Semester :V **Credits:5**

SYLLABUS

UNIT I(Hours: 16)

Equilibrium of a system of particles, Moment of a set of concurrent forces, Parallel forces, Couples, Equivalence of couples, Varignon's theorem, Reduction of any coplanar system of forces, Reduction of a coplanar system of forces - Analytical method.

Chapter II (Sections 2.1 - 2.11)

UNIT II(Hours: 14)

Friction (Definition) - Laws of Statical friction, Angle of friction, Cone of friction, Law of kinetic friction.

Chapter III (Sections 3.1 - 3.8)

Unit – III(Hours : 15)

Velocity and acceleration of a particle moving on a curve, velocity and acceleration components in cartesian coordinates, Velocity and acceleration components in polar coordinates(Plane motion)

Simple harmonic motion - Composition of two simple harmonic motions of the same period in the same straight line, Composition of two simple harmonic motions of the same period along two perpendicular lines, Simple Harmonic Motion as the projection of uniform circular motion, Oscillatory motion of particles connected to ends of elastic strings, The simple pendulum. The seconds pendulum.

Chapter 1(Section 1.10 only) and Chapter 4

UNIT- IV(Hours : 15)

Projectiles - The path of a projectile is a parabola, To trace the parabola, Maximum height reached, Time of flight, Horizontal range, Focus of the parabola, Directrix of the parabola, Velocity at any time 't' of the path, Maximum range on the horizontal plane, Range on an inclined plane through the point of projection, Maximum range on an inclined plane, Motion on an inclined plane.

Chapter 5 (Sections 5.4 - 5.4.1 - 5.4.9, 5.5 - 5.5.1 , 5.5.2 and 5.6)

Unit –V(Hours : 15)

Central force - Central orbit, The central orbit is a plane curve, Areal velocity about the centre of force is constant, Differential equation to a central orbit, p-r equation of the central orbit, Apse, Given the orbit, to find the law of force, Given the law of force, to find the orbit.

Chapter 6 (Section 6.6 - 6.9)

Books for study:

1. A. V. Dharmapadam - Statics, S. Viswanathan publications, Reprint 2011(For Unit I & II)
2. A.V. Dharmapadam - Dynamics**,** Viswanathan (Printers & Publishers) Pvt. Limited, 2006. (for Unit III , IV & V)

Books for Reference:

1. M.L. Khanna Statics, Jai Prakash Nath& Co., Meerut.
2. Dr. M. K. Venkataraman - A Text Book of Statics, Agasthiar Book Depot.
3. Dr. M.K. Venkataraman - Dynamics, Agasthiyar Publications, Thirteenth Edition, July 2009.
4. P. Duraipandian, LaxmiDuraipandian and Muthamizh Jayapragasam - Mechanics, S. Chand and company Pvt Ltd, 2014.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the principles of Statics and Dynamics and to develop the ability to describe the concepts.	**K-1**
2.	understand necessary conditions for the equilibrium of particles acted upon by various forces and laws of statical friction	**K-2**
3.	explain the concepts of velocity and acceleration of a particle moving on a curve, simple harmonic motion, Projectiles and Central forces	**K-2**
4.	apply moment, couples, Second's pendulum, friction, motion on an inclined plane and p-r equation of the central orbit to various real life situations	**K-3**
5.	gain ability to solve and analyse problems of Statics and dynamics in asystematic and logical manner.	**K-3, K-4**

K-1 Recall; K-2 Understand; K-3 Apply; K-4 Analyse; K-5 Evaluate; K-6 Create

Mapping of COs with POs :

PO / CO	PO								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	M	S	S	-	S	S	S	S
CO2	S	M	S	S	-	S	S	S	S
CO3	S	M	S	S	-	S	S	S	S
CO4	S	M	S	S	-	S	S	S	S
CO5	S	M	S	S	-	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title : B.Sc. MATHEMATICS
CourseTitle :BIOMATHEMATICS
CourseCode : 21UMAEC2 **Hours /Week:3**
Semester :V **Credits: 3**

CourseObjectives

1. TounderstandtheconceptofmodelingusingMATLAB/Scilab.
2. To develop the ability of solving the homogenous and non-homogenous system ofdifference

SYLLABUS

UnitI(Hours: 10)

Overviewof DiscreteDynamicalModeling and MATLAB/**Scilab**

IntroductiontoModelingandDifferenceEquations-TheModelingProcess-GettingStarted with MATLAB/Scilab (Chapter1)

Nernstequation(Chapter9)

UnitII(Hours: 09)

Modelingwithfirst–orderDifferenceEquations

ModelingwithFirst-OrderLinearHomogenousDifferencewithConstantCoefficients-ModelingwithNon-homogenousFirst-OrderLinearDifferenceEquations(Chapter2)

Diffusion-I:Diffusion equation (Chapter9)

UnitIII(Hours: 07)

ModelingwithMatrices

SystemsofLinearEquationsHavingUniqueSolutions-TheGauss-JordanEliminationMethodWith Models -Introductionto Matrices (Chapter3:3.3.10–3.3.17)

Diffusion-II:Mean-squareDisplacement(Chapter9)

UnitIV(Hours: 09)

ModelingwithMatrices

Determinants and System of Linear Equations (Chapter 3:3.4.1 & 3.4.2)ComputingEigenvaluesandEigenvectorswithMATLAB/Scilab(Chapter3:3.5.3–3.5.6)

Diffusion-III:Einstein'srelation(Chapter9)

UnitV(Hours: 10)

ModelingwithNonlinearSystemsofDifferenceEquations

Modelingof InteractingSpecies(Chapter5:5.1.1&5.1.2)

Books forstudy

(1) ExplorationsofMathematicalModelsinBiologywithMATLAB–MazenShahin,WileyPublishers. (forUnit Ito UnitV)

(2) IntroductiontoMathematicsforLifeScientists,E.Batschelet,SpringerVerlag,3rdeditio n(2003). (for UnitItoIV)

BooksforReferences:

(1) PhysicalBiologyoftheCell,RPhillips,JKondev,J.Theriot,GarlandScience(2009)

(2) RandomWalksinBiology,H.C.Berg,Princetonuniversitypress(1993)

(3)https://nptel.ac.in/courses/102/101/102101003/

CourseOutcomes(CO):On completionofthecourse,students would beableto

CO Number	COStatement	Knowledge Level
CO1	Learn the modeling process of first order homogenous and non-homogenous difference equations with equilibrium values andunderstandthe basics ofMATLAB	**K1 & K2**
CO2	ApplytheprocessofModelingusingdifferenceequationsanddiffusionequations	**K3**
CO3	ExaminetheroleofGauss-JordanEliminationmethodandEinstein'srelation in solving differenceequations	**K4**
CO4	Explain the recursions occurring in a difference equation throughmatrices, and compute the Eigenvalues and Eigenvectors throughMATLAB.	**K5**
CO5	Formulate Model for real situations using the system of linearequations in matrices and utilize MATLAB for finding solutionsforthe same.	**K6**

K-1:Recall,K-2: Understand,K-3:Apply, K-4:Analyse,K-5:Evaluate,K-6:Create

MappingofCOswithPOs:

CO \ PO	PO								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S
CO3	S	L	M	S	S	S	S	S	S
CO4	S	M	M	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S

Programme Title: B.Sc. MATHEMATICS

Course Title : BIOMATHEMATICS-PRACTICAL
Course Code : 21UMAEQC **Hours / Week: 2**
Semester : V **Credit: 1**

Course Objectives:

1. To use MATLAB/Scilab for solving problems on difference equations
2. To compute and solve problems on matrices using MATLAB/Scilab

UNIT-I:

Getting Started with MATLAB/Scilab - Operations on Vectors and Matrices

UNIT-II:

Problems onModeling with First - Order Linear Homogenous and Non- Homogenous Difference equations with Constant Coefficients for computing amount of drug present in blood after a few hours, Owl's population, in the process of Radioactive Decay and Carbon Dating and Forensic Application.

UNIT-III:

Problems solving usingGauss-Jordan Elimination Method for Biologists mixer problem, Nutrition Problems, Existence of bacteria, Balancing Chemical Equations

UNIT-IV:

Computing Eigenvalues and Eigenvectors with MATLAB/Scilab for Population movement problems

UNIT-V:

Problems on non-linear systems viz Predator-Prey Model using MATLAB/Scilab tools.

Book for study

Explorations of Mathematical Models in Biology with MATLAB – Mazen Shahin,Wiley Publishers(2014).

Books for References:

(1) Physical Biology of the Cell, R Phillips, J Kondev, J. Theriot, Garland Science (2009)

(2) Random Walks in Biology, H. C. Berg, Princeton University press (1993)

Web Resource:

https://www.mathworks.com/solutions/mathematical-modeling.html

Course Outcomes (CO):On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	recall the basics of MATLAB/Scilab	**K 1**
2.	express thedifference equations as matrices and solve them using MATLAB/Scilab	**K 2**
3.	apply MATLAB/Scilab to analyse the society connected problems	**K 3 & K 4**
4.	perceive the idea of recurrences in difference equations and compute the Eigenvalues and Eigenvectors using MATLAB/Scilab	**K 5**
5.	estimate the solution for problems occurring in real life by using MATLAB/Scilab	**K 6**

K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analyse, K-5 Evaluate, K-6 Create

Mapping of COs with POs:

PO / CO	PO								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	S	L	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S
CO4	S	M	M	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S

S –Strong, M – Medium, L – Low

Programme Title:B.Sc. MATHEMATICS
Course Title :DATA STRUCTURES
Course Code :21UMAESC2 Hours / Week:5
Semester: V Credits :4

Course Objectives: The course aims to

1. understand the concepts of built in data structures, Linked lists and sorting algorithm.
2. gain knowledge about operations on queues, get node and free node and pointer variables.
3. know about operations on stacks recursion and creating index.

SYLLABUS

Unit - I(Hours: 15)

Built in data structures - One and two dimensional arrays - Packed structures - Stacks - Operations on stacks - Implementation - Queue - Operations on Queues - Implementation - Another queue design - Application - Expression Evaluation, Simulation, Playing maze.

Unit - II(Hours: 15)

Linked lists - Operations - Get node and Free node - Implementation as an array of records - Implementing list operations - Inserting in an ordered list - Deleting from ordered list - Implementation - Stacks and queues as linked lists - Circular linked lists - Application - Magazine circulation.

Unit - III(Hours: 15)

Pointer variables - Up arrow syntax - Debugging hints - Recursion - Function sum - Reverse print - NFACT - Application - Quick Sort - Dynamic Storage Allocation.

Unit - IV(Hours: 15)

Binary Search trees - Searching - Insertion - Deletion - Implementations - Traversals - Binary expression trees - A non-linked representation - Heap sort - Application - Creating Index.

Unit – V(Hours: 15)

Sorting Algorithm - Analysing Quick Sort - Analyzing heap sort - Sequential searching - Binary Search - Hashing.

Text Books:

1. **Nell Dala** and **Susan C.Lilly** - Pascal Plus Data Structures Algotrithms and Advanced Programming, Tata McGraw Hill Pvt. Company Ltd., 16th edition 2001, New Delhi.
2. **RadhaGanesan**, -"C and Data Structures" - Scitech Publications Chennai 2nd edition 2002.
3. **Ellis Horowitz,** - "Fundamentals of Data Structures", SartajSahaniGalgotia Publishers, 1983, New Delhi.
4. **Seymour Lipschutz,** - "Theory and Problems of Data Structures" Schaum's series, Tata McGraw Hill Pvt. Company.

Books for Reference:

Data Structures & Algorithms, 1e by Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman , Pearson Education India publishers, Ist edition (2002).

Web Resource :

http://www.cs.yale.edu/homes/aspnes/classes/223/notes.pdf

Note: Questions to be taken only from the text books

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	recall the basic concepts of data structures, one and two dimensional arrays, packed structures, stacks and operations on queues	K-1
2.	understand the concept of stacks and queues as linked list operations	K-2
3.	illustrate pointer variables, up arrow syntax, debugging, recursion, function sum, reverse print, N-FACT with examples	K-2
4.	analyse the basic properties of binary search trees, binary expression trees, creating index, traversals and its applications	K-4
5.	relate data structure to the real-world problems	K-1

K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analyse, K-5 Evaluate, K-6 Create

Mapping of COs with POs:

PO / CO	PO								
	PO 1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO 9**
CO1	S	M	S	S	S	S	S	S	S
CO2	S	M	S	S	S	S	S	S	S
CO3	S	M	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S
CO5	S	M	S	S	S	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title: B.A/B.Sc/B.Com

Course Title : NON MAJOR SKILL BASED I - INDUSTRIAL MATHEMATICS WITH R PROGRAMMING - PRACTICAL

Course Code : 21UMAQNSC1 **Hours / Week: 2**

Semester : V **Credits: 2**

To inculcate the basics of Matrices, Linear Programming and Assignment Problems through R Programming Software

Unit I

Linear Equations – Matrix Inversion & Linear EquationsSolution.

Unit II

Linear programmingProblems.

Unit III

TransportationModel

- North West Corner Method
- Least Cost Method

Unit IV

Transportation Model

- Vogel's Approximation Method

Unit V

AssignmentProblems.

Books for study:

1. Resource Management Techniques(Operations Research) **by Prof. V. Sundaresan, Prof. K. S. Ganapathy Subramanian and Prof. K. Ganesan.**, AR Publications, Chennai.
2. R Programming for Data Science by Roger D. Peng

Web Resource:

1. https://analyticsindiamag.com/introduction-to-basic-concepts-of-r-programming-language/

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
CO 1	Find the solutions of Assignment problems with R Studio.	K-1
CO 2	Understand the basic matrix operations and solve the same with the aid of R studio	K-2
CO 3	Interpret and solve Linear Programming Problems and Dual Linear Programming Problem using R Studio	K-2 & K-3
CO 4	Solve problems using North West Corner Method and Least Cost Method faster with R studio	K-3
CO 5	Solve Problems using Vogel's Approximation Method more quickly with the aid of R studio	K-3

Programme Title :**B.Sc. MATHEMATICS**
Course Title :**REAL ANALYSIS – II**
Course code :**21UMAC12** **Hours/Week:6**
Semester :**VI** **Credits:4**

Course Objectives:

1. To gain knowledge about connected sets, compact metric spaces, totally bounded sets and complete metric spaces.
2. To discuss the concepts of the Riemann integral, existence of Riemann integral and properties of Riemann integral.
3. To understand the concepts of derivatives and fundamental theorem of calculus.
4. To develop the ability to reflect critically on the methods they have chosen to solve problems.

SYLLABUS

Unit –I(Hours : 14)

Continuous functions on metric spaces:
Open sets - Closed sets - Discontinuous functions on R^1.

Chapter 5(Sections 5.4 to 5.6)

Unit –II(Hours : 15)

Connectedness, Completeness and Compactness: More about open sets - Connected sets - Bounded set and totally bounded sets - Complete metric spaces.

Chapter 6(Sections 6.1 to 6.4)

Unit –III(Hours : 15)

Compact metric spaces - Continuous functions on compact metric spaces- Continuity of the inverse function - Uniform continuity.

Chapter 6(Sections 6.5 to 6.8)

Unit –IV(Hours : 15)

Sets of measure zero - Definition of the Riemann integral - Existence of the Riemann integral - Properties of the Riemann integral.

Chapter 7(Sections 7.1 to 7.4)

Unit –V(Hours : 16)

Derivatives - Rolle's theorem - The law of the mean - Fundamental theorem of calculus - L'Hospital's rule - Taylor's theorem - Taylor's series – Maclaurin series – Improper integral..

Books for study:

1. For Unit I to Unit IV Richard R.Gold Berg, Methods of Real Analysis, Oxford & IBH. PublicatinsCO.PVT.LTD.Newdelhi.
2. For Unit V: https://nptel.ac.in/courses/111/106/111106053/

Books for Reference:

1. M.K. Singhal and Asha Rani Singhal, A First Course in Real Analysis, R. Chand & Co., June1997 Edition
2. Shanthi Narayan, A Course of Mathematical Analysis, S. Chand & Co., 1995.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the concepts of open sets, closed sets, Connected sets, Taylor's series and Compact metric space	**K-1**
2.	understand several standard concepts of metric spaces	**K- 2**
3.	analyse totally bounded sets, discontinuous functions at a point, Rolle's theorem, mean value theorem and their applications	**K-4**
4.	prove the properties of Riemann integral, complete and compact metric spaces and apply them to solve the related problems	**K-3, K-5**
5.	examine Law of mean and fundamental theorem of calculus	**K-4**

K-1 :Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6 :Create.

Mapping of COs with POs:

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	M	S	L	-	S	S	S	S
CO2	S	M	S	L	-	S	S	S	S
CO3	S	M	S	L	-	S	S	S	S
CO4	S	M	S	L	-	S	S	S	S
CO5	S	M	S	L	-	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title :**B.Sc. MATHEMATICS**
Course Title : **COMPLEX ANALYSIS – II**
Course code :**21UMAC13** **Hours/Week:5**
Semester :**VI** **Credits:4**

Course Objectives

1. To acquire knowledge in series, functions, Residues and intergrals.
2. To understand the theorems on convergence of series, methods of finding residues at singular points of a function etc.
3. To analyze the different methods of evaluation of integrals.

SYLLABUS

Unit – I(Hours : 15)

Convergence of Sequences and series - Taylor Series - Proof of Taylor's theorem Examples - Laurent Series - Proof of Laurent's theorem - Examples.

Chapter 5 (Sections 55 - 62)

Unit – II(Hours : 15)

Absolute and Uniform Convergence of Power Series - Continuity of sums of Power series - Integration and Differentiation of Power Series - Uniqueness of series Representations - Multiplication and Division of Power Series.

Chapter 5 (Sections 63 - 67)

Unit – III(Hours : 15)

Isolated Singular Points - Residues - Cauchy's Residue Theorem - Residue at infinity - The Three types of Isolated Singular Points - Residues at Poles - Zeros of analytic functions - Zeros and Poles - Behavior of functions near isolated singular points.

Chapter 6 (Sections 68 - 77)

Unit – IV(Hours : 15)

Evaluation of Improper Integrals - Examples - Improper Integrals from fourier analysis - Jordan's Lemma- Indented Paths - An indentation around a branch point.

Chapter 7 (Sections 78 - 83)

Unit – V(Hours : 15)

The Argument (Counting) Principle - Rouche's Theorem and the Fundamental theorem of Algebra- Winding number- Branch of Complex Algorithm.

Books for study :

1. James Ward Brown and Ruel V.churchill - Complex variables and Applications,Eighth Edition, Mc.Graw - Hill, Inc. (For Unit I to IV)
2. 1. https://nptel.ac.in/courses/111/106/111106141/
   2. https://nptel.ac.in/courses/111/106/111106084/ (For Unit V)

Books for Reference :

1. S. Arumugam, A. Thangapandi Isaac and A. Somasundaram - Complex Analysis**,** New Scitech Publications (India) Pvt Ltd, 2002.
2. J. N. Sharma - Functions of Complex Variable, Thirteenth Edition, Krishna Prakasan Media(P) Ltd, 1996-97.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the significance of convergence and uniformly convergence of power series.	K-1
2.	apply the concepts of Taylor and Laurent series expansions of analytic functions, Residues and argument principle to solve the related problems	K-3
3.	expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.	K-4
4.	use the properties of three types of Isolated Singular Points, Improper Integrals from fourier analysis and analyze the problems related to that functions	K-3, K-4
5.	understand the idea of indented paths and integrals and apply on argument principle and Rouche's theorem.	K-2, K-3

K-1: Recall, K-2: Understand, K-3: Apply, K-4: Analyse, K-5: Evaluate, K-6: Create

Mapping of COs with POs:

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	M	S	S	-	S	S	S	S
CO2	S	M	S	S	-	S	S	S	S
CO3	S	M	S	S	-	S	S	S	S
CO4	S	M	S	S	-	S	S	S	S
CO5	S	M	S	S	-	S	S	S	S

S- Strong, M - Medium, L – Low

Programme Title **:B.Sc. MATHEMATICS**
Course Title **:LINEAR ALGEBRA**
Course code **:21UMAC14** **Hours/Week:6**
Semester **:VI** **Credits:4**
Course Objectives:

1. To gain knowledge about the third algebraic system, the vector space.
2. To inculcade knowledge about the linear transformation on vector space.
3. To determine the existence and nature of solution of systems of linear equations.
4. To acquire knowledge about the normal and self adjoint operators.

SYLLABUS

Vector Spaces and Inner Product Spaces

Unit –I(Hours : 18)

Definition and Simple properties – Subspaces and Quotient Spaces-Sums and Direct sums – Linear independence – Basis and dimensions.

Chapter 6(Sections : 6.1- 6.5)

Unit- II(Hours : 18)

Homomorphisms – Dual spaces – Inner product spaces.

Chapter 6(Sections : 6.6 - 6.8)

Linear Transformations and Matrices

Unit –III(Hours : 18)

The Algebra of linear transformations – Eigen values and Eigen vectors

Chapter 7 (Sections : 7.1 - 7.2)

Unit – IV(Hours : 18)

Matrix algebra - Triangular forms - Adjoints – Normal and self- adjoint operators – Spectral theorem for normal and self-adjoint operators

Unit –V(Hours : 18)

Linear equations – Determinants.

Chapter 7 (Sections :7.7, 7.8)

Books for study :

1. M.L. Santiago - Modern Algebra, Tata Mcgraw – Hill Publishing Company Ltd., New Delhi.(For Unit I to IV)
2. https://nptel.ac.in/courses/111/106/111106135/(For Unit IV)

Books for Reference :

1. I. N. Herstein - Topics in Algebra Second Edition**,** Wiley India Pvt. Ltd, New Delhi, 2008.
2. S. Arumugam, A. Thangapandi Isaac - Modern Algebra, New Gamma Publication House, Palayamkotti, 1997.

Course Outcomes (CO) : On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
1.	learn the concepts of vector spaces, matrices, linear equations and linear transformations	**K-1**
2.	understand the notions of vector spaces and its forms, linear transformations and inspect their properties	**K-2, K-4**
3.	assess the properties of matrix, eigen values and eigen vectors and triangular forms of linear transformations	**K-5**
4.	apply various methods to find solutions of linear equations, determine inverse of a matrix using Cayley – Hamilton theorem	**K-3, K-5**
5.	interpret the notions of vector spaces, linear transformations, matrices and determinants, adjoint and self-adjoint operators and solve related problems	**K-2, K-3**

K-1: Recall, K-2: Understand, K-3: Apply, K-4: Analyse, K-5: Evaluate, K-6: Create

Mapping of COs with POs:

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO9**
CO1	S	S	S	S	M	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title:B.Sc. MATHEMATICS
Course Title : NUMERICAL METHODS
Course Code :21UMAC15 **Hours / Week:5**
Semester: VI **Credits :4**
Course Objectives:

1.Tosolve algebraic and transcendental equations by various numerical methods.

2.Toacquire knowledge on numerical differentiation and integration.

3.Toknow about the concepts of finite differences and interpolation.

SYLLABUS

Unit-I(Hours:15)

The Solution of Numerical Algebraic and Transcendental Equations

The Bisection Method (or BOLZANO'S method or Interval halving method), Iteration method (or method of successive approximations), The conditions for the convergence of the method, Order of convergence of an iterative process, RegulaFalsi method (or the method of false position), Geometrical interpretation, Newton – Raphson method (or Newton's method), Geometrical meaning of Newton's method, Criterion for the convergence in Newton – Raphson method & Order of convergence of Newton's method.

Chapter-3-Sec:3.1.1, 3.2, 3.2.1, 3.2.2, 3.3, 3.3.1, 3.4, 3.4.1, 3.4.2 & 3.4.3 (Page No: 69 – 98)

Unit-II(Hours:15)

Solutions of Simultaneous Linear Algebraic Equations

Gauss – Elimination Method, Gauss – Jordan elimination Method (Direct method), Inversion of a matrix using Gauss – Elimination method, Iterative methods, Jacobi method of iteration or Gauss – Jacobi method & Gauss -Seidel method of iteration.

Chapter-4-sec: 4.1,4.2, 4.2.1, 4.3, 4.7, 4.8 & 4.9 (Page No: 112 – 132, 145 – 159)

Unit- III(Hours:15)

Finite Differences

First difference, Express any value of y in term of y_n and the backward differences of y_n , Differences of a polynomial, Factorial polynomial, Error Propagation, Summation of Series &Montmort's theorem.

Chapter-5-sec: 5.1, 5.2, 5.3, 5.4, 5.5, 5.7 &5.8 (Page No: 170 – 207)

Unit-IV(Hours:15)

Interpolation

Gregory – Newton forward interpolation formula or Newton's forward interpolation formula (*for equal intervals*), Gregory – Newton Backward Interpolation formula (*for equal intervals*)& Equidistance terms with one or more missing values.

Central Difference Interpolation Formulae (*for equal intervals*)

Gauss's forward interpolation formula, Gauss's backward interpolation formula, Bessel's formula.

Interpolation with unequal intervals

Divided differences,Newton's interpolation formula for unequal intervals, Lagrange's interpolation formula(for unequal intervals) ,Different form of Lagrange's interpolation formula & Inverse interpolation .

Chapter-6-sec: 6.2 & 6.3 - Page No: 210 – 225

Chapter-7-sec: 7.3, 7.4 & 7.6 - Page No: 231 – 240, 242

Chapter-8-sec: 8.2, 8.5,8.7& 8.8 - Page No: 257-260,263 – 280

Unit-V(Hours:15)

Numerical Differentiation and Integration

Newton's forward difference formula to get the derivative, Newton's backward difference formula to compute the derivative, Derivative using Stirling's formula & To find maxima and minima of the function given the tabular values. A general quadrature formula for equidistant ordinates(*or Newton-cote's formula*), Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighths rule & Weddle's rule.

Chapter-9-sec: 9.2, 9.3, 9.4, 9.6, 9.8, 9.9, 9.13, 9.14 & 9.15 - Page No: 281 – 301, 303 – 306

Book for Study:

P.Kandasamy, K,Thilagavathy, K.Gunavathy.- Numerical Methods,First edition, S.Chand& Company Ltd.

Book for Reference:

H.C. Saxena-Finite Differences and Numerical Analysis, S. Chand Publishers,2005.

Course Outcomes (CO) : On completion of the course, students would be ableto

CO Number	CO Statement	Knowledge Level
1.	learn the concepts of various topics in Numerical methods.	**K-1**
2.	understand various methods to obtain numerical solution of algebraic and transcendental equations , simultaneous linear algebraic equations ,the concepts of finite differences , various formula on interpolation with equal intervals and unequal intervals,numerical differentiation and integration	**K-2**
3.	apply the acquired knowledge to obtain numerical solution of algebraic and transcendental equations and simultaneous linear algebraic equations .	**K-3**
4.	use the interpolation techniques to compute and analyse the problems on Interpolation and apply the acquired knowledge to solve problems on finite differences .	**K-3,K-4**
5.	solve the problems/society connect problemsusing numericalmethodson differentiation and integration.	**K-3**

K-1 Recall; K-2 :Understand; K-3 :Apply; K-4 :Analyze; K-5 :Evaluate; K-6:Create.

Mappings of Cos with Pos:

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	S	M	S	S	S	S	S	S	S
CO2	S	M	S	S	S	S	S	S	S
CO3	S	M	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S
CO5	S	M	S	S	S	S	S	S	S

S - Strong, M - Medium, L – Low

Programme Title:B.Sc. MATHEMATICS
Course Title: GRAPH THEORY
Course Code: 21UMASEC3 **Hours / Week:5**
Semester: VI **Credits:4**

Course Objectives:
1. To Acquire the basic knowledge of various types of graphs.
2. To Know about the problem-solving power of the graph theory.
3. To Know about the applications of graphs to simple situations and puzzles.

SYLLABUS

Unit – I (15 Hours)

Graphs and Subgraphs Definition and examples, Degrees, Subgraphs, Operations on graphs

Unit – II (15 Hours)

Connectedness Walks, Trails and Paths, Connectedness and Components, Blocks, Connectivity.

Chapter 4

Unit – III (15 Hours)

Eulerian And Hamiltonian Graphs Eulerian graphs, Hamiltonian graphs.

Unit – IV (15 Hours)

Trees Characterisation of trees, Centre of a tree.

Unit – V (15 Hours)

Directed Graphs Definition and basic properties, Paths and connections, Digraphs and Matrices.

Book for Study:

S. Arumugam, S. Ramachandran - Invitation to Graph Theory,Year of Publication 2001, Scitech Publications, Chennai.

Books for Reference:

1. Narsingh Deo -Graph Theory with applications to Engineering and Computer Science , Prentice Hall of India, 2004.
2. Gary Chartrand and Ping Zhang - Introduction to Graph Theory, Tata McGraw-Hill Edition, 2004

Web Resources :

1. http://nptel.ac.in/courses/111106050
2. https://cs.bme.hu/fcs/graphtheory.pdf

(Questions to be taken only from the text books)

Course Outcomes (CO) : On completion of the course, students would be ableto

CO Number	CO Statement	Knowledge Level
1.	understand the definition and basics of graphs with types and examples	**K-2**
2.	interpret the concepts of Connectedness in graph	**K-2**
3.	apply Eulerian and Hamiltonian Graphs to solve related problems	**K-3**
4.	analyse the characterisation of trees and classification of directed graphs	**K-4**
5.	relate the graph theory to the real world problems	**K-1**

K-1 :Recall, K-2 :Understand, K-3 :Apply, K-4 :Analyse, K-5 :Evaluate, K-6 :Create

Mapping of COs with POs:

PO / CO	PO								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**
CO1	L	L	L	L	L	L	L	L	L
CO2	M	M	S	S	S	M	S	L	S
CO3	M	S	M	S	S	M	S	L	S
CO4	M	S	M	S	S	M	S	L	S
CO5	S	S	M	S	S	S	S	L	S

S - Strong, M - Medium, L – Low

Programme Title:B.A/B.Sc/B.Com
Course Title: NON MAJOR SKILL BASED II –MATHEMATICAL MODELING WITH R PROGRAMMING - PRACTICAL
Course Code:21UMAQNSC2 **Hours / Week: 2**
Semester: VI **Credits: 2**

Course Objectives

To introduce the notions of data frames and big data through R programming software

Unit I

Creating Vectors and Matrices

Unit II

Extrication of Vectors and Matrices

Unit III

Elementary operations on Vectors and Matrices

Unit IV

Big Data Analysis

Unit V

Control Structures

Book for Study:

Big data Analytics by David Loshin, MK Publications, USA.

Web Resource:

1. https://r4ds.had.co.nz/model-basics.html

Course Outcomes (CO): On completion of the course, students would be able to

CO Number	CO Statement	Knowledge Level
CO 1	Learn data frames and basics of Big Data using R Studio	K-1
CO 2	Understand the difference between creating a vector and matrix in R studio	K-2
CO 3	Apply the basics of R studio to extract necessary elements from a vector and matrix	K-3
CO 4	Compute basic arithmetic operations on vectors and matrices with the aid of R studio	K-3
CO 5	Build patterns and structures with the aid of R studio	K-3