PROGRAMME: M.Sc.,(MATHEMATICS & APPLIED MATHEMATICS)
SRI VENKATESWARA UNIVERSITY::TIRUPATI
S.V.U.COLLEGE OF SCIENCES
DEPARTMENT OF MATHEMATICS

Mission of the Mathematics Department:

1. To emerge as a global centre of learning academic excellence and innovative research.
2. To pursue collaborative programs with highly reputed National and International institutions.

Vision of the Mathematics Department:

1. Imparting quality mathematical education and inculcating the spirit of research through innovative teaching and Research methodologies.
2. To achieve high standards of excellence in generating and propagating knowledge in mathematics
3. To provide an environment where students can learn, become competent users of mathematics and understand the use of mathematics in other disciplines.

Program Out Comes (PO) of PG in Mathematics & Applied Mathematics:

Students are expected to know or able to do by the time of graduation. At the end of the programme, the students will be to:

1. Apply the knowledge of Mathematics in all the fields of learning including higher research and its extensions.
2. Equip the student with skills to analyse problems, formulate the hypothesis, evaluate and draw reasonable conclusions.
3. Investigate and apply mathematical problems and solutions in a variety of contexts related to science, technology, business and industry.
4. Able to design and develop mathematical experiments to solve environment problems like global pollution, aerosol particles weather and virus in atmosphere.
5. Utilize Number Theory in the field of Cryptography that helps in hiding information and maintaining secrecy in military information, transmission, computer password and e-commerce. Facilitate the study of groups in crystallography in chemistry and Lie symmetry groups in physics.
6. To interpret the data like dosage of medicine, nutritious food to children and effectiveness of new drugs and survival rate of cancer parents under certain treatments etc.
7. Illustrate solutions using numeric or graphical or programming methods.

8. Imbibe high standards in life by understanding the values and ethics in their life..
9. Investigate and solve unfamiliar math problems and allow to think on unsolved mathematical problems.
10. Imbibe effective, scientific / technical communications in both oral and write.
11. Acquire knowledge in designing Mathematical models .Also generate funds through various research projects..
12. Ability to think, acquire knowledge and skills through logical reasoning and develop a habit of self- learning throughout life.

Program Specific Outcomes:

1. To develop problem – solving skills and apply them independently to problems in pure and applied mathematics.
2. To assimilate complex mathematical ideas and argument.
3. To develop abstract mathematical thinking.
4. To improve own learning and performance.

SRI VENKATESWARA UNIVERSITY::TIRUPATI
S.V.U.COLLEGE OF SCIENCES
DEPARTMENT OF MATHEMATICS

(Syllabus common for SV University College and affiliated colleges offered P.G. Courses in SVU Area)
RESTRUCTURE OF M.Sc., I(A) : MATHEMATICS (CBCS) as per NEP-2020

((Revised Scheme of Instruction and Examination, Syllabus etc., with effect from the w.e.f the batch admitted in the academic year 2024-25)

M.Sc. MATHEMATICS

SCHEME OF INSTRUCTION AND EXAMINATION

SEMESTER-I

S.NO	COURSE	CODE MAT	TITLE OF THE COURSE	H/W	C	SEE	IA	TOTAL MARKS
1	CC	101	**1.**Algebra	4	4	70	30	100
2		102	**2(A).** Real Analysis **2(B).** Lattice theory	4	3	50	25	75
3		103	**3(A).** Differential Equations **3(B).** Integral Equations	4	3	50	25	75
4	P	104	**Practical-I** (related to CC 2&3)	6	2	35	15	50
5	SOC	105	**1(A).**Numerical Methods **1(B).** MATLAB	4	3	50	25	75
6		106	**2(A).** Discrete Mathematics **2(B).**C-Programming Language	4	3	50	25	75
7	P	107	**Practical- II** (related to SOC 1 &2)	6	2	35	15	50
			Total	36	22	340	160	500
8	Audit Course	109	Ancient Indian Mathematics	4	0	0	100	0

M.Sc., MATHEMATICS
SEMESTER-II

S.NO	COURSE	CODE MAT	TITLE OF THE COURSE	H/W	C	SEE	IA	TOTAL MARKS
1	**CC**	**201**	**4.** Galois Theory	**4**	**4**	**70**	**30**	**100**
2		**202**	**5(A).**Complex Analysis **5(B).**Semi group theory	**4**	**3**	**50**	**25**	**75**
3		**203**	**6(A).** Topology **6(B).** Linear Algebra	**4**	**3**	**50**	**25**	**75**
4	**P**	**204**	**Practical-III** (Related to CC 5&6)	**6**	**2**	**35**	**15**	**50**
5	**SOC**	**205**	**3(A).**Mathematical Statistics **3(B).**Data Structures and Algorithms	**4**	**3**	**50**	**25**	**75**
6		**206**	**4(A).** Operations Research For Industry and Community Development (TORA) **4(B)**. Python	**4**	**3**	**50**	**25**	**75**
7	**P**	**207**	**Practical -IV** **(related to SOC 3 &4)**	**6**	**2**	**35**	**15**	**50**
8	**OOTC-I**	**208**	edX/Swayam/NPTEL/ MOOCS	**-**	**2**	**-**	**-**	**100-**
			Total	**36**	**22**	**340**	**260**	**600**
9	**Audit Course**	**209**	Vedic Mathematics	**4**	**0**	**0**	**100**	**0**

M.Sc., APPLIED MATHEMATICS

SEMESTER-I

S.NO	COURSE	CODE AMA	TITLE OF THE COURSE	H/W	C	SEE	IA	TOTAL MARKS
1	**CC**	**101**	1. Methods of Applied Mathematics	**4**	**4**	**70**	**30**	**100**
2		**102**	**2(A).** Real Analysis **2(B).** Viscous Flows	**4**	**3**	**50**	**25**	**75**
3		**103**	**3(A).** Differential equations **3(B).** Integral Equations	**4**	**3**	**50**	**25**	**75**
4	**P**	**104**	**Practical-I** **(related CC 2&3)**	**6**	**2**	**35**	**15**	**50**
5	**SOC**	**105**	**1(A).**Numerical Methods **1(B).** MATLAB	**4**	**3**	**50**	**25**	**75**
6		**106**	**2(A).** Discrete Mathematics **2(B).C**-Programming Language	**4**	**3**	**50**	**25**	**75**
7	**P**	**107**	**Prcatical- II** (related to SOC 1 &2)	**6**	**2**	**35**	**15**	**50**
				36	**22**	**340**	**160**	**500**
8	**Audit Course**	**109**	Ancient Indian Mathematics	**4**	**0**	**0**	**100**	**0**

M.Sc.,APPLIED MATHEMATICS

SEMESTER-II

S.NO	COURSE	CODE AMA	TITLE OF THE COURSE	H/W	C	SEE	IA	TOTAL MARKS
1	CC	201	**4.**Mathematical Modeling	4	4	70	30	100
2		202	**5(A).**Complex Analysis **5(B).**Semi group theory	4	3	50	25	75
3		203	**6(A).**Topology **6(B).**Boundary Value Problems	4	3	50	25	75
4	P	204	**Practical-III** **(**Related to CC 5&6**)**	6	2	35	15	50
5	SOC	205	**3(A).**Mathematical Statistics **3(B).**Data Structures and Algorithms	4	3	50	25	75
6		206	**4(A).** Operations Research For Industry and Community Development (TORA) **4(B)**. Python	4	3	50	25	75
7	P	207	**Prcatical -IV** (related to SOC 3 &4)	6	2	35	15	50
8	OOTC-I	208	**edX/Swayam/NPTEL/ MOOCs**	-	2	-	-	100
				36	22	340	260	600
9	Audit Course	209	Vedic Mathematics	4	0	0	100	0

Instructions for evaluation:-

- Core 1, core 4 & core 7 are evaluated for 100 Marks out of which 70 Marks through end examination and internal assessment would be for 30 Marks mandatory with 4 credits.
- Core courses 2, 3, 5 , 6, 8 & 9 and SOC 1 , SOC 2 ,SOC 3 SOC 4, SOC 5 & SOC 6 are evaluated for 75 marks out of which 50 Marks through end examination and internal assessment would be for 25 Marks with 3 credits.
- Practicals for Core courses 2,3;5,6&8,9: SOC 1,SOC-2,SOC-3 SOC-4,SOC-5 & SOC-6 are for 50 marks out of which 35 Marks through end examination and internal assessment would be for 15 Marks with 2 credits.
- Totally 9 core courses are distributed in I, II and III semesters. Student must complete Open Online Transdisciplinary Courses during II and III Semesters each with 2 credits
- And student has to take Indian Knowledege system in I and II semesters respectively. They are Audit courses with zero credits. But mandatory with only a pass. A student has to secure 40 marks out of 100 marks.
- IV semester Students have to complete Open online Skill Development courses for 8 credits. Students have the option to select one or two or more courses to accumulate the designated 8 credits. Each course is designated to be at least 20 hours in duration to earn one credit. In IV semester Students have to take project work which carries 12 credits.
- The minimum marks for qualifying in theory subject shall be 40%.

1.End Examination Question Paper Pattern for Theory is as follows:

Section A&B	Questions	Units of the Syllabus	Marks for core 1	Marks for Core 2,3 and SOC 1 &2
A	Questions 1 To 8 (four short answer Questions, TWO from each unit)	Form UNIT-I to UNIT-IV	5x4M=20	5x2M=10
B	Questions 9.(a) or (b)	Form UNIT-I	12.5	10
B	Questions 10. (a) or (b)	From UNIT-II	12.5	10
B	Questions 11(a) or (b)	From UNIT-III	12.5	10
B	Questions 12(a) or (b)	From UNIT-IV	12.5	10
Total:			70	50

Procedure to evaluate internal examinations: Theory:

Internal Examinations –I &II	30 marks for core 1,4 &7
	25 marks for Core 2,3;,5,6;8,9 & and SOC 1,2,3,4,5,6.
Practicals	15 marks for Practicals -I and II

***Note 1: If the final marks are in fraction, it shall be rounded off to the next number**

- If the student is absent for the internal examination, no re-exam shall be conducted If the student failed to attend both the internal examinations, his/her aggregate marks shall be considered zero.
- **Note:** Final internal semester marks shall be awarded as average of two internal examinations.

Practical/Lab:

***Continuous assessment/ Day to day work**	**End examination**	**Total**
35 marks	35T+15P	50M

- Internal marks will be awarded by internal examiner only.

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(For admitted Batch 2024-26)

FIRST SEMESTER
MAT 101: ALGEBRA

Algebra is one of the broad areas of Mathematics together with Number theory Geometry and analysis. Algebra is applicable to all mathematical domains.

Course objectives:

1. To understand Sylow's theorems.
2. Develop knowledge on Ideals and homomorphism.
3. Discuss U.F.D, E.D and polynomial Rings.
4. To introduce algebraic structure Module.

UNIT-I

Structure theorems of groups:- Conjugacy and G-Sets- Direct products-Finitely generated abelian groups-Invariants of a finite abelian group-Sylow Theorems. (Sections 1 to 4 of the Chapter 8)

UNIT-II

Ideals and Homomorphisms:- Ideals-Homomorphisms-Sums and direct sums of ideals-Maximal and prime ideals-Nilpotent and nil ideals-Zorn's lemma. (Chapter 10)

UNIT-III

Unique factorization domains and Euclidean domains:- Unique factorization domains-Principal ideal domains-Euclidean domains-Polynomial rings over UFD (Chapter 11)

UNIT IV

Modules and Vector Spaces: Definition and examples – Submodules and direct sums – R-homomorphisms and quotient modules-Completely reducible Modules- Free Modules
(Sections 1 to 5 of Chapter 14)

Scope and standard in the book **"Basic Abstract Algebra" by P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Cambridge University Press, Reprint 1997.**

References:

1. Topics in Algebra, by I.N. Herstein
2. Commutative algebra, by Zariski and Samuel Affiliated East-West Press.
3. Abstract Algebra – Ronald. Solomon.
4. A First course in 'ABSTRACT ALGEBRA' seventh edition by John B. Fraleigh, Pearson Education.
5. Abstract algebra by David S. Summit, Richard .M.Forte, Wiley publication, 3rd edition.
6. Introduction to rings and modules by C.Musli, Narosa Publications.
7. A first course in abstract algebra by John B Fraleigh.
8. Basic algebra by Jacobson.Nathan , Vol 1, Hindustan Publishing corporation 1991 .

Course outcomes: After completing this course the student will be able to

1. Explain the applications of Sylow's theorems
2. Discuss homomorphism and ideals in Rings.
3. Understand U.F.D, E.D and Polynomial Rings
4. Develop concepts on modules

MAT 102:2 (A) - REAL ANALYSIS

(Common with the paper AMA 102: 2 (A) of Branch 1(B) Applied Mathematics)

This course covers Riemann-Stieltjes Integral, Sequences and Series of Functions, Functions of Several Variables, Improper Integrals, Fourier series, Maxima and Minima.

Course Objectives:

1) Acquire knowledge on Riemann-Stieltjes Integration and Differentiation.
2) Discuss Uniform Convergence, Continuity Integration and Differentiation
3) Learn comparison Tests
4). Understand the concept of functions of several variables.

UNIT –I:

The Riemann –Stieltijes Integral : Definition and Existence of the integral properties of the integral, integration and Differentiation, Integration of vector valued function, Rectifiable curves.

UNIT – II:

Sequence and series of functions : Discussions of main problem, uniform convergence, uniform convergence and continuity, Uniform convergence and Integration, Uniform convergence and Differentiation.

Scope and standard as in Chapters 6, sections 7.1 to 7.18 of chapter 7 of Walter Rudin" Principles of Mathematical Analysis" 3rd edition 1976, Nc. Graw hill International student edition.

UNIT – III:

Improper Integrals: Introduction, Integration of unbounded functions with finite limit of Integration, comparison tests for convergence at a ∞, infinite Range of Integration.

Fourier series: Trigonometrically series, some preliminary theorems.

UNIT-IV:

Functions of Several Variables : Explicit and Implicit functions, Continuity, Partial derivations, differentiability, partial derivatives of higher order, differentials of higher order, function of functions, change of variables, Taylor's theorem, Extreme values, Maxima and Minima, functions of several variables.

Scope and standard as in chapters 11, 12 and 15 of **Mathematical Anlaysis by " S.C. Malik 1994" Wiley Eastern limited**

Reference:

(1) Mathematical Analysis- A modern Approach to Advanced Calculus Narosa Book Distributors Pvt LTD- New Delhi

(2) Real Analysis - Golden Math Series By N.P. Bali.

(3) A course of Mathematical Analysis by Shanti Narayan -.K. Mittal , S-Chand & Company LTD-New Delhi

Course Outcomes:

1. Understand the concepts of Riemann Stieltijes integration and Differentiation.
2. Understand Uniform Convergence and continuity.
3. Learn comparison tests at a infinity.
4. Analyze the concept of functions of several variables.

MAT 102:2(B) - LATTICE THEORY

The course mainly designs with the aim of introducing the Lattice theory and Boolean algebra, the portion of lattice theory discuss modular, distributive lattice.

Course Objectives:

1. To study the Partially Ordered Sets.
2. To discuss Lattices.
3. To analyze Complete Lattices.
4. To explain distributive and modular lattices.

UNIT-I

Partially Ordered Sets: Set Theoretical Notations, Relations, Partially Ordered Sets, Diagrams, Special Subsets of a Partially Ordered Set, Length, Lower and Upper Bounds, The Minimum and Maximum Conditions, The Jordan–Dedekind Chain Condition, Dimension Functions.
(Sections 1 to 9 of Chapter 1)

UNIT-II

Lattices in General: Sub Lattices, Ideals, Bound Elements of a Lattice, Atoms and Dual Atoms, Complements, Relative Complements, Semi Complements, Irreducible and Prime Elements of a Lattice, The Homomorphism of a Lattice, Axiom Systems of Lattices. (Sections 10 to 21 of Chapter 2)

UNIT-III

Complete Lattices: Complete Lattices, Complete Sub Lattices of a Complete Lattice, Conditionally Complete Lattices, Compact Elements and Compactly Generated Lattices, Sub Algebra Lattice of an Algebra, Closure Operations, Galois Connections, Dedekind Cuts, Partly Ordered Sets as Topological Spaces.
(Sections 22 to 29 of Chapter 3)

UNIT-IV

Distributive and Modular Lattices: Distributive Lattices, Infinitely Distributive and Completely Distributive Lattices, Modular Lattices, Characterization of Modular and Distributive Lattices by their Sub lattices, Distributive Sub lattices of Modular Lattices, The Isomorphism Theorem of Modular Lattices, Covering Conditions, Meet Representation in Modular and Distributive Lattices.
(Sections 30 to 36 of Chapter 4)

Scope and Standard as in:

Introduction to Lattice Theory, Gabor Szasz, Academic press.

References:

Lattice Theory, G. Birkhoff, Amer, Math. Soc.

Course Learning Outcome(s): From this course students are able to

1. Identify Partiallly Ordered Sets.
2. Understand Lattices as Algebraic structures
3. Study complete Lattices.
4. Compare the distributive and modular lattices

MAT 103:3(A) - DIFFERENTIAL EQUATIONS
(Common with paper AMA 103:3(A) of Branch I (B) Applied Mathematics)

This course introduces fundamental knowledge in Differential Equations that is applicable in the engineering aspects. Also it is designed to strengthen the fundamental knowledge of P.D.Es which lead to understand the real world problems.

Course objectives:

1. To find solutions of power series and second order linear equations.
2. To provide knowledge on Special functions -Legendre polynomials and properties of Bessel functions.
3. To find integral surface passing through given surface using P.D.E
4. To explain methods to solve Linear P.D.Es with constant and Variable coefficients

UNIT –I:

Eigen values, Eigen functions –Series solutions of first order equations –Second order linear equations-Ordinary points-Regular singular points.

UNIT – II:

Legendre polynomials – properties of Legendre polynomials –Bessel functions –The gamma function- Properties of Bessel functions

UNIT –III:

Differential Equations in more than two variables: Methods of solutions of dx/P =dy/Q = dz/R-. (Sections 3, of Chapter 1)

Partial Differential Equations of the First order: Partial Differential equations-Origins of first order partial differential equations-Cauchy's problems for first order equations-Linear equations of first order -Charpit's method. (Sections 1,2,3,4,5 and 10 of Chapter 2)

UNIT – IV:

Partial Differential Equations of the Second order: The Origin of second order equations –Linear partial differential with constant coefficients-Equations with variable coefficients. (Sections 1, 4 and 5 of Chapter 3).

Scope and standard as in

1. **"Differential Equations with Applications and Historical notes" by George F. Simmons, (1992)** Tata McGraw Hill Publications for Units I & II**.**

2. "Elements of Partial Differential Equations" by IAN Sneddon for Units III & IV.

References:

1. Advanced Differential Equations, M.D. Raisinghania , S. Chand Publications
2. Differential Equations" Ross, Shepley L Wieley India Pvt LTD.
3. Engineering Mathematics y Bali NP, SatyanarayanaBhavanari, kelkar, University Science Press, New Delhi 2012.
4. An introduction to O.D.E by Earl.A.Coddington , Prentice Hall of India Private Limited, New Delhi 1991.
5. Theory of ODE by Sam Sundaram, Narosa Publications
6. Ordinary and Partial Differential Equations by M.D. Raisinghania.
7. An elementary course to P.D.E by T.Amarnath, Second Edition, Narosa publishing house.

Course outcomes: From this course students will be able to

1. Find solutions of power series and second order linear equations.
2. Acquire knowledge on Special functions -Legendre polynomials and properties of Bessel functions.
3. Analyze the origin of first order PDEs and Integral surfaces passing through a given Curve
4. Identify linear and nonlinear PDE and solve nonlinear PDE by Charpit's method.

MAT 103:3(B) - INTEGRAL EQUATIONS
(Common with paper AMA 103:3(B) of Branch I (B) Applied Mathematics)

Course Objectives:

1. To convert Ordinary Differential equations into Integral Equations
2. To study the Kernels
3. To understand he Volterra Equations and Hilbert Transform
4. To obtain the solutions of Linear Integral equations

Unit – 1: PRELIMINARY CONCEPTS

Introduction; Some Problems which give Rise to Integral Equations; Conversion of Ordinary Differential Equations into Integral Equations; Classification Linear Integral Equations; Integral-differential Equations.

Unit – 2: FREDHOLM EQUATIONS

Analogies with Matrix Algebra; Degenerate Kernels; Hermitian and Symmetric Kernels; The Hilbert-Schmidt Theorem; Hermitization and Symmetricization of Kernels; Solution of Integral Equations with Green's Function Type Kernels; Miscellaneous.

(Chapter 2 of Text Book).

Unit – 3 : VOLTERRA INTEGRAL EQUATIONS:

Types of Volterra Equations, Resolvent Kernel of Volterra Equation ;Convolution Type Kernels; Some Miscellaneous Types of Volterra IntegralEquations.

INTEGRAL EQUATIONS AND TRANSFORMATIONS:

Preliminary; Fourier Integral Equations; Laplace Integral Equations; Hilbert Transform; Finite Hilbert Transforms; Miscellaneous Integral Transforms.

Unit – 4: APPROXIMATE METHODS.

General; Non-linear Volterra Equations; Non-liner Fredholm Equations; Approximate Methods of Solution for Liner Integral Equations; Approximate Evaluation of Eigen values and Eigen functions.

Scope and standard as in Problems and Exercises in Integral Equations, MIR Oybkusgers, Moscow, 1971 by M. Krsnov, A. Kiselev and G. Makarendo.

References:

1) Integral Equations and their Applications, WIT press, 25 Bridge Street, Billerica, MA 01821, USA, by M. Rahman.
2) Introduction to Integral Equations with Applications, John Wiley & Sons, 1999, by Jerri, A.
3) Linear Integral Equation, Theory and Techniques, Academic Press, 2014 by Kanwal R. P.
4) A first course in Integral Equations, 2nd edition, World Scientific Publishing Co. 2015 by Wazwaz, A. M.

Course outcomes: From this course students will be able to

1. Apply and analyze the integral equations in ordinary differential equations.
2. Find Hermitian and Symmetric Kernels
3. Gain the knowledge about the types of Volterra equations.
4. Evaluate solutions of Linear Integral Equations.

MAT 104: PRACTICAL-I
(Common with paper AMA 104 of Branch I (B) Applied Mathematics)
(Related to CC : (2A) & CC : (3A)

Practicals for Real Analysis: CC 102:2A

1. Write a program to find the largest value in an array of elements.
2. Write a program using pointers to compute the sum of all elements stored in an array
3. Write a program to illustrate error handling in the file operators.
4. Write a program of function power that computes X raised to the power Y for integers X and Y and return double type value.
5. Write a program which would print the alphabet set a to z and A to Z in decimal and character form.
6. Write a program to evaluate the equation sum $\sum_{i=1}^{n}\left(\frac{1}{i}\right)$ using a cost

Practicals for Differential Equations: CC 103:3A

1. Evaluate the Eigen Values and Eigen functions for the equation.
2. Explain the Power series solution of the given Differential equation
3. Obtain the solution of the D.E using Recurrence formula
4. Discuss the Legendre polynomial of degree n.
5. Evaluate the D.E $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$.
6. Determine the solution of Nonlinear PDE by Charpits Method.
7. Evaluate the solution of second order PDE.

.(OR)

MAT 104: PRACTICAL-I
(Common with paper AMA 104 of Branch I (B) Applied Mathematics)

(Related to CC :2B & CC :3B)

Practicals for Lattice Theory: CC 102:2B

1. Demonstrate lattice homomorphism between two lattices with a given function.
2. Given a finite-dimensional vector space, list all its subspaces and show that they form a lattice.
3. Construct Galois connections between different posets and verify the defining properties.
4. Create a Hasse diagram for a finite poset and define the corresponding topology.
5. Verify the modular property in the lattice of subspaces of a three-dimensional vector space.
6. Identify distributive sub-lattices within the modular lattice of subspaces of R^3

Practicals for Integral equations: CC 103: 3B

1. Convert an ODE to Integral equation
2. Write kernels in finite-sum form and solve related integral equations.
3. Determine if kernels are Hermitian or symmetric and study their integral equation solutions.
4. Verify Hilbert-Schmidt conditions and compute eigenvalues and eigenfunctions for kernels.
5..Construct and use Green's functions to solve integral equations.
6.Solve Volterra integral equations of various types using appropriate methods (resolvent kernels, Laplace transforms).
7 Apply Laplace transforms/ Hilbert transforms/ Fourier transforms to handle convolution-type integral equations.

SKILL ORIENTED COURSE (SOC-I)

MAT 105: SOC-1(A) - NUMERICAL METHODS
(Common with paper AMA 105: SOC-1(A) of Branch I (B) Applied Mathematics)

Course objectives:

1. To provide suitable Numerical Methods, for obtaining Roots of algebraic and Transcendental equations
2. To study of different methods of Interpolation.
3. To know the interpolation with unevenly spaced points.
4. To study the various methods of Numerical integration.

UNIT-I:

Solutions of Algebraic and Transcendental Equations: Introduction - Bisection method – Method of False position - Newton Raphson –method solutions of non linear equations – Method of iteration.

[Above topics are from 2.1 to 2.7, 2.12 of Chapter-2 of the Text Book]

UNIT-II:

Interpolation : Introduction - Finite Differences- Newton's formulae for interpolation- Newton's forward difference interpolation- Backward difference interpolation- Central interpolation formulae –Gauss's central difference formulae- Strilling's formula- Bessel's formula.

[Above topics are from 3.1, 3.3, 3.6, 3.7:3.7.1,3.7.2, 3.7.3 of Chapter-3 of the Text Book]

UNIT-III:

Interpolation with unevenly spaced points- Lagrange's Interpolation Formula - Divided Differences and their properties – Newton's general Interpolation Formula- Spline Interpolation [Above topics are from 3.9.1, 3.10.1, 3.13 of Chapter-3 of the Text Book]

UNIT-IV:

Numerical integration: Trapezoidal rule- Simpsons rules – numerical solution of ODEs by Picard – Euler - Modified Euler – Runge-Kutta methods.

[Above topics are from 5.4.1 to 5.4.3 of Chapter- 5 and 7.1 to 7.5 of Chapter- 7of the Text Book]

Text Book:

Scope and standard as 1."**Introductory methods for Numerical Analysis by S.S.Sastry fourth edition**".

Reference Book:

1. An Introduction to Numerical Analysis by Kendall E. Atkinson.
2. Information Technology and Numerical methods fot Atul Kahate
3. Theory and problems in Numerical Methods with programs in C and C++.
4. Numerical Methods and computing by Ward Cheney and David Kincaid
5. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S.R K. Iyengar, R. K. Jain, New Age International (p) Limited, Publishers, 5th Edition

Course Outcomes:

From this Course Students are able to

1. Solve Algebraic and Transcendental polynomial equations.
2. Understand Interpolation.
3. Study interpolation with unevenly spaced points
4. Analyze and evaluate the accuracy of area, volume by Numerical methods.

MAT 105: SOC- 1(B) - MATLAB
(Common with paper AMA 105: SOC- 1(B) of Branch I (B) Applied Mathematics)

Course Objectives:

1. Getting started with MATLAB
2. To create M-files.
3. To learn 2D and 3D Plotting Techniques.
4. To know how to write programs to solve Algebraic Equations

UNIT-I (Basics of MATLAB)
Getting Started with MATLAB- Different windows-Mathematical Operators and Mathematical functions-Creating matrices and arrays- Matrix algebra-Linear algebra concepts.

UNIT-II:. **(MATLAB Programming)**
M-files-Script files- Function files-Relational operators-conditional statements.

UNIT-III
Graphics: Basic 2-D plots- 3-D plots

UNIT-IV:Algebraic Equations: solving linear system-Gaussian elimination-finding eigen values and eigen vectors.

Scope and Standard as in:

1.Getting Started with MATLAB – A Quick Introduction for Scientists and Engineers, RudraPratap, Oxford University Press.

References:

1.. MATLAB Programming for Engineers. (4th ed.), Stephen J. Chapman, Cl Engineering.

2. MATLAB: Demystified -Basic Concepts and Applications, K KSarma, Vikas Publishing House Pvt Lt.

3. Engineering Problem solving with MATLAB, D.M.Etter, Printice-Hall

Course Outcomes: From this course students will be able to

1. Understand the mathematical operations & functions.
2. Able to write a program to addition & multiplication matrices.
3. Understand the 2-D plotting and 3-D plotting techniques.
4. Able to Solve Algebraic equations.

SKILL ORIENTED COURSE (SOC-2)

MAT 106: SOC-2(A): DISCRETE MATHEMATICS
(Common with paper AMA 106: SOC-2(A) of Branch I (B) Applied Mathematics)

The aim of the discrete mathematics is the study of mathematical structure that are fundamentally discrete rather than continuous.

Course Objectives:

1. To understand the connectives & tautology.
2. To study the mathematical structure that is countable or distinct and separable.
3. To learn sets functions, logic, calculus and analysis.
4. To study the Algebraic systems such as Lattices, Boolean Algebra and Boolean function.

UNIT –I:
Introduction – connectives – well formed formula Tautologies – Equivalence formulas – duality Tautological implications – Formula with distinct truth tables – Functionally complete sets of connectives.
(Sections 1.1 and 1.2 to 2.11 of Chapter 1)

UNIT – II:
Normal Forms-Disjunctive-Conjunctive Principal Disjunctive, Principal Conjunctive Normal Forms –Ordering and Uniqueness of Normal Forms. The theory of Inference for the statement Calculus-Rules of inferences – Consistency of Premises (Sections 1.3 and 1.4 of Chapter 1)

UNIT – III:

The predicate calculus-Inference Theory of the Predicate Calculus (Sections 1.5 and 1.6 of Chapter 1)

UNIT-IV:
Lattices and Boolean Functions: Lattices as partially Ordered sets-Lattices as Algebraic Systems – Minimization.
(Sections 4.1 of Chapter 4)

Scope and Standard as in the book **" Discrete Mathematical Structures With Applications To Computer Science" by Tremblay, J.P&Manohar, R-Published by McGraw-Hill International Edition -1987 Edition**

References: 1. Discrete Mathematics & Graph Theory by BhavanariSatyanarana& KunchamSyam Prasad, PHI Publications, New Delhi, Second Edition, 2014.
2. Mathematical Foundation of Computer Science, by Bhavanari Satyanarayana, T.V. Pradeep Kumar, SK. Mohiddin Shaw, BS Publications, Hyderabad.2016.

Course Outcomes: From this course students will be able to

1. Use standard notations of propositional logic.
2. Understand the truth tables for expressions involving negation, conjunction, and disjunction
3. Determine if a logical argument is valid or invalid.
4. Understand Lattices as algebraic systems.

MAT 106 SOC-2(B) - C-Programming language
(Common with paper AMA 106 SOC-2(B) of Branch I (B) Applied Mathematics)

Course Objectives:
1. To learn basic concepts in C-language
2.To know the various operators in C-Language

3. To draw conclusion by using decision making, branching and looping
4.To learn more about arrays

UNIT-I:
Constants, Variables, and Data Types: Introduction-Character set-C Tokens-Key words and Identifiers-Constants–Variables-Data types – Declaration of variables-Declaration of storage class – Assigning Values to Variables- Defining Symbolic Constants – Declaring a Variables as Constant- Declaring a Variable as Volatile- Overflow and Underflow of Data.

UNIT-II:
Operators and Expressions : Introduction - Arithmetic operators –Relational operators –Logical operators –Assignment operators- Increment and decrement operators –Conditional operators- Bitwise Operators-Special Operators – Arithmetic Expressions- Evaluation of Expressions-Precedence of Arithmetic Operators – Some Computational Problems-Type Conversions in Expressions –Operator Precedence and Associatively- Mathematical Functions .

UNIT-III:

Decision making and Branching : Introduction – Decision making with if Statement-Simple if Statement-The if…Else Statement –Nesting of if… Else Statements-The Else if Ladder-The Switch Statement – The ?: Operator- The Go to Statement.

UNIT-IV:
Decision Making and Looping: - Introduction-The While Statement – The do Statement-The for Statement-Jumps in Loops-Concise Test Expressions.
Arrays
Introduction - One Dimensional Arrays – Declaration of One-Dimensional Arrays- Initialization of One Dimensional Arrays-Two Dimensional Arrays – Initializing Two –Dimensional Arrays-Multi-Dimensional Arrays- Dynamic Arrays-More about Arrays.

Scope and Standard as in sections 2.1 to 2.14 of Chapter 2, 3.1 to 3.16 of Chapter 3, 5.1 to 5.9 of Chapter 5, 6.1 to 6.6, of Chapter 6, 7.1 to 7.9 of Chapter 7, of " Programming in ANSI C" by E. Balaguruswamy(Sixth edition) Mc. Graw Hill Edition, India.

References: **1.** Programming in C by D. Ravichandran, New Age International, 1998.
2. C and Data Structures by Ashok N. Karthane, Pearson Education.

Course Outcomes: From this course students will be able

1. To use different data types and variables in C-language
2. To decide the various operators in C-Language while writing a program
3. To able to use decision making, branching and looping
4 .To create arrays and learn more about arrays

MAT 107: PRACTICAL-II
(Common with paper AMA 107 of Branch I (B) Applied Mathematics)

(Related to SOC 1:1A &SOC 2:2A)

Practicals for Numerical Methods: SOC 1:1A

(Practicals with C-Programming)

1. Bi-section method.
2. False position method.
3. Newton Raphson method.
4. Trapezoidal rule.
5. Simpson's $3/8^{th}$ rule
6. Picard's Method
7. Euler method
8. Modified Euler method
9. Range-Kutta Method

Practicals for DISCRETE MATHEMATICS: SOC 2: 2A

1. Generate truth tables automatically for complex formulas.

2. Convert logical expressions into their Disjunctive Normal Form (DNF) and Conjunctive Normal Form (CNF).

3. Construct truth tables for NAND, NOR, and XOR connectives.

4. Apply Karnaugh maps (K-maps) to minimize Boolean functions.

5. Draw Hasse diagrams and visually represent lattices. (Use graphing tools or software like Graphviz or Gephi).

6. Construct examples of modular lattices and distributive lattices and demonstrate their properties.

(OR)

MAT 107: PRACTICAL-II
(Common with paper AMA 107 of Branch I (B) Applied Mathematics)
(Related to SOC 1:1B &SOC 2:2B)

Practicals for MATLAB: SOC 1:1B

1. Create any M-file
2. Creating arrays and Matrices
3. Basic 2D-plots
4. Basic 3D-plots
5. Solving system of algebraic equations
6. To find Eigen values and Eigen vectors

Practicals for C-Programming language: SOC 2:2B

1. write a C- program of the given problems.
2. Write a C-program to evaluate the power series.
3. Write a C-program using single subscripted variables.
4. Write a C-program using a two dimensional array.
5. Write a C-program to compute and print a multiplication.
6. Write a C-program for standard deviation.

MAT 108: edX/Swayam/NPTEL/ MOOCS

(Common with paper AMA 108 of Branch I (B) Applied Mathematics)

MAT 109: Ancient Indian Mathematics
(Common with paper AMA 109 of Branch I (B) Applied Mathematics)

Course objectives :

1. To know about Ancient Indian Mathematicians.
2. To create awareness on Ancient Indian Mathematics
3. To inculcate interest on History of Mathematics
4. To understand the development of basic concepts

UNIT – I : Heralding the Golden Age: Aryabhata I and his Followers:

Introduction – The Mathematics in Aryabhatiya- I and its followers Aryabhatiya –Geometry – series –Algebra –Indeterminate equations.

Unit- II: Riding the Crest of a Wave: From Brahmagupta to Mahavira- I:
The Mathematics in the Brahmasphut a siddhanta –arithmetic of calculation –Triangles and Quadrilaterals

Unit-III : Riding the Crest of a Wave: From Brahmagupta to Mahavira-II:
Geometry of circles –intersecting circles -Shadow Problems –intermediate analysis works of Brahmasphut a siddhanta –solution of Quadratic equations –volume of sphere – Mahavira –Unit fractions.

Unit-IV: The 500 Year Climax: Bhaskaracharya and His Legacy:
The Contents of Lilavati – Arithmetic calculation –Method if inversion –Solution of Cubic and biquadratic equations.

Scope and standard as **"Indian Mathematics Engaging with the World from Ancient to Modern Times" by** George Gheverghese Joseph University of Manchester, UK National University of Singapore, Singapore McMaster University, Canada.

Reference Book:

1. **"History Of Ancient Indian Mathematics" by Srinivasiengar .C.N ,The World press Calcutta**.

Course outcomes: From this course students will be able to

1. Know about our Ancient Indian Mathematicians.
2. Get awareness on Ancient Indian Mathematics
3. Develop interest in research through History of Mathematics
4. Able to solve problems using basic concepts .

M.Sc., MATHEMATICS
SEMESTER-II

MAT 201: GALOIS THEORY

Galois Theory plays an important role in the development of modern mathematics and it has large applications in computer science.

Course objectives:

1. Discuss extension fields and algebraic extensions.
2. To study the roots of polynomials and their symmetries in terms of Galois Groups
3. To introduce Galois Theory and understand applications of Galois theory.
4. To study applications and cyclotomic polynomials

UNIT –I:
Algebraic Extensions of Fields: Irreducible polynomials and Eisenstein's Criterion-Adjunction of roots- Algebraic extensions- Algebraically closed fields.

UNIT – II:
Normal and Separable Extensions: Splitting fields- Normal extensions- Multiple roots- Finite fields- Separable extensions.

UNIT – III:
Galois Theory: Automorphic groups and fixed fields- Fundamental theorem of Galois Theory- Fundamental theorem of Algebra.

UNIT-IV:
Applications: Roots of unity and Cyclotomic polynomials- Polynomials solvable by radicals- Ruler and compass constructions.

Syllabus and Scope and Standard as in **"Basic Abstract Algebra" by P.. Bhattacharya, S.K. Jain and S.R. Nagpaul, Cambridge University Press, Reprint 1997**. Sections15.1, 15.2, 15.3 and 15.4 of chapter 15, Sections 16.1, 16.2, 16.3, 16.4and 16.5of chapter 16,Sections 17.1, 17.2 and 17.3 of chapter 17 and Sections 18.1, 18.3 and 18.5 of Chapter 18.

Reference:

1. Topics in Algebra by I.N. Herstein.
2. Field and Galois Theory-Howie. J.M
3. Galois Theory II Edition-Steven.H. Weintraub
4. Fields and Galois Theory-J.S. Milne.
5. Galois theory by Joseph Rotman, Second Edition 1998 Springer Publisher.
6. Algebra by Artinn, 1991 PHI
7. Abstract Algebra by David S summit and Richard M Forte , Wiley publications, 3rd edition

Course outcomes:

1. Study the roots of polynomials specially quintic polynomials which is the cause to develop Galois theory.
2. Understand the concepts such as extension fields and splitting fields
3. Explain the normal and separable extensions

4. Solve the problems on cyclotomic polynomials.
5. Apply the knowledge on polynomials solvable by radicals
6. Learn applications of Galois theory to classical problems
7. Analyze ruler and compass constructions

MAT 202: 5(A) - COMPLEX ANALYSIS
(Common with paper AMA 202:5A - of Branch I (B) Applied Mathematics)

Complex analysis, traditionally known as the theory of functions of a complex variable, is the branch of mathematical analysis that investigates functions of complex numbers.

Course Objectives:

1. To define analytic functions and derivative rules of complex functions.
2. To introduce Mobius transformations and explain its applications.
3. To evaluate definite integrals using Cauchy integral formula.
4. To understand power series and expansion of analytic function**.**

UNIT –I :

Differentiation: Analytic Functions: Derivative Rules for Differentiating Complex Functions-The Cauchy-Riemann Equations –Analytic Functions-Geometrical Interpretation of Arg $f^1(z)$ and $|f^1(z)|$ - Conformal Mapping –The Mapping w = $\frac{az+b}{cz+d}$.

UNIT – II:

Mobius Transformations: The Group Property of Mobius Transformations – The Circle – Preserving Property of Mobius Transformations-Fixed points of a Mobius Transformation-Invariance of Cross Ratio-Mapping of a circle onto a Circle –Symmetry Transformations.

UNIT – III:

Complex Integrals: Cauchy Integral Theorem: Rectifiable Curves-Complex Integrals-The Case of Smooth Curves-Cauchy's Integral Theorem-The Key Lemma proof of Cauchy's Integral Theorem-Application to the Evaluation of Definite Integrals Cauchy's Integral Theorem for a system of Contours. Cauchy'tas Integral Formula –Morera's Theorem – Cauchy's Inequalities.

UNIT-IV:

Power Series: The Cauchy-Hadamard Theorem – Taylor Series. The Uniqueness Theorem for Power series-Expansion of an Analytic Function in a power series –Liouvill'es Theorem. The Uniqueness Theorem for Analytic functions.

Scope and Standard as in Chapters 3,5,7,8 and 10 of **"Introductory Complex Analysis" by Richard A. Silverman Dover Publications, Inc. (1972). New York**

References : 1 Complex Variables - Schaum outline series, 2/E by Speigel
2. An Introductions to Complex Analysis, by C.L. Siegel: North Holland.

Course outcomes:

1. Identify curves and regions in the complex plane defined by simple expressions.
2. Describe basic properties of complex integration and having the ability to compute such integrals.
3. Decide when and where a given function is analytic and be able to find it series development.
4. Describe conformal mappings between various plane regions.
5. Apply the concepts of Complex Analysis in many branches of mathematics, including algebraic geometry, number theory, analytic combinatorics, applied mathematics; as well as in physics, including the branches of hydrodynamics, thermodynamicsand particularly quantum mechanics.

MAT 202:5(B) - SEMIGROUP THEORY
(Common with paper AMA 202:5(B) of Branch I (B) Applied Mathematics)

Course Objectives:

1. Introduce basic definitions and examples of semi groups and semi Lattices.
2. Discuss free semi groups and lattices of equivalences.
3. Explain Ree's theorem& primitive Idempotents.
4. Analyze O-simple semi groups and free semi groups with Illustrations.

UNIT-I

Basic definitions – Homogenic Semigroups – Ordered sets- Semi lattices and lattices – Binary relations- Equivalences- Congruences.

UNIT-II

Free Semi groups Ideals and – Rees Congruences. Lattices of equivalences and congruences – Green's equivalences. The structure of D.Classes – regular semigruops.

UNIT-III

Simple and Q-Simple semi groups. Principle factors, Rees's Theorem, Primitive idempotents.

UNIT-IV

Congruences on completely O-Simple semi groups. The Lattice of Congruences on a completely O-Simple semi groups. Finite Congruences, free semi groups.

Text Book :

An Introduction to Semi group Theory by J.M. Howie (1976), Academic Press, (Content of the Syllabus : Chapters-I, II and III).

Course Out comes:

1. Understand semi groups with the properties.
2. Explain the structure of D.Classes – regular semigruops.
3. Obtain proofs of Rees's Theorem.
4. Know the congruences on completely O-Simple semi groups

MAT 203:6A - TOPOLOGY
(Common with paper AMA 203:6A of Branch I(B) Applied Mathematics)

Topological concepts play important role in the development of modern mathematics and it has large applications in theoretical physics.

Course Objectives:

1. This course aims to teach the fundamentals of point set topology and constitute an awareness of need for the topology in Mathematics.
2. Introduce the basic definitions and standard examples of topological spaces.
3. Define and illustrate a variety of topological properties such as compactness, connectedness and separation axioms.
4. Explain the idea of topological equivalence and define homeomorphisms.

UNIT –I :

Metric spaces:-open sets-closed sets- convergence-completeness and Baire's theorem-Continuous mappings – Cauchy's Inequality and Minkowski's Inequality.

UNIT – II:

Topological Spaces, definition & examples-open bases and open sub bases- compact spaces

UNIT – III:

Product of spaces-Trychonoff's theorem -compactness for Metric spaces.

UNIT-IV:

Separation $-T^1$ space and Hausdorff spaces –completely regular spaces and Normal spaces – Urysohn's lemma- Tietze extension theorem-Urysohn's imbedding theorem.

Articles 9 to 14,16,17,18,21, 22, 23, 26-29 and 31 of Chapters II,III,IV,V,andVI of **Introduction to Topology and Modern Analysis" by G.F. Simmons of MC Graw Hill Publishing company, ltd**.

Reference:

1. 'Topology' by K.ChandraSekharaRao, Narosa Publications
2. "Topology" by J.P. Chauhan, J.N. Sharma, Krishna Publications
3. "General Topology" by M.G. Murdeshwar, new age International publications

Course Outcomes:

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

1. Understand to construct topological spaces from metric spaces and using general properties of neighbourhoods, open sets, closed sets, basic and sub-basis.
2. Apply the properties of open sets, closed sets, interior points, accumulation points and derived sets in deriving the proofs of various theorems.
3. To understand the concepts of countable spaces and separable spaces.
4. They know what we mean by connectedness, compactness, and hausdorf property and their general characteristics.
5. Understand the Countability axioms, the separation axioms and normal spaces.
6. Understand the classical theorems such as the Uryshon lemma, the Tietze extension theorem.

MAT 203:6B - LINEAR ALGEBRA

Course Objectives:

1. To study System of Linear Equations.
2 .To introduce the notions of abstract vector spaces and linear transformations.
3. To know the Direct-sum decompositionscyclic decomposition, Rational and Jordan forms.
4. To study Bilinear Forms.

UNIT –I:

Linear Equations:

Systems of Linear Equations, Matrices and Elementary Row
Operations, Row-Reduced Echelon Matrices.

UNIT –II:

Vector Spaces & linear transformations:

Vector Spaces, Subspaces, Bases and Dimension, Ordered basis and coordinates. Linear transformations, Rank-NullityTheorem, The algebra of linear transformations, Isomorphism, Matrix representation of linear transformations, Linear Functionals, Annihilator, Double dual, Transpose of a linear transformation. Characteristic Values and Characteristic Vectors of linear transformations.

UNIT –III:

Direct-sum decompositions:

Direct-sum decompositions –Invariant Direct sums.The primary decomposition theorem –cyclic subspaces and annihilators –cyclic decomposition, Rational and Jordan forms

UNIT –IV:

Bilinear Forms:

Bilinear Forms –Symmetric Bilinear Forms –Skew-Symmetric Bilinear Forms –Groups Preserving Bilinear Forms.

Text books:

1. K. Hoffman, R. Kunze, Linear Algebra, Prentice Hall of India, (2015).

2. Gilbert Strang, Introduction to Linear Algebra, Wellesley-Cambridge Press, (2009).

References:

1. I. N. Herstein, Topics in Algebra, Wiley, (2006).
2. S. Axler, Linear Algebra Done Right, Springer, (2004).
3. S. Lang, Linear Algebra, Springer, (2004).
4. S. Kumaresan, Linear Algebra: A Geometric Approach, Prentice Hall India, (2009).
5. M. Artin, Algebra, Pearson Education India, (2010).

Course outcomes: After completing this course the student will be able to

1. Solve the system of linear equations
2. Understand the concept of vector space, basis, dimension and linear Transformation
3. Explain the direct sum decompositions
4. Understand the Bilinear forms.

MAT 204 : PRACTICAL-III
(Related CC: 5A &CC: 6A)
(Common with paper AMA 204 of Branch I (B) Applied Mathematics)

Practicals for Complex Analysis: CC: 5A

1. Apply the derivative rules to differentiate several complex functions.
2. Verify that a function is analytic in a given domain by the Cauchy-Riemann equations.
3. Evaluate integrals of different analytic functions over smooth curves (like circles or ellipses).
4. Evaluate specific integrals using Cauchy's Integral Formula.
5. Derive the Taylor series expansion for given functions .
6. Compute the cross ratio of four distinct points in the complex plane.
7. Verify the given transformation is Mobius transformation.

Practicals for Topology: CC:6A

1. Write a program to evaluate the roots of the equation.
2. Write a program to evaluate the power series
3. Write a program to determine the range of values and the average cost of a personal computer in the market.
4. Write a program to evaluate the series $\left(\frac{1}{1-x}\right)$.
5. Write a program to using single- subscribed variable to evaluate the expression total= $\sum_{i=1}^{10}\left(x_i^2\right)$.
6. Write a program to read a line of text containing a series of words from the terminal.

(OR)

MAT 204: PRACTICAL-III
(Related CC: 5B & 6B)
(Common with paper AMA 204 of Branch I (B) Applied Mathematics)

Practicals for Semigroup Theory: CC:5B

1. Construct the Cayley graph of the free semigroup generated by X={a,b} up to length 2.
2. Work with generating sets, ideals, and construct Rees congruences.
3. Explore the lattice structure of equivalences and congruences, and analyze Green's equivalences for given semigroups.
4. Study the structure of D-classes in regular semigroups, construct examples.
5. Construct examples and identify principal factors, verifying simplicity and Q-simplicity.
6. Apply Rees's Theorem to constructcompletely 0-simple semigroups and identify primitive idempotents.

7.Explore congruences and the lattice structure of congruences, particularly in Rees matrix semigroups.

Practicals for Linear Algebra: CC:6B

1. Test the consistency of system of linear equations
2. Reduce row echelon form of simultaneous equations
3. Verify Rank-Nullity theorem for the Linear Transformation
4. Obtain he Characteristic equation, eigen values and eigen vectors of linear system of Equations.

5 . Explain the Jordan canonical form of the characteristic polynomial of linear transformation.

6. Write the Bilinear form corresponding to a given matrix.

SKILL ORIENTED COURSE (SOC-II)

MAT 205: SOC: 3A - MATHEMATICAL STATISTICS
(Common with the paper AMA 205: SOC-3A of Branch I(B) Applied Mathematics)

Course objectives:

1. To introduce basic concepts of statistics and the probability set functions.
2. To study the Binomial, Poisson, Gamma, chi-square, normal distribution.
3. Explain stochastic convergence
4. To explain the objective of Point estimation-Measures of quality of estimations.

UNIT –I:
Probability and Distributions:

Introduction-The probability set function – Conditional probability- Independence-Random variables–The distribution function-Expectations-Some special mathematical expectations – Chebyshev's inequality. (Section 1.1 to 1.10 of chapter 1)

UNIT- II:
Marginal and conditional distributions- Distributions of two variables- conditional distributions and expectations-The Correlation coefficient- Independent of Random variables. (Section 2.1 to 2.4 of chapter 2)

UNIT–III:
The Binomial, Poisson, Gamma, chi-square and Normal distribution. Distributions of functions of Random variables –Sampling theory- Transformation of Variables of Discrete type-Transformation of Variables of the continues type. (Section 3.1 to 3.4 of chapter 3, sections 4.1 to 4.3 of chapter 4)

UNIT – IV:

The t and F Distributions – Distribution of order statistics –The moment generating function Technique-The Distribution of X and Limiting distribution –Stochastic convergence-Limiting moment generating function-The central limit theorem. (Section 4.4, 4.6 &4.7 of chapter 4, 5.1 to 5.4 ofchapter 5)

Scope and Standard as in " Introduction to Mathematical Statistics" by Robert V. Hogg Allen T. Craig, Macmillan publishing co., Inc., New York -1978,

References: 1. Mathematical Statistics by J.N. Kapur, H.C. Saxena- S. Chand Publications
2. Introduction to Mathematical Statistics Robert V Hogg, Allencraig, Joseph W Mekean , Pearson Publishers
3. Fundamentals of mathematical Statistics by S.C.Gupta and V.K.Kapoor, 11th edition S.Chand and sons, New Delhi
4. Probability and Statistics for engineers and scientists by Walpole Myers and Keying ye, ninth edition, Pearson Publications

Course outcomes:

1. To learn the fundamental concepts of statistics and techniques required for data analysis.
2. Apply the knowledge of Binomial, Poisson, Gamma, chi-square, normal distribution in solving various problems,.
3. To explain stochastic convergence
4. To discuss measures of quality of estimations

MAT 205: SOC- 3(B) - DATA STRUCTURES AND ALGORITHMS
(Common with the paper AMA 205: SOC-3 (B) of Branch I(B) Applied Mathematics)

Course objectives:

1. Learn complexity analysis with examples
2. Study queues operations and applications of queues
3. Acquire knowledge on Binary trees and representations
4. Understand Basic algorithms to sort and to find the shortest paths

Unit-I

Performance and Complexity Analysis: Space Complexity, Time Complexity, Asymptotic Notation (Big-Oh), Complexity Analysis Examples.

Stacks: Basic Stack Operations, Representation of a Stack using Static Array and Dynamic Array, Multiple stack implementations using single array

Stack Applications: Reversing list, Factorial Calculation, In fix to post fix Transformation, Evaluating Arithmetic Expressions.

Unit-II

Queues: Basic Queue Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack

Applications of Queues: Round Robin Algorithm, Circular Queues.

Linked Lists: Introduction, Single Linked List, Representation of a Linked List in Memory,DifferentOperationsonaSingleLinkedList,ReversingaSingleLinkedList, Advantages and Disadvantages of Single Linked List, Circular Linked List, Double Linked List and Header Linked List.

Unit-III

Trees: Definition of Tree, Properties of Tree, Binary Tree, Representation of Binary Trees using Arrays and Linked Lists, Operations on a Binary Tree, Binary Tree Traversals (recursive), Binary Search Tree.

Hashing: Hash Table Representation, Application-Text Compression.

Unit-IV

Basic Search Algorithms: Linear Search and Binary Search Techniques and their Complexity Analysis.

Basic Sorting Algorithms: Bubble Sort, Insertion Sort, Selection Sort

Divide-and-Conquer Algorithms: merge sort, quick sort

Basic Graph Algorithms: traversals and shortest path.

Scope and Standard as in Data Structures and Algorithms by Alfred V. Aho,John E. Hopcraft and JefrynD. Ullman

References:

1. Data Structures and Algorithms by R.D.Sathiya
2. Data Structures and Algorithms Made Easy" by Narasimha Karumanchi
3. Data Structures and Algorithm Analysis in C++" by Mark Allen Weiss
4. Data Structures and Algorithm Analysis in Java" by Mark Allen Weiss

Course outcomes:

1.To understand the complexity analysis
2. To use queues operations and study applications of queues
3. To understand Binary trees and representations
4. To explain Basic sorting algorithms and Basic graph algorithms to find the shortest paths

MAT 206: SOC- 4A: OPERATIONS RESEARCH FOR INDUSTRY AND COMMUNITY DEVELOPMENT

(Common with the paper AMA 206: SOC-4A of Branch (B) Applied Mathematics)

Course Objectives:

1) To understand Linear Programming Methods
2) To solve linear programming problem through Dynamic Programming.
3) To introduce game theory.
4) To analyze Critical path method and program Evaluation and Review Technique.

UNIT –I :
Linear programming: Graphical Method-Simplex Method-Big M Method-Two phase method - Transportation Problem-(Sections 2.4 and 2.5.1, 2.5.2, 2.5.4 of chapter 2,sections 3.2, 3.3 and 3.4 of chapter 3).

UNIT – II:
Dynamic programming: Introduction –Capital Budgeting problem –Reliability improvement problem –Stage coach problem –Optimal subdividing problem (Chapter 8)

UNIT-III:
Game Theory: Introduction -Game with Pure Strategies-Game with Mixed Strategies – Dominance property-Graphical Methods for 2xn and mx2 Games. (Chapter 12)

UNIT-IV:
Project Management: Guidelines for Network Construction –Critical Path Method (CPM) – Program Evaluation and Review Technique (PERT) (Sections 10.3,10.4 and 10.6 of Chapter 10)

Scope and standard as **"OPERATIONS RESEARCH" By pannerselvam, R. published by Prentice Hall of India, New Delhi, 2002Edition,**

References: 1. Introduction to Management Sceicne " Operation Research" by Manmohan . P.K. Gupta, Kantiswarup, Sultan Chand & Sons Publishing house.
2. Operations Research –Theory and Applications by J.K. Sharma- Macmillan Publishers, India.
3. Operations Research –by Gupta, Prem Kumar, Hira S. Chand Publishers

Course Outcomes:

1) Formulate some real life problems into Linear Programming Problems.
2) Understand Dynamic Programming.
3) Solve the problems of Game with pure Strategies and Mixed Strategies.
4) Construct Reliable Networks.

MAT 206: SOC- 4B - Python

(Common with paper AMA 206: SOC- 4B of Branch I (B) Applied Mathematics)

Course Objectives:

1. To get familiar with Pyhon
2. To learn various operators and conditional statements
3. To create Modules and Strings
4. To understand functions, files and lists

Unit -I:- Basics of Python: Python Installation and Working of it, get familiar with python variables and data types, Operator understanding and its usage, understanding of python blocks
Operators in Python: Arithmetic Operators, Relational Operators, Assignment Operators, Logical Operators, Bitwise Operators, Shift Operators, Ternary Operators, Membership Operators, Identity Operators, Expressions and order of evaluations.
Input and Output statements: input() function, reading multiple values from the keyboard in a single line, print() function, 'sep' and 'end' attributes, Printing formatted string, replacement operator ({}).
Control flow statements: Conditional statements – if, if-else and if-elif-else statements. Iterative statements – for, while. Transfer statements – break, continue and pass.

Unit-II:-Functions: Defining Functions, Calling Functions, Types of Arguments - Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Function Returning Values, Global and Local Variables.
Modules: Creating modules, import statement, from Import statement.
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Unit-III:- Lists: Creation of list objects, Accessing and traversing the elements of list. Important functions of list – len( ), count( ), index( ), append( ), insert( ), extend( ), remove( ), pop( ), reverse( ) and sort( ).

Basic Operations on List: Aliasing and Cloning of List objects, Mathematical Operators for list objects, Comparing list objects, Membership operators on list, Nested Lists, List Comprehensions.

Tuples: Creation of Tuple objects, Accessing elements of tuple, Mathematical operators for tuple, Important functions of Tuple – len( ),count( ),index( ), sorted( ), min( ), max( ), cmp( ).Tuple Packing and Unpacking.
Files: Opening files, Text files and lines, Reading and writing files, Searching through a file, Using try, except and open, handling exceptions, debugging.

Unit-IV

Scientific and Mathematical Computing Using Python: Numerical Computing using NumPy, Matplotlib, SciPy

Python libraries and modules used in Data Science, AI and ML: Pandas, tensorflow, scikit-learn, pytorch, keras etc...

Scope and Standard as in "Learn Python the right way How to think like a computer scientist, Ritza," 2021-2022
References:

1. Think Python: How to Think Like a Computer Scientist', 3rd edition, Allen B. Downey, O'Reilly 2024
2. Learning To Program With Python. Richard L. Halterman. Copyright © 2018

Course Outcomes: After completion of this course students are able to

1. Familiar with basic concepts of Pyhon
2. Make use of various operators and conditional statements
3. Create Modules and Strings
4. Understand functions, files and lists

MAT 207: PRACTICAL-III
(Related to SOC -3A and 4A)
(Common with paper AMA 207: SOC-3A and 4A of Branch I (B) Applied Mathematics)

Practicals on Mathematical Statistics –SOC 3A

1. Basic programs to find mean, median and mode
2. Binomial distribution
3. Poisson Distribution
4. Normal Distribution
5. t-distribution
6. F-distribution

Practicals on Operations Research for Industry and Community Development:

SOC-4A:

1. A computer manufacturing company has the following monthly compensation policy to their sales-person:
Minimum base salary: 1500.00
Bonus for every computer sold: 200.00
Commission on the total monthly sales: 2 percent
Since the prices of the computers are changing, the Sales price of each computer program is fixed at the beginning of every month to compute a sales person's gross Salary.
2. The cost of operation of a unit consists of two components C_1 and C_2 which can be expressed as functions of a parameter p as follows:
$C_1 = 430-8P$ $C_2=10+p^2$ The parameter ranges from 0 to 10. Determine the Value of P with an accuracy of +0.1 where the cost of operation would be minimum.
3. In an organization, the employers are grouped according to their basic pay for the purpose of certain perks. The pay-range and the number of employees in each group are as follows:

Group	Pay-Range	No. of Employees
1	750-1500	12
2	1501-3000	23
3	3001-4500	35
4	4501-6000	20
5	above 6000	11

Draw a histogram to highlight the group sizes.

4. Plot the graphs of the functions of the type $y_1 = \exp(-ax)$, $y_2 = \exp(-ax^2/2)$ for x varying from o to 5.0.

5. Write a program to calculate the ratio a/b-c

6. Write a program that selects and prints the largest of the three numbers using nested if... else statement.

(OR)

MAT 207: PRACTICAL-IV
(Common with paper AMA 207 of Branch I (B) Applied Mathematics)
(Related to SOC -3B and 4B)

Practicals for Data Structures and Algorithms: SOC-3(B)

1. Round Robin Algorithm
2. Basic Search Algorithms: Linear Search and Binary Search
3. Basic Sorting Algorithms: Bubble Sort, Insertion Sort, Selection Sort
4. Divide-and-Conquer Algorithms: merge sort, quick sort

5. Basic Graph Algorithms: traversals and shortest path.

Practicals for Python: SOC-4(B)

1. Create a 2D array (matrix) and compute the transpose.
2. Perform numerical integration
3. Solve differential equations
4. Solve initial value problem
5. Implement a linear regression model to predict house prices.

MAT 208 : edX/Swayam/NPTEL/ MOOCS

MAT 209: Vedic Mathematics
(Common with paper AMA 209 of Branch I (B) Applied Mathematics)

Course objectives:

1. To inculcate interest on Vedic Mathematics.
2. To understand the development of basic concepts
3. To know about Vedic Sutras.
4. To create awareness on Vedic techniques

Unit -I:-Actual applications the Vedic Sutras- Arithmetical computations- Factorization

Unit-II:- Simple equations-simultaneous simple equations-quadratic equations- cubic equations

Unit-III:-Partial fractions-integration by partial fractuions.

Unit-IV:-Vedic Numerical code -recurring decimals

Standard Text Book:
Vedic Mathematics by Jagadguru Swamisri Bharathi Krsna Thirthaji Maharaja

Course Outcomes: After the completion of the course students are able to

1. Understand Vedic sutras and Techniques
2. Solve simple equations using Vedic formulae
3. Apply techniques to integrate by partial fractions
4. Write Numerical code

M.Sc., APPLIED MATHEMATICS

SEMESTER-I

AMA101: METHODS OF APPLIED MATHEMATICS

Course Objectives:

1. To familiarize students with a range of mathematical methods that are essential for solving advanced problems in theoretical physics.
2. To study Fourier series and Fourier Transforms.
3. To understand the applications of Sylow's Theorems.
4. To discuss the algebraic structures U.F.D, E.D and polynomial rings.
5. To investigate applications to problems in economics, management and related areas.
6. To develop the understanding of the theoretical concepts behind these methods.

UNIT I:

Fourier Transforms : Dirichlet conditions – Fourier integral formula –The (Complex) Fourier transform – Fourier sine and cosine transforms-Relationship of Fourier and Laplace transforms – Some useful results for direct applications-Linearity property of Fourier transforms –Change of scale property –Shifting property—Modulation theorem –Convolution or Falting-The convolution or Falting theorem for Fourier transforms –Parseval's identity for Fourier transforms Rayleigh's theorem of Plancherel's theorem – Relation between the Fourier transforms of the derivatives of a function –Multiple Fourier transforms-Applications of Fourier transforms to Boundary value problems. (Chapter 4)

UNIT-II

Finite Fourier Transforms: Fourier Series –The finite Fourier sine transform-The finite Fourier cosine transforms –Relation between the finite Fourier transforms of the derivations of a function –Multiple finite Fourier transforms –Applications of finite Fourier transforms to boundary value problems-Special case of boundary value problem (Chapter 5)

Scope and standard as in **" Integral Transforms" by Raisinghania, published by S. Chand & Co., New Delhi, 1995 Editon.**

ALGEBRA:

UNIT: III

Structure Theorems of Groups : Conjugacy and G-Sets, Normal series, Sovable groups, Simplicity of A_n, Sylow theorems.

(Sections 4 of Chapter 5, Sections 1 and 2 of Chapter 6, Section 3 of Chapter 7 and Sections 4 of Chapter 8)

UNIT IV : UNIQUE FACTORIZATION AND EUCLIDEAN DOMAINS:

Unique factorization domains-Principal ideal domains-Euclidean domains-Polynomial rings over UFD(chapter 11)

Scope and standard as in **"Basic Abstract Algebra" by Bhattacharya , P.B. Jain, S.K. and Nagpul S.R, Cambridge University Press, 1997 Reprint**

References: 1. Topics in Algebra – I.N. Herstein

Course outcomes:

1. Understand basic concepts of complex analysis including the important integral theorems.

2. Determine the residues of a complex function and use the residue theorem to compute certain types of integrals.
3. Solve ordinary second order differential equations particulary in the physical sciences; solve physically relevant partial differential equations using standard methods like separation of variables, series expansion (Fourier-type series), and integral transforms.
4. Expand a function in a Fourier series and able to know under what conditions such an expansion is valid.
5..Aware of the connection between integral transforms (Fourier and Laplace) and be able to use the latter to solve mathematical problems relevant to the physical sciences.
6. Receive basic training in tensor calculus.

AMA 102:2(A) - Real Analysis
(Common with the paper MAT 102:2(A) of Branch 1(A) Mathematics)

This course covers Riemann-Stieltjes Integral, Sequences and Series of Functions, Functions of Several Variables, Improper Integrals, Fourier series, Maxima and Minima.

Course Objectives:

1) Acquire knowledge on Riemann-Stieltjes Integration and Differentiation.
2) Discuss Uniform Convergence, Continuity Integration and Differentiation
3) Learn comparison Tests
4) Understand the concept of functions of several variables.

UNIT –I:
The Riemann –Stieltijes Integral: Definition and Existence of the integral properties of the integral, integration and Differentiation, Integration of vector valued function, Rectifiable curves.

UNIT – II:
Sequence and series of functions: Discussions of main problem, uniform convergence, uniform convergence and continuity, Uniform convergence and Integration, Uniform convergence and Differentiation.
Scope and standard as in Chapters 6, sections 7.1 to 7.18 of chapter 7 of Walter Rudin" Principles of Mathematical Analysis" 3rd edition 1976, Nc. Graw hill International student edition.

UNIT – III:

Improper Integrals: Introduction, Integration of unbounded functions with finite limit of Integration, comparison tests for convergence at a ∞, infinite Range of Integration.
Fourier series: Trigonometrically series, some preliminary theorems.

UNIT-IV:

Functions of Several Variables : Explicit and Implicit functions, Continuity, Partial derivations, differentiability, partial derivatives of higher order, differentials of higher order, function of functions, change of variables, Taylor's theorem, Extreme values, Maxima and Minima, functions of several variables.

Scope and standard as in chapters 11, 12 and 15 of **Mathematical Anlaysis by "S.C. Malik 1994" Wiley Eastern limited**

Reference:

(1) Mathematical Analysis- A modern Approach to Advanced Calculus Narosa Book Distributors Pvt LTD- New Delhi
(2) Real Analysis - Golden Math Series By N.P. Bali.
(3) A course of Mathematical Analysis by Shanti Narayan -.K. Mittal , S-Chand & Company LTD-New Delhi

Course Outcomes:

1. Understand the concepts of Riemann Stieltijes integration and Differentiation.
2. Understand Uniform Convergence and continuity.
3. Learn comparision tests at a and infinity.
4. Analyze the concept of functions of several variables.

AMA 102:2B - VISCOUS FLOWS

Course objectives:

1. To introduce and explain fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.

2. To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.

3. To determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies.

UNIT – I:

General theory of stress and rate of strain –Nature of stresses –Transformation of stress components –Nature of Strain Transformation of rates of strain –Relation between stress and rate of strain.

UNIT – II:

Fundamental equations of the flow of viscous incompressible fluids –The equation of continuity -conservation of momentum –the energy equation – conservation of energy –the equations of

state –perfect gases –the fundamental equations in cylindrical coordinate –equation of continuity –equations of motion –the energy equation.

UNIT –III:

Laminar flow of viscous incompressible fluids –similarity of flows –The Reynold's number – Viscosity from the point of view of the kinetic energy –Flow between parallel flat plates –couttee flow –plane Poiseuille flow –steady flow through a pipe –the Hagen Poiseuille flow –flow between two co-axial cylinders –Flow between two concentric Rotating cylinders –Applications of the parallel flow theory –The measure of viscosity –Hydro dynamics of bearing Lubrication – Steady flow around a sphere –the theory of very slow motion –unsteady motion os a flat plate

UNIT – IV:

The Laminar Boundary layer –properties of Navier-Stokes equations - Boundary layer concepts –The Boundary layer equations in two dimensional flow –The Boundary layer along a Flat plate –Blasius solution – Shearing stress and boundary layer thickness - Boundary layer as a surface with pressure Gradient –Momentum Integral theorems for the boundary layer –The Von Karman Integral relation.

Course outcomes: From this course students will be able to

1. Employ Bernoulli's equation for real flow and deduce expressions for orifice meter and Venturimeter.

2. Establish Hagen Poisueille's equation for laminar flow through pipe and parallel plates.

3. The course provides the student with knowledge about: - Formulating and solving problems in fluid mechanics where viscosity and heat conductivity are of importance, in particular at high Reynolds numbers where the boundary layer approximation applies. - Primary focus is on the laminar flow regime. Briefly about stability and transition to turbulence. - Quantitative methods for classical cases, such as Stokes problems, stagnation point flow, Blasius and Falkner-Skan problems, and integral methods for other boundary layers with pressure gradient and possible separation

Standard and treatment as in Articles 4.1 to 4.5 of chapter 4, Articles 5.1 to 5.6, Articles 8.1 to 8.8 of Chapter 8 and Articles9.1 to 9.5a of chapter 9 of **"FOUNDATIONS OF FLUID MECHANICS" by S.W.Yuvan, Prentice Hall of India Pvt.ltd. New Delhi,1969**.

AMA 103:3A - DIFFERENTIAL EQUATIONS
(Common with paper MAT 103:3A of Branch I (A) Mathematics)

This course introduces fundamental knowledge in Differential Equations that is applicable in the engineering aspects. Also it is designed to strengthen the fundamental knowledge of P.D.Es which lead to understand the real world problems.

Course objectives:

1. To find solutions of power series and second order linear equations.
2. To provide knowledge on Special functions -Legendre polynomials and properties of Bessel functions.
3. To find integral surface passing through given surface using P.D.E
4. To explain methods to solve Linear P.D.Es with constant and Variable coefficients

UNIT –I:

Eigen values, Eigen functions –Series solutions of first order equations –Second order linear equations-Ordinary points-Regular singular points.

UNIT – II:

Legendre polynomials – properties of Legendre polynomials –Bessel functions –The gamma function- Properties of Bessel functions

UNIT –III:

Differential Equations in more than two variables: Methods of solutions of dx/P =dy/Q = dz/R-. (Sections 3, of Chapter 1)-Partial Differential Equations of the First order: Partial Differential equations-Origins of first order partial differential equations-Cauchy's problems for first order equations-Linear equations of first order -Charpit's method.(Sections 1,2,3, 4,5,6 and 10 of Chapter 2)

UNIT – IV:

Partial Differential Equations of the Second order: The Origin of second order equations –Linear partial differential with constant coefficients-Equations with variable coefficients. (Sections 1, 4 and 5 of Chapter 3).

Scope and standard as in 1. **"Differential Equations with Applications and Historical notes" by George F. Simmons, (1992)** Tata McGraw Hill Publications for Units I & II**.**
2. "Elements of Partial Differential Equations" by IAN Sneddon for Units III & IV.

References:

1. Advanced Differential Equations, M.D. Raisinghania , S. Chand Publications
2. Differential Equations" Ross, Shepley L Wieley India Pvt LTD.
3. Engineering Mathematics y Bali NP, SatyanarayanaBhavanari, kelkar, University

Science Press, New Delhi 2012.
4. An introduction to O.D.E by Earl.A.Coddington , Prentice Hall of India Private Limited, New Delhi 1991.
5. Theory of ODE by Sam Sundaram, Narosa Publications
6. Ordinary and Partial Differential Equations by M.D. Raisinghania.
7. An elementary course to P.D.E by T.Amarnath, Second Edition, Narosa publishing house.

Course outcomes: From this course students will be able to

1. Find solutions of power series and second order linear equations.
2. Acquire knowledge on Special functions -Legendre polynomials and properties of Bessel functions.
3. Analyze the origin of first order PDEs and Integral surfaces passing through a given Curve
4. Identify linear and nonlinear PDE and solve nonlinear PDE by Charpit's method.

AMA 103:3B - INTEGRAL EQUATIONS

(Common with paper MAT 103:3B of Branch I (A) Mathematics)

Course Objective

1. To study the compact linear operators, which play an important role in the theory of integral equations.
2. Banach fixed point theorem helps us to get the existence of solutions of linear algebraic equations, ordinary differential equations and integral equations.
3. To understand the Banach fixed point theorem and its applications to ordinary differential equations and integral equations.

Unit – 1 : PRELIMINARY CONCEPTS

Introduction; Some Problems which give Rise to Integral Equations; Conversion of Ordinary Differential Equations into Integral Equations; Classification Linear Integral Equations; Integro-differential Equations.

Unit – 2 : FREDHOLM EQUATIONS

Analogies with Matrix Algebra; Degenerate Kernels; Hermitian andSymmetric Kernels; The Hilbert-Schmidt Theorem; Hermitization andSymmetricization of Kernels; Solution of Integral Equations with Green's FunctionType Kernels; Miscellaneous.

(Chapter 2 of Text Book).

Unit – 3 : VOLTERRA INTEGRAL EQUATIONS:

Types of Volterra Equations, Resolvent Kernel of Volterra Equation;Convolution TypeKernels; Some Miscellaneous Types of Volterra IntegralEquations.

INTEGRAL EQUATIONS AND TRANSFORMATIONS:

Preliminary; Fourier Integral Equations; Laplace Integral Equations; Hilbert Transform; Finite Hilbert Transforms; Miscellaneous Integral Transforms.

Unit – 4 : APPROXIMATE METHODS.:

General; Non-linear Volterra Equations; Non-liner Fredholm Equations;Approximate Methods of Solution for Liner Integral Equations; ApproximateEvaluation of Eigenvalues and Eigen functions.

Scope and standard as in Problems and Exercises in Integral Equations, MIR Oybkusgers, Moscow, 1971 by M. Krsnov, A. Kiselev and G. Makarendo.

References:

1) Integral Equations and their Applications, WIT press, 25 Bridge Street, Billerica, MA 01821, USA, by M. Rahman.
2) Introduction to Integral Equations with Applications, John Wiley & Sons, 1999, by Jerri, A.
3) Linear Integral Equation, Theory and Techniques, Academic Press, 2014 by Kanwal R. P.
4) A first course in Integral Equations, 2nd edition, World Scientific Publishing Co. 2015 by Wazwaz, A. M.

Course outcomes: From this course students will be able to

1. Apply and analyze the integral equations in ordinary differential equations.
2. Find Hermitian and Symmetric Kernels
3. Gain the knowledge about the types of Volterra equations.
4. Evaluate solutions of Linear Integral Equations.

AMA 104: PRACTICAL-I
(Common with paper MAT 104 of Branch I (A) Mathematics)

(Related to CC 2:5A & 3:6A)

Practical for Real Analysis CC 2:5A

1. Write a program to find the largest value in an array of elements.
2. Write a program using pointers to compute the sum of all elements stored in an array
3. Write a program to illustrate error handling in the file operators.
4. Write a program of function power that computes X raised to the power Y for integers X and Y and return double type value.
5. Write a program which would print the alphabet set a to z and A to Z in decimal and

character form.

6. Write a program to evaluate the equation sum $\sum_{i=1}^{n}\left(\frac{1}{i}\right)$ using a cost

Practicals for Differential Equations: CC 3:6A

1. Evaluate the Eigen Values and Eigen functions for the equation.
2. Explain the Power series solution of the given Differential equation
3. Obtain the solution of the D.E using Recurrence formula
4. Discuss the Legendre polynomial of degree n.
5. Evaluate the D.E $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$.
6. Determine the solution of Nonlinear PDE by Charpits Method.
7. Evaluate the solution of second order PDE.

(OR)

AMA 104 : PRACTICAL-I
(Common with paper MAT 104 of Branch I (A) Mathematics)

(Related to CC:2B & 3B)

Practicals for Viscous Flows: CC 2:2(B)

1. Transform the stress components
2. write about relation between stress and rate of Strain.
3 Derive the equation of continuity.
4. Deriven the conservation of energy equation.
5. Explain the flow between parallel plates - couette flow
6. Derive momentum integral theorem.

Practicals for Integral equations: CC: 3 (B)

1.Convert an ODE to Integral equation
2.: Write kernels in finite-sum form and solve related integral equations.
3.Determine if kernels are Hermitian or symmetric and study their integral equation solutions.
4.: Verify Hilbert-Schmidt conditions and compute eigenvalues and eigenfunctions for kernels.
5..Construct and use Green's functions to solve integral equations.
6.Solve Volterra integral equations of various types using appropriate methods (resolvent kernels, Laplace transforms).
7.Use Fourier transforms to handle convolution-type integral equations.
8.Apply Laplace transforms/ Hilbert transforms to solve integral equations with convolution kernels.
9. Apply iterative methods (Picard, Newton-Kantorovich) to solve non-linear Volterra and Fredholm equations.

SKILL ORIENTED COURSE (SOC-I)

AMA 105: SOC- 1 (A) - NUMERICAL METHODS
(Common with paper MAT 105: SOC - 1 (A) - of Branch I (A) Mathematics)

Course objectives:

1. To provide suitable Numerical Methods, for obtaining Roots of algebraic and Transcendental equations
2. To study of different methods of Interpolation.
3. To know the interpolation with unevenly spaced points.
4. To study the various methods of Numerical integration.

UNIT-I:

Solutions of Algebraic and Transcendental Equations: Introduction - Bisection method – Method of False position - Newton Raphson –method solutions of non linear equations – Method of iteration.

[Above topics are from 2.1 to 2.7, 2.12 of Chapter-2 of the Text Book]

UNIT-II:

Interpolation : Introduction - Finite Differences- Newton's formulae for interpolation- Newton's forward difference interpolation- Backward difference interpolation- Central interpolation formulae –Gauss's central difference formulae- Strilling's formula- Bessel's formula.

[Above topics are from 3.1, 3.3, 3.6, 3.7:3.7.1,3.7.2, 3.7.3 of Chapter-3 of the Text Book]

UNIT-III:

Interpolation with unevenly spaced points- Lagrange's Interpolation Formula - Divided Differences and their properties – Newton's general Interpolation Formula- Spline Interpolation [Above topics are from 3.9.1, 3.10.1, 3.13 of Chapter-3 of the Text Book]

UNIT-IV:

Numerical integration: Trapezoidal rule- Simpsons rules – numerical solution of ODEs by Picard – Euler - Modified Euler – Runge-Kutta methods.

[Above topics are from 5.4.1 to 5.4.3 of Chapter- 5 and 7.1 to 7.5 of Chapter- 7of the Text Book]

Text Book:

Scope and standard as 1."**Introductory methods for Numerical Analysis by S.S.Sastry fourth edition**".

Reference Books:

1. An Introduction to Numerical Analysis by Kendall E. Atkinson.
2. Information Technology and Numerical methods fot Atul Kahate
3. Theory and problems in Numerical Methods with programs in C and C++.
4. Numerical Methods and computing by Ward Cheney and David Kincaid
5. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S.R K. Iyengar, R. K. Jain, New Age International (p) Limited, Publishers, 5th Edition

Course Outcomes:

From this Course Students are able to

1. Solve Algebraic and Transcendental polynomial equations.
2. Understand Interpolation.
3. Study interpolation with unevenly spaced points
4. Analyze and evaluate the accuracy of area, volume by Numerical methods.

AMA 105: SOC 1(B) - MAT-LAB
(Common with paper MAT 105: SOC 1(B) - of Branch I (A) Mathematics)

Course Objectives:

1. Getting started with MATLAB
2. To create M-files.
3. To learn 2D and 3D Plotting Techniques.
4. To know how to write programs to solve Algebraic Equations

UNIT-I (Basics of MATLAB)

Getting Started with MATLAB- Different windows-Mathematical Operators and Mathematical functions-Creating matrices and arrays- Matrix algebra-Linear algebra concepts

UNIT-II:. **(MATLAB Programming)**

M-files-Script files- Function files-Relational operators-conditional statements

UNIT-III
Graphics: Basic 2-D plots- 3-D plots
UNIT-IV:Algebraic Equations: solving linear system-Gaussian elimination-finding eigen values and eigen vectors.
Syllabus and treatment as in the Book:

1.Getting Started with MATLAB – A Quick Introduction for Scientists and Engineers, RudraPratap, Oxford University Press.

References:

1.. MATLAB Programming for Engineers. (4th ed.), Stephen J. Chapman, Cl Engineering.

2. MATLAB: Demystified -Basic Concepts and Applications, K KSarma, Vikas Publishing House Pvt Lt.

3. Engineering Problem solving with MATLAB, D.M.Etter, Printice-Hall

Course Outcomes:
1. Understand the mathematical operations & functions.
2. Able to write a program to addition & multiplication matrices.
3. Understand the 2-D plotting and 3-D plotting techniques.
4. Able to SolveAlgebraic equations.

AMA 106: SOC- 2(A) - DISCRETE MATHEMATICS
(Common with paper MAT 106 SOC- 2(A) of Branch I (A) Mathematics)

The aim of the discrete mathematics is the study of mathematical structure that are fundamentally discrete rather than continuous.

Course Objectives:

1.To know the connectives & tautology.
2.To study the mathematical structure that is countable or distinct and separable.
3.To learn sets functions, logic, calculus and analysis.
4.To study the Algebraic systems such as Lattices ,Boolean Algebra and Boolean function.

UNIT –I: Introduction – connectives – well formed formula Tautologies – Equivalence formulas – duality Tautological implications – Formula with distinct truth tables – Functionally complete sets of connectives.
(Sections 1.1 and 1.2 to 2.11 of Chapter 1)
UNIT – II: Normal Forms-Disjunctive-Conjunctive Principal Disjunctive, Principal Conjunctive Normal Forms –Ordering and Uniqueness of Normal Forms. The theory of Inference for the statement Calculus-Rules of inferences – Consistency of Premises (Sections 1.3 and 1.4 of Chapter 1)

UNIT – III: The predicate calculus-Inference Theory of the Predicate Calculus (Sections 1.5 and 1.6 of Chapter 1)

UNIT-IV: Lattices and Boolean Functions: Lattices as partially Ordered sets-Lattices as Algebraic Systems – Minimization.
(Sections 4.1 of Chapter 4)

Scope and Standard as in the book **" Discrete Mathematical Structures With Applications To Computer Science" by Tremblay, J.P&Manohar, R-Published by McGraw-Hill International Edition -1987 Edition**

References: 1. Discrete Mathematics & Graph Theory by BhavanariSatyanarana& KunchamSyam Prasad, PHI Publications, New Delhi, Second Edition, 2014.
2. Mathematical Foundation of Computer Science, by Bhavanari Satyanarayana, T.V. Pradeep Kumar, SK. Mohiddin Shaw, BS Publications, Hyderabad.2016.

Course Outcomes: From this course students will be able to

1. Use standard notations of propositional logic.
2. Understand the truth tables for expressions involving negation, conjunction, and disjunction
3. Determine if a logical argument is valid or invalid.
4. Understand the Boolean algebraic structures.

AMA 106 SOC- 2(B) - C-PROGRAMMING LANGUAGE
(COMMON WITH PAPER MAT 106 SOC- 2(B) OF BRANCH I (A) MATHEMATICS)

UNIT-I:

Constants, Variables, and Data Types: Introduction-Character set-C Tokens-Key words and Identifiers-Constants–Variables-Data types – Declaration of variables-Declaration of storage class – Assigning Values to Variables- Defining Symbolic Constants – Declaring a Variables as Constant- Declaring a Variable as Volatile- Overflow and Underflow of Data.

UNIT-II:

Operators and Expressions : Introduction - Arithmetic operators –Relational operators –Logical operators –Assignment operators- Increment and decrement operators –Conditional operators- Bitwise Operators-Special Operators – Arithmetic Expressions- Evaluation of Expressions-Precedence of Arithmetic Operators – Some Computational Problems-Type Conversions in Expressions –Operator Precedence and Associativity- Mathematical Functions .

UNIT-III:

Decision making and Branching : Introduction – Decision making with if Statement-Simple if Statement-The if…Else Statement –Nesting of if… Else Statements-The Else if Ladder-The Switch Statement – The ?: Operator- The Goto Statement.

UNIT-IV:

Decision Making and Looping: - Introduction-The While Statement – The do Statement-The for Statement-Jumps in Loops-Concise Test Expressions.

Arrays

Introduction - One Dimensional Arrays – Declaration of One-Dimensional Arrays- Initialization of One Dimensional Arrays-Two Dimensional Arrays – Initializing Two –Dimensional Arrays-Multi-Dimensional Arrays- Dynamic Arrays-More about Arrays.

Scope and Standard as in: " Programming in ANSI C" by E. Balaguruswamy(Sixth edition) Mc. Graw Hill Edition, India.(Sections 2.1 to 2.14 of Chapter 2, 3.1 to 3.16 of Chapter 3, 5.1 to 5.9 of Chapter 5, 6.1 to 6.6, of Chapter 6, 7.1 to 7.9 of Chapter 7)

AMA 107 : PRACTICAL-II
(Common with paper MAT 107 of Branch I (A) Mathematics)

(Related to SOC 1A & 2A)

Practical for Numerical Methods: SOC- 1A

1. Bi-section method.
2. False position method.
3. Newton Raphson method.
4. Trapezoidal rule.
5. Simpson's $3/8^{th}$ rule

6. Picard's Method
7. Euler method
8. Modified Euler method
9. Range-Kutta Method

Practicals for DISCRETE MATHEMATICS: SOC 2- 2A

7. Generate truth tables automatically for complex formulas.

8. Convert logical expressions into their Disjunctive Normal Form (DNF) and Conjunctive Normal Form (CNF).

9. Construct truth tables for NAND, NOR, and XOR connectives.

10. Apply Karnaugh maps (K-maps) to minimize Boolean functions.

11. Draw Hasse diagrams and visually represent lattices. (Use graphing tools or software like Graphviz or Gephi).

12. Construct examples of modular lattices and distributive lattices and demonstrate their properties.

(OR)

AMA 107: PRACTICAL-II
(Common with paper MAT 107 of Branch I (A) Mathematics)
(Related to SOC 1B & 2B)

Practical for MATLAB: SOC 105 -1B

1. Create any M-file
2. Creating arrays and Matrices
3. Basic 2D-plots
4. Basic 3D-plots
5. Solving system of algebraic equations
6. Find Eigen values and Eigen vectors

Practical for C-PROGRAMMING LANGUAGE: SOC 106 - 2B

1. write a C- program of the given problems.
2. Write a C-program to evaluate the power series.
3. Write a C-program using single subscripted variables.
4. Write a C-program using a two dimensional array.
5. Write a C-program to compute and print a multiplication.
6. Write a C-program for standard deviation.

AMA 108: edX/Swayam/NPTEL/ MOOCS

(Common with paper MAT 108 of Branch I (A) Mathematics)

AMA 109: Ancient Indian Mathematics

(Common with paper MAT 109 of Branch I (A) Mathematics)

UNIT – I : (Heralding the Golden Age: Aryabhata I and his Followers):
Introduction – The Mathematics in Aryabhatiya- I and its followers Aryabhatiya –Geometry – series –Algebra –Indeterminate equations.

Unit- II: (Riding the Crest of a Wave: From Brahmagupta to Mahavira- I)
The Mathematics in the Brahmasphut a siddhanta –arithmetic of calculation –Triangles and Quadrilaterals

Unit-III : (Riding the Crest of a Wave: From Brahmagupta to Mahavira-II)
Geometry of circles –intersecting circles -Shadow Problems –intermediate analysis works of Brahmasphut a siddhanta –solution of Quadratic equations –volume of sphere – Mahavira –Unit fractions.

Unit-IV: (The 500 Year Climax: Bhaskaracharya and His Legacy)
The Contents of Lilavati – Arithmetic calculation –Method if inversion –Solution of Cubic and biquadratic equations.

Scope and standard as **"Indian Mathematics Engaging with the World from Ancient to Modern Times" by** George Gheverghese Joseph University of Manchester, UK National University of Singapore, Singapore McMaster University, Canada.

Reference:

"History Of Ancient Indian Mathematics" by Srinivasiengar .C.N ,The World press Culcutta.

SECOND SEMESTER
AMA 201: MATHEMATICAL MODELLING

Course Objectives:

1) Enable students understand how mathematical models for ODE of first order, second order and system of linear differential equations are formulated, solved and interpreted.
2) Make students appreciate the power and limitations of mathematics in solving practical real-life problems.
3) Equip students with the basic mathematical modeling skills.

UNIT –I

Mathematical modeling through ordinary differential equations of first order.

UNIT-II

Mathematical Modeling through system of ordinary differential equations of first order

UNIT: III

Mathematical Modeling through ordinary differential equations of second order

UNIT IV:

Mathematical Modeling through difference equations: Basic Theory of Linear Difference Equations with constant coefficients- Mathematical Modeling through difference equations in Economics and Finance- Mathematical Modeling through difference Equations in Population Dynamics and Genetics.

Mathematical Modeling Through partial Differential Equations: mass-Balance Equations – Momentum Balance Equations.

Scope and standard as in Chapter 2, Chapter 3, Chapter 4, sections 5.2 to 5.4 Chapters 5 and Sections 6.2 and 6.3 of Chapters 6 in **" Mathematical Modelling" by J.N. Kapur, Wiley Eastern Limited(1988)**

References : 1. Mathematical Modeling –Applications, Issues and analysis – by Vimal K Mishra, ANE Book Publishers –New Delhi

2. Mathematical Modeling by Meerscharet M. Elsevier India Pvt Ltd.

Course Outcomes:

1) Understand what a mathematical model is and explain the series of steps involved in a mathematical modeling process.
2) Identify some simple real-life problems that can be solved using mathematical models, model the problem, solve the resulting problem, and interpret the solution.
3) Acquire basic mathematical modeling skills that will enable them carry out simple modeling tasks individually or as a group.

4) State and explain the different classifications of mathematical models stating examples in each class.
5) Analyze the importance of partial differential equations in mathematical modeling. Frame quantitative problems and model them mathematically

AMA 202:5(A) - COMPLEX ANALYSIS
(Common with paper MAT 202: 5A of Branch I (A) Mathematics)

Complex analysis, traditionally known as the theory of functions of a complex variable, is the branch of mathematical analysis that investigates functions of complex numbers.

Course Objectives:

1. To define analytic functions and derivative rules of complex functions.
2. To introduce Mobius transformations and explain its applications.
3. To evaluate definite integrals using Cauchy integral formula.
4. To understand power series and expansion of analytic function**.**

UNIT –I :

Differentiation: Analytic Functions: Derivative Rules for Differentiating Complex Functions-The Cauchy-Riemann Equations –Analytic Functions-Geometrical Interpretation of Arg $f^1(z)$ and $|f^1(z)|$ - Conformal Mapping –The Mapping w = $\frac{az+b}{cz+d}$.

UNIT – II:

Mobius Transformations: The Group Property of Mobius Transformations – The Circle –Preserving Property of Mobius Transformations-Fixed points of a Mobius Transformation-Invariance of Cross Ratio-Mapping of a circle onto a Circle –Symmetry Transformations.

UNIT – III:

Complex Integrals: Cauchy Integral Theorem: Rectifiable Curves-Complex Integrals-The Case of Smooth Curves-Cauchy's Integral Theorem-The Key Lemma proof of Cauchy's Integral Theorem-Application to the Evaluation of Definite Integrals Cauchy's Integral Theorem for a system of Contours. Cauchy's Integral Formula –Morera's Theorem – Cauchy's Inequalities.

UNIT-IV:

Power Series: The Cauchy-Hadamard Theorem – Taylor Series. The Uniqueness Theorem for Power series-Expansion of an Analytic Function in a power series –Liouvill'es Theorem. The Uniqueness Theorem for Analytic functions-A Points.

Scope and Standard as in Chapters 3,5,7,8 and 10 of **"Introductory Complex Analysis" by Richard A. Silverman Dover Publications, Inc. (1972). New York**

References : 1 Complex Variables - Schuam outline series, 2/E by Speigel
2. An Introductions to Complex Analysis, by C.L. Siegel :North Holland.

Course outcomes:

1. Identify curves and regions in the complex plane defined by simple expressions.
2. Describe basic properties of complex integration and having the ability to compute such integrals.
3. Decide when and where a given function is analytic and be able to find it series development.
4. Describe conformal mappings between various plane regions.
5. Apply the concepts of Complex Analysis in many branches of mathematics, including algebraic geometry, number theory, analytic combinatorics, applied mathematics; as well as in physics, including the branches of hydrodynamics, thermodynamicsand particularly quantum mechanics.

AMA 202:5 (B) - SEMIGROUP THEORY
(Common with paper MAT 202:5(B) of Branch I (A) Mathematics)

Course Objectives:

1. Introduce basic definitions and examples of semi groups and semi Lattices.
2. Discuss free semi groups and lattices of equivalences.
3. Explain Ree's theorem& primitive Idempotents.
4. Analyze O-simple semi groups and free semi groups with Illustrations.

UNIT-I

Basic definitions – Homogenic Semigroups – Ordered sets- Semi lattices and lattices – Binary relations- Equivalences- Congruences.

UNIT-II

Free Semi groups Ideals and – Rees Congruences. Lattices of equivalences and congruences – Green's equivalences. The structure of D.Classes – regular semigruops.

UNIT-III

Simple and Q-Simple semi groups. Principle factors, Rees's Theorem, Primitive idempotents.

UNIT-IV

Congruences on completely O-Simple semi groups. The Lattice of Congruences on a completely O-Simple semi groups. Finite Congruences, free semi groups.

Text Book :

An Introduction to Semi group Theory by J.M. Howie (1976), Academic Press, (Content of the Syllabus : Chapters-I, II and III).

Course Out comes:

1. Understand semi groups with the properties.
2. Explain the structure of D.Classes – regular semigruops.
3. Obtain proofs of Rees's Theorem.
4. Know the congruences on completely O-Simple semi groups

AMA 203:6 (A) - TOPOLOGY
(Common with paper MAT 203:6(A) of Branch I(A) Mathematics)

Topological concepts play important role in the development of modern mathematics and it has large applications in theoretical physics.

Course Objectives:

1. This course aims to teach the fundamentals of point set topology and constitute an awareness of need for the topology in Mathematics.
2. Introduce the basic definitions and standard examples of topological spaces.
3. Define and illustrate a variety of topological properties such as compactness, connectedness and separation axioms.
4. Explain the idea of topological equivalence and define homeomorphisms.

UNIT –I :

Metric spaces:-open sets-closed sets- convergence-completeness and Baire's theorem-Continuous mappings – Cauchy's Inequality and Minkowski's Inequality.

UNIT – II:

Topological Spaces, definition & examples-open bases and open sub bases- compact spaces

UNIT – III:

Product of spaces-Trychonoff's theorem -compactness for Metric spaces.

UNIT-IV:

Separation $-T^1$ space and Hausdorff spaces –completely regular spaces and Normal spaces – Urysohn's lemma- Tietze extension theorem-Urysohn's imbedding theorem.

Articles 9 to 14,16,17,18,21, 22, 23, 26-29 and 31 of Chapters II,III,IV,V,andVI of **Introduction to Topology and Modern Analysis" by G.F. Simmons of MC Graw Hill Publishing company, ltd**.

Reference:

1. 'Topology' by K.ChandraSekharaRao, Narosa Publications
2. "Topology" by J.P. Chauhan, J.N. Sharma, Krishna Publications
3. "General Topology" by M.G. Murdeshwar, new age International publications

Course Outcomes:

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

1. Understand to construct topological spaces from metric spaces and using general properties of neighbourhoods, open sets, closed sets, basic and sub-basis.
2. Apply the properties of open sets, closed sets, interior points, accumulation points and derived sets in deriving the proofs of various theorems.
3. To understand the concepts of countable spaces and separable spaces.
4. They know what we mean by connectedness, compactness, and hausdorf property and their general characteristics.
5. Understand the Countability axioms, the separation axioms and normal spaces.
6. Understand the classical theorems such as the Uryshon lemma, the Tietze extension theorem.

AMA 203:6B - BOUNDARY VALUE PROBLEMS

Course objectives:

To learn series solution of some well known differential equations, Legendre & Chebysheve polynomials, Fourier &Henkel transforms linear programming problems and basics of probability.

UNIT-I:

Stability of linear and weakly non-linear systems, continuous dependence and stability properties of linear, non-linear and weakly non-linear systems. Two dimensional systems. (chapter III of text book-1)

UNIT-II:

Stability by Liapunov second method, Autonomous systems, quadratic forms, Krasovski'sMethod. Construction of Liapunov functions for linear systems with constant coefficients. Selection of total energy function as a Liapunov Function, Stability based on first approximation (Chapter V of text book-1)

UNIT-III:

Mathematical Models in Population Dynamics: Introduction, single species Models, Two species Lotka volterra Models, Multi species Models. (chapter VI of text book-1)

UNIT-IV:

Analysis and Methods of non-linear differential equations, Existence theorem, extremal solutions, upper and lower solutions. Existence via upper and lower solutions, Monotone iterative Method and Method of quasilinearlization, Bihari's inequality, Application of Bihari's integral inequality. Non-linear variation of parameters formula Alekseev's formula. (Chapter VI of text book-2)

Text Books:

1. M.Rama Mohan Rao, Ordinary Differential equations, Theory methods and applications, Affiliated East-West Press Pvt.Ltd., New Delhi. (1980).

2. V.Lakshmikantam, S.G.Deo and V.Raghavendra, Text book of ordinary differential equations (second edition) Tata Mc Graw Hill, New Delhi. (1997)

Course Outcomes:

After completing this course the students would be able to:

1. Use the knowledge of Legendre and Chebyshev polynomials.
2. Apply Fourier and Hankel transforms in engineering problems.
3. Solve boundary value problems.
4. Understand the probability theory.

AMA 204: PRACTICAL-III
(Common with paper MAT 204 of Branch I (A) Mathematics)

Practicals for Complex Analysis CC 2- 2A

1. Apply the derivative rules (sum, product, quotient, and chain rules) to differentiate several complex functions.
2. Prove that a function is analytic in a given domain by verifying the existence of its derivative and applying the Cauchy-Riemann equations.
3. Evaluate integrals of different analytic functions over smooth curves (like circles or ellipses).
4. Evaluate specific integrals using Cauchy's Integral Formula.
5..Derive the Taylor series expansion for given functions .
6. Derive the Taylor series expansion for given functions .
7. Compute the cross ratio of four distinct points in the complex plane and verify its invariance under a given Möbius transformation .
8 .Verify the given transformation is Mobius transformation.

Practical for Topology CC 2- 3A

1. Write a program to evaluate the roots of the equation.
2. Write a program to evaluate the power series
3. Write a program to determine the range of values and the average cost of a personal computer in the market.
4. Write a program to evaluate the series $\left(\frac{1}{1-x}\right)$.
5. Write a program to using single- subscribed variable to evaluate the expression total= $\sum_{i=1}^{10}\left(x_i^2\right)$.
6. Write a program to read a line of text containing a series of words from the terminal.

(or)

AMA 204 CC-5B &6(B): PRACTICAL-I
(Common with paper MAT 204 5B &6(B) of Branch I (A) Mathematics)

Practicals for SEMIGROUP THEORY CC 2 - 3B

1. Construct the Cayley graph of the free semigroup generated by X={a,b} up to length 2.
2. Work with generating sets, ideals, and construct Rees congruences.
3. Explore the lattice structure of equivalences and congruences, and analyze Green's equivalences for given semigroups.
4. Study the structure of D-classes in regular semigroups, construct examples, and explore their properties.
5. Construct examples and identify principal factors, verifying simplicity and Q-simplicity.
6. Apply Rees's Theorem to constructcompletely 0-simple semigroups and identify primitive idempotents**.**

7. Explore congruences and the lattice structure of congruences, particularly in Rees matrix semigroups.

Practicals for BOUNDARY VALUE PROBLEMS CC 3 - 4B

1. Derive the stability of linear and weakly non- linear systems.
2. Write about two dimensioned systems.
3. Test the stability by Liapunov second method
4. Explain about Krasovski method,
5. Describe two species Lotka volterra models.
6. State and prove existence theorem

SKILL ORIENTED COURSE (SOC-II)
AMA 205: SOC -3(A) - MATHEMATICAL STATISTICS
(Common with the paper MAT 205: SOC -3 (A) of Branch I(A) Mathematics)

Course objectives:

1. To introduce basic concepts of statistics and the probability set functions.
2. To study the Binomial, Poisson, Gamma, chi-square, normal distribution.
3. Explain stochastic convergence
4. To explain the objective of Point estimation-Measures of quality of estimations.

UNIT –I:
Probability and Distributions:

Introduction-The probability set function – Conditional probability- Independence-Random variables–The distribution function-Expectations-Some special mathematical expectations – Chebyshev's inequality. (Section 1.1 to 1.10 of chapter 1)

UNIT- II:
Marginal and conditional distributions- Distributions of two variables- conditional distributions and expectations-The Correlation coefficient- Independent of Random variables. (Section 2.1 to 2.4 of chapter 2)

UNIT–III:
The Binomial, Poisson, Gamma, chi-square and Normal distribution. Distributions of functions of Random variables –Sampling theory- Transformation of Variables of Discrete type-Transformation of Variables of the continues type. (Section 3.1 to 3.4 of chapter 3, sections 4.1 to 4.3 of chapter 4)

UNIT – IV:

The t and F Distributions – Distribution of order statistics –The moment generating function Technique-The Distribution of X and Limiting distribution –Stochastic convergence-Limiting moment generating function-The central limit theorem. (Section 4.4, 4.6 &4.7 of chapter 4, 5.1 to 5.4 of chapter 5)

Scope and Standard as in " Introduction to Mathematical Statistics" by Robert V. Hogg Allen T. Craig, Macmillan publishing co., Inc., New York -1978

References: 1. Mathematical Statistics by J.N. Kapur, H.C. Saxena- S. Chand Publications
2. Introduction to Mathematical Statistics Robert V Hogg, Allencraig, Joseph W Mekean , Pearson Publishers
3. Fundamentals of mathematical Statistics by S.C.Gupta and V.K.Kapoor, 11th edition S.Chand and sons, New Delhi
4. Probability and Statistics for engineers and scientists by Walpole Myers and Keying ye, ninth edition, Pearson Publications

Course outcomes:

1. To learn the fundamental concepts of statistics and techniques required for data analysis.
2. Apply the knowledge of Binomial, Poisson, Gamma, chi-square, normal distribution in solving various problems,
3. To explain stochastic convergence.
4. To discuss measures of quanlity of estimations

AMA 205: SOC 3(B) - DATA STRUCTURES AND ALGORITHMS
(Common with the paper MAT 205- SOC 3 (B) of Branch I (A) Mathematics)

Course objectives:

1. Learn complexity analysis with examples.
2. Study queues operations and applications of queues.
3. Acquire knowledge on Binary trees and representations.
4. Understand Basic algorithms to sort and to find the shortest paths.

UNIT-I

Performance and Complexity Analysis: Space Complexity, Time Complexity, Asymptotic Notation (Big-Oh), Complexity Analysis Examples.

Stacks: Basic Stack Operations, Representation of a Stack using Static Array and Dynamic Array, Multiple stack implementations using single array

Stack Applications: Reversing list, Factorial Calculation, In fix to post fix Transformation, Evaluating Arithmetic Expressions.

UNIT-II

Queues: Basic Queue Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack

Applications of Queues: Round Robin Algorithm, Circular Queues.

Linked Lists: Introduction, Single Linked List, Representation of a Linked List in Memory,DifferentOperationsonaSingleLinkedList,ReversingaSingleLinkedList, Advantages and Disadvantages of Single Linked List, Circular Linked List, Double Linked List and Header Linked List.

UNIT-III

Trees: Definition of Tree, Properties of Tree, Binary Tree, Representation of Binary Trees using Arrays and Linked Lists, Operations on a Binary Tree, Binary Tree Traversals (recursive), Binary Search Tree.

Hashing: Hash Table Representation, Application-Text Compression.

UNIT-IV

Basic Search Algorithms: Linear Search and Binary Search Techniques and their Complexity Analysis.

Basic Sorting Algorithms: Bubble Sort, Insertion Sort, Selection Sort

Divide-and-Conquer Algorithms: merge sort, quick sort

Basic Graph Algorithms: traversals and shortest path.

Scope and Standard as in Data Structures and Algorithms by Alfred V. Aho,John E. Hopcraft and JefrynD. Ullman.

References:

1. Data Structures and Algorithms by R.D.Sathiya
2. Data Structures and Algorithms Made Easy" by Narasimha Karumanchi
3. Data Structures and Algorithm Analysis in C++" by Mark Allen Weiss
4. Data Structures and Algorithm Analysis in Java" by Mark Allen Weiss.

AMA 404:SOC-4A: OPERATIONS RESEARCH FOR INDUSTRY AND COMMUNITY DEVELOPMENT

(Common with the paper MAT 404: SOC-4A of Branch 1(A) Mathematics)

Course Objectives:

1) To understand Linear Programming Methods
2) To solve linear programming problem through Dynamic Programming.
3) To introduce game theory.
4) To analyze Critical path method and program Evaluation and Review Technique.

UNIT –I :

Linear programming: Graphical Method-Simplex Method-Big M Method-Two phase method - Transportation Problem-(Sections 2.4 and 2.5.1, 2.5.2, 2.5.4 of chapter 2,sections 3.2, 3.3 and 3.4 of chapter 3).

UNIT – II:

Dynamic programming : Introduction –Capital Budgeting problem –Reliability improvement problem –Stage coach problem –Optimal subdividing problem (Chapter 8)

UNIT-III:

Game Theory: Introduction -Game with Pure Strategies-Game with Mixed Strategies – Dominance property-Graphical Methods for 2xn and mx2 Games. (Chapter 12)

UNIT-IV:

Project Management: Guidelines for Network Construction –Critical Path Method (CPM) – Program Evaluation and Review Technique (PERT) (Sections 10.3,10.4 and 10.6 of Chapter 10)

Scope and standard as **"OPERATIONS RESEARCH" By pannerselvam, R. published by Prentice Hall of India, New Delhi, 2002Edition,**

References: 1. Introduction to Management Sceicne "Operation Research" by Manmohan . P.K. Gupta, Kantiswarup, Sultan Chand & Sons Publishing house.

2. Operations Research –Theory and Applications by J.K. Sharma- Macmillan Publishers, India.

3. Operations Research –by Gupta, Prem Kumar, Hira S. Chand Publishers

Course Outcomes:

1) Formulate some real life problems into Linear Programming Problems.
2) Understand Dynamic Programming.
3) Solve the problems of Game with pure Strategies and Mixed Strategies.
4) Construct Reliable Networks.

AMA 206:SOC-4B: Python
(Common with paper MAT 206: SOC- 4B of Branch I (A) Mathematics)

Course Objectives:

1. To get familiar with Pyhon
2. To learn various operators and conditional statements
3. To create Modules and Strings
4. To understand functions, files and lists

UNIT –I : Basics of Python: Python Installation and Working of it, get familiar with python variables and data types, Operator understanding and its usage, understanding of python blocks
Operators in Python: Arithmetic Operators, Relational Operators, Assignment Operators, Logical Operators, Bitwise Operators, Shift Operators, Ternary Operators, Membership Operators, Identity Operators, Expressions and order of evaluations.
Input and Output statements: input() function, reading multiple values from the keyboard in a single line, print() function, 'sep' and 'end' attributes, Printing formatted string, replacement operator ({}).
Control flow statements: Conditional statements – if, if-else and if-elif-else statements. Iterative statements – for, while. Transfer statements – break, continue and pass.

UNIT –II:-Functions: Defining Functions, Calling Functions, Types of Arguments - Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Function Returning Values, Global and Local Variables.
Modules: Creating modules, import statement, from Import statement.
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

UNIT –III:- Lists: Creation of list objects, Accessing and traversing the elements of list. Important functions of list – len( ), count( ), index( ), append( ), insert( ), extend( ), remove( ), pop( ), reverse( ) and sort( ).

Basic Operations on List: Aliasing and Cloning of List objects, Mathematical Operators for list objects, Comparing list objects, Membership operators on list, Nested Lists, List Comprehensions.

Tuples: Creation of Tuple objects, Accessing elements of tuple, Mathematical operators for tuple, Important functions of Tuple – len(),count(),index(), sorted(), min(), max(), cmp().Tuple Packing and Unpacking.
Files: Opening files, Text files and lines, Reading and writing files, Searching through a file, Using try, except and open, handling exceptions, debugging.

UNIT –IV:

Scientific and Mathematical Computing Using Python: Numerical Computing using NumPy, Matplotlib, SciPy

Python libraries and modules used in Data Science, AI and ML: Pandas, tensorflow, scikit-learn, pytorch, keras etc...

Scope and Standard as in: Learn Python the right way How to think like a computer scientist, Ritza, 2021-2022
References:

1. Linear Algebra in Data Science, notes by Madhu Babu Pachha (To be prepared)
   Suggested Reading:
3. Think Python: How to Think Like a Computer Scientist', 3rd edition, Allen B. Downey, O'Reilly 2024
4. Learning To Program With Python. Richard L. Halterman. Copyright © 2018

Course Outcomes: After completion of this course students are able to

1. Familiar with basic concepts of Pyhon
2. Make use of various operators and conditional statements
3. Create Modules and Strings
4. Understand functions, files and lists

AMA 207: PRACTICAL-II
(Common with paper MAT 207 of Branch I (A) Mathematics)

Practicals on Mathematical Statistics –SOC 3A

1. Basic programs to find mean, median and mode
2. Binomial distribution
3. Poisson Distribution
4. Normal Distribution
5. t-distribution
6. F-distribution

Practicals for Operations Research for Industry and Community Development: SOC-4(A):

1. A computer manufacturing company has the following monthly compensation policy to their sales-person:
Minimum base salary: 1500.00
Bonus for every computer sold: 200.00
Commission on the total monthly sales: 2 percent
Since the prices of the computers are changing, the Sales price of each computer program is fixed at the beginning of every month to compute a sales person's gross Salary.

2. The cost of operation of a unit consists of two components C_1 and C_2 which can be expressed as functions of a parameter p as follows:
$C_1 = 430\text{-}8P$ $C_2=10+p^2$ The parameter ranges from 0 to 10. Determine the Value of P with an accuracy of +0.1 where the cost of operation would be minimum.

3. In an organization, the employers are grouped according to their basic pay for the purpose of certain perks. The pay-range and the number of employees in each group are as follows:

Group	Pay-Range	No. of Employees
1	750-1500	12
2	1501-3000	23

3	3001-4500	35
4	4501-6000	20
5	above 6000	11

Draw a histogram to highlight the group sizes.

4. Plot the graphs of the functions of the type $y_1 = \exp(-ax)$, $y_2 = \exp(-ax^2/2)$ for x varying from o to 5.0.
5. Write a program to calculate the ratio a/b-c
6. Write a program that selects and prints the largest of the three numbers using nested if... else statement.

(OR)

AMA 207 : PRACTICAL-II

(Common with paper MAT 207 of Branch I (A) Mathematics)

Practicals for Data Structures and Algorithms: SOC-3(B)

1. Round Robin Algorithm
2. Basic Search Algorithms: Linear Search and Binary Search
3. Basic Sorting Algorithms: Bubble Sort, Insertion Sort, Selection Sort
4. Divide-and-Conquer Algorithms: merge sort, quick sort
5. Basic Graph Algorithms: traversals and shortest path.

Practicals for Python: SOC-4(B)

1. Create a 2D array (matrix) and compute the transpose.
2. Perform numerical integration
3. Solve differential equations
4. Solve initial value problem
5. Implement a linear regression model to predict house prices.

AMA 208: edX/Swayam/NPTEL/ MOOCS

(Common with paper MAT 208 of Branch I (A) Mathematics)

AMA 209: Vedic Mathematics

(Common with paper MAT 209 of Branch I (A) Mathematics)

Course objectives:

1. To inculcate interest on Vedic Mathematics.
2. To understand the development of basic concepts
3. To know about Vedic Sutras.
4. To create awareness on Vedic techniques.

Unit -I:-Actual applications the Vedic Sutras- Arithmetical computations- Factorization

Unit-II:- Simple equations-simultaneous simple equations-quadratic equations- cubic equations

Unit-III:-Partial fractions-integration by partial fractions.

Unit-IV:-Vedic Numerical code -recurring decimals

Standard Text Book:
Vedic Mathematics by Jagadguru Swamisri Bharathi Krisna Thirthaji Maharaja.

Course Outcomes: After the completion of the course students are able to

1. Understand Vedic sutras and Techniques.
2. Solve simple equations using Vedic formulae.
3. Apply techniques to integrate by partial fractions.
4. Write Numerical code.