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

RESTRUCTURED CURRICULUM FOR M.Sc. APPLIED MATHEMATICS (REGULAR) PROGRAMME TO BE IMPLEMENTED WITH EFFECT FROM THE ACADEMIC YEAR 2021-2022

SYLLABUS
Choice Based Credit System (CBCS)
NEP-2020

PROGRAMME: M.Sc.,(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 Knowledge in Mathematics in all the fields of learning including higher research and its extensions.
2. 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.
3. Facilitate the study of groups in crystallography in chemistry and Lie symmetry groups in physics.
4. Ability to think, acquire knowledge and skills through logical reasoning and in culture the habit of self- learning throughout life.
5. Inculcate critical thinking to carry out scientific investigation objectively.
6. Equip the student with skills to analyse problems, formulate the hypothesis, evaluate and draw reasonable conclusions.
7. Imbibe effective, scientific / technical communications in both oral and write.
8. Demonstrate the high standards of ethical issues.
9. Investigate and apply mathematical problems and solutions in a variety of contexts related to science, technology, business and industry.
10. Illustrate solutions using numeric or graphical or programming methods.

11. Investigate and solve unfamiliar math problems and allow to think on unsolved mathematical problems.
12. Able to qualify Lectureship and fellowship exams approved by UGC like CSIR-NET, GATE and SET.

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.

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(Syllabus common for SV University College and affiliated colleges offered P.G. Courses in SVU Area)
(Revised Scheme of Instruction and Examination, Syllabus etc., with effect from the Academic Years 2021-22 for I and II Semesters and 2022-23 for III and IV Semesters)

M.Sc. APPLIED MATHEMATICS

SCHEME OF INSTRUCTION AND EXAMINATION
Semester-I

Sl. no	Components of study	Code	Title of the course	Hrs / week	No. of Credits	Uni. Exams (Hour	IA	Semester end exam	Total Marks
1.	Core	AMA 101	Methods of Applied Mathematics	6	4	3	20	80	100
2.	Core	AMA 102	Real Analysis	6	4	3	20	80	100
3.	Compulsory Foundation	AMA 103	A) Ordinary Differential Equations B) Viscous Flows	6 6	4	3	20	80	100
4.	Elective foundation	AMA 104	A) Numerical Methods B) Boundary Value Problems	6 6	4	3	20	80	100
5.	Theory	AMA 105	Complex Analysis	6	4	3	20	80	100
6.	Theory	AMA 106	Discrete Mathematics	6	4	3	20	80	100
			TOTAL	48	24		120	480	600

Semester-II

Sl. no	Components of study	Code	Title of the course	Hrs / week	No. of Credits	Uni. Exams (Hour	IA	Semester end exam	Total Marks
1.	**Core**	AMA 201	**Mathematical Modeling**	**6**	**4**	**3**	**20**	**80**	**100**
2.	**Core**	AMA 202	**Partial Differential Equations**	**6**	**4**	**3**	**20**	**80**	**100**
3.	**Compulsory Foundation**	AMA 203	**A) Topology** **B) Magneto Hydro Dynamics**	**6** **6**	**4**	**3**	**20**	**80**	**100**
4.	**Elective foundation**	AMA 204	**A) Advanced Complex Analysis** **B) Nonlinear Analysis**	**6** **6**	**4**	**3**	**20**	**80**	**100**
5.	**Theory**	AMA 205	**Measure and Integration**	**6**	**4**	**3**	**20**	**80**	**100**
6.	**Theory**	AMA 206	**Mathematical Statistics**	**6**	**4**	**3**	**20**	**80**	**100**
			TOTAL	**48**	**24**		**120**	**480**	**600**

Semester-III

Sl. no	Components of study	Code	Title of the course	Hrs / week	No. of Credits	Uni. Exams (Hour	IA	Semester end exam	Total Marks
1.	**Core**	AMA 301	**Continuum Mechanics**	**6**	**4**	**3**	**20**	**80**	**100**
2.	**Core**	AMA 302	**Functional Analysis**	**6**	**4**	**3**	**20**	**80**	**100**
3.	**Generic Elective**	AMA 303	**A) Differential Geometry** **B) Mathematical Methods**	**6** **6**	**4**	**3**	**20**	**80**	**100**
4.	**Course**	AMA 304	**Classical Mechanics**	**6**	**4**	**3**	**20**	**80**	**100**
5.	**Skill Oriented course**	AMA 305	**MAT-LAB**	**3T +18 P**	**4**	**3**	**20**	**80 (50T+ 30P)**	**100**
6.	**Open Elective (Other Departments)**	AMA 306	**A) Business Mathematics-I** **B) Foundation of Mathematical Statistics**	**6** **6**	**4**	**3**	**20**	**80**	**100**
TOTAL				**45 T+ 18P**	**24**		**120**	**480**	**600**

Semester-IV

Sl. no	Components of study	Code	Title of the course	Hr/ week	No. of Credits	Uni. Exams (Hour	IA	Seme-ster end exam	Total Marks
1.	**Core**	AMA 401	**Number Theory**	**6**	**4**	**3**	**20**	**80**	**100**
2.	**Core**	AMA 402	**Fluid Dynamics**	**6**	**4**	**3**	**20**	**80**	**100**
3.	**Generic Elective**	AMA 403	**A) Graph Theory** **B) Approximation Theory**	**6** **6**	**4**	**3**	**20**	**80**	**100**
4.	**Practical/ Course**	AMA 404	**Operations Research for Industry and Community Development**	**6**	**4**	**3**	**20**	**80**	**100**
5.	**Multi Disciplinary Course /Project Work**	AMA 405	**Computer Oriented Numerical Methods**	**3 T + 18 P**	**4**	**3**	**20**	**80 (50T+ 30P)**	**100**
6.	**Open Elective (Other Departments)**	AMA 406	**A) Business Mathematics-II** **B) Mathematics for Social Sciences**	**6** **6**	**4**	**3**	**20**	**80**	**100**
TOTAL				**45 T + 18 P**	**24**		**120**	**480**	**600**

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Instructions for evaluation:-Each theory subject is evaluated for 100 Marks out of which 80 Marks through end examination and internal assessment would be for 20 Marks. The minimum marks for qualifying in theory subject shall be 40%.

1. End Examination Question Paper Pattern is as follows:

Section A&B	Questions	Units of the Syllabus	Marks
A	Questions 1 To 8 (four short answer Questions, TWO from each unit)	Form UNIT-I to UNIT-IV	4x5=20
B	Questions 9.(a) & (b) or 10 .(a) &(b)	Form UNIT-I	15
B	Questions 11. (a) &(b) or 12.(a) &(b)	From UNIT-II	15
B	Questions 13. (a) &(b) or 14.(a) &(b)	From UNIT-III	15
B	Questions 15(a) &(b) or 16(a) &(b)	From UNIT-IV	15
		Total:	80

Procedure to evaluate internal examinations:

Theory:

Internal Examinations –I &II	20 marks

The pattern for the internal examination: 20 marks will be divided into descriptive (two out of four questions each carries 4 marks and two questions each carries 6 marks for each question with internal choice & 60 minutes duration).

***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.

Example:

Marks obtained in first internal: 20
Marks obtained in second internal: 20
Final internal semester Marks: (20+20) = 40/2=20

Practical/Lab:

*Continuous assessment/ Day to day work	End examination	Total
20 marks	80M (50T+30P)	100M

*Continuous assessment format given below.

Note: For practical courses, there shall be a continuous evaluation during the semester for 20 sessional marks and end examination shall be for 50 T+30P marks. Day-to-day work in the laboratory shall be evaluated for 20 marks by the concerned laboratory teacher based on the regularity/record/viva. Both day to day evaluation and two internal should be finalized by 20 marks. The end examination shall be conducted by the concerned laboratory teacher and external examiner in the subject nominated by the university.

- Internal marks will be awarded by internal examiner only.

Open elective eligibility criterion:

For all branches of B.SC/BA/B.Com without mathematics background
(Submit Degree certificate Xerox).

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M.Sc. APPLIED MATHEMATICS

SCHEME OF INSTRUCTION AND EXAMINATION
FIRST SEMESTER (ODD)

AMA101: METHODS OF APPLIED MATHEMATICS

Course Objectives:

1. To study Fourier series and Fourier Transforms
2. To know applications of finite 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.

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 Theory 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. Expand a function in a Fourier series and able to know under what conditions such an expansion is valid.
2. 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.
3. Understand the applications of Sylow theorems.
4. Describe Unique Factorization and Euclidean Domains.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1				M								
CO2												S
CO3						M						
CO4							M					
CO5					M							
CO6									M			

AMA 102 Real Analysis
(Common with the paper MA 102 of Branch 1(B) 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) To acquire knowledge on Riemann-Stieltjes Integration and Differentiation.
2) To know Integration of Vector Valued Functions, Rectifiable Curves.
3) To discuss Sequences and Series of Function.
4) To learn Uniform Convergence, Continuity, Integration and Differentiation.

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, Equicontinuous families of functions, The stone –Weierstrass theorem .

Scope and standard as in Chapters 6, sections 7.1 to 7.26 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 $\propto$, infinite Range of Integration.

Fourier series: Trigonometrically series, some preliminary theorems, the Main theorem intervals other than - $[-\Pi, \Pi]$

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 Integration and Differentiation.
2. To learn the different types of Sequences and Series of Functions, Equicontinuous Families of Functions.
3. Understand Uniform Convergence and continuity.
4. Apply the Stone-Weierstrass theorem.

5. Analyze the concept of functions of several variables.
6. Study the applications of Integration and Differential forms.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S											
CO2		M										
CO3								M				
CO4										S		
CO5							M					
CO6									M			

AMA 103 A: ORDINARY DIFFERENTIAL EQUATIONS
(Common with paper MA 103 of Branch I(B) Mathematics)

This course introduces fundamental knowledge in mathematics that is applicable in the engineering aspects.

Course objectives:

1. To study linear equations with regular singular points.
2. To provide knowledge on Legendre polynomials and properties of Bessel functions
3. To know the existence and uniqueness of solutions.
4. To Study surfaces and curves in 3-D space.

UNIT –I :

Oscillation Theory and boundary value problems: Qualitative properties of solutions –The Sturm comparison theorem-Eigen values, Eigen functions and the vibrating string.

UNIT – II:

Power series solutions: Series solutions of first order equations –Second order linear equations-Ordinary points-Regular singular points- Gauss's hyper geometric equation.

UNIT – III:

Some special functions of Mathematical Physics :Legender polynomials – properties of Legender polynomials –Bessel functions –The gamma function- Properties of Bessel functions.

UNIT-IV:
The existence and uniqueness of solutions: The method of successive approximations-Picard's theorem-systems. The second order linear equations.

Scope and standard as in sections 22 to 24 of Chapter 4 (excluding Appendix A), Sections 26 to 30 of Chapter 5, Sections 32 to 35 of Chapter 6 (Excluding Appendices) and sections 55 to 57 of Chapter 11 of **" Differential Equations with Applications and Historical notes" by George F. Simmons, (1992) Tata McGraw Hill Publications**

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

Course outcomes: From this course students will be able to

1. Recognize and classify O.D.Es.
2. Learn boundary value problems, Eigen values and Eigen functions
3. Apply knowledge on special functions of Mathematical Physics.
4. Understand the method of successive approximation and solve the second order linear questions.
5. Solve the problems related to Picard's theorem
6. Identify research problems where D.Es can be used .
7. Analyse engineering problems like series/ parallel circuits etc using 1st and 2nd order O.D.Es.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1												S
CO2									M			
CO3	S											
CO4				M								
CO5											M	
CO6					M							

AMA 103 B: 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**.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

MA 104 A: NUMERICAL METHODS
(Common with paper AMA 104 of Branch I (B) Applied Mathematics)

Course objectives :

1. To provide suitable and effective methods called Numerical Methods, for obtaining

approximate representative numerical results of the problems

2. To make the students familiarize with the ways of solving complicated mathematical problems numerically.

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 And Approximation: Introduction - Lagrange Interpolation - Newton Divided Differences - Finite Difference Operators - Interpolating Polynomials using finite differences- Gregory- Newton forward difference interpolation- Backward difference interpolation - Stirling and Bessel interpolation - Spline interpolation – cubic splines. Finite differences- newton's formulae for interpolation- central interpolation formulae –gauss central difference formulae- strilling formula- bessels formula – legrange's interpolation formula.

[Above topics are from 3.1, 3.3, 3.6 ,3.7, 3.7.3,3.9.1,3.10, 3.13 of Chapter-3 of the Text Book]

UNIT-II:

Direct methods – matrix inversion method -Gauss Elimination Method - Gauss – Jordan Method – eigen value problems –Iterative Methods

[Above topics are from 6.3.1 to 6.3.4 , 6.3.7 and 6.4 of Chapter-6 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.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 in chapters 2,3,5,6 and 7 of "**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 Learning Outcomes:

From this Course Students are able to

1. solve Algebraic and Transcendental polynomial equations.
2. Learn how to apply the Numerical method for various Mathematical operations and tasks.

3. Understand Interpolation,Differentiation,Integration,the solution of Differential Equations
4.Analyse and evaluate the accuracy of common Numerical methods.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	M											
CO2				S								
CO3		M										
CO4									M			

AMA 104 B: BOUNDARY VALUE PROBLEMS

Course objectives:

To learn series solution of some wellknown differential equations, Legendre & Chebysheve polynomials, Fourier &Hankel 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.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1						S						
CO2		S										
CO3									M			

CO4				M								

AMA 105: COMPLEX ANALYSIS
(Common with paper MA 105 of Branch I (B) 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 $\left|f^1(z)\right|$ - Conformal Mapping –The Mapping w = $\frac{az+b}{cz+d}$ -Conformal Mapping of the Extended Plane.

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 and Zeros-Weirstrass' Double Series Theorem-Substitution of One Power Series into Another- Division of Power series.

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.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	M											
CO2						M						
CO3				S								
CO4									M			
CO5					S							

AMA 106: DISCRETE MATHEMATICS
(Common with paper MA 106 of Branch I (B) Mathematics)

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

Course Objectives:

1. To study the mathematical structures that are countable or distinct and separable.
2. To learn sets, functions, logic,calculus and analysis.
3. To study the Algebraic systems such as Lattices ,Boolean Algebra and Boolean functions
4. To introduce basic concepts of graph theory

UNIT –I :

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-Automatic Theorem proving(Sections 1.3 and 1.4 of Chapter 1)

UNIT – II:

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

UNIT – III:

Lattices and Boolean Functions: Lattices as partially Ordered sets-Lattices as Algebraic Systems –Boolean Algebra-Boolean Functions- Minimization. (Sections 4.1 , 4.2,4.3 and 4.4 of Chapter 4)

UNIT-IV:

Finite – State Machines-Basic Concepts of Graph Theory –Basic Definitions-Paths-Reach ability, and Connectedness-Matrix Representation of Graphs-Trees (Section 4.6 of Chapter 4 and Section 5.1 of Chapter)

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:

1. Use standard notaions of propositional logic.
2. Understand the truth tables for expressions involving nagation, conjuction, and disjunction
3. Determine if a logical argument is valid or invalid.
4. Find concepts and notations from discrete mathematics are useful in studying Automata theory,Number theory and mathematical cryptography.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1							L					
CO2				M								

CO3						M						
CO4				S								

SECOND SEMESTER (EVEN)

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.
6) Frame quantitative problems and model them mathematically.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1				M								
CO2						M						
CO3							M					
CO4				M								
CO5	S											
CO6									S			

AMA 202: PARTIAL DIFFERENTIAL EQUATIONS
(Common with paper MA 202 of Branch I (B) Mathematics)

This course is designed to strengthen the fundamental knowledge of P.D.Es which lead to understand the real world problems.

Course Objectives:

1. To provide the students various methods to find solutions of O.D.Es and P.D.Es
2. To introduce orthogonal trajectories in 3D space
3. To explain methods to solve Linear P.D.Es with constant and Variable coefficients.
4. To discuss the boundary value problems and Laplace Equation.

UNIT –I:
Differential Equations in more than two variables : Methods of solutions of dx/P =dy/Q = dz/R-Orthogonal trajectories of a system of curves on surface-Pfaffian differential forms and equations in Three variables . (Sections 3,4,5 and of Chapter 1)

UNIT – II:
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-Integral surfaces passing through a given curve –Surfaces orthogonal to a given system of surfaces-Charpit's method.(Sections 1,2,3, 4,5,6 and 10 of Chapter 2)

UNIT – III:
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)

UNIT-IV:
Laplace's Equations : Elementary solution of Laplace's equation-Families of equipotential surfaces-Boundary value problems – Separation of variables.(Sections 2,3,4 and 5 of Chapter 4)

Scope and Standard as in **" Elements of Partial Differential Equations" by IAN Sneddon** Chapter 1: Section 1 to 6, Chapter 2: Sections 1,2,4,5,6,10 Chapter 3: Sections 1,4,5, chapter 4: Sections 2,3,4,5, Chapter 5: Sec2, Chapter 6: Section 3 and 4.

Reference :

1. Ordinary and Partial Differential Equations by M.D. Raisinghania.
2. Advanced Differential Equations by M.D.Raisinghania, S. Chand Company Limited, New Delhi, 2021.
3. An elementary course to P.D.E by T.Amarnath, Second Edition, Narosa publishing house.

Course outcomes:

Students will be able to

Analyze the origin of first order PDEs and Integral surfaces passing through a given curve

1. Identify linear and nonlinear PDE and solve nonlinear PDE by Charpit's method.
2. Apply Variables separable methods to solve Laplace Equation in cylindrical or spherical coordinates.
3. Obtain equipotential surfaces using Laplace's equation.
4. Understand the importance of partial differential equations in geometry, physics and other subjects.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1				S								
CO2	S											
CO3										M		
CO4						M						
CO5									S			

AMA 203(A): TOPOLOGY
(Common with paper MA 203 A of Branch I(B) 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 MinKowskisInequality- Euclidean and Unitary Spaces

UNIT – II:

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

UNIT – III:

Product of spaces-Trychonoff's theorem and loally compact spaces-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 –
Connected spaces.

Articles 9 to 13,16,17,18,21 to 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.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	M											
CO2							M					
CO3					L							
CO4						M						
CO5				M								
CO6		M										

AMA 203 (B) MAGNETO HYDRO DYNAMICS

Course Objectives:

Magneto hydrodynamics has been successfully applied to a number of astrophysical problems (e.g., to problems in Solar and Magnetosphere Physics), as well as to problems related to laboratory physics, especially to fusion devices. This module gives an introduction to classical magneto hydrodynamics. Students will get familiar with the system of magnetohydrodynamic equations and main theorems that follow from this system (e.g., conservation laws, anti-dynamo theorem). They will study the simplest magnetic equilibrium configurations, propagation of linear waves, and magneto hydrodynamic stability.

UNIT-I :

Three dimensional flows – Introduction – Sources, Sinks and Doublet – Images in a rigid infinite plane –Images in solid sphere – axisymmetric flows – Stroke's stream function – some special forms of the stream function for axisymmetric irrotational motion.

UNIT-II:

Two dimensional flows – Meaning of two dimensional flow – Use of Cylindrical polar co-ordinates – The complex potential for two dimensional, Irrotational Incompressible flow – complex velocity potentials for standard two dimensional flows – examples – Two dimensional Image systems – The Milne-Thomson Circle Theorem – The theorem of Blassius.

UNIT-III:

Magneto Hydro Dynamics: Nature of MHD – Maxwell's Electro magnetic field equations – Medium at rest – Medium in motion – The equation of motion of a conducting fluid – Rate of flow of change – Simplification of the Electro magnetic field equations – The magnetic Reynold's number – Alfven's theorem.

UNIT-IV:

The magnetic body force – Ferraro's Law of Isorotation – The magneto hydrodynamic waves – A more detailed Investigation of Alfven Waves – Laminar flow – of a viscous conducting liquid between parallel walls in a transverse field.

Standard and treatment as in Articles 4.1 to 4.5 of Chapter 4, Articles 5.1 to 5.9 of Chapter 5, Articles 9.1 to 9.10,9.12.1 and 9.14 of Chapter 9 of **"TEXT BOOK OF FLUID DYNAMICS" by F. Chorlton, CBS Publications and Distributors, Delhi, 1985**.

Course Outcomes:

1. Understanding the basic concepts and the equations of flow of viscous fluids. Understanding the electromagnetic induction mechanism which has its origin in the movement of fluids that are good electrical conductors
2. Ability to translate a magnetic hydrodynamic problem in an appropriate mathematical form.
3. Ability to interpret the solutions of the equations established in physical terms.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1												
CO2												
CO3												
CO4												
CO5												

AMA 204: (A) ADVANCED COMPLEX ANALYSIS
(Common with paper MA 204(A) of Branch I(B) Mathematics)

Course Objectives:

1. To introduce some topics of contemporary Advanced complex analysis.
2. To explain Laurent Series, poles and singular points.
3. To understand Residue theorem and its applications.
4. To discuss Laplace's equation, Harmonic functions and Dirichlet problem.
5. To analyse various methods to solve problems in day to day life.

UNIT –I:

Laurent Series-Singular Points: Laurent Series-Laurent's Theorem-Poles and Essential Singular points-Behavior at an Essential Singular point. Picard's Theorem-Behavior at infinity.

UNIT – II:

The Residue Theorem and its Applications: The Residue Theorem-Residues at infinity-Jordan's Lemma-Evaluation of Definite Integrals – The Argument principal-The Theorems of Rouche and Hurwitz-Local Behavior of Analytic Mappings-The Maximum Modulus principle and Schwarz's Lemma.

UNIT – III:

Harmonic Functions: Laplace's Equations-Conjugate Harmonic Functions-Poisson's integral. Schwartz's Formula-The Dirichlet problem.

Conformal Mapping: General Principles of Conformal Mapping –Mapping of the Upper Half-Plane onto a Rectangle –The Schwarz-Christoffel Transformation.

UNIT-IV:

Infinite product and Partial Fraction Expansions: Preliminary Results- Infinite Products- Weierstrass' Theorem –Mittage – Leffer's Theorem – The gamma Functions –Cauchy's Theorem on Partial Fraction Expansions.

Scope and Standard as in **" Introductory Complex Anlaysis" by Richard A. Silverman, Dover Publications, Inc. New York (1972)** Chapter 11 to 15.

Reference:

1. Fundamentals of Complex Analysis- Edward B. Saff, Arthur David Snider, Pearson Education
2. Foundations of Comlex Analysis by S. Ponnusamy- Narosa Publications.

Course Outcomes:

1. Explain the basic properties of complex integration and compute such integrals.
2. Learn topics of contemporary Advanced complex analysis in particular spaces of holomorphic functions, entire functions, harmonic functions and conformal mapping functions.
3. Apply advanced techniques to evaluate definite integrals and differential equations in applied areas.
4. Explain general principles of conformal mapping.
5. Compute the residue of a function and use the Residue Theory to evaluate a contour integral or an integral over the real line

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1						M						
CO2		M										
CO3	S											
CO4				M								
CO5												S
CO6												

AMA 204 :(B): NON LINEAR ANALYSIS
(Common with paper MA 204 (C) of Branch I (B) Mathematics)

Course Objectives:

1. Analyse and describe Fixed point theory, Banach's Contraction Principle, Schavder's theorem, Krasnoselski's theorems and its applications.
2. Define linear operators, normed spaces, Banach algebra, compact linear operators, spectrum, approximation theory.
3. Proving the spectoral theorem, properties of bounded linear operators, Fredholm alternative, operative equations etc.,.

UNIT-I

Fixed point theory and Applications :Banach's Contraction principle (Theorem 4.1.1 of text Book 1) – its applications (Theorem 8.1.1 and Theorem 8.2.4 of text book 1. Schavder's fixed point theorem (Theorem 4.3.10 of text book 1)- its application (Theorem 8.1.3 of text book 1). Krasnoselskii's fixed point theorem (Theorem 4.3.16 of text book 1) – its application to integral equations (theorem 8.2.3 of text book 1)

UNIT-II

Approximation Theory: Approximation in Normed spaces- Uniqueness, strict convexity-uniform approximation- chebyshev polyamines- Approximation in Hilbert space-splines. (Chapter 6 of text book 2)

UNIT-III

Spectral Theory of Linear Operators in Normed Spaces : Spectral Theory in Finite Dimensional Normed Spaces- Basic concepts spectral properties of Bounded linear operators-Further

properties of Resolvent and spectrum- Use of Complex Analysis in spectral Theory – Banach algebras –Further properties of Banach algebras. (Chapter 7 of text book 2)

UNIT-IV

Compact Linear operators in Normed spaces and their Spectrums : Compact linear operators on Normed Spaces- Further of Compact linear operators –Spectral properties of compact linear operators on normed spaces – Further spectral properties of compact linear operators –Operator equations involving compact linear operators –Further theorems of fredholm type – Fredholm alternative (Chapter 8 of text book 2)

Text Book:

1. **Mohan C. Joshi and Remendar K. Bose – Some topics in Nonlinear functional Analysis, Wiley Eastern Limited 1985, New Delhi.**
2. **Ervin Kreyszig:- Introductory Functional Analysis with Applications, John Wiley & sons. Inc., 1978, New York.**

Course Outcomes:

1) Explain fixed point theory and its applications by well known theorems.
2) Analyse the approximations in Normed spaces, strict convexity – uniform, Chebyshev polyamines, Hilbert space , splines.
3) Evaluation of spectral theory in normed spaces, finite dimensional normed spaces.
4) Spectral properties of boundary linear operator, compact linear operator, Resolvent and spectrum.
5) Use of complex analysis in spectral theory, Banach algebras.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1					M							
CO2						S						
CO3							M					
CO4	S											
CO5				M								
CO6												

AMA 205: MEASURE AND INTEGRATION
(Common with paper MA 205 of Branch I(B) Mathematics)

Course Objectives

1. To acquire basic knowledge of measure Theory.
2. To Explain the Contents : Lebesgue integral, general theory of measure spaces **.**
3. To understand the Riemann integtal and lebesgue integral of a bounded function.
4. To analyse the differentiation of monotone functions of bounded variation.

UNIT –I :
Lebesgue Measure: Introduction, Outer measure, Measurable sets and Lebesgue measure, a non measurable set, Measurable functions, Little wood's three principles

UNIT – II:
The Lebesgue Integral: The Riemann integral, the Lebesgue integral of a bounded function over a set of finite measure, the integral of a non negative function, the general Lebesgue integral , convergence in measure.

UNIT – III:
Differentiation and Integration: Differentiation of Monotone functions –Functions of bounded variations-Differentiation of an integral – Absolute continuity –Convex functions.

UNIT-IV:
The Classical Banach Spaces: The $\boldsymbol{L^P}$ Spaces, The MinKowski and Holder inequalities, Convergence and completeness, Approximation in $\boldsymbol{L^P}$,Bounded linear functional on the $\boldsymbol{L^P}$ Spaces.

Syllabus and Scope and Standard as in **" Real Analysis" by H.L. Royden, Prentice Hall of India private limited, New Delhi,2001-Third edition**. Chapter 3, Chapter 4, Chapter 5, and Chapter 6.

Reference :

1. Principles of Mathematical Analysis , Third Edition by Walter Rudin.
2. A Real Analysis by H.L.ROYDEN, III ED., Peasion publishers .
3. Measure theory by P.R. HALMOS, 1974. Spingerverlag.
4. Measure theory by V.I.BOGACHVE,1997., Spingerverlag.

Course Outcomes:

To document insight in modern theory of integration as a tool in advanced analysis and in statistics.

1. Compute Lebesgue measures.
2. Establish the measurability or non-measurability of sets and functions.
3. Approximate measurable functions by simple and step functions.
4. Compute Lebesgue integrals of bounded functions over a set of finite measure. Explain Fourier analysis.
5. Decide under which conditions the fundamental theorem of calculus is applicable in the context of Lebesgue integration.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1		M										
CO2					M							
CO3						M						
CO4									S			
CO5	S											

AMA 206: MATHEMATICAL STATISTICS
(Common with the paper MA 206 of Branch I(B) Mathematics)

Course objectives:

1. To introduce basic concepts of statistics, various distribution functions
2. To help in acquiring skills in handling situations involving more than one variable.
3. To explain the objective of Central limit Theorem and theorems on limiting distributions.

UNIT –I :

The probability set function –Random variables –The probability density function –The distribution function-Mathematical expectations-Some special mathematical expectations – Chebyshev inequality. Conditional probability –Marginal and conditional distributions-The Correlation coefficient-Stochastic Independence.

UNIT – II: The Binomial, Poisson, Gamma, chi-square normal distribution. Distributions of functions of Random variables –Sampling theory- Transformation of Variables of Discrete type-Transformation of Variables of the continues type.

UNIT – III:
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 –Some theorems on Limiting Distribution.

UNIT-IV:
Point estimation-Measures of quality of estimations-confidence intervals for means-confidence intervals for difference of Means-confidence intervals for variances.
A Sufficient statistics for a parameters- The Rao –Blackwell theorem-The Rao Cramer's inequality.

Syllabus and Scope as in **" Introduction to Mathematical Statistics" by Robert V. Hogg Allen T. Craig, Macmillan publishing co., Inc., New York -1978,** section 1.4,1.5,1.6,1.7,1.9,1.10,1.11, of chapter 1, chapter 2, sections 3.1 to 3.4 of chapter 3, sections 4.1 to 4.4, 4.6 to 4.8 of chapter 4, chapter 5, sections 6.1 to 6.5 of chapter 6, section 10.1, 10.2 chapter 10, section 11.1 of chapter 11.

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. To explain stochastic convergence
3. To discuss measures of quantity of estimations
4. Study confidence intervals of variances.
5. Understand Rao-Blackwell theorem and Rao Cramer's inequality
6. Able to analyze the data of practical problems.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1						M						
CO2				M								
CO3					M							
CO4								M				
CO5							L					
CO6	S											

THIRD SEMESTER (ODD)

AMA 301 CONTINUUM MECHANICS

Course Objectives:

1) The purpose of the course is to expose the students to the basic elements of continuum mechanics in a sufficiently rigorous manner.
2) To provide advanced treatment of the fundamental, unifying concepts of the mechanics of continua such as mechanics of viscous fluids, two dimensional flows.

UNIT I:

Kinematics of Fluids in motion (Chapter 2).

UNIT-II
Equations of motion of a Fluid (Chapter 3)

UNIT: III
Some Three –Dimensional Flows(Chapter 4)

UNIT IV :
Some two –Dimensional Flows. (Sections 5.1 to 5.9 of Chapter 5) Scope and standard as in the book **" Text Book of Fluid Dynamics" by F. Chorlton, C.B.S Publishers and Distributors , Delhi, 1985**

References : 1. D.S. Chandrasekharaiah and L. Debnatha Continuum Mechanics – Academic Press -1994
2. A.J.M. Speneer : Continuum Mechanics Long Man, 1980
3. Y. C. Feng, A first Course in Continuum Mechanics – Prentice Hall (2nd Edition) 1997

Course Outcomes:

1) Be able to describe motion, deformation and forces in a continuum.
2) Be able to derive equations of motion and conservation laws for a continuum.
3) Understand constitutive models for fluids and viscoelastic solids.
4) Formulate and solve specific technical problems of displacement, strain and stress.
5) Perform experiments with stresses and deformations.
6) Numerically model and analyse the stresses and deformations of simple geometries under an arbitrary load in both solids and liquids.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1				M								
CO2					S							
CO3			M									
CO4	S											
CO5									M			

AMA 302: FUNCTIONAL ANALYSIS
(Common with paper MA 302 of Branch I (A) Mathematics)

Functional analysis is one of the primary branches of mathematics mainly dealing with a variety of metrics' and linear operators.

Course Objectives:

1) Define and illustrate several normed spaces.
2) Introduce linear operators and derive their properties.
3) Elaborate basic theorems like open and closed mapping theorem, implicit function theorem and spectral theorem.

UNIT –I :

The definitions and some examples –continuous –linear transformations-the Hahn-Banach Theorem.

UNIT – II:

Natural imbedding of N in N**-Open mapping theorem –Conjugate of an Operator.

UNIT – III:
Definition and Simple Properties –Orthogonal Complements- Orthonormal sets –Conjugate spaces-Adjoint of an Operator.

UNIT-IV:
Self adjoint operators –Normal and Unitary Operators-Projection –Spectral theorem.
Scope and Standard as in Sections 46 to 51 of Chapter 9, section 52 to 59 of chapter 10, section 62 of chapter 11 of **" Introduction to Topological and Modern analysis by G.F. Simmons McGraw Hill Book Company**.

References:

1. " Foundations of Functional Analysis" by S. Ponnyusamy-Narosa Publications
2. " Text book of Functional Analysis – A Problem oriented Approach" by V.K. Krishnan-Prentice Halls of India Publishers
3. " Functional Analysis" by B.V. Limaye New age International Publishers

Course Outcomes:

1) They can work with different distance metrics and normed spaces.
2) Understand continuous linear transformations and the Hahn-Banach Theorem.
3) Comprehend the Open mapping theorem and Closed graph theorem.
4) Construct orthonormal sets and conjugate spaces.
5) Understand the relevance of self-adjoint operators, normal, unitary operators and projections.
6) Comprehend the ideas of determinants and the spectrum of an operator.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1				M								
CO2						M						
CO3					M							
CO4	S											
CO5												M
CO6											M	

Generic Elective

AMA 303(A): DIFFERENTIAL GEOMETRY

(Common with paper MA 303(A) of Branch I (A) Mathematics)

The aim of the course is to provide knowledge of the geometry of curves and surfaces. The course integrates concepts from different parts of mathematics, such as linear algebra, calculus and differential equations. It also provides intuitive examples for many concepts in linear algebra, calculus and differential equations. These examples are fundamental to physics and mechanics: they play a role in our understanding of the movements of particles and the theory of relativity.

Course Objectives:

1. Define the equivalance of two curves.
2. Find the derivative map of an isometry.
3. Analyse the equivalence of two curves by applying some theorems.
4. Defines surfaces and their properties
5. Express definition and parametrization of surfaces.
6. Express tangent spaces of surfaces.
7. Explain differential maps between surfaces and find derivatives of such maps.
8. Integrate differential forms on surfaces.

UNIT –I :
The Theory Space Curves: Introductory remarks about space curves –Definitions –Arc length-Tangent, normal, and binormal –Curvature and torsion of a curve given as the intersection of two surfaces –Contact between curves and surfaces-Tangent surface, involutes and evolutes.(Sections 1 to 7 of Chapter 1).

UNIT – II:
The Metric: Local Intrinsic Properties of a Surface: Definitions of a Surface- Curves on a surface-Surfaces of revolution –Helicoids- Metric-Direction Coefficients-Families of curves – Isometric correspondence –Intrinsic properties. (Sections 1 to 9 of Chapter 11).

UNIT – III:
Geodesics-Canonical Geodesic Equations-Normal Property of geodesics –Existence theorems-Geodesic parallels-Geodesic curvature-Gauss-Bonnet theorem –Gaussian curvature-Surfaces of constant curvature –Conformal mapping-Geodesic mapping (Sections 10 to 20 of Chapter 11).

UNIT-IV:
The second Fundamental Form: Local non – intrinsic properties of a surface: The second fundamental form-principal curvatures –Lines of curvature -Developables associated with space curves-Developables associated with curves on surfaces –Minimal surfaces-Ruled surfaces-The fundamental equations of surface theory –Parallel surfaces. (Sections 1 to 10 Chapter III).

Scope and Standard as in Sections and chapters as specified above of the book **" An Introduction to Differential Geometry" of T.J Willmore, Oxford University Press, Thirteenth Impression, 1997.**

References: 1. A first course in Differential Geometry- D. Soma sundaram – Narosa Publications.

Course Outcomes: After completing this course, students should be able to

1. Determine and calculate curvature of curves in different coordinate systems.
2. Parameterize surfaces and use the metric tensor. Calculate isometries.
3. Treat geodesic curves and parallel translation.
4. Calculate and analyse curvature of surfaces in different settings.
5. Know the concept of tensor and recognize tensors that are used in mechanics, image processing and theory of relativity.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	M											
CO2				M								
CO3					M							

CO4									M			
CO5					S							

AMA 303 (B): Mathematical Methods

Course Objectives:

This course develops a student's proficiency in working with mathematical methods, and it investigates some applications to problems in economics, management and related areas. The course also develops the student's understanding of the theoretical concepts behind these methods.

UNIT –I:

Laplace's wave and Heat Conduction equation, Laplace equation, Wave equation, Heat Conduction equation

UNIT –II:

Applications of Laplace equation to boundary value problems –Applications of Electric circuit – Applications to dynamics, applications to beans Applications to heat conduction equation – Applications to wave equations.

UNIT –III:

Integral Equations: introduction –relation between differential and integral equations –The green's function –linear equations in cause and effect –the influence function (chapter-3 section 3.1 to 3.11)

UNIT –IV:

Fredholm equation with separable kernel –illustrative examples –Hilbert schemed theory – iterative methods for solving equations of second kind –The Neumann series – Fredholm.

TEXT BOOKS

1. Stand as an integral equations by Dr.J.K Goyal Gupta 1st edition. Pragathi prakasam part-2 units 2&3

2. Stand as in methods of applied mathematics by franciesB.Hilbrand ,second edition ,prentice hall of india 1960.

Course Outcomes: After completing this course, students should be able to

1. Knows and can use: a) concepts, results and methods from real analysis of single-variable functions related to limits, continuity, differensiation, integration and differential equations. b) concepts, results and methods related to systems of linear equations. c) numerical methods for solving equations, integrals and differential equations.

2. Knows some engineering applications of mathematics.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

304: CLASSICAL MECHANICS
(Common with paper MA 304 of Branch I (B) Mathematics)

Course Objectives:

1) This course is intended to provide a treatment of basic knowledge in mechanics used in deriving a range of important results and problems related to rigid bodies.
2) The objective is to provide the student the classical mechanics approach to solve a mechanical problem.
3) 3) To enable the students to acquire knowledge of Mechanics. Also to understand the concepts of Lagrange's Equation and Hamiltonian Principle.

UNIT –I :

D'Alembert's Principle and Lagrange's Equations: Some Definitions-Classification of Dynamical System-Some Examples of Constraints Virtual Displacement-Principle of Virtual Work –Generalised Force in Holonomic System-Mathematical Expression for the principle of Virtual work-D'Alember's principle-Lagrange's Equations for a Holonomic system-Velocity-dependent potential –Lagrange's Equations of Motion for conservative , Non-holonomic system-physcial Significance of 1 –Harmonic Oscillator.

UNIT – II:

Variational Principle and Lagrange's Equations:Variational Principle-Calculus of Variations-Hamilton Principle-Derivation of Hamilton's Principle from Lagrange's Equations-Derivation of Lagrange's Equations from Hamilton's Principle –Extension of Hamilton's Principle – Hamilton's Principle for Non-conservative, Non-holonomic System –Generlised Force in Dynamic system-Hamilton Principle for Conservative-Non holonomic System -Lagrange's Equations for Non –conservative –Holonomic System –Cyclic or lgnorable Coordinates – Conservation Theorem-Conservation of Linear Momentum in Lagrangian Formulation-Conservation of Angular Momentum in Lagrangian Formulation –Conservation of Angular Momentum –Conservation of Energy in Lagrangian Formulation.

UNIT – III:
Hamilton's Equations of Motion: Derivation of Hamilton's Equations of Motion (using Lagrange's Equations)-Routh's Procedure-Equations of Motion-Derivation of Hamilton's Equations from Hamilton's Principle –Principle of Least Action-Distinction between Hamilton's Principle and Principle of Least Action.

UNIT-IV:
Canonical Transformations: Canonical Coordinates and Canonical Transformations –The necessary and Sufficient Condition for a Transformation to be Canonical –Examples of Canonical Transformations-Properties of Canonical Transformulations- Infinitesimal Contact Transformation-Relation between Infinitesimal Contact Transformation and Poissson's Bracket-Hamilton Jacob Theory –Hamilton-Jacobi equations for Hamilton's Principle Function.

Syllabus and treatment as in the Book **" Classical Mechanics" by C.R. MONDAL Prentice Hall of India PrivateLimited, New Delhi, 110001,2001**, Chapter 1,2,4 and 5.

References: 1. Classical Mechanics by Goldstein Herbert, Charles P Poole, John safiko-Pearson India
2. Introduction to Classical Mechanics by Takwale R. Puranik P, Mc. GrawHill Education

Course Outcomes:

1) Understand D' Alembert's Principle and simple applications of the Lagrangian Formulation.
2) Derive the Lagrange's Equation from Hamilton's Principle.
3) Study the concept of the Equations of Motion and the Equivalent One-Dimensional Problems.
4) Distinguish the concept of the Hamilton Equations of Motion and the Principle of Least Action.
5) Get familiar with canonical transformations, conditions of cononicity of a transformation in terms of Lagrange and Poisson brackets.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	M											
CO2				M								
CO3					M							
CO4									M			
CO5					S							

SKILL DEVELOPMENT COURSE
AMA305: MAT-LAB
(Common with paper MA 305 of Branch I (B) Mathematics)

Course Objectives:

1. Getting started with MATLAB
2. To create Matrices.
3. To learn 2D and 3D Plotting Techniques.
4. Write programming ways to solve algebraic & Transcendental 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-plotting techniques- 2-D plotting-Subplot- 3-D plotting

UNIT-II (MATLAB Programming)

M-files-Script files-Relational operators-conditional statements-Numerical solutions to algebraic and transcendental equations- Solution of Simultaneous Algebraic Equations.
Syllabus and treatment as in the Book:
Getting Started with MATLAB – A Quick Introduction for Scientists and Engineers, Rudra Pratap, Oxford University Press.

References:

1. Engineering Problem solving with MATLAB, D.M.Etter, Printice-Hall
2. MATLAB Programming for Engineers. (4th ed.), Stephen J. Chapman, Cl Engineering.
3. MATLAB: Demystified -Basic Concepts and Applications, K K.Sarma, Vikas Publishing House Pvt Lt.

Course Outcomes:

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

MATLAB Practicals:

1. Basic 2D-plots

2. Basic 3D-plots

3. Bi-section method

4. False position method

5. Newton Raphson method

6. Creation and operations on Matrices

7. Gauss Elimination method

8. Gauss Jordan method

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1				M								
CO2						M						
CO3										S		
CO4	S											
CO5												
CO6												

Open Elective (Other Departments)

AMA 306 A: BUSINESS MATHEMATICS -1

(Common with paper MA 306 of Branch I(A) Mathematics)

The Business mathematics contains Investments, Interest, Annuities, Mortgages, Cost, Revenue, Profit, supply and demand, Mathematical Modelling, and optimization,etc.

Course Objectives:

1. To understand the basic concepts of Mathematics.
2. To know how to calculate percentages, profit and loss of problems.

3. To solve Linear equations
4. To understand of one number system To Another System.

Unit - I
Number- H.C.F. and L.C.M. of Numbers - Decimal Fractions.

Unit - II
Surds and Indices – Percentage - Profit and loss.

Unit - III
Linear Equations in Two Variables – Ratio and Proportion- Variation.

Unit -IV
Number System: Types of Number Systems – Conversion of Decimal Number to Binary Number and Vice versa -Conversion of Decimal numbers to Octal numbers and Vice versa - Conversion of Hexadecimal number into Decimal number and Vice versa - Binary Arithmetic.
Scope and Standard Treatment as in Chapters 1,2,3,9,10,11,31,12 of"**OBJECTIVEARITHMETIC" , by R.S.AGGARWAL , S.Chand and Company**.
Scope and Standard Treatment as in Chapter 1 of "**BUSINESS MATHEMATICS", by P.R.VITTAL , MARGHAM PUBLICATIONS.**

Course Outcomes:

1. Apply the knowledge in mathematics (algebra, matrices, calculus) in solving business problems.
2. Analyse and demonstrate mathematical skills required in mathematically intensive areas in Economics and business
3. Explain the Concepts and use Equations, formulae and Mathematical expressions and in a variety of contexts.
4. Understand the Binary ,octal , decimal and hexadecimal system.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1						M						
CO2	S											
CO3				M								
CO4								M				
CO5							M					

CO6				M								

AMA 306 B: Fundamentals of Mathematical Statistics
(Common with paper MA B: 306 of Branch I (A) Applied Mathematics)

Course Objectives

1. To introduce basic concepts of statistics, various distribution functions
2. To help in acquiring skills in handling situations involving more than one variable.
3. To explain the objective of Central limit Theorem and theorems on limiting distributions.

UNIT - I

Correlation analysis: measuring and significance of correlation –types of correlation; important methods of Studying correlation –scatter diagram methods, Karl Pearson's coefficient of correlation, and Rank correlation Coefficient –Coefficient of Determination.

UNIT -II

Regression analysis: Meaning and significance of regression lines, regression equations, Coefficient of regression, standard error of the estimate.

UNIT- III

Test of Significance: (small sample sets only) –t, X2 and F tests and their applications

UNIT - IV

Elements of matrix algebra: Elementary operations –rank of matrix –inverse of a matrix – solutions of linear equations by matrix method and Cramer's rule.

References:

1." Gupta, S.P".Statistical Methods.
2. "Hooda R.P" Statistical for business Economics, Macmillan, New Delhi.
3.Statistical Methods Concepts, applications and computation by Aggarwal YP Sterling Publications.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	M											
CO2						S						
CO3							M					
CO4									S			
CO5												
CO6												

FOURTH SEMESTER

AMA 401: NUMBER THEORY

(Common with the paper MA 401 of Branch (B) Mathematics)

Course Objectives:

1. Identify certain number theoretic functions and their properties
2. Explain the Arithmetical Functions.
3. Understand the concept of a congruence and use various results related to Congruence including the Chinese Remainder Theorem.
4. Discuss Quadratic Residues and its Applications.

UNIT –I :

Arithmetical Functions and Dirichlet Multiplication: Introduction-The Mobius function μ (n)-The Euler totient function $\emptyset$ (n) –A relation connection $\emptyset$ and μ -A product formula for $\emptyset$ (n) -The Dirichlet product of arithmetical functions –Dirichlet inverses and the Mobius inversion formula-The Mangoldt function Λ(n) –Multiplicative functions-Multiplicative functions and Dirichlet multiplication-The inverse of a completely multiplicative function-Liouville's Function λ(n)-the divisor functions $\sigma_{\propto}$(n) – Generalized convolutions –Formal power series –The Bell series of an arithmetical function –Bell series and Dirichlet multiplications –Derivatives of arithmetical functions-The Selberg identity .

UNIT – II:

Averages of Arithmetical Functions : Introduction –The big oh notation Asymptotic equality of functions-Euler's summation formula –Some elementary asymptotic formulas-The average order of d(n)-The average order of the divisor functions $\sigma_{\propto}$(n)-The average order of $\emptyset$ (n) -An application to the distribution of lattice points visible from the origin-The average order of μ (n) and of Λ(n) - Another identity for the partial sums of a Dirichlet product.

UNIT – III:

Congruences: Definition and basic properties of congruences-Residue classes and complete residue systems-Linear congruences –Reduced residue systems and the Euler-Fermat theorem-Polynomial congruences modulo p.Langranage's theorem-Applications of Lagarange's theorem-Simultaneous linear congruences – The Chinese remainder theorem –Applications of the Chinese remainder theorem –Polynomial congruences with prime power moduli- The Principle of cross-classification- A decomposition property of reduced residue systems.

UNIT-IV:
Quadratic Residues and the Quadratic Reciprocity Law: Quadratic residues-Lengendre's symbol and its properties –Evaluation of (-1|p) and (2|p) –Gauss' lemma-The quadratic reciprocity law – Applications of the reciprocity law –The Jacobi symbol
Primitive Roots: The exponent of a number mod m. Primitive roots –Primitive roots and reduced residue systems –The nonexistence of primitive roots mod 2^{α} for $\propto \geq 3$.
Scope and Standard as in chapter 2, Chapter 3, Chapter 5, Sections 9.1 to 9.7 of Chapter 9 and Sections 10.1 to 10.3 of chapter 10 by **Tom. M. Apostal , " Introduction to Analytical Number Theory" Springer International Student Edition** .

Course outcomes:

1. the Arith Understand metical Functions.
2. Use Φ(n), LI(n), Λ(n).
3. Understand the definitions of congruences, residue classes and least residues
4. Apply legendary polynomial and application of reciprocity law.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1									M			
CO2	S											
CO3												S
CO4							L					
CO5				M								
CO6												

AMA 402: FLUID DYNAMICS

Course Objectives:

1) Prepare a foundation to understand the motion of fluid and develop concept, models and techniques which enables to solve the problems of fluid flow.
2) Explain Navier –Stokes Equations
3) Analyse the Laminar Boundary Layer in incompressible flow.

4) To Analytic solutions of the Boundary layer equations

UNIT –I

Dynamics of Real fluids- Introduction-Equations of motion for viscous flow .

UNIT-II

Some exact solutions of the Navier –Stokes Equations –Very slow motion

UNIT- III

The Laminar Boundary Layer in incompressible flow -Introduction - The Boundary layer equations.

UNIT IV:

Analytic solutions of the Boundary layer equations

Scope and standard as in chapter 5, sections 6.1,6.2, 6.3.1 to 6.3.4 of Chapter 6 of **" Modern Fluid Dynamics" (Volume I, Incompressible Flow) by N. Curle and H.J Davies, D. Van Nostrand Company Ltd., London, 1968.**

References: 1. Foundations of Fluid Mechanics by S.W. Yuan – Prenctice Hall of India PVT Ltd, New Delhi.

2. An Introduction to Fluid Dynamics by Batchelor G.K., Cambridge Mathematical Library.

Course Outcomes:

1) Be familiar with continuum model of fluid flow and classify fluid/flows based on physical properties of a fluid/flow along with Eulerian and Lagrangian descriptions of fluid motion.
2) Derive and solve equation of continuity, equations of motion, vorticity equation, equation of moving boundary surface, pressure equation and equation of impulsive action for a moving inviscid fluid.
3) Understand Boundary layer Equations.
4) Solve Analytic Boundary layer equations .

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1									M			
CO2	S											
CO3			M									
CO4						L						
CO5											M	
CO6								M				

Generic Elective

AMA 403(A) GRAPH THEORY

(Common with the paper MA 403(A) of Branch (B) Mathematics)

Course Objectives:

1.To introduce the fundamental concepts of graph theory
2.To Study the properties of Trees and Connectivity.
3. To explain Eulerian graphs and Hamiltonian graphs
4. To apply graph theory in diversified fields such as Electrical Engineering computers science and communication networks etc

UNIT –I :

Graphs &Subgraphs: Graphs and simple Graphs-Isomorphism-Incidence and adjacency Matrices-Sub graphs-Vertex Degrees-Paths ad connection –Cyles-Shortest path-Problem-Sperner's Lemma

UNIT – II:
Trees: Trees-Edges and Bonds-Cut vertices, cayley's Formula –Applications-Connected problem

UNIT – III:
Connectivity-Connectivity –Blocks-Application Construction of Reliable communications Networks.

UNIT-IV:
Euler Tours and Hamiltonian Cycles: Euler Tours – Hamilton cycles Application –Chinese Postman Problem –Travelling Salesman Problem .

Scope and standard as in chapters 1 to 4 **" Graph Theory with application" J.A. Bondy and U.S.R. Murthy, M.C. Millan Press**

Rererences : 1. Discrete Mathematics & Graph Theory, by SatyanarayanaBhavanari, K. Syam Prasad, PHI Pvt Ltd, New Delhi Second Edition,2014
2. Mathematical Foundation of Computer Science by SatyanarayanaBhavanari, T. V. Pradeep Kumar, Sk. Mohiddin Shaw, BS Publications, Hyderabad,2016.
3. Graph Theory with applications to Engineering and Computer Science – NarsinghDeo
4. First look at Graph Theory- John Clark Derek Allaw Holton.
5. Introduction to Graph Theory- Robin . J. Wilson
6. Introduction to Graph Theory- Douglas B. West
7. Graph theory with applications to engineering and computer science by Narsing Deo, PHI
8.Discrete mathematics for computer scientists and Mathematics by J.L.Mott, A.Kandel and T.P.Baker, Prentice Hall of India

Course outcomes:
1. Able to define basic concepts of graphs
2. Utilize the algorithms to find the shortest path,Optimal tree from a given graph
3 . Construct the Reliable Communication netwprks
4. Understand the concepts of practical problems like Chinese postman problem and travelling salesman problem.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1				M								
CO2						M						

CO3										S		
CO4									S			
CO5							M					
CO6											L	

AMA 403 (B) APPROXIMATION THEORY
(Common with the paper MA 403 (B) of Branch I (B) Mathematics)

Course Objectives:

Main objective to teach students many important results on several useful topics including metric spaces.

1) To learn about metric spaces, normed linear spaces, innerproduct spaces, convexity.
2) Describe the existence and unicity of best approximation, characterization of the solution.
3) Description of Algorithms like Polya's, Ascent, Descent, Reems and Interpolation, Weierstrass Theorem.
4) Discretize Errors in general and Algebraic Polynomials.

UNIT –I :

Nomenclature-Metric spaces-Normed linear space-Inner product spaces-convexity

UNIT – II:

Existence and Unicity of Best approximation-Convex functions-System of Equations with one unknown –Characterization of the solution –The special case n=n+1.

UNIT – III:
Polya's Algorithm-Ascent Algorithm –Descent Algorithm –Interpolation-Weierstrass Theorem.

UNIT-IV:
General linear Families –The Unicity Problem –Discretization Errors: General and Algebraic Polynomials-Markoff and Bernstein inequalities –Remes Algorithm.

Scope and standard as in sections 1 to 7 of chapter 1, sections 1 to 8 of chapter 2, sections 1 to 8 of chapter 3 of "**Introduction to Approximation Theory, E.W. Cheney, "McGraw Hill Book Company.**

References : 1. Fundamentals of Approximation Theory by H.N. Mhaskar-Narosa Publications.
2. Approximation theory and methods, M.j.d. Powell , Cambridge University Press.

Course Outcomes:

1) Know the basic concepts of metric space and normed linear spece
2) Knows existence and uniqueness theorems for the best approximations in various Banach spaces.
3) Knows Bernstein's lethargy theorem and its practical and theoretical implications.
4) Be able to use and analyze the basic methods for polynomial approximations, interpolation.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1											L	
CO2				M								
CO3			M									
CO4				M								
CO5					M							
CO6				S								

AMA 404: OPERATIONS RESEARCH FOR INDUSTRY AND COMMUNITY DEVELOPMENT
(Common with the paper MA 404 of Branch (B) Mathematics)

Course Objectives:

1) Operations research helps in solving problems in different environments that needs decision.
2) This module aims to introduce students to use quantitative methods and techniques for effective decisions-making: model formulation and applications that are used in solving business decision problems.
3) Deterministic inventory models, EOQ model, no step model, setup model.
4) Queuing system, Elements of a queuing model, pure birth, death model.
5) Generalized poisson queuing model specialized poisson queues, single server model, multi-server model.
6) Network models, enumeration of cuts, maximal flow algorithm, linear programming formulation of maximal flow mode, CPM computations.

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 –Solution Linear programming Problem through Dynamic Programming (Chapter 8)

UNIT-III:

Game Theory: Introduction -Game with Pure Strategies-Game with Mixed Strategies – Dominance property-Graphical Methods for 2xn and mx2 Games –Linear programming approach to Game Theory (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 Problem.
2) Solve linear programming problem by using algebraic graphical method.
3) Use the simplex method to find an optimal vector for the standard linear programming problem and the corresponding dual problem.
4) Prove the optimality condition for feasible vectors for Linear Programming Problem and Dual Linear Programming Problem.
5) Use operations research to solve transportation problems during the allocation of trucks to the formulate operation research models to solve real life problem.
6) Understand Queuing theory basic concepts and solve queuing theory problems.
7) Deterministic inventory models, static economic, classic EOQ models.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1				M								
CO2	M											
CO3					S							

CO4						M						
CO5					M							
CO6										L		

MULTI DISCIPLINARY COURSE /PROJECT WORK

MA 405: COMPUTER ORIENTED NUMERICAL METHODS
(Common with paper AMA 405 of Branch I (A) Applied Mathematics)

Course objectives:

1. To provide the knowledge of the C-Language.
2. To make the students familiarize with the ways of solving complicated mathematical problems numerically.

UNIT-I:

Fundamentals of C language:

UNIT-I:

Fundamentals of C language:

Constants, Variables, and Data Types –Operators and Expressions –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 Decision making and loops: The WHILE Statement – the DO Statement –the FOR Statement –Jumps in LOOPS, Arrays: One dimensional arrays –Two dimensional arrays –Multidimensional arrays.

UNIT –II:

Numerical Integration- – Trapezoidal rule – Simpsons rules – Numerical solution by ODEs by Picard – Euler modified method – Range-Kutta Methods.

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1. Scope and Standard Programming in ANSI C" by E. Balaguruswamy(Sixth edition) Mc. Graw Hill Edition, India.

2. Scope and standard books Information Technology and Numerical methods fot Atul Kahate

Reference:

1. Numerical Methods: Problems and solutions, M.K. Jain, R.K. Jain, SRK Iyengar- New age International Publications
2. Let us "C"- Kanetkar BPB Publications
3. The "C" Programming Language- Kerghan, Brian W, Riechie Dennis M PHI Publisher.

Course outcomes:

1. Gain Knowledge in C-Language
2. Able to use commands operations of C.
3. Write the programming to solve problems in numerical methods.

Practicals:

1. Trapezoidal rule
2. Simpson's 1/3rd rule
3. Simpson's 3/8th rule
4. Picard's Method
5. Euler method
6. Modified Euler method
7. Range-Kutta Method
8. Milne's Simpson's method

.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	S											
CO2				M								
CO3										S		
CO4						M						

Open Elective (Other Departments)

AMA 406: BUSINESS MATHEMATICS-II
(Common with paper MA 406 of Branch I(B) Mathematics)

Course Objectives:

1. To understand the basic concepts of Mathematics
2. To have a proper understanding of Mathematical applications.
3. To understand the given data with data interpretation.

UNITI

Time and Work – pipes &cisterns-Time and distance

UNIT-II

Alligation or Mixture- Simple Interest – Compound Interest

UNIT-III

Algebraic Quadratic equations – series-Arithmetic and Geometric Progressions

UNIT-IV

Data Interpretation- Pie chart-Bar Diagram-Line graphs

1.Scope and Standard Treatment as in Chapters 15,16,17,20,21,22,32,33,41,42,43. Of **"OBJECTIVE ARITHMETIC" , by R.S.AGGARWAL , S.Chand and Company.**
2.Scope and Standard Treatment as in Chapter 1 of "**BUSINESS MATHEMATICS**", **by P.R.VITTAL , MARGHAM PUBLICATIONS.**

References:
1. Quick Arithmetic by Ashish Aggarwal S.Chand
2. Quantitative Aptitude for competitive Examinations bu Dr. R.S. Aggarwal

Course Outcomes:

1. Able to solve problems on Time and work, Distance
2. Understand the mixtures
3. Calculate the Simple intertest and compound interest.
4. Analyse the data from charts and graphs.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1				S								

CO2						M						
CO3									M			
CO4										S		

AMA 406(B) : BASIC MATHEMATICS FOR SOCIAL SCIENCES (EE)
(Common with paper MA 305 (C) of Branch I(A) Mathematics)

Course Objectives:

1. Understand the concepts of Linear independence,bases of a vector space & linear transformations.
2. Study Eigen values and Eigen vectors.
3. Discuss operations on vectors.
4. Introduce the Numerical Techniques of Taylor series & Runge-Kutta Methods.

UNIT –I :

Linear Algebra : Matrices-Rank of a matrix, Elementary transformations of a matrix, Inverse of a Matrix, System of linear equations, Linear transformations, Eigen values and Eigen vectors. Vector Analysis-Definition of a vector, Vector addition, Vector manipulation – Scalar product, Vector ; Orthogonal components manipulation-Scalar product, Vector product; Orthogonal components of a vector, Differentiation of vectors.

UNIT – II:

Differential Calculus : Limits and Continuity, Differentiation of functions, Successive differentiation, Leibnitz's theorem for nth derivative, Taylor's and Maclaurin's series, Applications to maxima and minima of functions, partial differentiation, Euler's theorem.

UNIT – III:

Integral Calculus: Introduction, Integration –by substitution, by parts, by partial fractions: Definite integrals, Applications to areas, length, and volumes.
Differential Equations: Equations of 1 st order and 1st degree.

UNIT-IV:
Numerical Methods –I Computer arithmetic, Representation of numbers, computer errors in representing numbers, Finding roots of equations-Bisection, Newton, and Secant methods; Interpolation and Numerical differentiation- Polynomial interpolation, Newton-Gregory forward interpolation, Backward differences; Numerical integration-Trapezoidal and Simpson's rules Elements of matrix algebra-elementary operations – rank of matrix-inverse of a matrix-solutions of linear equations by matrix method and Cramer's rule .

Text Books :

1. **Grewal B.S. Elementary Engineering Mathematics, 10th edition, Khanna publishers**
2. **Cheney W. and Kincaid D, Numerical Mathematics and Computing, vikas Publications, 2003**.

References:

1. Lispschutz S, and Lipson M, Schaum'sOut line of Linear Algebra, McGraw-Hill, 2000.
2. Ayres F, and Mendelson E, Schaum's Outline of Calculus, 4th edition, Mc.Graw-Hill, 1999.
3. Rajaraman V, Computer Oriented Numerical Mehtods, 3rd edition, PHI 1993.
4. Finite Dimensional vector spaces by Paul R.Halmas,2nd edition, Princeton N.J.D Company,1918.
5. Linear algebra by K.Hoffman and R.Kunze 2nd edition,Pearson Education Taiwan ltd.
6. Numerical Methods:Problems and solutions M.K.Jain, R.K.Jain, SRK.Iyengar, Newage International publications

Course Out comes:

1. Understand the concepts of vector spaces with bases.
2. Discuss algebra of Transformations and orthogonal components.
3. Understand the concepts of Limit, continuity &differentiation of functions.
4. Apply Integrals to find areas, length & volume of regions.
5. Apply the numerical Techniques to solve differential equations &Algebraic equations.

CO/PO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1				M								
CO2						M						
CO3					M							
CO4												S

CO5										S		