SRI VENKATESWARA UNIVERSITY : TIRUPATI

Master of Sciences

CBCS Pattern

( With Effect From 2016-17)

The Course of study And The Scheme of Examinations

## SEMESTER = I

## M.Sc. Mathematics

| S. No | Components of study | | Title of the paper | Instructions hours per week | Credits | Internal Assessment Marks | End Semester Exam Marks | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | Core | 1 | Algebra | 6 | 5 | 20 | 100 | 120 |
| 2 | | 2 | Real Analysis | 6 | 5 | 20 | 100 | 120 |
| 3 | | 3 | Ordinary Differential Equations | 6 | 5 | 20 | 100 | 120 |
| 4 | | 4 | Complex Analysis | 6 | 5 | 20 | 100 | 120 |
| 5 | Compulsory Foundation | 5 | Human Values and Professional Ethics- I | 6 | 5 | 20 | 80 | 100 |
| 6 | Elective Foundation | 6 | Computer Oriented Numerical Methods | 6 | 5 | 20 | 100 | 120 |
| | Total | | | 36 | 30 | 120 | 580 | 700 |

## SEMESTER = II

## M.Sc. Mathematics

| S. No | Components of study | | Title of the paper | Instructions hours per week | Credits | Internal Assessment Marks | End Semester Exam Marks | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | Core | 1 | Galois Theory | 6 | 5 | 20 | 100 | 120 |
| 2 | | 2 | Partial Differential Equations | 6 | 5 | 20 | 100 | 120 |
| 3 | | 3 | Topology | 6 | 5 | 20 | 100 | 120 |
| 4 | | 4a<br>4b<br>4c | Advanced Complex Analysis<br>Semigroup Theory<br>Nonlinear Analysis | 6 | 5 | 20 | 100 | 120 |
| 5 | Compulsory Foundation | 5 | Human Values and Professional Ethics- II | 6 | 5 | 20 | 80 | 100 |
| 6 | Elective Foundation | 6 | Measure and Integration | 6 | 5 | 20 | 100 | 120 |
| | Total | | | 36 | 30 | 120 | 580 | 700 |

## SEMESTER = III

## M.Sc. Mathematics

| S. No | Components of study | | Title of the paper | Instructions hours per week | Credits | Internal Assessment Marks | End Semester Exam Marks | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | Core | 1 | Commutative Algebra | 6 | 5 | 20 | 100 | 120 |
| 2 | | 2 | Functional Analysis | 6 | 5 | 20 | 100 | 120 |
| 3 | | 3 | Classical Mechanics | 6 | 5 | 20 | 100 | 120 |
| 4 a | Generic Elective | 4a | Differential Geometry | 6 | 5 | 20 | 100 | 120 |
| 4b | | 4b | Cryptography | | | | | |
| 4c | | 4c | Fuzzy sets and Fuzzy logic | | | | | |
| 5a | Open Elective | 5a | Discrete Mathematics | 6 | 5 | 20 | 100 | 120 |
| 5b | | 5b | Business Mathematics | | | | | |
| 5c | | 5c | Basic Mathematics for Social Sciences | | | | | |
| | Total | | | 36 | 25 | 100 | 500 | 600 |

## SEMESTER = IV

## M.Sc. Mathematics

| S. No | Components of study | | Title of the paper | Instructions hours per week | Credits | Internal Assessment Marks | End Semester Exam Marks | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | Core | 1 | Number Theory | 6 | 5 | 20 | 100 | 120 |
| 2 | | 2 | Banach Algebra | 6 | 5 | 20 | 100 | 120 |
| 3 | | 3 | Graph Theory | 6 | 5 | 20 | 100 | 120 |
| 4 a | Generic Elective | 4a | Mathematical Statistics | 6 | 5 | 20 | 100 | 120 |
| 4b | | 4b | Approximation Theory | | | | | |
| 4c | | 4c | Algebraic Coding Theory | | | | | |
| 5a | Open Elective | 5a | Operations Research | 6 | 5 | 20 | 100 | 120 |
| 5b | | 5b | Theoretical Computer Science | | | | | |
| 5c | | 5c | Biomechanics | | | | | |
| | Total | | | 36 | 25 | 100 | 500 | 600 |

## MA 101 ALGEBRA

**UNIT –I :**

**Structure Theory of Groups :**Conjugacy and G-Sets, Direct products, Finitely generated abelian groups, Invariants of finite abelian group, Sylow Theorems.

( Sections 4 of Chapter 5, Sections 1,2,3 and 4 of chapters 8).

**UNIT – II:**

**Ideals and Homomorphisms :** Ideals – Homomorphisms –Sum and direct sum 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:** Definition and examples, sub modules 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.

**Reference :**

(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

**MA 102 Real Analysis**

**(Common with the paper AM 102 of Branch 1(B) Applied Mathematics)**

**UNIT –I :**

The Riemann –StieltijesIntegral : 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 Rudins" 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 ,Integral as a product of functions.

**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 Estern 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

## MA 103 : ORDINARY DIFFERENTIAL EQUATIONS

**(Common with paper AM 103 of Branch I(B) Applied Mathematics)**

**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

Ref : 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.

## MA 104 : COMPLEX ANALYSIS

**(Common with paper AM 104 of Branch I(B) Applied Mathematics)**

**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, (1989)

# MA 105 :Human Values and Professional Ethics – I

**(Common with paper AM 105 of Branch I(B) Mathematics)**

**Unit – I**

Definition and Nature of Ethics- Its relation to Religion, Politics, Business, Legal, Medical and Environment.Need and Importance of Professional Ethics - Goals - Ethical Values in various Professions.

**Unit- II**

Nature of Values- Good and Bad, Ends and Means, Actual and potential Values, Objective and Subjective Values, Analysis of basic moral concepts- right, ought, duty, obligation, justice, responsibility and freedom, Good behavior and respect for elders.

**Unit- III**

Ahimsa (Non-Violence), Satya (Truth), Brahmacharya (Celibacy), Asteya(Non possession) and Aparigraha(Non- stealing). Purusharthas(Cardinal virtues)-Dharma (Righteousness), Artha(Wealth), Kama( Fulfillment Bodily Desires), Moksha(Liberation).

**Unit – IV**

Bhagavad Gita- (a) Niskama karma. (b) Buddhism- The Four Noble Truths - Aryaastangamarga, (c) Jainism- mahavratas and anuvratas. Values Embedded in Various Religions, Relirious Tolerance, Gandhian Ethics.

**Unit – V**

Crime and Theories of punishment- (a) Reformative, Retributive and Deterrent. (b) Views on manu and Yajnavalkya.

**Books for study:**


1. John S Mackenjie: A manual of ethics.
2. "The Ethics of Management" by Larue Tone Hosmer, Richard D. Irwin Inc.
3. "Management Ethics - integrity at work' by Joseph A. Petrick and John F. Quinn, Response Books:New Delhi.
4. "Ethics in Management" by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly : Introduction to Ethics

**8.** Sinha: A Manual of Ethics

**9.** Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil(ed.) G.C.Haughton.

**10.** SusrutaSamhita: Tr.KavirajKunjanlal, KunjalalBrishagratha, Chowkamba Sanskrit series, Vol I,II and III, Varnasi, Vol I OO, 16-20, 21-32 and 74-77 only.

**11.** CarakaSamhita :Tr. Dr.Ram Karan Sarma and VaidyaBhagavan Dash, Chowkambha Sanskrit Series office, Varanasi I, II, III Vol I PP 183-191.

**12.** Ethics, Theory and Contemporary Issues., Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.

**13.** Analyzing Moral Issues, Judith A. Boss, Mayfield Publishing Company, 1999.

**14.** An Introduction to Applied Ethics (Ed.) John H.Piet and Ayodhya Prasad, Cosmo Publications.

**15.** Text book for Intermediate logic, Ethics and Human Values , board of Intermediate Education & Telugu Academic Hyderabad

**16.** I.C Sharma Ethical Philosophy of India. Nagin&coJulundhar.

**MA 106 :COMPUTER ORIENTED NUMERICAL METHODS**

**(Common with paper AM 106 of Branch I(B) Applied Mathematics)**

**UNIT –I** : **Interpolation with Cubic Splines**-Derivation of the Governing Equations-End Conditions –Minimzing Property of Cubic Splines- Numerical solutions of Ordinary Differential Equations: Taylor series method – Runge-kutta $4^{th}$order method, Predictor-Corrector methods: Adams –Moulton and Milne's methods- Boundary value problems: Finite difference method-The Shooting Method-The Cubic Spline Method.

**UNIT-II**: **Numerical methods of Partial Differential Equations** : Finite difference approximations to derivatives –Laplace's equation: Jacobi's method, Gauss-Seidel method, Successive over-Relaxation method, The ADI method-Parabolic equations-Iterative methods for the solution of equations-Hyperbolic equations.

Scope and standard as in sections 3.14, 3.15, of Chapter 3 and 7.1 , 7.2, 7.5,7.6,7.7, and 7.10 of Chapter 7, 8.1 to 8.6 of Chapter 8 of " Introductory methods of Numerical Analysis" by S.S.Sastry ( Thirty six Printing (Fourth Edition) July 2005, Published by Prentice –Hall of India Pvt. Ltd., Delhi

**Fundamentals of C language**

**UNIT-III:**

**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.

**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 .

**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 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.

Ref : 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

**M.Sc. Mathematics II nd Semester Syllabus**

**MA 201 GALOIS THEORY**

**UNIT –I :**

**Algebraic Extensions of Fields:** Irreducible polynomials and Eisensteins 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.

Ref :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

**MA 202 : PARTIAL DIFFERENTIAL EQUATIONS**

**(Common with paper AM 202 of Branch I(B) Applied Mathematics)**

**UNIT –I :**

**Ordinary 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 asuface-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.

**MA 203: TOPOLOGY**

**(Common with paper AM 203 of Branch I(B) Mathematics)**

**UNIT –I :**

**Metric spaces**-open sets-closed sets- convergence-completeness and Baire's theorem-Continuous mappings spaces of continuous functions-Euclidean and Unitary Spaces

**UNIT – II:**

**Topological Spaces**, definition & examples-open bases and open sub bases weak topologies.

**UNIT – III:**

**Compact spaces**- product spaces-Trychonoff's theorem and loally compact spaces-compactness in Metric spaces- Acoli's Theorem.

**UNIT-IV:**

**Separation** $-T$ 1 Spaces and Hausdorff spaces –completely regular spaces and Normal spaces –Urysohn's lemma- Urysohn's imbedding theorem –Stone – Cechcompactification

Connected spaces-Components of a space.

Standard and treatment as in chapters 2, articles 16-19 of Chapter III, Articles 21-25 of Chapter IV, Chapter 26-30 of Chapter V and articles 31 and 32 Chapter VI of : Introduction to Topology and Modern Analysis" by G.M. Simmons of MC Graw Hill Book company, inc. International student edition.

**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

## MA 204 : (A) ADVANCED COMPLEX ANALYSIS

**(Common with paper AM 204(A) of Branch I(B) Applied Mathematics)**

**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. Schwarz'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.

Ref: 1. Fundamentals of Complex Analysis- Edward B. Saff, Arthur David Snider, Pearson Education

2. Foundations of Complex Analysis by S. Ponnusamy- Narosa Publications

## MA 204: (B) :SEMIGROUP THEORY

### (Common with paper AM 204( B) of Branch I(B) Mathematics)

**UNIT-I**

Basic definitions – HomogenicSemigroups – Ordered sets- Semi lattices and lattices – Binary relations0- 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).

## MA 204 :( C ): NON LINEAR ANALYSIS

### (Common with paper AM 204(C ) of Branch I(B) Mathematics)

**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.

**MA 205 :HUMAN VALUES AND PROFESSIONAL ETHICS – II**

**(Common with paper AM 205 of Branch I(B) Applied Mathematics)**

(With effect from 2015-16)
(effective from the batch of students admitted from the academic year 2014-15)

**Unit – I**

Value Education – Definition – relevance to present day - Concept of Human Values – self introspection – Self esteem, Family values –Components, structure and responsibilities of family- Neutralization of anger – Adjustability – Threats of family life – Status of women in family and society – Caring for needy and elderly – Time allotment for sharing ideas and concerns.

**Unit – II**

Medical ethics – Views of Charaka, Sushruta and Hippocratus on moral responsibility of medical practitioners. Code of ethics for medical and health care professionals, Euthanasia, Ethical obligation to animals, Ethical issues in relation to health care professionals and patients. Social justice in health care, human cloning, problems of abortion. Ethical issues in genetic engineering and Ethical issues raised by new biological technology or knowledge.

**Unit -III.**

Business ethics – Ethical standards of business-Immoral and illegal practices and their solutions.Characterics of ethical problems in management, ethical theories, causes of unethical behavior, ethical abuses and work ethics

**Unit - IV.**

Environmental ethics-Ethical theory man and nature-Ecological crisis, Pest control, Pollution and Waste,Climate change, Energy and Population, Justice and
Environmental health.

**Unit - V.**

Social ethics-Organ trade, Human trafficking, Human rights violation and social disparities, Feminist ethics, Surrogacy/Pregnancy. Ethics of media-Impact of Newspapers, Television, Movies and Internet.

Books for study:


1. John S Mackenjie: A manual of ethics.
2. “The Ethics of Management” By Larue Tone Hosmer, Richard D. Irwin Inc.
3. “Management Ethics – integrity at work’ by Joseph A. Petrick and John F. Quinn,Response Books: New Delhi.
4. “Ethics in Management: by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil (ed.) G.C.Haughton.
10. SusrutaSamhita: Tr.KavirajKunjanlal, KunjalalBrishagratha, Chowkamba Sanskrit series, Vol I, II and III, Varnasi, Vol I OO, 16-20, 21-32 and 74-77 only.
11. CarakaSamhita: Tr.Dr.Ram Karan Sarma and VaidyaBhagavan Dash, Chowkambha Sanskrit Series office, Varanasi I, II, III Vol I PP 183-191.
12. Ethics, TheoryandContemporarty Issues, Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.
13. Analyzing Moral Issues, Judith A. Boss, Mayfield Publishing Company, 1999.
14. An Introduction to Applied Ethics (Ed.) John H.Piet and Ayodhya Prasad, Cosmo Publications.
15. Text book for Intermediate logic, Ethics and Human Values, board of Intermediate Education & Telugu Academic Hyderabad.
16. I.C Sharma Ethical Philosophy of India. Nagin& co Julundhar.

## MA 206 : MEASURE AND INTEGRATION

**(Common with paper AM 206 of Branch I(B) Applied Mathematics)**

**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 $L^P$ Spaces, The MinKowski and Holder inequalities, Convergence and completeness, Approximation in $L^P$,Bounded linear functional on the $L^P$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.

**M.Sc. MATHEMATICS**

**IIIrd SEMESTER**

**MA 301 : COMMUTATIVE ALGEBRA**

**UNIT –I :**

**Ideals and Modules**, Operations on submodules, the isomorphism theorems, rings homomorphism and residue class rings. The order of a subset of a module, operations on ideals, prime and maximal ideals and primary ideals.

**UNIT – II:**

Finite conditions, composition series and direct sums.

**UNIT – III:**

**Noetherian rings**: Definitions, the Hillbert basis theorem, Rings with descending chain conditions, Primary rings and alternative method for studying the rings with d.c.c.

**UNIT-IV:**

The Lasker –Noetherian decomposition theorem-Uniqueness theorems, Applicationas to Zero –divisors and nilpotent elements and applications to the intersection of the powers of an ideal.

Standard and treatment as in section 1 to 12 Chapter III and section 1 to 7s chapter IV of the text book " COMMUTAVIVE ALGEBRA" By Zariski and Samuel, D. Van NostranedCo.Inc .Princeton

Reference : 1. Topics in Algebra- I.N. Hierstein

2. Lectures in Abstract Algebra- Nathan Jacobson

## MA 302 : FUNCTIONAL ANALYSIS

**(Common with paper AM 302 of Branch I(A) Mathematics)**

**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

## MA 303 (A) CLASSICAL MECHANICS (IE)

**(Common with paper AM 303 of Branch I(A) Mathematics)**

**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. Graw Hill

Education

**Generic Elective**

## MA 304 : ( A) DIFFERENTIAL GEOMETRY

**(Common with paper AM 304 of Branch I(A) Mathematics)**

**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

## MA 304 : ( B) CRYPTOGRAPHY

**(Common with paper AM 304 ( B) of Branch I(B) Mathematics)**

**UNIT –I : Definition, Cryptography**

Encryption Schemes- Symmetric and asymmetric Cryptosystems- Cryptanalysis – Alphabets and Words- Permutations- Block Ciphers-Multiple Encryption- The use of Block Ciphers - Stream Ciphers- The Affine Cipher-Matrices and Linear Maps- Affine Linea Block Ciphers -Vigenere, Hill and Permutation Ciphers – Cryptanalysis of Affine Linear Block Ciphers – Secure Cryptosystems

**UNIT – II: DES**

Feistel Ciphers-DES Algorithm-An Example-Security of DES-Exercises

**UNIT – III: AES**

Notation-Cipher-Key Expansion- AN Example- Invcipher- Exercises

**UNIT-IV: Public Key Encryption**

Public –Key Encryption: Idea- Security-RSA Cryptosystem-Rabin Encryption-Diffie-Hellman Key Exchange-ElGamal Encryption- Exercises.

Scope and Standard as in Sections 3.1 to 3.15 of chapter 3, 5.1 to 5.5 of Chapter 5, and 6.1 to 6.6 of chapter 6, and 8.1 to 8.7 of chapter 8 above of the book " Introduction to Cryptography: " of Johannes A. Buchmann, Springer Publishers.

References : 1. Cryptography and Network Security- authors Forozezan, Behrouz A.

MukhopadhyayDebdeep- MC Graw hill Education PVT Ltd

2. Cryptography : Theory and Practice , Douglas Stinson, Stinson- CRC Publishers

## MA 304 (C) FUZZY SETS AND FUZZY LOGIC (IEC)

**(Common with the paper AM 304 ( C ) of Branch I(A) Mathematics)**

**UNIT –I :**

**Fuzzy Sets :** An overview –Basic Types and Concepts-Characteristics and significance of the Paradigm-Properties of –Cuts-Representation of Fuzzy sets-Extension Principle for Fuzzy Sets.

**UNIT – II:**

**Operations on Fuzzy Sets:** Types of Operations –Fuzzy complements –t-norms-conorms-Combinations of operations-Aggregation of Operations-Fuzzy Arithmetic – Fuzzy Numbers-Linguistic Variables-Arithmetic Operations on Intervals-Arithmetic Operations on Fuzzy Numbers-Lattice of Fuzzy Numbers –Fuzzy Equations.

**UNIT – III:**

**Fuzzy Relations :** Crisp versus Fuzzy Relations –Projections and Cylindric Extensions-Binary Fuzzy Relations-Binary Relations on a Single Set-Fuzzy Compatibility Relations –Fuzzy Ordering Relations – Fuzzy Morphisms-Sup –i Compositions of Fuzzy Relations –inf-wi Compositions of Fuzzy Relations – Fuzzy Relation Equations –General Discussion –Problem partifining-Solution Method-Fuzzy Relation Equations Based on sup-i Compositions Fuzzy Relation Equations Based on inf –wi Compositions –Approximate Solutions –The use of Neural Networks.

**UNIT-IV:**

Possibility Theory –Fuzzy Measures-Evidence Theory –Possibility Theory-Fuzzy sets and possibility Theory Versus-Probability Theory-Fuzzy logic –Classical Logic-Multivalued Logics- Fuzzy propositions – Fuzzy Quantifiers –Linguistic Hedges-Inference from Conditional Fuzzy Propositions – Inference from quantified propositions.

Scope and standard as in chapters 1 to 8 " Fuzzy sets and Fuzzy logic Theory and Applications" by George J. Klir/ Bo Yuan, PH, 2001.

References : 1. Introduction to Fuzzy sets and Fuzzy Logic –M. Ganesh –Phi Learning Pvt Ltd.

2. Fuzzy logic with Engineering Applications , Timothy J. Ross Wieley students Edition

**Open Elective**

## MA 305 ( A) : DISCRETE MATHEMATICS

**(Common with paper AM 305( A) of Branch I(A) Mathematics)**

**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, TV Pradeep Kumar, SK. Mohiddin Shaw, BS Publications, Hyderabad.2016.

## MA 305 ( B) : BUSINESS MATHEMATICS

### (Common with paper AM 305 (B) of Branch I(A) Mathematics)

Unit - I

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

Unit - II

Surds and Indices – Percentage - Profit and loss.P

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 - Converation of Hexadecimal number into Decimal number and Vice versa - Binary Airthmetic.

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.

**MA 305 ( C) : BASIC MATHEMATICS FOR SOCIAL SCIENCES (EE)**

**(Common with paper AM 305 (C) of Branch I(A) Mathematics)**

**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 $1^{st}$ 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.

## IV SEMESTER

## MA 401 : NUMBER THEORY

**(Common with the paper AM 401 of Branch Mathematics)**

**UNIT –I :**

**Arithmetical Functions and Dirichlet Multiplication:** Introduction-The Mobius function $\mu$ (n)-The Euler totient function $\emptyset$ (n) –A relation connection $\emptyset$ and $\mu$ -A product formula for $\emptyset$ (n) - The Dirichlet product of arithmetical functions –Dirichlet inverses and the Mobius inversion formula-The Mangoldt function $\Lambda(n)$ – Multiplicative functions-Multiplicative functions and Dirichlet multiplication-The inverse of a completely multiplicative function-Liouville's Function $\lambda(n)$-the divisor functions $\sigma_{\alpha}(n)$ – 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 $\sigma_{\alpha}(n)$-The average order of $\emptyset$ (n) -An application to the distribution of lattice points visible from the origin-The average order of $\mu$ (n) and of $\Lambda(n)$ - 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 $2^{\alpha}$ 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 .

## MA 402 (A) : BANACH ALGEBRAS (IE)

**UNIT –I :**

Definition and some examples-Regular and Singular elements- Topological divisors of z zeros. Spectrum –formula for the spectral radius –Radical and Semi-simplicity

**UNIT – II:**

Gelfand mapping – Applications of the formula r(x) = lim $\|x^n\|^{1/n}$ –Involutions in Bnach algebras –GelfandNeumark Theorem.

**UNIT – III:**

Ideals in C (X) and Banach stone theorem –Stone $C^{\wedge}$ ech compactification-Commutative $C^*$ algebras.Connectivity –Blocks-Application Construction of Reliable communications Networks.

**UNIT-IV:**

Fixed points theorems and some applications to analysis –Boolean algebras, Boolean Rings, and Stone's theorem.

Text Book : Scope and Standard as in Sections 64 to 66of Chapter 12, Sections 67 to 69 of chapter 12, sections 70 to 73 of Chapter 13, sections 74 to 76 of chapter 14, one an d three of Appendices of " Introduction to Topology and Modern analysis" by G.F. Simmons McGraw Hill book Company

**Reference Books :**

(1) W. Arveson, introduction to C algebras, springs-Verlay 1976

(2) KehezhuAn introduction to Operator Algebras, CRC Press Inc. 1993

(3) T.W. Padmer, Banch Algebra Vol 1, Cambridge University Press 1994

## MA 403 GRAPH THEORY

**(Common with the paper AM 403 of Branch Mathematics)**

**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

**Generic Elective**

## MA 404 (A) MATHEMATICAL STATISTICS (IE)

**(Common with the paper AM 404 (A) of Branch I(A) Mathematics)**

**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

## MA 404 (B) APPROXIMATION THEORY (IE)

**(Common with the paper AM 404 ( B )of Branch I( B ) Mathematics)**

**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

## MA 404 (C) ALGEBRAIC CODING THEORY(IE)

**(Common with the paper AM 404 (C) of Branch I(A) Mathematics)**

**UNIT –I :**

**Introduction to Coding Theory** : Introduction –Basic Assumptions- Correcting and Detecting Error Patterns-Information Rate-The Effects of Error Corrections and Detection-Finding the Most Likely Codeword Transmitted-Some Basic Algebra-Weight and Distance –Maximum Likelihood Decoding-Reliability of MLD-Error-Detecting Codes-Error-Correcting Codes.

**UNIT – II:**

**Linear Codes:** Two Important Subspaces-Independence, Basis, Dimension-Matrices-Bases for C= < S > and C?-Generating Matrices and Encoding-parity –Check Matrices-Equivalent Codes- Distance of a Linear Code-Cosets-MLD for Linear Codes- Reliability of IMLD for Linear Codes.

**UNIT – III:**

**Perfect and Related Codes-** Some Bounds for Codes-Perfect Codes-Hemming Codes-Extended Codes-The Extended Golay Code- Decoding the Extended Golay Code- The Golay Code –Reed-Mullar Codes-Fast Decoding for RM (1,m)

**UNIT-IV:**

**Cyclic Linear Codes;** Polynomials and Words – Introduction to Cyclic Codes-Polynomial Encoding and Decoding –Finding Cyclic Codes-Dual Cyclic Codes. Burst Error –Correcting Codes: Introduction –Interleaving –Application to Compact Disc.

Scope and Standard as in Sections 1.1 to 1.12 of Chapter 1, sections 2.1 to 2.12 of Chapter 2, sections 3.1 to 3.9 of chapter 3, sections 4.1 to 4.5 of chapter 4 and sections 7.1 to 7.3 of chapter 7 of " Coding Theory the Essentials: by D.G. Hoffman, D.A Leonard, C.C. Lindner, K.T. Phelps, C.A. Rodger, J.R. Wall, Monographs and text books in pure and Applied Mathematics.

References : 1. Algebraic coding theory and Applications Longo. G. Hartmenn C.R. Springer publications

2. Introduction to coding theory by J.H. Vanlint, Springer publications

**Open Elective**

## MA 405 ( A) OPERATIONS RESEARCH FOR INDUSTRY AND COMMUNITY DEVELOPMENT

**(Common with the paper AM405 ( A) of Branch Mathematics)**

**UNIT –I :**

**Linear programming:** Graphical Method-Simplex Method-Big M Method-Two phase method –Duality in LP-Transportation Problem- Assignment problem- ( Sections 2.4, 2.5 and 2.7 of chapter 2, sections 3.2, 3.3 and 3.4 of chapter 3, sections 4.3 and 4.4 of chapter 4.

**UNIT – II:**

**Inventory Control :** Models of Inventory-Operation of Inventory Systems –Quantity Decisions-Implementation of Purchase Inventory Model-Multiple Item Model with shortage limitation . ( Sections 7.1 to 7.6 of Chapter 7)

Queuing Theory ( Sections 9.1 , 9.2, 9.3.1, to 6.3.4 of chapter 9)

**UNIT – III:**

**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-IV:**

**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)

**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, 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

**MA 405( B) THEORETICAL COMPUTER SCIENCE (SSC 1)**

**(Common with the paper AM 405 ( B) of Branch I( B ) Applied Mathematics)**

**UNIT –I :**

**The Theory of Automata :** Definition of an Automaton-Description of a Finite Automaton0Transition Systems-Properties of Transition Functions-Acceptability of a String by a Finite Automation- Nondeterministic Finite State Machines-The Equivalence of DFA and NFDA-Mealy and Moore models- Minimistion of Finite Automata( Chapter 2 )

**UNIT – II:**

**Formal Lanquages:** Basic Definitions and Examples –Chomsky Classification of Languages- Languages and Their Relation –Recursive and Recursively Enumerable Sets-Languages and Automata

**Regular Sets and Regular Grammars:** Regular Expressions-Finite Automata and Regular Expressions-Pumping Lemma for Regular sets-Application of Pumping Lemma-Closure properties of Regular sets Regular Sets and Regular Grammars ( Chapter 40.

**UNIT – III:**

**Context- Free languages :** Context –free Languages and Derivations Trees –Ambiguity in Context-Free Grammars –Simplification of context –free grammers-oramla forms for Context-Free Grammars –Pumping lemma for Context –free Languages-Decision algorithms for Context-Free Languages( Chapter 5)

**UNIT-IV:**

**Pushdown Automata :** Basic Definitions-Acceptance by pda-Pushdown Automata and Context Free Languages ( Sections 6.11 6.2 and 6.3 of chapter 6)

Turing Machines: Turing Machine model-Representation of Turing Machines-Language acceptability by Turing machines-Design of Turing Machines. ( Sections 7.1 7.2, 7.3 and 7.4 of Chapter 7).

Scope and standard as in : Theory of Computer Science ( Automata, Languages and Computation)" by Mishra, K.L.P and Chandrasekharan, N. Published by Prenctic Hall of India, Second Edition ( 4th Printing), August 1998.

References :1. Theoretical Computer Sciences – JurajHromkovic Springer Publications

2. Discrete Mathematics & Graph Theory, by SatyanarayanBhavanari, K. Syam Prasad, PHI PVT. Ltd, New Delhi, Second Edition, 2014.

## MA 405 ( C ) BIOMECHANICS

**(Common with the paperAM 405 ( C ) of Branch I( B ) Applied Mathematics**

**UNIT –I :**

Introduction –Circulatory Biofluid Mechanics

**UNIT – II:**

Blood Rheology-Properties of flowing

**UNIT – III:**

Modles of Biofluid flows

**UNIT-IV:**

Non-Newtonian fluids.

Scope and standard as in Chapters 1 to 5 of of " Biofluids Mechanics" by Jagan N. Muzumdar ( 1992), Published by World Scientific, Signapore.

References : 1. Text book of Bio Mechanics –Subrata Pal –Viva Publishers

2. Biofluid Mechanics by Ruberstein, Weiyin, Mary D. Frame Elsevier Edition