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

RESTRUCTURED CURRICULUM FOR M.Sc. MATHEMATICS (REGULAR) PROGRAMME TO BE IMPLEMENTED WITH EFFECT FROM THE ACADEMIC YEAR 2017-2018

SYLLABUS
Choice Based Credit System (CBCS)

PROGRAMME: M.Sc.,(MATHEMATICS)
SRI VENKATESWARA UNIVERSITY::TIRUPATI
S.V.U.COLLEGE OF SCIENCES
DEPARTMENT OF MATHEMATICS (2017-2018)

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.

About the Department:

The Department of Mathematics of Sri Venkateswara University was one among the first six departments started in September1954. The department had the good fortune of being lead by the renowned Indian Mathematician Prof. R. Vaidyanatha Swamy followed by Prof. M.V. SubbaRao, Prof D.P. Banerjee, Prof. K. Sitaram and

Prof. P. V. Arunachalam. The department has made many studies and established a multi-dimensional growth in the fields of Semi Group theory, Number theory, Geometry, Graph theory, Approximation theory, Forecasting, Fluid Dynamics, Differential Equations and Theoritical Computer Sciences.

Programme Objectives:

1. Develop the knowledge, skills and attitudes necessary to pursue further studies in mathematics.
2. Become confident in using mathematics to analyze and solve problems in real life situations.
3. Able to apply knowledge of mathematical methods in solving, interpreting the solutions of problems.
4. Formulate & design appropriate mathematical model in a variety of areas of mathematics.
5. Able to develop a mathematical tool for solving real world problems.
6. Build the capacity to investigate and apply mathematics to find solutions in a variety of contexts related to Science, Technology, Business and Industry.
7. Apply the knowledge of mathematics in understanding concepts like weather, forecasting, earthquakes & Tsunami's...etc, and finds the suitable method to solve the problem.
8. Understand the values, Professional ethics and responsibilities. Deal any situation in their personal and professional life without fear.

9. Function effectively and work meritoriously as a team member and lead multidisciplinary teams in high quality programs by mathematical analysis.
10. Develop abilities to communicate, present their reports and design effectively on various issues.
11. Acquires skills in drafting & managing projects and in generating funds.
12. Recognize the importance of learning process to understand day to day technology changes and developments.

Program Out Comes (PO) :

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:

PO1	Apply the knowledge of Mathematics in all the fields of learning including higher research and its extensions
PO2	Equip the student with skills to analyse problems, formulate the hypothesis, evaluate and draw reasonable conclusions
PO3	Investigate and apply mathematical problems and solutions in a variety of contexts related to science, technology, business and industry.
PO4	Able to design and develop mathematical experiments to solve environment problems like global pollution, aerosol particles weather and virus in atmosphere
PO5	Utilize Number Theory in the field of Cryptography that helps in hiding information and maintaining secrecy in military information, transmission, computer password and e-commerce. Facilitate the study of groups in crystallography in chemistry and Lie symmetry groups in physics.
PO6	To interpret the data like dosage of medicine, nutritious food to children and effectiveness of new drugs and survival rate of cancer parents under certain treatments etc.
PO7	Illustrate solutions using numeric or graphical or programming methods
PO8	Imbibe high standards in life by understanding the values and ethics in their life.
PO9	Investigate and solve unfamiliar math problems and allow to think on unsolved mathematical problems.
PO10	Imbibe effective, scientific / technical communications in both oral and write.
PO11	Acquire knowledge in designing Mathematical models .Also generate funds through

	various research projects..
PO12	1. Ability to think, acquire knowledge and skills through logical reasoning and develop a habit of self- learning throughout life.

Program Specific Outcomes:

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

Program Educational Objectives:

- Apply their knowledge in modern industry or secure acceptance in high quality post graduate program in mathematics
- Development in their chosen profession and / or progress toward an advanced degree.
- The trust and respect to others as effective and ethical team members.
- Graduates will become effective collaborators and innovators, leading or participating in effort to address social, technical and business challenges.
- Promote the culture of interdisciplinary research among all disciplines and applied mathematics.
- Explore the emerging areas of science and engineering like Nonlinear dynamic, computational mathematics and cryptography.
- Plan, analyze and investigate engineering problems using contemporary design and simulation tools.

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

(Syllabus common for SV University College and affiliated colleges offered P.G. Courses in SVU Area)

(Revised Scheme of Instruction and Examination, Syllabus etc., with effect from the Academic Years 2017-18 for I and II Semesters and 2018-19 for III and IV Semesters)

M.Sc. 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	MA 101	Algebra	6	4	3	20	100	120
2.	Core	MA 102	Real Analysis	6	4	3	20	100	120
3.	Core	MA 103	Ordinary Differential Equations	6	4	3	20	100	120
4.	Core	MA 104	Complex Analysis	6	4	3	20	100	120
5.	Compulsory Foundation	MA 105	Computer Oriented Numerical Methods	6	4	3	20	100	120
6.	Elective Foundation	MA 106	Human Values and Professional Ethics-I	6	4	3	20	80	100
			TOTAL	36	24		120	580	700

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**	MA 201	**Galois Theory**	**6**	**4**	**3**	**20**	**100**	**120**
2.	**Core**	MA 202	**Partial Differential Equations**	**6**	**4**	**3**	**20**	**100**	**120**
3.	**Core**	MA 203	**Topology**	**6**	**4**	**3**	**20**	**100**	**120**
4.	**Core**	MA 204	**Advanced Complex Analysis**	**6**	**4**	**3**	**20**	**100**	**120**
5.	**Compulsory Foundation**	MA 205	**Measure and Integration**	**6**	**4**	**3**	**20**	**100**	**120**
6.	**Elective Foundation**	MA 206	**Human Values and Professional Ethics-II**	**6**	**4**	**3**	**20**	**80**	**100**
			TOTAL	**36**	**24**		**120**	**580**	**700**

Semester-III

Sl. no	**Components of study**	**Code**	**Title of the course**	**Hrs / week**	**No. of Credits**	**Uni. Exams (Hour**	**IA**	**Seme-ster end exam**	**Total Marks**

1.	**Core**	MA 301	**Commutative Algebra**	**6**	**4**	**3**	**20**	**100**	**120**
2.	**Core**	MA 302	**Functional Analysis**	**6**	**4**	**3**	**20**	**100**	**120**
3.	**CORE**	MA 303	**Classical Mechanics**	**6** **6**	**4**	**3**	**20**	**100**	**120**
4.	**Generic Elective**	MA 304	**A) Differential Geometry** **B)Cryptography** **C) Linear Algebra** **D) Discrete Mathematics**	**6** 6	**4** **4**	**3** **3**	**20** 20	**100** **100**	**120** **120**
5.	**Open Elective (Other Departments)**	MA 305	**A) Business Mathematics** **B) Basic Mathematics for social sciences**	**6**	**4**	**3**	**20**	**80**	**100**
TOTAL				**36**	**24**		**120**	**580**	**700**

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**	MA 401	**Number Theory**	**6**	**4**	**3**	**20**	**100**	**120**
2.	**Core**	MA 402	**Banach Algebra**	**6**	**4**	**3**	**20**	**100**	**120**
3.	**Core**	MA 403	**Graph Theory**	**6**	**4**	**3**	**20**	**100**	**120**
4.	**Generic Elective**	MA 404	**A) Mathematical Statistics** **B) Approximation Theory** **C)Algebraic Coding Theory** **D)Operations Research**	**6** **6**	**4** **4**	**3** **3**	**20** **20**	**100** **100**	**120** **120**
5.	**Open Elective (Other Departments)**	MA 405	**A) Theoretical Computer science** **B) Biomechanics**	**6**	**4**	**3**	**20**	**80**	**100**
TOTAL				**36**	**24**		**120**	**580**	**700**

PROGRAMME: M.Sc.,(MATHEMATICS)
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DEPARTMENT OF MATHEMATICS

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 2. (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).

FIRST SEMESTER

MA 101 ALGEBRA

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

Course objectives:

1. To introduce action and conjugation of G-sets, the basic structures of Algebra such as groups, cyclic groups
2. To develop working knowledge on Sylow's theorems
3. Provide information on Ideals and homomorphism.
4. Discuss U.F.D, E.D and polynomial Rings.

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

Course objectives:

1. To introduce the basic structures of Algebra such as groups, rings, fields and Modules which are pillars of modern mathematics
2. To develop working knowledge on Sylow's theorem
3. Provide information on Ideals and homomorphims.
4. Discuss U.F.D,E.D and polynomial Rings.
5. To develop the concepts of linear independence, dependence and basis of modules.

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.

References :

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

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

1. Identify the concept of action and conjugation.
2. Analyze the maximal, prime, nilpotent and Nil ideals.
3. Understand U.F.D,E.D and Polynomial Rings
4. Solve the problems on homomorphism, quotient modules and the basis of modules.

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

MA 102 Real Analysis

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

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

Course Objectives:

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

UNIT –I:

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

UNIT – II:

Sequence and series of functions : Discussions of main problem, uniform convergence, uniform convergence and continuity, Uniform convergence and Integration, Uniform convergence and Differentiation, Equicontinuous families of functions, The stone –Weistrass 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 Stieltijes integration and Differentiation.
2. Understand Uniform Convergence and continuity.
3. Learn comparision tests at a and infinity.
4. Analyze the concept of functions of several variables.

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

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

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

Course objectives :

1. To study boundary value problems.
2. To find solutions of power series and second order linear equations.
3. To provide knowledge on Special functions -Legendre polynomials and properties of Bessel functions
4. To know the method of successive approximation and Picard's theorem.

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 Legendre 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. Learn boundary value problems, Eigen values and Eigen functions
2. Solve the second order linear questions.
3. Apply knowledge on special functions of Mathematical Physics.
4. Understand the method of successive approximation and solve the problems related to Picard's theorem

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

MA 104: COMPLEX ANALYSIS
(Common with paper AMA 104 of Branch I (B) Applied Mathematics)

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

Course Objectives :

1. To define analytic functions and derivative rules for 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. Decide when and where a given function is analytic .
2. Understand the Mobius Transformation.
3. Describe basic properties of complex integration and having the ability to compute such integrals.
4. Understand Power series and expansion of analytic function.

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

MA 105 :COMPUTER ORIENTED NUMERICAL METHODS
(Common with paper AM 105 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.
1. To learn MATLAB and other convenient numerical software such as Microsoft Excel with simple programming.

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.

Reference :

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

Course outcomes:
1. Apply numerical methods to obtain approximate solutions to mathematical problems.
2. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and non linear equations, and the solution of differential equations.
3. Solve any numerical problem by using programming.
4. Develop interest in Numerical analysis to use finite precision computer arithmetic.

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

MA 106 : Human Values and Professional Ethics – I
(Common with paper AM 106 of Branch I(B) Mathematics)

Course objectives :

2. To promote Ethics and Human values.
3. To create awareness, conviction & commitment to values for improving the quality of life through education and for advancing social and human well being.

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.

References :

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
16. Education & Telugu Academic Hyderabad
17. I.C Sharma Ethical Philosophy of India. Nagin&coJulundhar.

Course outcomes:

1. Develop Morals, Values and Ethics, Integrity, Work Ethic, Service Learning, Civic virtue, Respect for others, Living Peacefully, Caring, Sharing, Honesty, Courage, Cooperation, Commitment, Empathy, Self Confidence character, Spirituality, Case study.
2. Understand human values .
3. Develop character, affection and love towards other human beings.
4. Know the value of Four Noble Truths of Buddhism

SECOND SEMESTER (EVEN)

MA 201 GALOIS THEORY

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

Course objectives:

1. Discuss extension fields and algebraic extensions.
2. To study the Normal and Separable Extensions
3. To introduce Galois Theory and understand applications of Galois Theory.
4. To study the roots of polynomials and Ruler & compass constructions.

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.

Reference:

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

Course outcomes:

1. Apply the knowledge on polynomials solvable by radicals, Extension field.
2. Understand the normal and separable extensions.
3. Study the roots of polynomials specially quintic polynomials which is the cause to develop Galois theory.
4. Solve the problems on cyclotomic polynomials.

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

MA 202: PARTIAL DIFFERENTIAL EQUATIONS
(Common with paper AMA 202 of Branch I (B) Applied 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 methods to find solutions of O.D.Es and P.D.Es
2. To find integral surface passing through given surface.
3. To explain methods to solve Linear P.D.Es with constant and Variable coefficients.
4. To discuss the boundary value problems and Laplace's 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

1. solve Pfaffian differenrial equations and find orthogonal trajectories of a curve.
1. Analyze the origin of first order PDEs and Integral surfaces passing through a given curve
2. Identify linear and nonlinear PDE and solve nonlinear PDE by Charpit's method.
3. Apply various methods to solve Partial Differential Equations of the Second order.
4. Obtain equipotential surfaces using Laplace's equation.

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

MA 203 : TOPOLOGY
(Common with paper AMA 203 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. To study basic concepts of Metric spaces.
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. To study the Hausdorff space and normal spaces.

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 and VI 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 neighborhoods, open sets, closed sets, basic and sub-basis.
2. Understand Topological Spaces, definition & examples.
3. Know the concepts connectedness, compactness, and Hausdorff property and their general characteristics.
4. Understand the Countability axioms, the separation axioms and normal spaces. And also 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	3	3	2	1	2				1	1		
CO2	1	2	1	2	1				1	1		

CO3	2	1	3	2	2				1	1		
CO4	2	1	1	2	3				1	1		

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

Course Objectives:

1. To explain Laurent Series, poles and singular points.
2. To understand Residue theorem and its applications.
3. To discuss Laplace's equation, Harmonic functions and Dirichlet problem.
4. To analyse infinite product and Partial Fraction Expansions.

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 Complex Analysis by S. Ponnusamy- Narosa Publications.

Course Outcomes:

1. To learn Laurent Series-Singular Points.

2. Explain the basic properties of complex integration and compute such integrals.
3. Learn topics of contemporary Advanced complex analysis in particular spaces of holomorphic functions, entire functions, harmonic functions and conformal mapping functions.
4. Understand the Infinite product and Partial Fraction Expansions.

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

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

Course Objectives

1. To acquire basic knowledge of measure Theory.
2. To understand the Riemann integtal and lebesgue integral of a bounded function.
3. To analyze the differentiation of monotone functions of bounded variation.
4. To study the Classical Banach Spaces.

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.
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. Compute Lebesgue integrals of bounded functions over a set of finite measure
3. Solving the Differentiation and Integration of Monotone functions.
4. Understand the L^P Spaces, the MinKowski and Holder inequalities, Convergence and completeness

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

MA 206 :HUMAN VALUES AND PROFESSIONAL ETHICS – II
(Common with paper AM 206 of Branch I(B) Applied Mathematics)

Course Objectives:

1. To understand the moral values,responsibilities and adjustments in life.
2. To create awareness, conviction and commitment for improving the quality of life.
3. To understand medical ethics.
4. To know and follow the moral and legal policies in business**.**

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.

Course Outcomes:

1. Understand the fundamental responsibilities and respect towards women
2. Know the value of education.
3. Question the illegal practices in the medical and business fields.
4. Understand the value of ecological balance and act in such a way which saves it.
5. Analyze the impact of media.

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

THIRD SEMESTER (ODD)

MA 301: COMMUTATIVE ALGEBRA

This course enables the students to acquire knowledge on algebra to analyse real world problems.

Course objectives:

1. To explain the operations on ideals and modules
2. To introduce the concepts of A.C.C and D.C.C in ideals and modules
3. To provide knowledge on Noetherian rings and their properties.
4. To understand decompostion theorem and uniqueness theorem.

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.
3. Introduction to rings and modules by C Musli, Narosa Publications.
4. Basic algebra by Jacobson nathan volume 1 , Hindustan Publishing Corporation 1991
5. Introduction to commutative Algebra by M.F.Atiyah, Macdonald.
6. Basic algebra by P B Bhattacharya, S K Jain and S R Nagpaul, Cambridge University Press, Reprint 1997.

Course outcomes:

1. To understand the ideals, Modules and operations on them.
2.To learn the structures of composition series with ACC and DCC
2. To study the theoretical properties of Noetherian rings
3. Explain decomposition theorem and applications.

5. To develop applications in the different fields.

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

MA 302: FUNCTIONAL ANALYSIS
(Common with paper AMA 302 of Branch I (A) Applied 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) Work with different distance metrics and normed spaces,understand continuous linear transformations and the Hahn-Banach Theorem.
2) Comprehend the Open mapping theorem and Closed graph theorem.
3) Construct orthonormal sets and conjugate spaces.
4) Understand the relevance of self-adjoint operators, normal, unitary operators and projections.

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

MA 303: CLASSICAL MECHANICS

(Common with paper AMA 303 of Branch I (B) Applied Mathematics)

Course Objectives:

1) To provide basic knowledge in mechanics to solve a mechanical problem.
2) To understand the concepts of Lagrange's equation and Hamiltonian principle.
3) To discuss Hamilton's equations of motion and principle of least action.
4) To understand canonical transformations.

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 Private Limited, 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	2	3	1	3	1				1	1		
CO2	1	2	2	1	2				1	1		
CO3	3	2	3	2	2				1	1		

CO4	2	1	2	3	2				1	1		

Generic Elective
MA 304(A): DIFFERENTIAL GEOMETRY
(Common with paper AMA 304(A) of Branch I (A) Applied 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 surfaces and their properties
2. Explain local intrinsic properties of a surface
3. Study geodesic equations of conformal mapping
4. Discuss lines of curvature and parallel 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. Define space curves , curvature and torsion of a curve.
2. Parameterize surfaces and isometric correspondence.
3. Understand geodesic curves and conformal mapping.
4. calculate and analyse curvature of surfaces in different settings.

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

MA 304 : (B) CRYPTOGRAPHY
(Common with paper AM 304 (B) of Branch I(B) Mathematics)

Course Objectives:

1) To introduce the basic terminology, concepts, and standards of cryptography.
2) To explain the principles and underlying mathematical theory of today's cryptography algorithms.
3) To provide an understanding of potential weaknesses and problems with ciphers and cryptographic protocols.
4) To learn fundamentals of cryptography and its application to network security.
5) To understand network security threats, security services, and countermeasures.

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

Course Outcomes:

1) Understand various Cryptographic Techniques.
2) Apply various public key cryptography techniques.
3) Understand the various Security Applications.
4) Implement system level security applications.
5) Be familiar with secure random bit generator and linear feedback shift register sequences.
6) Know classical ciphers such as Vigenere Cipher and Hill Cipher.
7) Know of RSA, attacks on RSA, Diffie-Hellman key exchange and ElGamal, public key crptosystem.

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						

MA 304 (C) : Linear Algebra

Course Objective:
1. To study Systems of Linear Equations.
2 .To introduce the notions of abstract vector spaces and linear transformations.
3. To know the Direct-sum decompositions cyclic decomposition, Rational and Jordan forms.
4. To study Bilinear Forms.

UNIT –I:
Linear Equations:
Systems of Linear Equations, Matrices and Elementary Row
Operations, Row-Reduced Echelon Matrices.

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

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

UNIT –IV:
Bilinear Forms:
Bilinear Forms –Symmetric Bilinear Forms –Skew-Symmetric Bilinear Forms –Groups Preserving Bilinear Forms.

Text books:
1. K. Hoffman, R. Kunze, Linear Algebra, Prentice Hall of India, (2015).
2. Gilbert Strang, Introduction to Linear Algebra, Wellesley-Cambridge Press, (2009).

Reference(s):

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

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

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

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

MA 304 (D): DISCRETE MATHEMATICS
(Common with paper AMA 304 (D) of Branch I (B) Applied Mathematics)

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

Course Objectives:

1. To learn Normal Forms-Disjunctive-Conjunctive Principal Disjunctive, Principal Conjunctive Normal Forms.
2. Understand predicate calculus.
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& Kuncham Syam 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 Normal Forms-Disjunctive-Conjunctive Principal Disjunctive
2. Discuss Inference Theory of the Predicate Calculus
3. Understand Lattices and Boolean Functions.
4. Understand basic concepts of graph theory.

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

CO3	2	1	3	2	1				1	1		
CO4	3	1	2	2	2				1	1		

Open Elective (Other Departments)

MA 305 A: BUSINESS MATHEMATICS

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Course Objectives:

1. To understand the basic concepts of Mathematics.
2. To calculate percentages- profit and loss.
3. To solve Linear equations.
4. To understand Conversion of one Number System to Another.

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 relationships in a variety of contexts
4. Understand The Binary Octal , Octal, Decimal and Hexadecimal Systems.

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

MA 305(B): BASIC MATHEMATICS FOR SOCIAL SCIENCES (EE)

Course Objectives:

1. Understand the basic concepts of a vector space and linear transformations.
2. Study Taylor and Maclaurin's series.
3. Discuss methods of integration to find length,area and volume of regions.
4. Introduce the Numerical Techniques to find roots of equations and solutions of linear equations.

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, algebra of Transformations and orthogonal components.
2. Understand the concepts of Limit, continuity &differentiation of functions.
3. Apply Integrals to find areas, length & volume of regions.
4. 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	2	3	3	2	3				1	1		

CO2	2	2	1	1	2				1	1		
CO3	1	2	3	2	1				1	1		
CO4	2	1	1	2	2				1	1		

FOURTH SEMESTER (EVEN)

MA 401: NUMBER THEORY

(Common with the paper AMA 401 of Branch (B) Applied Mathematics)

Identify and apply various properties of and relating to the integers including the Well-Ordering Principle, primes, unique factorization, the division algorithm and greatest common divisors.

Course Objectives:

1. Identify certain Arithmetical Functions and their properties
2 . Explain the averages 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 properties.

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 outcome

1. Understand the concepts of vector spaces with bases, algebra of Transformations and orthogonal components.
2. Understand the concepts of Limit, continuity &differentiation of functions.

3. Apply Integrals to find areas, length & volume of regions.
4. 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	2	2	2	1	2				1	1		
CO2	2	1	1	2	2				1	1		
CO3	3	2	3	2	3				1	1		
CO4	1	2	1	2	2				1	1		

MA 402: BANACH ALGEBRA

Course Objectives:

1. To study Algebraic, Topological fields and the structure of Banach Algebra.
2. To discuss properties of Gelfand mapping.
3. To emphasize on applications of commutative C*-algebras.
4. To study the fixed point theorem and its applications.

UNIT –I :

Definition and some examples –Regular and Singular elements- Topological divisors of 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- CommutativeC^* 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

Course Outcomes:

1. Understand different types of Banach Algebras with examples.
2. Know the essence of Gelfand mapping
3. Understand the Application of Commutative C*- algebras.
4. Derive the applications of Banach Algebra in analysis, Fourier series,Boolean Algebras and other significant areas of mathematics.

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

Generic Elective

MA 403 GRAPH THEORY

(Common with the paper AMA 403 of Branch (B) Applied 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 Euler Tours and Hamilton cycles in real life .

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 reliable communication network.
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	2	2	2	1	2				1	1		
CO2	3	1	1	3	2				1	1		
CO3	2	3	3	1	1				1	1		
CO4	1	2	2	3	2				1	1		

404 (A): MATHEMATICAL STATISTICS
(Common with the paper AMA 404(A) of Branch I(B) Applied Mathematics)

Course objectives:

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

UNIT –I :

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. Apply the knowledge of Binomial, Poisson, Gamma, chi-square, normal distribution in solving various problems,.
2. To explain stochastic convergence
3. To discuss measures of quanlity of estimations

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

MA 404 (B) APPROXIMATION THEORY
(Common with the paper AMA 404 (B) of Branch I (B) Applied 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 Algorithm and Weierstrass Theorem.
4) Discretization 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 spaces And Normed Linear space.
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.

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								

MA 404 (C): ALGEBRAIC CODING THEORY

Course Objectives:

1. To develop the knowledge among students about coding and decoding.
2. Explain linear codes and reliability of IMLD.
3. Hamming codes and extended Golay coad of
4. Introduce cylic coads and polynomial Encoding and Decoding.

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-Hamming 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.

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 **"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.
3. Introduction to Algebraic and combinatorial coding theory, Academi press,INC. Newyork,1977.
4. The Theory of ERROR Correcting codes by N.J.A.Sloane, Vol I&V,North –Holland Amsterdam,1977.

Course Out comes:

1.Analyse Error detecting and error correcting codes.
2. Understand and apply algorithms in applications like sending messages without errors.
3. Use bounds for different types of codes.
4.Understand the polynomial encoding and decoding.

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

MA 404(D): OPERATIONS RESEARCH
(Common with the paper AMA 404(D) of Branch (B) Applied Mathematics)

Course Objectives:

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

UNIT –I :

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

UNIT – II:

Dynamic programming : Introduction –Capital Budgeting problem –Reliability improvement problem –Stage coach problem –Optimal subdividing problem –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 Problems.
2) Understand Dynamic Programming.
3) Solve the problems of Game with pure Strategies and Mixed Strategies.
4) Construct Reliable Networks.

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

MA 405(A) THEORETICAL COMPUTER SCIENCE (SSC 1)

Theoritical computer science is mathematical& abstracts is spirit but derives its motivation from practice & every day

Course Objectives:

1. Develops methods to describe and analyze the dynamic behavior of discrete systems Regular grammer.
2. Understand nature of computation.
3. Efficient in solving problems using algorithms.
4. Helps to develop mathematical and logical models.

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.
3. Introduction to Theoritical Computer science by Boaz Barak.
4. Introduction of the Theory of Computation- Micheal Sipser,PWS Publishers,1997.

Course Out comes:

1. Understand how machines solve problems.
2. Design systems that can perform special tests such as personal computer systems, automatic aircrafts pilots etc.
3. Write efficient algorithms &programming languages.
4. Understand Turing machines and language acceptability .

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

MA 405 (B) BIOMECHANICS

Course Objectives:

1) Define and apply proper anatomical and biomechanical terminology associated with body structures, directional location, and movement.
2) Describe factors contributing to range of motion, joint actions (concentric, isometric, and eccentric), coordinated movement, muscle action in joint movement.
3) Evaluate an understanding of basic biomechanical concepts, including mechanical lever systems, stability, and laws of motion.
4) Apply the concepts of kinetics(forces) and kinematics(motion) and explain their interrelationship and instrumentation commonly used to assess them.
5) Analyze and describe different forces which act on the body and relate them to injury and illness through evaluation of current scholarly research.

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 ElsevierEdition

Course Outcomes:

1) Describe the kinematics of projectile motion and factors influencing projectile trajectory.
2) Identify, analyze and solve various biomechanical problems.
3) Demonstrate an understanding of kinetic concepts including inertia, force, torque and impulse.
4) Identify the major factors involved in the angular kinematics of human movement.
5) Define Newton's laws of Physics.
6) Identify the steps involved in finding the center of gravity.
7) Develop ability to analyse the kinetics and kinematic motions of all the joints.
8) Analyse the alterations in gait and posture.
9) Discuss the normal cytoskeleton structure and components of joints and muscles.
10) Develop ability to analyse the muscle activity in various postures.

11) List the kinematic variables for analysing human motion.

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					L							