G.T.N. ARTS COLLEGE(Autonomous)
Dindigul

(Affiliated to Madurai Kamaraj University)
(Accredited with 'B' Grade by NAAC)

DEPARTMENT OF MATHEMATICS (PG)

SYLLABUS

(With effect from the academic year 2017 – 2018)

PRINCIPAL

Dr. N.Krishnamoorthy, M.Com., M.B.A., M.Sc., M.Phil., M.Ed., PGDCA., PGDFM., Ph.D.,

STAFF

1. Mrs. K. Sujatha, M.Sc., M.Phil., B.Ed., -Assistant Professor and Head
2. Mrs. N. Sumathi, M.Sc., M.Phil., - Assistant Professor
3. Mrs. A. Theeba, M.Sc., M.Phil., B.Ed., - Assistant Professor
4. Mrs. S. LathaMaheswari, M.Sc., M.Phil., B.Ed., CCA., - Assistant Professor
5. Mr. G. Ranjithkanna, M.Sc., M.Phil., - Assistant Professor
6. Mr. A. Mohamed Ali, M.Sc., M.Phil., PGDCA., - Assistant Professor
7. Mr. S. Rajkumar, M.Sc., M.Phil., - Assistant Professor

G.T.N. ARTS COLLEGE (Autonomous), DINDIGUL

SYLLABUS FOR M.Sc., (Mathematics)UNDER CBCS
(With effect from the academic year 2017 – 2018)

1. OBJECTIVES:

The aim of the course is to introduce the students

- To get a sound knowledge in Mathematical techniques and its applications.
- To develop skills with capable of facing the competitive situation prevailing now.
- To get a successful placement.

2. ELIGIBILITY:

A pass in B.Sc. Mathematics or B.Sc., Mathematics with Computer Applications of any recognized university.

3. DURATION OF THE COURSE:

The students who are joining the M.Sc., (Mathematics) degree shall undergo a study period of two academic years – Four semesters.

4. COURSE OF STUDY AND SCHEME OF EXAMINATION :

The Course offered in major Mathematics for four semesters and the scheme of examinations are given.

5. QUESTION COURSE PATTERN :

The Internal and External marks is 25 : 75

EXTERNAL:

The pattern of Question Course will be as follows:

Time: 3 Hours Max Marks: 75

SECTION – A [10 x 1 = 10 marks]

Question No: 1 to 10

1. Two questions from each Unit.
2. Four choices in each question.
3. No "none of these" choice.

SECTION – B [5 x 7 = 35 marks]

Question No: 11 to 15

1. Answer all questions choosing either (a) or (b).
2. Answers not exceeding two pages.
3. One question from each Unit.

SECTION – C [3 x 10 = 30 marks]

Question No: 16 to 20

1. Answers not exceeding four pages.
2. Answer any three out of five questions.
3. One question from each Unit.

Note: There must be at least one problem in Section B and Section C.

INTERNAL:

The pattern for internal valuation may be

1. Two tests – 15 marks each: average 15 marks.

2. Group Discussion / Seminar / Quiz – 5 marks.
3. Two Assignments – 5 marks each: average 5 marks.
4. Third test may be allowed for absentees of anyone of the two tests.
5. For Quiz, two quizzes should be conducted.

Blue Print of the Question Course (External) – Core Course

Maximum Marks: 75

Sections	Types of questions	No. of questions	No. of questions to be answered	Marks for each question	Total Marks
A	Multiple Choice : Two questions from each Unit	10	10	1	10
B	Not exceeding two pages (either or type) : One question from each Unit *	5	5	7	35
C	Not exceeding four pages (any three out of five) : one question from each Unit	5	3	10	30

6. ELIGIBILITY FOR THE DEGREE:

(i) A candidate will be eligible for the M.Sc., (Mathematics) degree by completing two years (four semesters) and passing all the prescribed examinations.

(ii) A candidate shall be declared as passed the course, if he / she scored a minimum of 50 % marks in each Course of all the Course.

Courses studied by M.Sc., Mathematics students:

M.Sc., Mathematics – Semester – I

Part	Study Component	Course Code	Credit	Hours	Internal Marks	External Marks	Total Marks
III	Core CourseI Algebra – I	17PMAC11	5	6	25	75	100
III	Core CourseII Analysis- I	17PMAC12	5	6	25	75	100
III	Core Course III Ordinary Differential Equations	17PMAC13	5	6	25	75	100
III	Core Course IV Numerical Analysis	17PMAC14	5	6	25	75	100
IV	Elective Course I Integral Equation Elective Course II Fuzzy sets and their Applications	17PMAE11 17PMAE12	4	6	25	75	100
	Total		24	30			

M.Sc., Mathematics – Semester – II

Part	Study Component	Course Code	Credit	Hours	Internal Marks	External Marks	Total Marks
III	Core Course I Algebra – II	17PMAC21	5	6	25	75	100
III	Core Course II Analysis- II	17PMAC22	5	6	25	75	100
III	Core Course III Partial Differential Equations	17PMAC23	5	6	25	75	100
III	Core Course IV Operations Research	17PMAC24	4	6	25	75	100
IV	Elective Course I Calculus Of Variations Elective Course II Discrete Mathematics	17PMAE21 17PMAE22	4	6	25	75	100
	Total		23	30			

M.Sc., Mathematics – Semester – III

Part	Study Component	Course Code	Credit	Hours	Internal Marks	External Marks	Total Marks
III	Core Course I Measure Theory	17PMAC31	5	6	25	75	100
III	Core Course II Topology	17PMAC32	5	6	25	75	100
III	Core Course III Differential Geometry	17PMAC33	5	6	25	75	100
III	Core Course IV Graph Theory	17PMAC34	5	6	25	75	100
IV	Non Major Elective Course Bio Statistics	17PMAN31	4	6	25	75	100
	Total		24	30			

M.Sc., Mathematics – Semester – IV

Part	Study Component	Course	Credit	Hours	Internal	External	Total

		Code			Marks	Marks	Marks
III	Core Course I Complex Analysis	17PMAC41	5	6	25	75	100
III	Core Course II Functional Analysis	17PMAC42	5	6	25	75	100
III	PROJECT	17PMAC4P	5	12	25	75	100
IV	Elective Course I Stochastic Process Elective Course II Mathematical Statistics	17PMAE41 17PMAE42	4	6	25	75	100
	Total		19	30			

Summary of credit and marks

Part	Study Component	Total Credit	Total Marks
III	Core Course	74	1600
IV	Elective Course	12	300
IV	Non Major Elective Course	4	100
Grand Total		90	2000

SYLLABUS FOR M.Sc., (Mathematics) UNDER CBCS

(With effect from the academic year 2017 onwards)

Course Title: Algebra -I Semester: 1

Course Code : 17PMAC11 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To introduce advanced topics in Sylow's theorem, finite abelian group, ideals and Quotient ring, Euclidean Rings and more about fields.

Unit I **18 Hours**

Another Counting Principle - Sylow's Theorem.

Unit II **15 Hours**

Direct Products - Finite Abelian Groups.

Unit III **22 Hours**

Ideals and Quotient Rings - More Ideals and Quotient Rings - the Field of Quotients of an Integral Domain - Euclidean rings.

Unit IV **20 Hours**

A particular Euclidean Ring- Polynomial Rings - Polynomials over the Rational Field - Polynomial Rings over Commutative Rings.

Unit V **15 Hours**

Extension fields – Roots of polynomials.

Text Book

1. Herstein. I. N, (2007), "*Topics in Algebra*", John Wiley and Sons.

Reference Books

1. Joseph Gallian,(2009), "*Contemporary Abstract Algebra*", Cengage Learning.
2. Vijay K. Khanna.,Bhambri. S.K., (1999), "*A Course in Abstract Algebra*", Vikas Publication House Private Limited.
3. Judson ,(2017), "*Abstract Algebra Theory and Application*", PWS Publishing Edition.

Course Title: Analysis - I Semester: 1
Course Code : 17PMAC12 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To give a comprehensive idea about Cauchy sequences, series of non-negative terms ,power series, continuity and compactness , continuity and connectedness, differentiation.

Unit I **22 Hours**

Definition and examples: finite set – countable and uncountable sets – Metric spaces – Compact sets – Perfect sets – connected sets (excluded for Exam) Convergent Sequences – Subsequences - Cauchy Sequences - Upper and Lower Limits. Series - Series of Nonnegative Terms - The number e - The root and ratio Tests - Power Series.

Unit II **18 Hours**

Summation by Parts - Absolute Convergence - Addition and Multiplication of Series - Rearrangements.

15 Hours

Unit III

Limits of Function - Continuous Functions - Continuity and Compactness.

Unit IV **15 Hours**

Continuity and Connectedness – Discontinuities - Monotonic Functions - Infinite Limits and Limits at Infinity.

Unit V **20 Hours**

The Derivative of a Real Function - Mean Value Theorems - The continuity of Derivatives - L'Hospital's Rule - Derivatives of Higher Order - Taylor's Theorem.

Text Book

1. Walter Rudin , Edition- 2013,"*Principles of Mathematical Analysis*", McGraw – Hill Education (India) Private Limited.

Reference Books

1. Malik. S.C., and Savita Arora., (1991), " *Mathematical Analysis*", Wiley Eastern Limited, New Delhi.
2. Gupta. A.L., and Gupta N.R., (2003), "*Principles of Real Analysis*", Pearson Education, (Indian print).
3. Roydon. H.L., (1988), " *Real Analysis*", Macmillan, New York, Third Edition.

Course Title: Ordinary Differential Equations Semester : 1

Course Code : 17PMAC13 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To develop strong background on finding solutions for wronskian, homogeneous and Legendre's, linear equations, Picard's method and Lipschitz condition.

Unit I **22 Hours**

Differential equation:Definition-Ordinary differential equation –partial differential equations-order of a differential equations – Degree of a differential equations – Linear and non linear equation (Excluded for the examination)

The Wronskian .Definition- linearly dependent and independent set of functions – existence and uniqueness theorem – some theorems related to Art.1.14 - solved examples based on Art 1.14 and 1.14A – some important theorems – solved examples based on Art 1.16.

Unit II **18 Hours**

Homogeneous linear equations (or Cauchy – Euler equations) – Method of solution homogeneous linear differential equations – Working rule for solving linear homogeneous differential equations – Solved examples based on Art 6.3 - Definition of $\{1/f(D_1)\}$X, where $D_1 \equiv \frac{d}{dz}, x = e^z$ and X is any function of x .

Unit III **20 Hours**

An alternative method of getting particular integral of homogeneous equation – Particular cases – Solved examples based on Art 6.5 and 6.6A - Solved examples based on Art 6.5 and 6.6B - Equation reducible to homogeneous linear form. Legendre's linear equations – Working rule for solving Legendre's linear equations – Solved examples based on Art 6.10.

Unit IV **15 Hours**

Introduction - Picard's method of successive approximation – Solved examples based on Art 1.2A – Working rule for Picard's method of solving simultaneous differential equations with initial conditions – Solved examples based on Art 1.3A .

Unit V **15 Hours**

Problems of existence and uniqueness – Lipschitz condition – Picard's theorem. Existence and uniqueness theorem – An important theorem – Solved examples based on Articles 1.4 to 1.7– Strum – Liouville equations – solved examples.

Text Book

1. Raisinghania.M.D, (2012), "*Ordinary and Partial Differential equations*", S. Chand and company Limited, Fourteenth Revised Edition.

Reference Books

1. Nandhakumaran A.K., (2017), "*Ordinary Differential Equations*", Cambridge university press.

2. Richard Bronson (2017), "*Differential Equations*", McGraw-Hill publications.
3. Sanchez. D.A., (1968), "*Ordinary Differential Equations and Stability Theory*", W.H.Freeman & Company, San Francisco.

Course Title: Numerical Analysis Semester: 1

Course Code : 17PMAC14 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To develop strong background on finding solution for solving algebraic equations numerically, interpolation numerical differentiation and integration, field of ordinary differential equations.

Unit I **22 Hours**

Introduction - Bisection method - Iteration methods based on first degree equation - Iteration methods based on second degree equation - Rate of convergence - General iteration methods - system of non-linear equation - Methods for complex roots - Polynomial equations - choice of an iterative method and implementation.

Unit II **20 Hours**

Introduction- Direct methods - Error analysis for direct methods - Iteration methods - Eigen values and Eigen vectors - Bounds of Eigen values.

Unit III **18 Hours**

Introduction - Lagrange and Newton interpolations - Finite difference Operators - Interpolating polynomials using finite differences - Hermite interpolation - Piecewise and spline interpolation.

Unit IV **15 Hours**

Introduction - Numerical Differentiation - Extrapolation methods - Partial Differentiation - Numerical integration - Methods based on interpolation - Composite integration methods - Romberg Integration -. Double integration.

Unit V ` **15 Hours**

Introduction - Difference equations - Numerical methods - Single step methods.

Text Book

1. Jain.M. K., Iyengar.S.R.K., and Jain.R.K., (2012), "*Numerical Methods for Scientific and Engineering Computation*", New Age International Publishers, Sixth Edition.

Reference Books

1. Chapra. S.C., and Raymond. P.C.,(2000), " *Numerical Methods for Engineers*", Tata McGraw Hill, New Delhi.
2. Sastry. S.S., (1998), "*Introductory Methods of Numerical Analysis*", Prentice Hall of India New-Delhi.
3. Francis Scheid (2008), "*Numerical Analysis*", McGraw Hill Education.

Course Title: Integral Equations Semester: 1

Course Code : 17PMAE11 Part : IV Contact Hours /Week : 6 Credit : 4

Objectives

To introduce to the students the concept of special types of Kernals, Volterra and Fredholm integral equations, Characteristic values.

Unit-I **22 Hours**

Integral equation. Definition – Linear and non-linear integral equations – Fredholm integral equations- Volterra integral equation – singular integral equation – special kinds of Kernals – integral equation of the convolution type – Iterated Kernals or functions- ResolventKernal or reciprocal Kernal – Eigen values – Leibnit'z rule of differentiation under integral sign – an important formula for converting a multiple integral into a single ordinary integral – regularity conditions – the inner or scalar product of two functions – solution of an integral equation. Definition – solved example based on Art. 1.17. (Problems Only)

Unit – II **18 Hours**

Introduction – initial value problem – method of converting an initial value problem into a Volterra integral equation – alternative method of converting an initial value problem into a Volterra integral equation – boundary value problem –method of converting a boundary value problem into a Fredholm integral equation.(Problems Only)

Unit - III **15 Hours**

Characteristic values(or Characteristic numbers or Eigen values). Characteristic functions (or Eigen functions) – solution of homogeneous Fredholmintergral equation of the second kind with separable (or degenerate) Kernal's – solved examples based on Art. 3.1 and Art. 3.2.(Problems Only)

Unit - IV **15 Hours**

Solution of Fredholm integral equations of the second kind with separable (or degenerate) Kernals – solved examples based on Art. 4.1- Fredholm alternative- Fredholm theorem – Fredholm alternative theorem – solved examples based on Art. 4.3. – an approximate method(excluded theorem). (Problems Only)

Unit - V **20 Hours**

Introduction – Iterated Kernals or functions – Resolvent (or reciprocal) Kernal – theorem to prove that $K_m(x,t) = \int_a^b K_r(x,y)K_{m-r}(y,t)dy$ - solution of Fredholm integral equation of the second kind by successive substitutions – solution of Volterra integral equation of the second kind by successive substitutions - solution of Fredholm integral equation of the second kind by successive approximation. Iterative method (Iterative scheme). Neumann series – some important theorems – solved example based on solution of Fredholm integral equation of the second kind by successive approximation (or Iterative method) – reciprocal functions Volterra solution of Fredholm integral equation of the second kind – solution of the Volterra integral equation of the second kind by successive approximations(or Iterative method). Neumann series. – theorem to prove that $R(x,t;\lambda) = K(x,t) + \lambda\int_t^x K(x,z)R(z,t;\lambda)dz$ - solved examples based on solution of Volterra integral equation of the second kind by successive approximation

(or iterative method) – Solution of volterra integral equation of the second kind by reducing to differential equation – Volterra integral equation of the first kind – Solution of Volterra integral equation of the first kind.(Problems Only)

Text Book

1. Raisinghania. M. D., (2007), "*Integral Equations and Boundary Value Problems*", S. Chand & Company, New Delhi.

Reference Books

1. Kanwal. P., (1971), "*Linear Integral Equation Theory and Techniques* ", , Academic Press, New York.
2. Sudir K. Pundir and RimplePundir, (2005), "*Integral Equations and Boundary Value Problems*", PragatiPrakasam, Meerut.
3. MatiurRahman, (2007), "*Integral Equations and Their Applications*", WIT Press.

Course Title: Fuzzy Sets And Their Applications Semester: 1
Course Code : 17PMAE12 Part : IV Contact Hours /Week : 6 Credit : 4

Objectives

To study the uncertainty environment, incorporate imprecision and subjectivity , model formulation and solution process, final crisp values.

Unit I **20 Hours**

From Classical Sets to Fuzzy Sets – Fuzzy Set: Basic types – Fuzzy Sets Versus Crisp sets - Extension Principle for Fuzzy Sets – Operations on Fuzzy sets - Types of Operations – Fuzzy Complements.

Unit II **20 Hours**

Fuzzy Arithmetic – Fuzzy numbers – Linguistic variables – Arithmetic operations on intervals - Arithmetic operations on Fuzzy numbers – Lattice of Fuzzy numbers – Fuzzy equations.

Unit III **20 Hours**

Fuzzy Logic – Multi-valued Logics – Fuzzy propositions – Unconditional and Unqualified Fuzzy Propositions – Unconditional and qualified Propositions – Conditional and unqualified Propositions Conditional and qualified Propositions - Linguistic Hedges – Inference from conditional Fuzzy propositions - Inference from conditional and qualified Propositions.

Unit IV **15 Hours**

Fuzzy Decision making – Individual decision making – Fuzzy Ranking methods – Fuzzy Linear Programming.

Unit V **15 Hours**

Fuzzy Relations – Composition of fuzzy relations – properties of fuzy relations.

Text Books

1. George J. Klir and Bo yuan, (2004), "*Fuzzy Sets and Fuzzy Logic*" , Theory and Applications Prentice – Hall of India Private Limited.
2. NagoorGani. A., and Chandrasekaran. V.J., (2010), "*A First look at Fuzzy Graph theory*", Allied Publilshers Private Limited.

Reference Books

1. Zimmer Mann. H.J., (1991), "*Fuzzy set Theory and its applications*", Allied Publishers Limited.
2. Ganesh, M., (2006), "*Introduction to Fuzzy sets and Fuzzy logic*", Prentice Hall of India Private Limited, New Delhi.
3. Dubois, Didier, Prade, Henri, (2000), "*Fundamentals of Fuzzy Sets*", Springer.

Course Title: Algebra – II Semester: 2

Course Code : 17PMAC21 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To introduce advanced topics in the elements of Galois Theory, linear transformations.

Unit I **20 Hours**

More about roots – The elements of Galois theory – Solvability by radicals.

Unit II **18 Hours**

The Algebra of Linear Transformations - Characteristic Roots

Unit III **15 Hours**

Matrices - Canonical Forms: Triangular form

Unit IV **22 Hours**

Nil Potent -Transformations Canonical forms: A Decomposition of V: Jordan forms - Rational Canonical form

Unit V **15 Hours**

Trace and Transpose – Determinants - Hermitian - Unitary and Normal Transformations Real Quadratic forms.

Text Book

1. Herstein. I.N., (2007), "*Topics in Algebra*", John Wiley and Sons.

Reference Books

1. Joseph Gallian, (2009), "*Contemporary Abstract Algebra*", Cengage Learning.
2. Vijay K. Khanna , Bhambri. S.K., (1999), "*A Course in Abstract Algebra*", Vikas Publication House Private Limited.
3. David C. Lay, (2002), " *Linear Algebra and its Applications*", Third Edition.

Course Title: Analysis-II Semester :2

Course Code : 17PMAC22 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To know more about Integration and Differentiation,Sequences and Series of Function, Completeness of the Complex Field.

Unit I **22 Hours**

Definitions and existence of the Integral, Properties of the Integral, Integration and Differentiation, Integration of vector valued functions Rectifiable curves

Unit II **18 Hours**

Sequences and Series of Function: Discussion of Main Problem - Uniform Convergence - Uniform Convergence and Continuity - Uniform Convergence and Integration.

Unit III **20 Hours**

Sequences and Series of Function: Uniform Convergence and Differentiation - Equicontinuous Families lf Functions - The Stone-Weierstrass Theorem. .

Unit IV **15 Hours**

Some Special Functions: Power Series - The Exponential and Logarithmic Functions - The Trigonometric Functions.

Unit V **15 Hours**

Some Special Functions: The Algebraic Completeness of the Complex Field - Fourier Series - The Gamma Function.

Text Book

1. Walter Rudin, (2013) , "*Principles of Mathematical Analysis*", McGraw Hill Education (India) Private Limited.

Reference Books

1. Malik.S.C.,and Savita Arora, (2001), "*Mathematical Analysis*", Wiley Eastern Limited, New Delhi.
2. A.L.Gupta and Gupta.N.R., (2003), "*Principles of Real Analysis*", Pearson Education.
3. Roydon.H.L., (2001), "*Real Analysis*", Macmillan, New York, Third Edition.
4. Karunakaran.V., (2011), "*Real Analysis*", Pearson Education, South Asia.

Course Title: Partial Differential Equations Semester: 2

Course Code : 17PMAC23 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To develop strong background on finding solutions to Lagrange's equations, non-linear partial differential equations of order one, homogeneous linear partial differential equations with constant co-efficients, partial differential equations reducible to equations with constant co-efficients

Unit I **22 Hours**

Lagrange's equations – Lagrange's method for solving $Pp + Qq = R$ - Working rule for solving$Pp + Qq = R$. Lagrange's method and examples – Type I based on rule 1 for solving$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ and examples - Type II based on rule 2 for solving$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ and examples - Type III based on rule 3 for solving$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ and examples - Type IV based on rule 4 for solving$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ and examples

Unit II **18 Hours**

Complete integral, Particular integral , singular integral and general integral – Geometrical interpretation of integrals of $f(x, y, z, p, q) = 0$ – Method of getting singular integral directly from the partial differential equation of first order - Compatible system of first order equations – A particular case of Compatible system of first order equations and examples – Charpit's method – Working rule while using Charpit method and example.

Unit III **15 Hours**

Jacobi's method – Working rule for Solving partial differential equations with three or more independent variables. Jacobi's method and examples – Jacobi's method for solving non-linear first order partial differential equation in two independent variables – Cauchy's method of characteristics for solving non-linear partial differential equations – Some theorems and examples.

Unit IV **20 Hours**

Homogeneous and non homogeneous linear partial differential equations with constant coefficients – Solution of a homogeneous linear partial differential equations with constant coefficient – Method of finding the complementary function(C.F) of linear homogeneous partial differential equation with constant coefficient – Working rule for finding C.F of linear partial differential equations with constant coefficient – Particular integral (P.I) of homogeneous partial differential equations – Short methods of finding P.I in certain cases – Short method I. When $f(x, y)$ is of the form $\varphi(ax + by)$ and examples – short method II when $f(x, y)$ is of the form $x^m y^n$ or a rational integral algebraic function of x and y and examples – a general method of finding the particular integral of linear homogeneous particular differential equations with constant coefficients and examples.

Unit V **15 Hours**

Method of reducible Euler – Cauchy type equation to linear partial differential equation with constant coefficients – working rule for solving the Euler – Cauchy type equations and examples.

Text Book

1. Raisinghania.M.D., (2012), "*Ordinary and Partial Differential Equations*", S. Chand and company Limited , Fourteenth Revised Edition.

Reference Books

1. SankarRao.K., (2005), "*Introduction to Partial Differential Equations*", Prentice Hall of India, New Delhi, Second Edition.
2. Sneddon.I.N., (2008), "*Elements of Partial Differential Equations*", McGraw Hill, New Delhi.
3. Walter A. Strauss, (2007), "*Partial Differential Equations: An Introduction*", Wiley.

Course Title: Operations Research Semester: 2

Course Code : 17PMAC24 Part : III Contact Hours /Week : 6 Credit : 4

Objectives

To introduce revised simplex method and dual simplex method, PERT and CPM , classical optimization technique, quadratic programming and separable programming.

Unit I **20 Hours**

Revised simplex method – Dual simplex method

Unit II **20 Hours**

Project Management by PERT – CPM

Unit III **20 Hours**

Classical optimization Techniques (Lagrangian Method & Kuhn – Tucker Conditions)

Unit IV **15 Hours**

Quadratic Programming (Wolfe's and Beale's Method)

Unit V **15 Hours**

Separable Programming

Text Book

1. Sharma.S.D., (2009), "*Operations Research*" ,Kedar Nath Ram Nath, Meerut, Delhi.

Reference Books

1. Kanthiswarup., and Gupta.P.K., Man Mohan,(2011), "*Operations Research*", Sultan Chand & Sons.
2. Gurusamy.S., (2018), "*Operation Research*", Vijay Nicole Imprints Private Limited, Chennai.
3. Rao.S.S., (2003), "*Optimization Theory and Applications*", Wiley Eastern Limited, New Delhi.

Course Title: Calculus of Variations Semester: 2

Course Code: 17PMAE21 Part : IV Contact Hours /Week : 6 Credit : 4

Objectives

To enable the students to find the solution of different variational problems from different forms of ordinary differential equations, Moving boundaries in explicit form, Higher order variations and Ritz method.

Unit – I **20 Hours**

Introduction- Functionals - Euler's Equations - Another Form of Euler's Equations - Particular cases of Euler's equations –Necessary condition of Extremums - Sufficient condition of Extremums – Functionals dependent on higher order derivatives – Extension of the variational case(several dependent variables) – Isoperimetric problems – Lagrange's equation – Invariance of Euler equation (problems only).

Unit – II **18 Hours**

Introduction – Transversality condition – Variational problem with moving boundary in implicit form – Basic problem with variable end – Generalised boundary and transversality condition for the variable end points(problems only).

Unit – III **18 Hours**

General definitions – Jacobi condition – Weirstrass function - Sufficient condition of Extremums : Legendre condition(problems only).

Unit – IV **17 Hours**

Canonical or contact transformation – Condition for a transformation to be canonical (problems only).

Unit – V **17 Hours**

Direct methods in variational problems -Ritz Method - Galerkin's Method – Collocation methos – Least square method(problems only).

Text Book

1. Pundir and pundir, (2015), "*Calculus of Variations*", Pragati Prakashan, Meerut.

Reference Books

1. Mukeshkumar Singh., (2017), "*Calculus of Variations*", Krishna's Prakashan.
2. Naveenkumar., (2005), "*An Elementary course on variational problems in calculus*", Narosa Publishing House.
3. Gupta.A.S., (2015), "*Calculus of Variations with applications*", PHI, New Delhi.
4. Gelffand.I.M., and Fomin.S.V., (2012), "*Calculus of Variations*", Prentice Hall.

Course Title: Discrete Mathematics Semester: 2

Course Code : 17PMAE22 Part : IV Contact Hours /Week : 6 Credit : 4

Objectives

To explore the topics like lattices and their applications in switching circuits, finite fields and Polynomials, coding Theory.

Unit - I **22 Hours**

Lattices: Properties and examples of Lattices - Distributive lattices - Boolean algebras - Boolean polynomials - Minimal Forms of Boolean Polynomials.

Unit - II **18 Hours**

Applications of Lattices: Switching Circuits - Applications of Switching Circuits

Unit - III **15 Hours**

Finite Fields and Polynomials: Finite fields

Unit - IV **20 Hours**

Finite Fields and Polynomial: Irreducible Polynomials over Finite fields - Factorization of Polynomials over Finite fields.

Unit – V **15 Hours**

Coding Theory: Introduction to Coding - Linear Codes.

Text Book

1. Rudolf Lidl & Gunter Pilz, (2006), "*Applied Abstract Algebra*" , Second Indian Reprint, Springer Verlag, NewYork.

Reference Books

1. Gill.A., (1976), "*Applied Algebra for Computer Science*", Prentice Hall Inc,New Jersey.
2. Gersting.J.L., (2015), "*Mathematical Structures for Computer Science*", Computer Science Press, New York, Third Edition.
3. Witala.S., (1987), "*Discrete Mathematics*", A Unified Approach, McGraw Hill Book Company.

Course Title: Measure Theory Semester: 3
Course Code : 17PMAC31 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To develop strong background on Lebesgue Outer Measure , Integration of Non-negative functions, Riemann and Lebesgue integrals and functions of bounded variations.

Unit I **18 Hours**

Lebesgue outer measure - Measurable sets – Regularity.

Unit II **18 Hours**

Measurable functions - Borel and Lebesgue measurability.

Unit III **18 Hours**

Integration of non-negative functions - The general integral - Integration of series.

Unit IV **18 Hours**

Riemann and Lebesgue integrals - The four derivatives - Continuous non-differentiable functions.

Unit V **18 Hours**

Functions of bounded variations - Lebesgue differentiation theorem - Differentiation and Integration - The Lebesgue set.

Text Book

1. Barra. G.de., (2013), "*Measure Theory and Integration*", Willey Eastern Limited, Second Edition.

Reference Books

1. Malik S.C., and Savita Arora, (1991), "*Mathematical Analysis*", Wiley Eastern Limited, New Delhi.
2. Gupta.A.L., and Gupta.N.R., (2003), "*Principles of Real Analysis*", Pearson Education.
3. Roydon.H.L., (1988), "*Real Analysis*", Macmillan, New York.
4. Walter Rudin, (1976), "*Principles of Mathematical Analysis*", McGraw Hill International, Third Edition.

Course Title: Topology Semester: 3

Course Code : 17PMAC32 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To introduce the basic notions and study the techniques of Topological spaces, Continuity and Homeomorphism, connectedness, compactness, Product spaces.

Unit I **22 Hours**

Introduction - Various types of topologies - Intersection and Union of topologies - Greatest lower bound - Least upper bound of the family of topologies for a non-empty set X - Closed sets - Intersection and Union of closed sets - characterisation of a topological space in terms of closed set - Neighbourhood- $\Im$-nbd - properties of neighbourhoods Characterization of open in a topological space in terms of neighbourhoods - characterization of a topological space in terms of neighbourhoods - Base for the neighbourhood system of a point or a local base - First Countable space - Properties of local base at a point of $(X - \Im)$ characterization of a topological space in terms of local base - Base for a topology - Sub Base - Adherent points - Limit points and derived sets in a topological space - some theorem on derived sets - Hausdorff space (separated space or T2-space) $\Im$ - closure of a set - Closure operator and kuratowski closure Axioms - Characterization of a topological space in terms of closure operator - Interior point - Interior operator - Exterior point - Properties of exterior points - Exterior operator - Frontier point.

Unit II **18 Hours**

Continuity - Certain Theorems giving the criteria for a continuous function - Open and Closed mappings - Certain theorem on open and closed mappings – Homeomorphism - Certain theorems on Homeomorphism giving the properties and criteria for a mapping to be homeomorphism - Sequential continuity - Topologies generated by a mapping.

Unit III **20 Hours**

Separated sets - Certain theorems giving the properties of Separated sets - Connected and Dis-Connected sets - Certain theorems giving the properties of Connected and Dis-Connected sub spaces - Connectedness on the real line – Components - Certain theorems on properties of Components - Totally disconnected spaces - Locally connected space

Unit IV **15 Hours**

Cover and Sub cover - Compact Spaces - Properties of compact Space – Sequentially - countably and locally compact spaces - Compactness of real line - Bounded mapping.

Unit V **15 Hours**

Introduction - Projection Mapping - Properties of product spaces - Topology for the Cartesian product of a finite collection of topological spaces - Topology for the Cartesian product of an arbitrary collection of topological spaces - Product Invariant Properties.

Text Book

1. Khanna.M.L., (2004), "*Topology*" ,Jai Prakash Nath and Company, Meerut.

Reference Books

1. George F. Simmons., (1963), "*Introduction to Topology and Modern Analysis*", McGraw Hill Book Company.
2. James R.Munkers .,(2002), "*Topology*" Prentice-Hall of India Private Limited, New Delhi, Second Edition.
3. Kelley.J.L., (1995), "*General Topology*" , Van Nostrand , Reinhold Company, New York.
4. Kumaresan.S., (2011) , "*Topology of metric Spaces*", second edition, Narosa publication.
5. Gupta.K.P., (2015), "*Topology*", Pragati Edition .

Course Title: Differential Geometry Semester: 3
Course Code : 17PMAC33 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To introduce preliminary concepts of theory of space curves, arc length, Tangent and Osculating Plane, Principal normal, bi-normal, curvature, torsion.

Unit I **18 Hours**

Theory of space curve – Representation of space curve – Unique parametric representation of space curve-arc length

Unit II **15 Hours**

Tangent and Osculating Plane – Principal normal and bi-normal – curvature and torsion

Unit III **20 Hours**

Curvature and torsion of a curve as the intersection of two surfaces – contact between curves and surfaces – Osculating circle – Osculating sphere

Unit IV **15 Hours**

Intrinsic equations of space curves – Fundamental existence theorem for space curves- Helices (Problems excluded)

Unit V **22 Hours**

Introduction – Definition of a surface - Nature of points on a surface - Helicoids – Metric on a surface – The first fundamental form-Geodesics- Introduction – Geodesics and their differential equations.

Text Book

1. Somasundaram.D., (2012), "*Differential Geometry – A First Course*", Narosa Publishing House.

Reference Books

1. Willmore.T., (1997), "*Differential Geometry*" Mac Millan, New York.
2. Weatherburn.C.E., (1930), "*Differential Geometry of Three dimensions*", University Press, Cambridge.
3. Somasundaram.D., (2008), "*Differential Geometry*", Narosa Book Distributors.
4. Jeffery M.Lee, (2009), "*Manifolds and Differential Geometry*", Americian Mathematical Society.

Course Title: Graph Theory Semester: 3

Course Code : 17PMAC34 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To study and develop the concept of Graphs and simple graphs, trees &connectivity , Euler tours, Matchings and Edge chromatic number.

Unit I **18 Hours**

Graphs and simple graphs - Graph isomorphism - The incidence and adjacency matrices - Sub graphs - Vertex degrees - Paths and connection -Cycles - The shortest path problem - Sperner's lemma.

Unit II **18 Hours**

Trees - Cut edges and Bonds - Cut vertices - Cayley's formula - the connector problem – connectivity – Blocks - Construction of Reliable COMMUNICATION Networks.

Unit III **20 Hours**

Euler tours - Hamiltonian cycles - The Chinese postman problem - The travelling-Salesman problem

Unit IV **17 Hours**

Matchings - Matchings and coverings in Bipartite graphs - Perfect matching

Unit V **17 Hours**

Edge Chromatic number - Vizing's theorem

Text Book

1. Bondy. J.A., and Murty.U.S.R., (1976), "*Graph Theory with Applications*".

Reference Books

1. Frank Harary, (1969), "*Graph theory*", Addition-Wesley Publishing Company , First Edition.
2. Murugan.M., (2003) , "*Topics in Graph theory and Algorithms*", Muthali Publishing House, Annanagar, Chennai.
3. Clark.J., and Holton.D.A., (1995) , "*A First look at Graph Theory*", Allied Publishers, New Delhi.
4. Wilson. R.J., (2004), "*Introduction to Graph Theory*", Pearson Education , Fourth Edition.
5. Yadav.S. K., (2010), "*Elements of graph Theory*", Ane Books Private Limited.

Course Title: Bio Statistics Semester: 3

Course Code : 17PMAN31 Part : IV Contact Hours /Week : 6 Credit : 4

Objectives

To practice the students more employable in the field of Data collection, Probability, Some Special Distributions, Statistical data.

Unit I **22 Hours**

Collection of Data - Primary and secondary data - Classification and Tabulation - Diagrammatic representation - Measures of central Tendency: Mean – Median – Mode - Geometric Mean - Harmonic Mean

Unit II **18 Hours**

Measures of Dispersion: Range - Quartile deviation of combined sets - Standard Deviation - Coefficient of variation - Correlation - Regression lines and Rank correlation

Unit III **20 Hours**

Probability: Addition theorem and Multiplication theorem - Binomial distribution - Poisson distribution - Normal distribution - Simple problems.

Unit IV **15 Hours**

Chi-Square Test - Degrees of freedom - Test of Goodness of fit - Test of Independence

Unit V **15 Hours**

Application - Health surveys - Sample size determination - Methods of Mortality data analysis - Path coefficient analysis in medicine - Statistical modeling in health and disease.

Text Books

1. Pillai. R.S.N., and Bagavathi.V., (2008), "*Statistics: Theory and Practice*", S.Chand Company , seventh Revised Edition.
2. Verma.B.L., Shukla.G.D., and Srivastava.R.N., (1994), "*Bio Statistics*", C.B.S. Publishers and Distributers, Delhi.

Reference Books

1. Mandal. R.B., (2014), "*Statistics For Geographers And Social*" , Bio-Green Books.
2. Smith.J.E., Gao Smith.F., (2002) , "*Key Topics in Clinical Research and Statistics*", Bio Scientific Publishers Limited.
3. GirumTayeZeleke, (2010) , "*An Introduction To Epidemiology And Bio-Statistics*", Lap Lambert Academic Publishing.

Course Title: Complex Analysis Semester: 4
Course Code : 17PMAC41 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To introduce advanced concepts of analytic function, Power series and Elementary function, Complex Integration and Calculus of residues.

Unit I **20 Hours**

Curves in the Argand plane – Functions of a complex variable - Neighbourhood of a point – Limits and continuity – Differentiability – Analytic,holomorphic and regular functions – The necessary and sufficient conditions for f(z) to be analytic – Polar Form of cauchy-riemann Equations – Derivative of w = f(z) in polar form – Orthogonal system – Harmonic function – Methods of constructing A Regular function (Milne-Thomson's method).

Unit II **22 Hours**

Sequences – Infinite series – sequences and series of functions – Principal of uniform convergence of sequence – Cauchy's criterion for series – Power series – Elementary Transcendental functions – Exponential function – Addition theorem for Exponential Function e^z - Trigonometrical function sin z and cos z – Hyperbolic functions sinh z and cosh z – Relation between Trigonometric and Hyperbolic functions – Periodicity – Periodicity of sin z and cos z – Periodicity of e^z - Logarithmic function – Branches of log w – Addition Theorem for log w – Analyticity of log w – The general power z^a - Inverse Trigonometric functions.

Unit III **18 Hours**

Line Integrals as functions of Arcs – Cauchy's Fundamental theorem – Cauchy's Integral formula – Derivative of an analytic function – Higher order Derivatives of an analytic function – Poisson's Integral formula for a Circle – Morera's Theorem – Cauchy's Inequality.

Unit IV **15 Hours**

Integral Function – Expansion of Analytic Functions at power series – The Zeros of an Analytic function – Singularities of an Analytic function

Unit V **15 Hours**

Maximum Modulus Principle – The Excess of the Number of Zeros over the Number of Poles of the Meromorphic function. The Argument Principle – Rouche's Theorem – Schwarz lemma – Residue at pole – Computation of Residue At a Finite Pole – Residue at Infinity – Computation of Residue at Infinity - Cauchy's Residue Theorem .

Text Book

1. Vasishtha.A.R., (2016), "*Complex Analysis*", SatyendraRastogi "Mitra" for Krishna Prakahsan Media Private Limited.

Reference Books

1. Karunakaran.V., (2005), "*Complex Analysis*" , Narosa Publication ,Second Edition.
2. Lars V. Ahlfors, (2017), "*Complex Analysis*", McGraw Hill Education (India) Private Limited.

3. Roopkumar.R., (2015), "*Complex Analysis*", Pearson.
4. Ponnusamy.S., (2011), "*Foundation of complex Analysis*", Narosaook Distributors.
5. Singh.A.P., (2017), "*Complex Analysis*", Info study Publications.

Course Title:Functional Analysis Semester: 4

Course Code : 17PMAC42 Part : III Contact Hours /Week : 6 Credit : 5

Objectives

To have a good foundation in Banach Spaces, Hilbert Spaces and finite dimensional theory.

Unit I **20 Hours**

Banach spaces – The definition and some examples – Continuous linear Transformations – The Hahn-Banach theorem .

Unit II **18 Hours**

The natural imbedding of N in N** - The open mapping theorem - The conjugate of an operator .

Unit III **22 Hours**

Hilbert spaces – The definition and some simple properties – Orthogonal Complements Orthonormal sets - The Conjugate space H*.

Unit IV **15 Hours**

The adjoint of an operator – Self-adjoint operators – Normal and Unitary operators – Projections.

Unit V **15 Hours**

Matrices – Determinants and the spectrum of an operator – The Spectral theorem –A survey of the situation.

Text Book

1. Simmons.G.F., (2017), " *Introduction to Topology and Modern Analysis*" , McGraw Hill Education India Private Limited, New Delhi.

Reference Books

1. Bachman.G., and Narici.L., (1966) , "*Functional Analysis*", Academic Press, New York.
2. Somasundaram.D., (2015), "*A First course in Functional Analysis*", Narosa Publishing House.
3. Balmohan . V. Limaye, (2014), "*Functional Analysis*", New Age International Publication.
4. Ponnusamy.S., (2008), "*Foundation of Functional Analysis*" , Narosa Book Distributors.

Course Title: Stochastic Process Semester: 4

Course Code : 17PMAE41 Part : IV Contact Hours /Week : 6 Credit : 4

Objectives

To introduce advanced topics in Stochastic process , Markov chains, Markov Process with Discrete state space,Markov Process with Continuous state space.

Unit I **18 Hours**

Introduction - Specification of stochastic processes – stationary processes – Martingale convergence theorem - Markov Chains : Definitions and Examples – Higher transition probabilities.

Unit II **22 Hours**

Generalization of independent Bernoulli trials – Sequence of chain dependent trials – Classification of States and chains – Determination of Higher Transtition probabilities - Stability of Markov system.

Unit III **15 Hours**

Markov chain: Graph theoretic approach – Markov chain with denumerable number of state – Reducible chains – Statistical inference for Markov chain – Markov chains with continuous state space.

Unit IV **20 Hours**

Poisson process: Poisson process and related distributions – Generalizations of Poisson process – Birth and death process – Markov process with discrete state space (Continuous time Markov chain).

Unit V **15 Hours**

Introduction: Brownian Motion – Winer process – Differential Equations for a Wiener process – Kolmogorov Equations – First Passage Time Distribution for Wiener process.

Text Book

1. Medhi.J., (2002), "*Stochastic Processes*", New Age International.

Reference Books

1. Cinlar.E., (2000), "*Introduction to Stochastic Processes*", PHI.
2. Srinivasan.S.K., and Vijayakumar.A., (2003), "*Stochastic Processes*", Narosa Publication.
3. Sheldon M. Ross, (2008), "*Stochastic Processes*", Wiley.

Course Title:Mathematical Statistics Semester: 4

Course Code : 17PMAE42 Part : IV Contact Hours /Week : 6 Credit : 4

Objectives

To understand the more concept in Statistics, various distributions, Some Special Distributions, Distribution of function of random variables, Limiting Distribution.

Unit I **22 Hours**

Introduction – Algebra of a Sets – Set function – The Probability Set Function – Random Variables – The Probability Density Function – The Distribution Function - Certain Probability Models - Mathematical Expectation – Some Special Mathematical Expectations – Chebyshev's Inequality.

Unit II **18 Hours**

Conditional Probability – marginal and Conditional Distributions – The Correlation Coefficient – Stochastic Independence

Unit III **15 Hours**

The binomial, Trinomial and multinomial Distributions – The Poisson Distributions – The Gamma and Chi square distributions – The Normal Distributions- The Bivariate Normal Distribution

Unit IV **20 Hours**

Sampling theory – Transformation of Variables of the Discrete Type - Transformation of Variables of the Continuous Type – The t and F Distributions - Expectations of Functions of Random Variables

Unit V **15 Hours**

Stochastic Convergence- Limiting Moment Generating Functions – The Central Limit Theorem- Some theorem on Limiting Distributions

Text Book

1. Kadarkarai Thangam.K., and Subas Chandra Bose.A., (1988), "*Probablity And Statistics*" Jeyalakshmi Publishers, Tuticorin.

Reference Books

1. Roger E.Kirk, (2007), "*Statistics*" , Fifth Edition.
2. Narayanan Nadar.E., (2007), " *Statistics*", Second Edition.
3. Gupta.S. C., and Kapoor.V. K.., (2014), "*Fundamentals of Mathematical Statistics*", sultan chand and sons.
4. Vijay . K. Rohatgi, (2008), "*An Introduction to Probability and Statistics*" , Wiley.