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दुरध्वनी (ईपीएबीएक्स) २६०९००० (अभ्यास मंडळे विभाग— २६०९०९४)
फॅक्स : ००९१-०२३१-२६९१५३३ व २६९२३३३.e-mail:bos@unishivaji.ac.in

Estd. 1962
NAAC 'A' Grade

SU/BOS/Science/ No 0142 **Date:** 04 JAN 2021

To,

The Director,
Center for Distance Education ,
Shivaji University, Kolhapur.

Subject: Regarding syllabi, equivalence of M. Sc. Part-II (Sem. III & IV (CBCS) degree programme under the Faculty of Science and Technology.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of M. Sc. Part-II (Sem. III & IV) (CBCS) degree programme under the Faculty of Science and Technology.

M.Sc.-II (Sem. III & IV) (CBCS)	
1.	Mathematics (Distance Mode)

For Students of Distance Education this syllabi and equivalence shall be implemented from the academic year 2021-2022 (i.e. from June 2021) onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website **www.unishivaji.ac.in**)

The question papers on the pre-revised syllabi of above mentioned course will be set for the examinations to be held in October /November 2021 & March/April 2022. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy Registrar

Copy to:

1	The Dean, Faculty of Science and Technology	8	P.G.Seminar Section
2	Director, Board of Examinations and Evaluation	9	Computer Centre
3	The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.)
4	B.Sc. Exam	11	Affiliation Section (P.G.)
5	Eligibility Section	12	P.G.Admission Section
6	O.E. I Section	13	Centre for Distance Education
7	Appointment Section		

SHIVAJI UNIVERSITY, KOLHAPUR

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Accredited By NAAC with 'A' Grade

Distance Mode

Syllabus For

M.A./M.Sc. Mathematics Part -II

SEMESTER III AND IV

(Syllabus to be implemented from June, 2021 onwards.)

Title of the course: M.A./M. Sc. (Distance Mode)

M.A./M.Sc. program has semester pattern and Distance mode.

Structure of the course

The following table gives the scheme of Examination at M.A./M.Sc. (Part II) (Distance Mode) according to the New Syllabus and pattern of Examination.

M.A./M. Sc. (Part II) (Semester III)

Course Code	Title of course	Duration of Term end Exam	Marks Term end exam	Marks-(Internal) Mid Semester Exam
MT - 301	Real Analysis	3	90	30
MT - 302	Field Theory	3	90	30
Optional Courses (Any three)				
MT - 303	Number Theory	3	90	30
MT – 304	Operation Research – I	3	90	30
MT - 305	Fuzzy Mathematics –I	3	90	30
MT - 306	Fluid Dynamics	3	90	30

M.A./M. Sc. (Part II) (Semester IV)

Course Code	Title of course	Duration of Term end Exam	Marks Term end exam	Marks-(Internal) Mid Semester Exam
MT - 401	Integral Equations	3	90	30
MT - 402	Advanced Discrete Mathematics	3	90	30
Optional Courses (Any three)				
MT - 403	Algebraic Number Theory	3	90	30
MT – 404	Operation Research – II	3	90	30
MT - 405	Fuzzy Mathematics –II	3	90	30
MT - 406	Computational Fluid Dynamics	3	90	30

Nature of the Question Papers

1. Mid semester examination shall be in online mode and will have objective type questions

Question Paper Pattern

1. 15 multiple choice questions (MCQs)with four alternatives and having only one alternative most correct.
2. MCQs will be based on Unit-I and Unit-II
3. Each MCQ carries 2 marks
4. Total Marks: 30
5. Time Allotted: 30 Minutes

Instructions:

1. All questions are compulsory.
2. Tick correct option.
3. Examination will be open from 11:00 AM to 12:30 PM as per the time scheduled given by the Centre for Distance Education.

2. End Semester Examination:

The pattern of question paper will be as follows

1. There shall be 7 questions each carrying 18 marks
2. Question No.1 is compulsory. It consists of objective type questions.
3. Students have to attempt any four questions from Question No.2 to Question No.7.
4. Question No.2 shall consists of short-answer type sub-questions
5. Question No.2 to Question No.7 shall consists of descriptive-answer type questions /sub-questions.

M.A./M. Sc. (Mathematics) (Part II) (Semester III)

M.A./M. Sc. Mathematics (Part II) (Semester III)
(Distance Mode)
(Introduced from June 2021onwards)

Course Code: MT 301
Title of Course: Real Analysis
Course Outcomes: Upon successful completion of this course, the student will be able to:
1. generalise the concept of length of interval.
2. analyse the properties of Lebesgue measurable sets.
3. demonstrate the measurable functions and their properties.
4. understand the concept of Lebesgue integration of measurable functions.
5. characterize Riemann and Lebesgue integrability.
6. prove completeness of L^p Spaces.

UNIT I:
σ - algebraand Borel sets of real numbers, Lebesgue outer measure, The sigma algebra of Lebesgue measurable sets, Outer and inner approximation of Lebesgue measurable sets, Countable additivity, Continuity and Borel-Cantelli lemma.
UNIT II:
Non measurable Sets, Lebesgue Measurable Functions: Sums, product and composition of measurable functions, Sequential pointwise limits and simple approximation, Littlewood's three principles, Egoroff's theorem, and Lusin's theorem.

UNITIII:
Lebesgue integration of a bounded measurable function, Lebesgue integration of a non-negative measurable function, The general Lebesgue integral, Characterization of Riemann and Lebesgue integrability.

UNIT IV:
Differentiability of Monotone Functions, Lebesgue's theorem, Functions of bounded variations, Jordan's theorem (Statement only),Absolutely continuous functions, integrating derivatives: differentiating indefinite integrals, The L^p Spaces: Normed linear spaces, The inequalities of Young, Hölder and Minkowski, The Riesz-Fischer Theorem.

Recommended Books:

1. H. L. Royden, P.M. Fitzpatrick, Real Analysis, Fourth Edition, PHI Learning Pvt. Ltd., New Delhi, 2010

Reference Books:

1. G. deBarra, Measure Theory and Integration, New Age International (P) Ltd., 1981.
2. I. K. Rana, An Introduction to Measure and Integration, Narosa Book Company, 1997.
3. S. K. Berberian, Measure and Integration, McMillan, New York, 1965.
4. P. K. Jain, V. P. Gupta, Lebesgue Measure and Integration, Wiley Easter Limited, 1986.
5. P. K. Halmos, Measure Theory, Van Nostrand, 1950.

M.A./M. Sc. Mathematics (Part II) (Semester III)
(Distance Mode)
(Introduced from June 2021onwards)

Course Code: MT 302
Title of Paper: Field Theory
Course Outcomes: Upon successful completion of this course, the student will be able to:
1) determine the basis and degree of a field over its subfield.
2) construct splitting field for the given polynomial over the given field.
3) find primitive n^{th} roots of unity and n^{th}cyclotomic polynomial.
4) make use of Fundamental Theorem of Galois Theory and Fundamental Theorem of Algebra to solve problems in Algebra.
5) apply Galois Theory to constructions with straight edge and compass.

UNIT-I: Algebraic Extensions of fields
Adjunction of roots, Algebraic extensions, Algebraically closed fields.

UNIT-II: Normal and Seperable extensions
Splitting fields, Normal extensions, Multiple roots, Finite fields, Separable extensions.

UNIT-III: Galois Theory
Automorphism groups and fixed fields, Fundamental theorem of Galois theory, Fundamental theorem of algebra, Roots of unity and cyclotomic polynomials, Cyclic extensions.

UNIT-IV: Applications of Galois theory
Polynomials solvable by radicals, Symmetric functions, Constructions by ruler and compass.

Unit- V: Examples, seminars, group discussions on above four units.

Recommended Book(s):
1. Bhattacharya, Jain and Nagpal, Basic Abstract Algebra, 2nd edition, Cambridge University Press, UK.(Asian edition) 2005.

Reference Books:
1. Nathan Jacobson, Basic Algebra I, second edition, W. H. Freeman and company, New York
2. I. N. Herstein, Topics in Algebra, Wiley Eastern Ltd.
3. U. M. Swamy, A. V. S. N. Murthy, Algebra: Abstract and Modern, Pearson Education, 2012
4. John Fraleigh, A first course in Abstract Algebra (3rd edition) Narosa publishing house, New Delhi
5. I. T. Adamson, Introduction to Field Theory, second edition, Cambridge University Press,1982.
6. M. Artin, Algebra, PHI, 1996.
7. Ian Stewart, Galois Theory, CRC Publication.

M.A./M. Sc. Mathematics (Part II) (Semester III)
(Distance Mode)
(Introduced from June 2021onwards)

Course Code: MT 303
Title of Paper: Number Theory
Course Outcomes: Upon successful completion of this course, the student should be able to:

1. learn more advanced properties of primes and pseudo primes.
2. apply Mobius Inversion formula to number theoretic functions.
3. explore basic idea of cryptography.
4. understand concept of primitive roots and index of an integer relative to a given primitive root.
5. derive Quadratic reciprocity law and its apply to solve quadratic congruences.

Unit I: Review of divisibility : The division algorithm, G.C.D., Euclidean algorithm, Diophantine equation ax + by = c. Primes and their distribution : Fundamental theorem of Arithmetic, The Goldbach Conjecture.

Unit II: Congruences : Properties of Congruences, Linear congruences, Special divisibility tests. Fermat's theorem : Fermat's factorization method, Little theorem, Wilsons theorem. Number theoretic functions : The functions τ and σ. The Mobius Inversion formula, The greatest integer function.

Unit III: Euler's Generalization of Fermat's theorem: Euler's phi function, Euler's theorem, properties of phi function, An application to Cryptography. Primitive roots : The order of an integer modulo n.

Unit IV: Primitive roots for primes, composite numbers having primitive roots, The theory of Indices. The Quadratic reciprocity law : Eulerian criteria, the Legendre symbol and its properties, quadratic reciprocity, quadratic reciprocity with composite moduli .

Unit V: Examples, seminars, group discussions on above four units.

Recommended Book:

1. D. M. Burton : Elementary Number Theory, Seventh Ed. MacGraw Hill Education(India)Edition 2012, Chennai.

Reference Books:

1. S. B. Malik :Basic Number theory, Vikas publishing House.
2. George E. Andrews : Number Theory, Hindustan Pub. Corp.(1972).
3. Niven, Zuckerman : An Introduction to Theory of Numbers. John Wiley & Sons.
4. S. G. Telang , Number Theory, Tata Mc.Graw-Hill Publishing Co., New Delhi.
5. M. B. Nathanson, Methods in Number Theory, Springer(2009).

M.A./M. Sc. Mathematics (Part II) (Semester III)
(Distance Mode)
(Introduced from June 2021onwards)

Course Code: MT 304
Title of Course: Operations Research I
Course Outcomes-: Upon successful completion of this course, the student will be able to:-

1. identify Convex set and Convex functions.
2. Construct linear integer programming models and discuss the solution techniques,
3. Formulate the nonlinear programming models,
4. Propose the best strategy using decision making methods,
5. solve multi –level decision problems using dynamic programming method.

Unit I : Convex set and their properties: Lines and hyper planes, convex set, Important Theorems, Polyhedral convex sets, Convex combination of vectors, Convex hull, Convex polyhedron, Convex cone, Simple and convex functions. General formulation of linear programming, Matrix form of linear programming problem, Definitions of standard linear programming problem, Fundamental Theorem of linear programming, Simplex method, Computational procedure of simplex method, Problem of degeneracy and method to resolve degeneracy.

Unit II: Revised simplex method in standard form I, Duality in linear programming, duality theorems, Dual simplex method, Integer linear programming, Gomory's cutting plane method, Branch and bound method.

Unit III: Dynamic programming: Bellman's principle of optimality, Solution of problem with a finite number of stages, Application of dynamic programming in production, Inventory control and linear programming.

Unit IV : Non – linear programming unconstrained problems of maximum and minimum,
Lagrangian method ,Quadratic programming, Kuhn Tucker necessary and sufficient condition, Wolfe method, Beale's method.
Unit V: Examples, seminars, group discussions on above four units.

Recommended Books :

1. S.D. Sharma : Operations Research , Kedar Nath Ram Nath and Co.
2. J K Sharma: Operations Research Theory and Applications, Mac Millan Co.

Reference Books :

1. Kanti Swarup ,P.K.Gupta and Manmohan : Operations Research , S. Chand & Co.
2. Hamady Taha : Operations Research : Mac Millan Co.
3. S.D. Sharma: Linear Programming ,Kedar Nath Ram Nath and Co.
4. S.D. Sharma : Nonlinear and Dynamic Programming , Kedar Nath Ram Nath and Co. Meerut.
5. R. K. Gupta : Operations Research, Krishna Prakashan Mandir , Meerut.
6. G. Hadley : Linear Programming , Oxford and IBH Publishing Co.

M.A./M. Sc. Mathematics (Part II) (Semester III)
(Distance Mode)
(Introduced from June 2021onwards)

Course Code: MT 305
Title of Paper: Fuzzy Mathematics-I
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. acquire the knowledge of notion of crisp sets and fuzzy sets,
2. understand the basic concepts of crisp set and fuzzy set,
3. develop the skill of operation on fuzzy sets and fuzzy arithmetic,
4. demonstrate the techniques of fuzzy sets and fuzzy numbers.
5. apply the notion of fuzzy set, fuzzy number in various problems.

Unit I: Fuzzy sets and crisp sets, examples of fuzzy sets, types of fuzzy sets, standard operations, cardinality, degree of subset hood, level cuts and its properties, **r**epresentation of fuzzy sets, decomposition theorems, extension principle, properties of direct and inverse images of fuzzy sets.

Unit II: Operations on fuzzy sets, types of operations, fuzzy complement, equilibrium and dual point, Increasing and decreasing generators, fuzzy intersection: t-norms.

Unit III: Fuzzy union t-conorms, characterization theorem of t-conorm, combination of operators, aggregation operations, ordered weighted averaging operations.

Unit IV: Fuzzy numbers, characterization theorem, linguistic variables, arithmetic operations on intervals, arithmetic operations on fuzzy numbers, lattice of fuzzy numbers, fuzzy equations.

Unit V: Examples, seminars, group discussions on above four units.

Recommended Books:

1. George J. Klir, Bo Yuan, Fuzzy sets and Fuzzy Logic. Theory and Applications, PHI, Ltd.2000

Reference Books:-

1. M.Grabish, Sugeno, and Murofushi Fuzzy Measures and Integrals: Theory and Applications,PHI, 1999.

2. H.J.Zimmerermann, Fuzzy Set Theory and its Applications, Kluwer, 1984.

3. M. Hanss, Applied Fuzzy Arithmetic, An Introduction with EngineeringApplications, Springer-Verlag Berlin Heidelberg 2005.

4. M. Ganesh, Introduction to Fuzzy Sets & Fuzzy Logic; PHI Learning Private Limited, New Delhi 2011.

5. Bojadev and M. Bojadev, Fuzzy Logic and Application, World Scientific Publication Pvt.Ltd. 2007.

M.A./M. Sc. Mathematics (Part II) (Semester III)
(Distance Mode)

(Introduced from June 2021onwards)

Course Code: MT 306
Title of Paper: Fluid Dynamics
Course Outcomes: Upon successful completion of this course, the student will be able to:
1) explain physical properties of fluids.
2) represent general motion of fluid element.
3) test possible fluid flows, classify rotational and irrotational fluid flows .
4) transform stress components from one co-ordinate system to another, establish relation between strain and stress tensor..
5) develop constitutive equations for Newtonian fluids, conservation laws and Navier-Stokes equation.
6) determine the complex potential and images of a two dimensional source, sink and doublet.

Unit I: Physical properties of fluids and kinematics of fluids: Concepts of fluids, continuum hypothesis, density, specific weight, specific volume, pressure, viscosity, surface tension, Eulerion & Lagrangian methods of description of fluids, Equivalence in Eulerian and Lagrangian methods, General motion of a fluid element, Integrability and compatibility conditions, general orthogonal curvilinear co-ordinate system, stream lines, path lines, streak lines, stream function, vortex lines, circulation, condition at rigid boundary.

Unit II: Stresses in fluids: Strain rate tensor, stress tensor, normal stress, shearing stress, symmetry of stress tensor, Transformation of stress components from one co-ordinate system to another, principle axes and principle values of stress tensor. Newtonian fluids, non Newtonian fluids, purely viscous fluids, Constitutive equations for Newtonian fluids.
Unit III. Conservation laws: Equation of conservation of mass, equation of conservation of momentum, Navier-Stokes equation, equation of moment of momentum, Equation of energy, Basic equations in different co-ordinate systems: Cartesian co-ordinate system, Cylindrical co-ordinate system, Spherical co-ordinate system, boundary conditions.

Unit IV. Rotational and irrotational flows: Theorems about rotational and irrotational flows: Kelvins minimum energy theorem, Kinetic energy of finite and an infinite fluid, uniqueness of irrotational flows, Bernoullis's equation, Bernoullis equation for irrotational flows, Two dimensional irrotational incompressible flows, Blasius theorem, circle theorem, Sources and sinks, sources, sinks and doublets in two dimensional flows, Methods of images.

Unit V: Examples, seminars, group discussions on above four units.

Recommended Books:

1. R. K. Rathy, An introduction to Fluid Dynamics, Oxford & IBH publishing company.
2. F. Chorlton, Text book of Fluid Dynamics, CHS Publishers, Delhi, 1985.

Reference Books:

1. L. D. Landay and E. M. Lipschitz, Fluid Mechanics, Pergamon Press London 1985.
2. Kundu and Cohen, Fluid Mechanics, Elsevier pub. 2004.
3. L M Milne-Thomson, Theoretical Hydrodynamics, Macmillan Education Ltd, London 1986.

M.A./M. Sc. (Mathematics) (Part II) (Semester IV)

M.A./M. Sc. Mathematics (Part II) (Semester IV)

(Distance Mode)

(Introduced from June 2021onwards)

Course Code: MT 401

Title of Paper: Integral Equations

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

1. classify the linear integral equations and demonstrate the techniques of converting the initial and boundary value problem to integral equations and vice versa.
2. develop the technique to solve the Fredholm integral equations with separable kernel.
3. develop and demonstrate the technique of solving integral equations by successive approximations, using Laplace and Fourier transforms
4. to analyze the properties of symmetric kernel.
5. toprove Hilbert Schmidt Theorem and solve the integral equation by applying it.

UNIT– I

Classification of linear integral equations, conversion of initial value problem to Volterra integral equation, conversion of boundary value problem to Fredholm integral equation, separable kernel, Fredholm integral equation with separable kernel, Fredholm alternative. Homogeneous Fredholm equations and eigen functions.

UNIT –II

Solutions of Fredholm integral equations by: Successive approximations method, successive substitution method, Adomian decomposition method, modified decomposition method, resolvent kernel of Fredholm equations and its properties, solutions of Volterra integral equations, successive approximations method, Neumann series, successive substitution method.

UNIT –III

Solution of Volterra integral equations by Adomian decomposition method and the modified decomposition method, resolvent kernel of Volterra equations and its properties, convolution type kernels, applications of Laplace and Fourier transforms to solutions of Volterra integral equations, symmetric kernels**,** fundamental properties of eigen values and eigen functions for symmetric kernels, expansion in eigen functions and bilinear form.

UNIT – IV

Hilbert Schmidt Theorem and its consequences, solution of symmetric integral equations, operator method in the theory of integral equations, solution of Volterra and Fredholm integro-differential equations by Adomian decomposition method. Green's function: Definition, construction of Green's function and its use in solving boundary value problems.

Unit V

Examples, seminars, group discussions on the above four units.

Recommended Books:

1. R. P. Kanwal, Linear Integral Equation: Theory and Technique, Birkhauser 2012.
2. Abdul-Majid Wazwaz, Linear and Nonlinear Integral Equations-Methods and Applications, Springer, 2011

Reference Books:

1. L. G. Chambers, Integral Equations- A Short Course, International Text Book Company, 1976.
2. M. A, Krasnov, et.al. Problems and exercises in Integral equations, Mir Publishers, 1971.
3. J. A. Cochran, The Analysis of Linear Integral Equations, Mc Graw Hill Publications, 1972.
4. C. D. Green, Integral Equation Methods, Thomas Nelson and sons, 1969.

M.A./M. Sc. Mathematics (Part II) (Semester IV)

(Distance Mode)

(Introduced from June 2021onwards)

Course Code: MT 402

Title of Course: Advanced Discrete Mathematics

Course Outcomes: Upon successful completion of this course, the student will be able to:
1. classify the graphs and apply to real world problems.
2. simplify the graphs using matrix.
3. study Binomial theorem and use to solve various combinatorial problems.
4. simplify the Boolean identities and apply to switching circuits.
5. locate and use information on discrete mathematics and its applications.

Unit I

Graph: Definition, examples, isomorphism, simple graph, bipartite graph, complete bipartite graph, vertex degrees, regular graph, sub-graphs, complement of a graph, self complementary graph, paths and cycles in a graph, the matrix representation of a graph, fusion, definition and simple properties of a tree.

Unit II

Bridges, spanning trees, cut vertices and connectivity, Euler Tours and Hamiltonian cycles, Fleury's Algorithm, Hamiltonian graphs, plane and planar graphs, Euler's formula.

Unit III

Principle of inclusion and exclusion, Pigeonhole principle, permutations and combinations, Binomial theorem, discrete numeric functions, manipulation of numeric functions, generating functions, linear recurrence relations with constant coefficients, particular solutions of linear recurrence relations, total solutions, solution by the method of generating function.

Unit IV

Posets: Definition, examples, Hasse diagrams of posets, supremum and infimum, isomorphic ordered sets, duality. Lattices: Definition, examples, sublattices. Ideals: Definition, examples, bounded lattices, distributive lattices, modular lattices, complemented lattices, Boolean algebra, basic definitions, basic theorems, Boolean algebras as lattices, CNF, DNF, applications of Boolean algebra to switching circuit.

Unit V

Examples, seminars, group discussions on the above four units.

Recommended Books:

1. John Clark and Derek Holton , A first look at Graph Theory, Allied Publishers Ltd.,1991.
2. C. L. Liu, D. P. Mohapatra, Elements of Discrete Mathematics, Tata McGraw Hill Pvt Ltd, 1985.
3. G. Gratzer, General Lattice Theory, Birkhauser,2002.

Reference Books:

1. SeymonLipschutz and Mark Lipson, Discrete Mathematics (second edition) Tata Mc Graw Hill Publishing Company Ltd. New Delhi.
2. Garrett Birkhoff : Lattice Theory, American mathematical society,1940.
3. Richard A. Brualdi: Introductory Combinatorics,Pearson,2004.

M. A. / M. Sc. Mathematics (Part II) (Semester IV)

(Distance Mode)

(Introduced from June 2021onwards)

Course Code: MT 403
Title of Paper: Algebraic Number Theory.
Course Outcomes: Upon successful completion of this course, the student will be able to

1. deal with algebraic numbers , algebraic integers and its applications,
2. concept of lattices and geometric representation of algebraic numbers.
3. Understand the concept of fractional ideals.
4. relate Finitely generated abelian groups and modules
5. derive Minkowski's theorem.
6. compute class groups and class numbers.

Unit I: Revision of basic module theory, Fundamental concepts and results, Free modules and matrices, Direct sums of modules, Finitely generated modules over a P.I.D., Equivalence of matrices with entries in a P.I.D., Structure theorem for finitely generated modules over a P.I.D. and applications to abelian groups.

Unit II: Algebraic Numbers, Quadratic and cyclotomic fields, Factorization into irreducibles , Euclidean quadratic fields.

Unit III: Prime factorization of ideals, Lattices, Minkowski's theorem.

Unit IV: Geometric Representation of algebraic numbers, class groups and class numbers, computational methods.

Unit V: Examples, Seminars and group discussion on the above four units.

Recommended Books:

1. N.Jacobson, Basic Algebra - I, Hindustan Publishing Corporation (India), Delhi (Unit-I)
2. I.N. Stewart and D.O. Tall, Algebraic Number Theory and Fermat's Last Theorem,2015,CRC press. (Chapters 2 to 10) (Unit-II to Unit-IV)

Reference Books:

1. Algebraic Number Theory : Mathematical Pamphlet, TIFR, Bombay .
2. Paulo Ribenboim, Classical Theory of Algebraic Numbers, Springer , New York(2001).
3. N. S. Gopalkrishnan, University Algebra, New Age International(P) Ltd. Publishers.
4. Ian Stewart, Galoi Theory, CRC press(2015).
5. Harry Pollard, The Theory of Algebraic Numbers, The Mathematical Association of America.

M.A./M. Sc. Mathematics (Part II) (Semester IV)
(Distance Mode)
(Introduced from June 2021onwards)

Course Code: MT 404

Title of Paper: Operations Research – II

Course Outcome-: Upon successful completion of this course, the student will be able to:-
1.decide policy for replacement.
2.calculate economic lot size.
3.derivePoission distribution theorem and compute attributes of distribution model.
4.construct Shannon Fano codes.
5.identify optimal path by using CPM and PERT.

Unit I

Replacement problems: failure mechanism of items, replacement policy for items whose maintenance cost increases with time and money value is constant, Money value, Present worth Factor, Discount rate, replacement policy for items whose maintenance cost increases with time and money value changes with constant rate, group replacement of items that fail completely.

Unit II

Inventory : cost involved in inventory problems, variables in inventory problem, symbols in inventory, concept of EOQ , Model I (a) The economic lot size system with uniform demand, Model I (b) The economic lot size with different rates of demand in different cycles, Model I (c) The economic lot size with finite rate of replenishment ,(EOQ production model) EOQ model with shortages, Model II (a) The EOQ with constant rate of demand , scheduling , time constant, Model II (c) The production lot size model with shortages , probabilistic inventory models, instantaneous demand , no set up cost model, Model VI (a) Discrete case , Model VI (b) continuous case.

Unit III

Queuing theory, queuing systems, queuing problems, transient and steady states. traffic intensity, probability distributions in queuing system, Poisson process, properties , exponential process , classification of queuing models , Model I : (M/M/I) : (infinity / FCFS)
Model II (a) : General Erlang Queuing model .

Unit IV

Information theory : Communication process, quantitative measure of information , a binary unit of information , measure of uncertainty: entropy , basic properties of entropy function (H), joint and conditional entropies , uniqueness theorem, channel capacity ,efficiency and redundancy , encoding , Shannon Fano encoding procedure ,PERT / CPM: Applications of PERT / CPM techniques , network diagram, representations, rules for constructing the network diagram, determination of the critical path.

Unit V: Examples, seminars, group discussions on above four units.

Recommended Books :

1.S.D. Sharma : Operations Research , KedarNath Ram Nath and Co.
2.J K Sharma: Operations Research :Theory and Applications, Mac Millan Co.

Reference Books :

1. KantiSwarup ,P.K.Gupta and Manmohan : Operations Research , S. Chand & Co.
2. Hamady Taha : Operations Research : Mac Millan Co.
3. S.D. Sharma: Linear Programming ,KedarNath Ram Nath and Co.
4. S.D. Sharma : Nonlinear and Dynamic programming KedarNath Ram Nath and Co. Meerut.
5. R.K.Gupta : Operations Research, Krishna PrakashanMandir , Meerut.
6. G.Hadley : Linear Programming , Oxford and IBH Publishing Co.

M.A./M. Sc. Mathematics (Part II) (Semester IV)

(Distance Mode)

(Introduced from June 2021onwards)

Course Code: MT 405
Title of Paper: Fuzzy Mathematics-II

Course Outcomes: Upon successful completion of this course, the student will be able to:
1. acquire the concept of fuzzy relations.
2. understand the basic concepts of fuzzy logic and fuzzy algebra.
3. develop the skills of solving fuzzy relation equations.
4. construct approximate solutions of fuzzy relation equations.
5.solve problems in Engineering and medicine.

Unit I
Projections and cylindrical extensions, binary fuzzy relations on single set, fuzzy equivalence relations, fuzzy compatibility relations, fuzzy ordering relations, fuzzy morphisms sup-i composition and inf-w_i composition.
Unit II
Fuzzy relation equations, problem partitioning, solution methods, fuzzy relational equations based on sup-i and inf-wi compositions, approximate solutions.
Unit III
Fuzzy propositions, fuzzy quantifiers, linguistic hedges, inference from conditional fuzzy propositions, qualified and quantified propositions
Unit IV
Fuzzy algebra, fuzzy groups and fuzzy rings and their basic properties
Unit V
Examples, seminars, group discussions on the above four units.
Recommended Books:
1. George J Klir, Bo Yuan, Fuzzy Sets and Fuzzy Logic. Theory and applications,PHI.Ltd. (2000)
2. John Mordeson, Fuzzy Mathematics,Springer,2001
Reference Books:
1.M.Grabish, Sugeno, and Murofushi, Fuzzy Measures and Integrals: Theory and Applications PHI, 1999.
2. H.J.Zimmerermann, Fuzzy set :Theory and its Applications, Kluwer, 1984.
3.M. Ganesh, Introduction to Fuzzy sets & Fuzzy Logic; PHI Learning Private Limited, New Delhi. 2011.

M.A./M. Sc. Mathematics (Part II) (Semester IV)

(Distance Mode)

(Introduced from June 2021onwards)

Course Code: MT 406

Title of Paper: Computational Fluid Dynamics

Course Outcomes: Upon successful completion of this course, the student will be able to:
1. classify partial differential equations (PDEs) mathematically and physically.
2. apply separation of variables method for solving initial boundary value problems.
3. construct forward, backward and centered difference formulae.
4. test stability, convergence & consistency of finite difference schemes.
5. solve problems in CFD using computer software.

Unit I

Comparison of experimental, theoretical and numerical approaches, governing equations, continuity equation, momentum equation (inviscid, viscous flows) energy equation, incompressible viscous flow, laminar boundary layer flow. Introduction of Scilab to solve problems in CFD.

Unit II

Nature of a well posed problems, physical classification and mathematical classification of partial differential equations: hyperbolic, parabolic, elliptic partial differential equations (PDEs). Conversion of PDE to canonical form. Traditional solution method: separation of variables, transformation relationships, evaluation of transformation parameters, forward, backward, centered difference formulae, generalized co-ordinates structure of first and second order PDE.

Unit III

Stability, convergence and consistency of finite difference scheme, Explicit, Implicit and Crank- Nicolson methods for heat equation, Von Neumann analysis, Euler's explicit method, upstream differencing method, Lax method, Euler implicit method for wave equation. Finite difference representation of Laplace equation, five point method. Problem solving by Scilab: codes of explicit methods for heat and wave equations and five point method for Laplace equation.

Unit IV

Finite difference schemes for Burgers equation (inviscid): Lax method, implicit methods. Finite difference schemes for Burgers equation (viscous): FTCS method, Briley – Mc Donald method. convergence and stability, grid generation, orthogonal gird generation, order of magnitude analysis, Reduced Navier-Stokes equations, boundary layer flow, flow in a straight rectangular duct, flow in a curved rectangular duct. Introduction to Finite Element Methods (FEM).

Unit V

Examples, Seminars and group discussion on the above four units.

Recommended Books:

1. Dale A Anderson, John Tannelhill, R. H. Fletcher, Computational Fluid Mechanics and Heat Transfer, Hemisphere publishing corporation, 1984.
2. G D Smith, Numerical Solution of Partial Differential Equations: Finite Difference Methods, Oxford Applied Mathematics and Computing Science Series, Oxford University Press, 1985.
3. C. A.J. Fletcher, Computational Techniques for Fluid Dynamics Vol. I & II, Springer Verlag Berlin Heidelberg, 1988.

Reference Books:

1. T J Chung, Computational Fluid Dynamics, Cambridge University Press, 2002.