

M.A. / M.Sc. Semester III Examination -2020-21

IMPORTANT NOTICE

CANDIDATE HAS TO OPT OPTIONAL PAPER IN FOURTH SEMESTER KEEPING THE SAME PAPER NUMBER OF THIRD SEMESTER.

IMPORTANT INFORMATION : - NEW OPTIONAL PAPER WILL BE STARTED IF ASPIRANTS ARE AT LEAST 10

SCHEME OF STUDY: THERE SHALL BE 5 PAPERS INCLUDING TWO COMPULSORY AND THREE OPTIOAL PAPRES FOR EACH SEMESTER.

PATTERN OF QUESTION PAPER (SEMESTER EXAM.)

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The syllabus for each theory paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

Section-A : One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10

Section-B : this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks.

Total marks : 25

Section-C : this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words.

Total marks : 35

SEMESTER III

compulsory Paper –MATH 3 C(i)- FUNCTIONAL ANALYSIS I

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

Section-A : One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10

Section-B : this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks.

Total marks : 25

Section-C : this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit - I

Metric spaces and their examples, Bounded and unbounded metric spaces , open sphere , closed ball, limit point, closure , interior , exterior and boundary of a set .

Unit II

Subspaces , product spaces , dense and non dense sets , separable spaces

Unit -III

Sequences and subsequences in a metric space , Cauchy's sequences , complete metric space , cantor's intersection theorem ,

Unit IV

Bair's category theorem , continuity in metric spaces , contracting mapping , fixed point theorem .

Unit - V

Normed linear spaces, Banach Spaces and their examples, subspaces and quotient spaces in Banach space

Book Recommended:

1. G.F. Simmons. Introduction to Topology and Modern Analysis, Mc Graw Hill Book Company Chapters 2, 9 and 10 (1963).
2. Ervin Kreyszig. Functional Analysis
3. J. N. Sharma. Functional Analysis (Krishna Prakashan)

Compulsory Paper –MATH 3 C(ii) -TOPOLOGY I

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

Section-A : One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10

Section-B : this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks.

Total marks : 25

Section-C : this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

Section-A : One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10

Section-B : this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25

Section-C : this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit-I

Definition and examples of topological spaces, closed sets, closure, dense sets, Neighbourhoods, interior, exterior, Boundary and accumulation points, derived sets

Unit-II

Local Bases, Bases and Sub bases, Subspaces and relative topology, First and Second Countable spaces, Lindelof's theorem

Unit-III

Continuous function, continuity, sequentially continuous, open and closed mapping, bicontinuous mapping, homeomorphism, topological property, topology induced by mapping

Unit-IV

Separation axiom, T_0 , T_1 , T_2 , spaces, normal space, hausdorff spaces, regular spaces, T_3 , T_4 , spaces, completely regular spaces, Tyconoff space, completely normal

Unit-V

Compactness, compact sets, basic property of compactness, compactness and finite intersection property, Sequentially and countably, compact sets, local compactness, Heine-Borel theorem

References :

1. James R.Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.
2. George F.Simmons, Introduction to Topology and Modern Analysis McGraw Hill Book Company, 1983.
3. K.D. Joshi, Introduction to General Topology, Wiley Eastern Ltd.

M.A. / M.Sc. Semester III- Optional Papers

Candidate has to opt three papers which are running in the University / College

Opt. Paper –MATH3 O(i) - OPERATIONS RESEARCH I

duration :- 3 Hrs. Max. Marks: – 100
distribution of marks :- Internal assessment 30 Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

Section-A : One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10

Section-B : this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25

Section-C : this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit - I

Linear Programming : Two Phase Simplex method, Bounded variable problems.

Unit II

Duality, Dual Simplex methods. Sensitivity analysis.

Unit - III

Game Theory : Two person Zero sum game, Games with mixed Strategies, Solution of game theory by Linear programming.

Unit IV

Integer Programming. Revised simplex method.

Unit - V

Network Analysis : Shortest Path Problem, PERT and CPM

References :-

- 1.Kanti Swaroop: Operations Research, S.Chand Publications
- 2.S.D.Sharma: Operations Research
3. V. K. Kapoor : Operations Research Sultan Chand and Sons
4. B.S. Goyal and S. K. Mittal: Operations Research Pragati Prakashan
5. Prem Kumar Gupta, D.S. Hira S. Chand and Co.

PAPER MATH 3 O(ii) FLUID DYNAMICS I

duration :- 3 Hrs. Max. Marks: – 100
distribution of marks :- Internal assessment 30 Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

- Section-A :** One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10
- Section-B :** this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25
- Section-C :** this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit - I

Kinematics-Lagrangian methods. Equation of Continuity. Boundary surfaces. Stream lines, Path lines and streak lines, Velocity potential, Irrotational and rotational motion. Vortex Lines.

Unit II

Equations of Motion-Lagrange's and Euler's equations of motion, Bernouli's theorem, Equation of motion by flux method.

Unit - III

Equations referred to moving axes. Impulse reactions. Stream function, Irrotational motion in two-dimensions.

Unit IV

Complex velocity potential. Sources, Sinks, Doublets and their images. Conformal mapping. Milne-Thomson circle theorem.

Unit - V

Two-dimensional Irrotational motion , motion of circular, co-axial and elliptic cylinders in an infinite mass of liquid, Kinetic energy of liquid, Theorem of Blasius,

References :

1. W.H.Besaint and A.S.Ramsey. Freatiseon Hydromechanics, Part II, CBS Publishers, Delhi 1988.
2. G.K. Batchelor and Introduction to Fluid Mechanics, Foundation, Books, New Delhi 1991.
3. F.Chorton, Textbook of fluid Dynamics, C.B.S, Publishers, Delhi 1985.
- 4.A.J.Chorin and A.Marsden, A Mathemetical Introdution to Fuild Dynamics, Springer-Vertag, New Yark 1993.
5. L.D.Landau and E.M. Lipschitz, Fluid mechanics, Pergamon Press, London, 1985.
6. M Ray : Hydrodynamics
7. M Ray : Fluid Dynamics
8. Shanti Swaroop Fluid Dynamics Krishna Prakashan

MATH 3 O(iii) -MATHEMATICAL STATISTICS I

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

- Section-A :** One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10

Section-B : this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25

Section-C : this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit - I

Probability inequalities (Tchebyshef, Markov, Jenson), Convergence in distribution, weak law of large numbers and central limit theorem for independent, identically distributed(i.i.d.) random variable with finite variance.

Unit II

Marginal and conditional distribution in multivariate case, Covariance matrix and Correlation Coefficient (Product moment- Partial and multiple), Regression.

Unit - III

Probability Distributions:- poisson, Multinomial, Hypergeometric, Geometric.

Unit IV

Probability Distributions : Uniform, Exponential, Cauchy, Gamma, Beta and Normal distribution.

Unit V

Statistical Quality Control : control chart for process control ,setting control limits using \bar{x} chart, R chart, σ chart and their interpretation . Control chart for attributes control chart for fraction defectives (p chart),control chart for number of defects(c chart)

References :

1. Fundamentals of Statistics: Gupta, Kapoor, S.Chand Publications
2. Mathematical Statistics: Kapoor, Saxena, S.Chand Publications
3. Basic Statistics : B. L. Agrawal , New age International Publishers

Opt. Paper MATH 3 O(iv) -PROGRAMMING IN C WITH ANSI FEATURES I

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

Section-A : One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10

Section-B : this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25

Section-C : this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one

question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit - I

An overview of programming. Programming language, Classification. C Essentials-Program Development, Functions, Anatomy of a Function, Variables and Constants, Expressions.

Unit II

Assignment Statements. Formatting Source Files. Continuation Character. The preprocessor.

Unit - III

Scalar Data Types-Declarations, Different Types of Integers. Different kinds of Integer Constants. Floating-Point Types. Initialization. Mixing Types. Explicit Conversions-Casts. Enumeration Type. The Void Data Type. Typedefs. Finding the Address of an object.

Unit IV

Pointers. Control Flow-Conditional Branching. The Switch Statement. Looping. Nested Loops. The break and continue Statements. The goto statement. Infinite Loop.

Unit - V

Operators and Expressions-Precedence and Associativity, Unary Plus and Minus operators. Binary Arithmetic Operators. Arithmetic Assignment Operators. Increment and Decrement Operators. Comma Operators.

References :

1. Peter A.Darnell and Phillip E.Margolis. C: A. Software Engineering Approach, Aarosa Publishing House (Singapur International Student Edition) 1993.
2. Samiel P. Harkison and Gly L. Steele Jr. C: A Reference manuai 2nd Edition Prentice house 1984
3. Brain n. Kernighan & Dennis M. Ritchie. The C Programme Language, 2nd Edition ANSI 1989

Opt. Paper – MATH 3 O(v) -MATHEMATICAL MODELLING I

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

Section-A : One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10

Section-B : this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25

Section-C : this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit - I

Techniques, classification and simple illustrations. Mathematical Modelling through ordinary differential equation of first order.

Unit II

Mathematical Modelling through system of linear inequalities

Unit III

Mathematical models of Investment and annuity

Unit - IV

Mathematical Modelling through systems of ordinary differential equation of first order.

Unit V

Mathematical Modelling through ordinary differential equation of second order.

Opt. Paper MATH 3 -O(vi) – RELATIVITY I

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

- Section-A :** One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10
- Section-B :** this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25
- Section-C :** this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit - I

Concepts of relativity, Michelson- Morley experiment, Equation of geodesics for the given metric, Riemann Christoffel tensors .

Unit II

Postulates of special theory of Relativity, Lorentz-Fitzgerald contraction hypothesis, Lorentz transformation.

Unit - III

Mass-Energy formula, Minkowski's 4 dimensional continuum, Space like and time like intervals.

Unit IV

Hamiltonian principle, Energy - Momentum tensor and its expression for perfect fluid, principle of Covariance, Principle of equivalence.

Unit - V

Condition for flat space time, Einstein's law of gravitation for empty space and material world

References :

1. Tolman R.C. : Relativity, Thermodynamics and Cosmology, Oxford University Press.
2. Synge J.L. : Relativity the Special and General North Holland Publishing Company, Amsterdam.
3. Eddington A.S. : The Mathematical Theory of Relativity, Cambridge.

Opt. Paper – MATH 3 O(vii) - ORTHOGONAL POLYNOMIALS

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

- Section-A :** One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10
- Section-B :** this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25
- Section-C :** this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit - I

Orthogonal polynomials : condition for orthogonality, zeros and expansion of polynomials, recurrence relation, the christoffel - Darboux formula, Bessel's inequality.

Unit II

Legendre polynomials : generating functions, differential equations, Rodrigues formula, more generating functions, orthogonality, expansions of x^n , and analytical functions.

Unit- III

Hermite polynomials : definition, recurrence relations, Rodrigues formula, integral representation, orthogonality, expansion of polynomials, more generating functions.

Unit IV

Laguerre polynomials : definitions, recurrence relations, Rodrigues formula, orthogonality, expansion of polynomials and special properties, other generating functions.

Unit - V

Jacobi polynomials : definitions, Bateman's generating function, orthogonality, pure, differential and mixed recurrence relations, Brafman's generating function, expansion in series of polynomials

Ultraspherical and Gegebauer polynomials : definition, generating function and related properties.

Suggested Books :

- 1.Special functions by E.D. Rainville, Chelsea publishing company, Bronex, New York
- 2.Special functions by Y.L.Luke, Academic press, New York, London
- 3.Special functions by M.A. Pathan, P.K. Benarji, V.B.L. Chourasia and MC. Goyal, Ramesh Book Depot, Jaipur
4. Special functions by R.K. Saxena and D.C. Gokharoo, Jaipur Publishing House, m Jaipur

M.Sc. MATHEMATICS SEMESTER IV
Compulsory papers
Paper –MATH 4 C(vi)- FUNCTIONAL ANALYSIS II

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

- Section-A :** One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10
- Section-B :** this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25
- Section-C :** this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit - I

Continuous linear transformations, Riesz lemma , Hahn Banach theorem and its applications
Natural imbedding of N into N^{**} .

Unit II

The open mapping theorem , projections , the closed graph theorem the uniform boundedness theorem .

Unit III

Inner product spaces, Hilbert spaces and their examples , Cauchy Schwartz inequality, parallelogram law.

Unit IV

orthogonal complements , Orthonormal sets, Projection theorem , Pythagorean theorem , Bessel's inequality , Gram Schmidt orthogonalization process Conjugate space H^* , Riesz representation theorem ,

Unit V

The adjoint of an operator , self adjoint , normal and unitary operators , perpendicular projections, invariance and reducibility , Orthogonal projections.

Book Recommended:

4. G.F. Simmons. Introduction to Topology and Modern Analysis, Mc Graw Hill Book Company Chapters 2, 9 and 10 (1963).
5. Ervin Kreyszig. Functional Analysis
6. J. N. Sharma. Functional Analysis (Krishna Prakashan)

Paper –MATH 4 C(vii) -TOPOLOGY II

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

- Section-A :** One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10
- Section-B :** this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25
- Section-C :** this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit-I

Compactness in metric space, Equivalence of compactness, Countable and sequential compactness in metric space

Unit-II

Connected space, connectedness on the real line, locally connected space, separated space, continuity and connectedness, components

Unit-III

Product Topology, projection map, product invariant properties, general product space, Tychonoff topology, Separation axioms and product spaces, Connectedness and product space, compactness and product space, Tychonoff theorem

Unit-IV

Binary relation, directed sets, residual subsets, cofinal subset, net sequence, convergence of a net, cluster point, subnet, isotone map, ultranet , Hausdorffness and nets, compactness and nets

Unit-V

Filters, standard filters, neighbourhood filters, comparison of filters, intersection of filters, filters generated by collection of sets, filters generated by family of sets, filter base, base of filters , ultra filter, convergence of filters

References :

1. James R.Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.
2. George F.Simmons, Introduction to Topology and Modern Analysis McGraw Hill Book Company,1983.
3. K.D. Joshi, Introduction to General Topology, Wiley Eastern Ltd.

M.A. / M.Sc. Semester IV- Optional Papers

Opt. Paper –MATH 4 O(i) - OPERATIONS RESEARCH II

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

- Section-A :** One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10
- Section-B :** this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25
- Section-C :** this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit I

Dynamic Programming : Deterministic models, probabilistic models

Unit - II

Inventory problems and their analytical structures. Simple deterministic problems.

Unit III

Nonlinear Programming : One and multivariable unconstrained Optimization, K.T. Conditions for Constrained Optimization. Sequencing

Unit - IV

Quadratic programming, Separable programming

Unit V

Queuing System : Steady state solution of queuing model : M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited waiting space.

References :-

- 1.Kanti Swaroop: Operations Research, S.Chand Publications
- 2.S.D.Sharma: Operations Research
3. V. K. Kapoor : Operations Research Sultan Chand and Sons
4. B.S. Goyal and S. K. Mittal: Operations Research Pragati Prakashan
5. Prem Kumar Gupta, D.S. Hira S. Chand and Co.

Paper - MATH 4 O(ii) FLUID DYNAMICS II

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

- Section-A :** One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10
- Section-B :** this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25
- Section-C :** this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit I

Motion of a sphere through a liquid at rest at infinity. Liquid streaming past a fixed sphere. Equation of motion of a sphere, Stoke's stream function.

Vortex motion and its elementary properties, Kelvin's proof of permanence, Motions due to circular and rectilinear vortices.

Unit - II

Fluid Properties : General properties of Newtonian and Non-newtonian and plastic fluids Stress components in real fluid, Relations between rectangle components of stress. Relation between stresses and gradients of velocity,

Unit III

Navier-stoke equations of motion: Cartesian , Polar Cylindrical , Polar Spherical system of coordinates

Unit - IV

Plane Poiseuille and Couette flows between two parallel plates. Theory of Lubrication. Flow through tubes of uniform cross section in form of circle, annulus and equilateral triangle under constant pressure gradient, Unsteady flow over a flat plate.

Unit V

Reynolds number, Prandtl's boundary layer. Boundary layer equations in two dimensions. Blasius solution, Boundary layer thickness. Displacement thickness. Karman Integral Conditions. Separation of boundary layer flow.

References :

1. W.H.Besaint and A.S.Ramsey. Freatiseon Hydromechanics, Part II, CBS Publishers, Delhi 1988.
2. G.K. Batchelor and Introduction to Fluid Mechanics, Foundation, Books, New Delhi 1991.
3. F.Chorton, Textbook of fluid Dynamics, C.B.S, Publishers, Delhi 1985.
- 4.A.J.Chorin and A.Marsden, A Mathematical Introdtion to Fuild Dynamics, Springer-Vertag, New Yark 1993.
5. L.D.Landau and E.M. Lipschitz, Fluid mechanics, Pergamon Press, London, 1985.
6. Shanti Swaroop : Fluid Dynamics Krishna Prakashan

MATH 4 O(iii) -MATHEMATICAL STATISTICS II

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

- Section-A :** One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10
- Section-B :** this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25
- Section-C :** this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit - I

Sampling Distribution:- t, F, Chi-Square distribution as sampling distribution, Standard errors and large Sampling distribution. Distribution of order statistics.

Unit II

Theory of Statistics:- Methods of estimation, maximum likelihood method, method of moments, minimum chi square method, least square method.

Unit - III

Unbiasedness, efficiency, Consistency, Cramer Rao inequality. Statistical Method : Test of mean and variance in normal distribution, one Population and two Population cases, related confidence intervals, Tests of Product Moment.

Unit IV

Partial and multiple Correlation Coefficients of Karl Pearson. Regression and Regression analysis.

Unit - V

Analysis of discrete data : Chi-square test of goodness of fit, Contingency table Analysis of variance:- one way and two way classification, large sample tests through normal approximation, Non-Parametric tests, Sign test, Median test, rank correlation and test of independence.

References :

1. Fundamentals of Statistics: Gupta, Kapoor, S.Chand Publications
2. Mathematical Statistics: Kapoor, Saxena, S.Chand Publications
3. Basic Statistics : B. L. Agrawal , New age International Publishers

Opt. Paper – MATH 4 O(iv)-PROGRAMMING IN C WITH ANSI FEATURES II

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

- Section-A :** One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10
- Section-B :** this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25
- Section-C :** this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one

question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit I

Relational Operators. Logical Operators. Bit - Manipulation Operators. Bitwise Assignment Operators. Cast Operator. Size of Operators. Conditional Operator. Memory Operator.

Unit - II

Arrays and Pointers-Declaring an Array. Arrays and Memory Initializing Arrays Encryption and Decryption. Pointer Arithmetic. Passing pointers as Function Arguments, Accessing Array. Elements through Pointers. Passing Arrays a Function Arguments. Sorting Algorithms.

Unit III

Strings. Multidimensional Arrays. Arrays of Pointers. Pointers to Pointers. Storage Classes-Fixed vs. Automatic Duration. Scope. Global variables. The register Specific. ANSI rules for the syntax and Semantics of the storage-class keywords. Dynamic Memory Allocation

Unit - IV

Structure and Union-Structures. Linked Lists, Union.Declarations. Functions-Passing Arguments. Declarations and Calis, Pointers to Functions. Recursion. The Main Function. Complex Declarations

Unit V

The C Preprocessor-Macro Substitution. Compilation. Include Facility line Control. Input and Output-Streams, Buffering. The <stdio.h> Header file. Error Handling. Opening and Closing a file. Reading and writing Data. Selecting an I/O Method, Unbuffered. I/O Random Access. The standard library for Input / Output.

References :

1. Peter A.Darnell and Phillip E.Margolis. C: A. Software Engineering Approach, Aarosa Publishing House (Singapur International Student Edition) 1993.
2. Samiel P. Harkison and Gly L. Steele Jr. C: A Reference manuai 2nd Edition Prentice house 1984
3. Brain n. Kernighan & Dennis M. Ritchie. The C Programme Language, 2nd Edition ANSI 1989

Opt. Paper – MATH 4 O(v) -MATHEMATICAL MODELLING II

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

Section-A : One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10

Section-B : this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25

Section-C : this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit - I

Mathematical Modelling through difference equation. Mathematical Modelling through partial differential equations.

Unit - II

Mathematical Modelling through graphs. Mathematical Modelling through functional Integral, Delay-differential.

Unit - III

Mathematical Modelling through calculus of variations and dynamic programming.

Unit IV

Mathematical Modelling of statistical quality control.

Unit V

Mathematical Modelling through mathematical programming, maximum principle and maximum entropy principle.

References

1. Mathematical Modelling : J. N. Kapur New Age Int. Pub.
2. Mathematical Modelling : Dr. Maurya Navkar pub. Ajmer
3. Basic statistics :B. L. Agrawal , NEW AGE International Publisher
4. Operations Research P. K.Gupta , D.S. Hira , S. Chand and Co. Ltd.

Paper - MATH 4 - O(vi) – RELATIVITY II

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

- Section-A :** One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10
- Section-B :** this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25
- Section-C :** this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit I

Schwartz child exterior and interior solution for gravitational field.

Unit - II

Planetary orbit, three crucial tests, Advances of perihelion, Gravitational deflection of light, Shift in spectral lines

Unit III

Wayl hypothesis, Displacement of the Fraunhoffer lines.

Unit - IV

Einstein and De-sitter models, their comparison with the actual universe,

Unit V

Red shift in the spectral line on distant galaxies, Hubble constant, Birkhoits theorem.

References :

1. Tolman R.C. : Relativity, Thermodynamics and Cosmology, Oxford University Press.
2. Synge J.L. : Relativity the Special and General North Holland Publishing Company, Amsterdam.
3. Eddention A.S. : The Mathematical Theory of Relativity, Cambridge.

Opt. Paper – MATH 4 O(vii) – H-FUNCTION OF ONE VARIABLE AND FRACTIONAL CALCULUS

duration :- 3 Hrs.

Max. Marks: – 100

distribution of marks :- Internal assessment 30

Theory paper 70

The paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

- Section-A :** One compulsory question with 10 parts, having 2 questions from each unit,. Answer limit 20 words for each question. Each question will carry equal marks. Total marks : 10
- Section-B :** this section will 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer limit 250 words for each question. Each question will carry equal marks. Total marks : 25
- Section-C :** this section will carry 05 questions. Question Number 12 will be compulsory and irrespective of units and carry 15 marks. Remaining 4 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, 2 questions to be attempted. Each question will carry 10 marks. answer limit 500 words. Total marks : 35

Unit-I

Definition of H-function. Asymptotic expansion of H-function. Simple transformation formulae and elementary properties of H-function. Mellin transform and Laplace transform of H-function. Special cases of H-function.

Unit- II

Differentiation formulae for H-function. Contiguous relations and simple expansion formulae for H-function. Summation formulae for the H-function.

Unit -III

Integral formulae involving product of two H-function. Finite integrals involving H-function. Expansions of the H-function in series of orthogonal polynomials. Expansions of the H-function in series of product of generalized hypergeometric function and the H-function.

Unit – IV

The Riemann-Liouville fractional integral: Introduction, Definitions, Fractional integrals of elementary functions, Derivative of fractional integral and fractional integral of derivative. Laplace transform of fractional integral.

Unit -V

The Riemann-Liouville Fractional Calculus: Introduction, Fractional derivative, Leibnitz's formulae for fractional derivatives. Fractional derivatives of elementary functions, Integral representations, Laplace transform of fractional derivatives.

Suggested Books :

1. The H-function with application in Statistics and other disciplines by A.M. Mathai and R.K. Saxena, Willey Eastern Ltd, New Delhi
2. The H-functions of one and two variables with applications by H.M. Srivastava, K.C. Gupta and S.P. Goyal, South Asian Publishers, New Delhi, Madras.
3. The Fractional Calculus: Theory and Applications of Differentiation and Integration to arbitrary order by K.B. Oldham and J. Spanier, Academic Press New York, London.
4. An introduction to the Fractional Calculus and Fractional Differential Equations by K.S. Miller and B. Ross, John Wiley and Sons Inc., New York, Chichester.
5. Fractional Integrals and Derivatives: Theory and Applications by S.G. Samko, A.A. Kilbas and O.I. Marichev, Gordon and Breach Science Publishers, Switzerland and USA

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