

B.A. Third Year (With effect from June – 2010)
Subsidiary Optionals

Paper No. – V

Marks : 100

Real Analysis

1. Sequences of real Numbers:

Definition of sequences and subsequences, Limit of a sequence, Convergent sequence, Divergent Sequence, Bounded sequences, Monotone Sequences, Operations on Convergent Sequences, Operations on divergent sequences, Limit superior and limit inferior, Cauchy Sequences [1]

2. Series of Real Numbers:

Convergence and divergence, Series with non-negative terms, Alternating series, Conditional convergence and absolute convergence [1]

3. Limits in Metric Spaces

Metric spaces, Limits in Metric spaces [1]

4. Continuous functions on Metric Spaces:

Functions continuous on metric spaces, Open sets, Closed sets [1]

5. Connectedness, Completeness and Compactness:

More about open sets, Connected sets, Bounded sets and Totally bounded sets, Complete metric spaces, Compact metric spaces, continuous functions on compact metric spaces, Uniform continuity [1]

6. Calculus:

Sets of measure zero, Definition of the Riemann Integral, Existence of the Riemann integral, Properties of the Riemann Integral, Fundamental Theorem of Calculus [1]

7. Fourier Series:

Introduction [2]

Recommended Books:

[1] R. R. Goldberg: *Methods of Real Analysis: Oxford and IBH Publishing Co. Pvt. Ltd Dew Delhi.*

Scope:

Ch. 2: 2.1 (A, B, C, D), 2.2 (A, B), 2.3 (A, B, C, D), 2.4 (A, B, C), 2.5 (A, B), 2.6(A, B, C, D), 2.7 (A, B, C, D, E, F, G, H, I), 2.8 (A, B, C, D), 2.9(A, B, C, D, E, F, G, H, I, K, M), 2.10 (A, B, C, D)

Ch. 3: 3.1(A, B, C, D), 3.2 (A, B, C, E), 3.3 (A, B), 3.4 (A, B, C)

Ch. 4: 4.2 (A, B, C), 4.3 (A, C, D)

Ch. 5: 5.3 (A, B, C, D, E, F, G, H), 5.4 (A, B, C, D, E, F, G), 5.5 (A, B, C, D, E, F, G, H, H, I, J, L, M,)

Ch. 6: 6.1 (A, B), 6.2 (A, B), 6.3 (A, B, C, D, E), 6.4 (A, B, C, D, E, F), 6.5(A, B, C, D, E), 6.6 (A, B, C, D), 6.8 (A, B, C, D, E)

Ch. 7: 7.1 (A, B, C, D), 7.2 (A, B, C, D, E, F, G), 7.3 (Theorem and Lemma without Proof), 7.4 (A, B, C, D, E, F), 7.8 (A, B, C, D, E, F, G)

[2] D. Somsundaram, B. Chaudhary: First Course in Mathematical Analysis: Narosa Publishing House.

Scope:

Ch. 10: 10.1

Paper No. – VI

Marks : 100

Number Theory and Numerical Analysis

Number Theory

1. Divisibility Theory in the integers:

The Division Algorithm, The greatest common divisor, The Euclidean algorithm, The Diophantine equation $ax + by = c$.

2. Primes and their Distribution:

The Fundamental Theorem of Arithmetic

3. The theory of Congruences:

Basic Properties of congruences, Linear congruences

4. Fermat's Theorem:

Fermat's Factorization Theorem, The little Theorem, Wilson's Theorem.

5. Number-Theoretic Functions:

The functions τ and σ , The Mobius inversion formula

6. Euler's Generalization of Fermat's Theorem:

Euler's Phi-function, Euler's Theorem, Some properties of the Phi-function

Numerical Analysis

1. Differences, Operators, Interpolation with equal intervals:

Differences, Factorial notation, The operator E, Properties of the two operators Δ and E, The operator D, Relations between the operators Δ , E and D, Interpolation with equal intervals, Newton-Gregory Formula for Forward interpolation, Newton-Gregory Formula for Backward interpolation, Equidistant terms with one or more missing terms

2. Interpolation for unequal intervals of the Arguments:

Divided differences with unequal arguments, Divided differences when two or more arguments are same or coincident, Properties of divided difference, Newton formula for unequal intervals, Lagrange's interpolation formula for unequal intervals, Lagrange's interpolation formula for equal intervals

3. Central Difference Interpolation Formulae:

Central difference, Notation, Operators δ , ∇ , σ and μ , Gauss's interpolation formula, Stirling's interpolation formula, Bessel's interpolation formula, Laplace-Everett interpolation formula

4. Inverse Interpolation:

Method of solving the problem of inverse interpolation by making use of Lagrange's interpolation formula, Method of solving the problem of inverse interpolation by using the technique of Successive approximations or Iteration, To find the roots of an algebraic equation by inverse interpolation

5. Numerical Differentiation:

Approximate expressions for the derivative of a function, Unsymmetrical expression for the third derivative

Recommended Text Books:

1] David M. Burton: Elementary Number Theory: Tata McGraw Hill, New Delhi (Second Edition) – 1987

Scope: Ch. (2) : Complete

Ch. (3) : Article 3.1

Ch. (4) : Articles 4.2, 4.4

Ch. (5) : Articles 5.2, 5.3, 5.4

Ch. (6) : Articles 6.1, 6.2

Ch. (7) : Articles 7.2, 7.3, 7.4

2] H. C. Saxena : Finite Differences and Numerical Analysis : S. Chand and Co. (Pvt) Ltd, New Delhi

Scope: Ch. (1) : Articles 1.2, 1.3, 1.5.1, 1.5.2, 1.5.3, 1.6, 1.6.1, 1.6.2, 1.8, 1.8.1, 1.8.2, 1.8.3,

Ch. (2) : Complete

Ch. (3) : Complete

Ch. (4) : Articles 4.2, 4.2.1, 4.2.2, 4.2.3

Ch. (5) : Complete

Main Optionals

Paper No – VII

Marks : 100

Mathematical Statistics**1) Frequency Distribution**

Construction and Graphical Representation of Frequency distribution, Histograms, Frequency Polygon, Frequency cumulative, Frequency curve, Cumulative frequency curve

2) Measures of Central Tendency:

Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median and Quartiles, Properties of arithmetic mean

3) Measures of Dispersion:

Various measures of dispersions, coefficient of Dispersion and variations, Moments, Skewness and kurtosis

4) Curve fitting and principle of least square:

What is curve fitting, Principles of least squares, Fitting a data to a line and to a parabola

5) Theory of Probability:

Deterministic and non-deterministic experiments, Trial and events, Mathematical and Statistical definition of Probability, Axiomatic approach to a probability, Laws of addition and multiplication of probability (Extensions without proof)

6) Random Variables:

Discrete and continuous random variables, Probability density functions, Distribution function and its properties

7) Mathematical Expectations:

Definition, Addition and multiplication theorem on mathematical expectation, Covariance, Expectation and Variance of linear combination of random variables, Moment generating function, Cumulants

8) Probability Distributions:

Binomial Distribution. Poisson distribution, Uniform distribution, Normal and Exponential distribution

Recommended Book:

S. G. Gupta and V. K. Kapoor: *Fundamentals of Mathematical Statistics*: Sultan Chand and Co. New Delhi (9 th Edition).

Scope:

Ch. 2: 2.1, 2.1.1, 2.1, 2.2.1, 2.2.2, 2.3, 2.4, 2.5, 2.5.1, 2.5.2, 2.5.3, 2.6, 2.6.1, 2.6.2, 2.7, 2.7.1, 2.7.2, 2.8, 2.8.1, 2.9, 2.9.1, 2.11

Ch. 3: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.7.1, 3.7.2, 3.7.3, 3.8, 3.8.1, 3.9, 3.9.1, 3.10

Ch. 4: 4.1, 4.3, 4.3.1, 4.3.2, 4.6, 4.6.1 (Theorems 4. 2 to 4.6), 4.6.2, 4.7(Theorems 4.9 to 4. 12), 4.7.3 (Theorems 4.13 to 4.17)

Ch. 5: 5.1 (Theorems without proof), 5.2, 5.2.1, 5.3, 5.3.1, 5.4, 5.4.2, 5.4.3

Ch. 6: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.6.1, 6.7, 6.10, 6.10.1, 6.10.2, 6.11, 6.11.1, 6.11.2

Ch. 7: 7.2, 7.2.1, 7.2.2, 7.2.6, 7.2.7, 7.2.9, 7.2.10, 7.3, 7.3.1, 7.3.2, 7.3.4, 7.3.5, 7.3.7, 7.3.8

Ch. 8: 8.1, 8.1.1, 8.1.2, 8.2, 8.2.2, 8.2.3, 8.2.4, 8.2.5, 8.2.6, 8.2.7, 8.6, 8.6.1

Ch. 5: 9.1, 9.1.1, 9.1.2, 9.1.3, 9.1.4

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Paper No – VIII

Marks: 100

Operations Research

- 1 **Linear Programming**, Simplex Method of solving L.P.P. with surplus and artificial variables. Two phase method and Big-M method.
- 2 **Assignment Model**: Introduction, mathematical formulation Method of solving assignment problems.
- 3 **Transportation Models**: Introduction, Mathematical formulation, tabular representation, Optimal solution, Methods of obtaining an optional solution, Methods of obtaining an optional solution, Optimality test.
- 4 **Games theory**: Introduction, Basic definitions, Rectangular games with a without saddle points, Solution of $m \times n$ games, dominance property.

Scope of Syllabus:

Recommended Text Book:

S.D. Sharma: *Operation Research*: Kendrath Ramnath and Comp. Meerut, Revised Edition – 1997

Scope:

Part-2 Chapter 3: 3.1 to 3.8

Chapter 9: 9.1 to 9.6 (Theorems without proofs)

Chapter 10: 10.1 to 10.7.3 (Theorems without proofs)

Part-4 Chapter 1: 1 to 1.15

Reference Books:

- 1 Operation Research: Kantiswarup, Manmohan, Gupta, *S Chand and company Ltd. New Delhi*
- 2 Linear Programming : R.K.Gupta, *Krishna Prakashan Media Pvt. Ltd. Meerut*
- 3 Vector Spaces and linear programming : Dr.S.R.Joshi and Prof. V.K.Kulkarni *Anand Prakashan, Aurangabad*

Note: Candidates opting this paper may be allowed to use nonprogrammable calculators at the time of examinations.