B.Sc. Third Year (With effect from June – 2010)

Paper No. – VI 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] ***Methods of Real Analysis***: R. R. Goldberg, 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] ***A First Course in Mathematical Analysis***: D. Somsundaram, B. Chaudhary, Narosa Publishing House.
Scope:
Ch. 10: 10.1

==========

Paper No. – VII Marks : 100

Number Theory and Numerical Analysis

Number Theory

1. <u>Divisibility Theory in the integers:</u>
The Division Algorithm, The greatest common divisor, The Euclidean algorithm, The Diophantine equation $ax + by = c$.

2. <u>Primes and their Distribution:</u>
The Fundamental Theorem of Arithmetic

3. <u>The theory of Congruences:</u>
Basic Properties of congruences, Linear congruences

4. <u>Fermat′s Theorem:</u>
Fermat′s Factorization Theorem, The little Theorem, Wilson′s Theorem.

5. <u>Number-Theoretic Functions:</u>
The functions τ and σ, The Mobius inversion formula

6. <u>Euler′s Generalization of Fermat′s Theorem:</u>
Euler′s Phi-function, Euler′s Theorem, Some properties of the Phi-function

Numerical Analysis

1. <u>Differences, Operators, Interpolation with equal intervals:</u>
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:* (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

==========

Optional Paper (Any One)
Paper No – VIII (A) Marks : 100

Mathematical Statistics

1) Frequency Distribution
Construction and Graphical Representation of Frequency distribution, Histograms, Frequency Polygon, Frequency cummulative, Frequency curve, Cummulative 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:
Fundamentals of Mathematical Statistics: S. G. Gupta and V. K. Kapoor, 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 t0 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

==========

Paper No – VIII (B) **Marks: 100**

Spherical Astronomy

1) Introduction:

Section of a sphere, Great and small circles, number of great circles through two points, shortest arc joining two points, Axis and poles, properties of poles, Spherical radius, Angular distance, Two great circles bisects each other, Secondaries, Length of the arc of a small circle, Spherical triangles, Angles of a spherical triangle cannot be greater than two right angles, Some properties about spherical triangle [1]

2) Fundamental Formulae:

Cosine formula, General proof of the cosine formula, Supplimental cosine formula, Sine formula, Formulae for half angles, Formulae for half sides, Sine-cosine formula, Supplimental sine-cosine formula, Cotangent formulae, Napier′s analogies, Delambre′s analogies [1]

3) Right angled triangles:

Right angled triangles, Napier′s rule to write all formulae of right angled triangle, Lune, Area of spherical triangle, Cagnoli′s theorem, L′Huilier′s theorem [1]

4) Refraction:

Refraction, laws of refraction, refraction of a star near zenith, Cassini′s hypothesis, Differential equation for refraction, Simpsion′s hypothesis, Bradley′s formula, Effect of refraction on sun-rise or sunset, Effect of refraction on right ascension and declination, Refraction in any direction, Effect of refraction in the distance of two neighbouring stars, Effect of refraction on the shape of the disc of the sun [2]

5) Time:

Sidereal time, Tropical year, The mean sun, the equation of time, To prove the equation of the time vanishes four times in a year, Seasons, Lengths of seasons [2]

6) Kepler′s laws of planetary motion:

Kepler′s laws, Deduction of Kepler′s laws from Newton′s law of gravitation, Definitions, To express the true anomaly in terms of eccentric anomaly, Kepler′s equation Kepler′s problem, To express the true anomaly in terms of mean anomaly, Lembert theorem, Euler′s Theorem [2]

Recommended Books:

[1] ***Spherical Trignometry and Spherical Astronomy***: G .S. Malik and H. D. Pandey, Pragati Prakashan Meerut.

Scope: Chapter 1 (Complete), Chapter 2 (Complete) Chapter 3 (Complete)

[2] ***Spherical Astronomy***: S. K. Sharma, R. K. Gupta and Dhirendra Kumar, Krishna Prakashan Mandir, Meerut.

Scope: Chapter 3 (Complete), Chapter 4 (Complete) Chapter 9 (Complete)