

Syllabus Prescribed for B.Sc. Second Year Examination

Semester III

3S Mathematics Paper- V(Advanced Calculus)

Unit I: Sequence: Definition of sequence, uniqueness of limit of sequence, algebra of limit of a sequence, positivity theorem, sandwich theorem, monotonic and bounded sequence, Cauchy sequence.

Unit II: Series: Series of nonnegative terms, convergence of geometric series and the series $\sum \frac{1}{n^p}$ Comparison tests, Cauchy's integral test, ratio test, root test, absolute convergent, conditional convergent, Leibnitz rule, Abel's test, Dirichlet test.

Unit III: Limit and continuity of functions of two variables, algebra of limit and continuity, intermediate value property, fixed point property, Taylor's theorem for function of two variables.

Unit IV: Maxima and minima of two variables, Lagrange's multipliers method, Jacobians.

Unit V: Double integral (definition and evaluation technique), change of order of double integral, triple integral, Gauss and Stoke's theorem.

Reference Books :

1. Gorakh Prasad : Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
2. Gorakh Prasad : Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
3. Muray R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Outline Series.
4. S. C. Malik and Arora : Mathematical Analysis, Wiley Eastern Ltd., New Delhi.
5. O. E. Stanaitis : An Introduction to Sequences, Series and improper Integrals, Holden- Dey , Inc. San Francisco, California.
6. T. M. Karade, J. N. Salunke, A. G. Deshmukh, M. S. Bendre: Lectures on Advanced Calculus, Sonu-Nilu Publication, Nagpur.
7. Earl D. Rainville : Infinite series, The Macmillan Co., New York.
8. N. Piskunov : Differential and Integral Calculus, Peace publishers, Moscow.
9. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi.
10. D. Somasundaram and B. Choudhary: A First course in Mathematical Analysis, Narosa Publ. House.

Semester III
3S Mathematics Paper- VI (Elementary Number Theory)

Unit I: Divisibility, division algorithm, the greatest common divisor, greatest common divisor of more than two integers, Euclidean algorithm, least common multiple.

Unit II: Prime numbers, the fundamental theorem of arithmetic or unique factorization theorem, Fermat numbers, linear Diophantine equation.

Unit III: Congruence, properties of congruence, special divisibility test, linear congruences, Chinese remainder theorem.

Unit IV: Arithmetic functions, Euler's theorem, the τ and σ functions, Mobius μ function.

Unit V: Primitive roots, primitive roots for prime, polynomial congruences, The congruence, $x^2 \equiv a \pmod{p}$ general quadratic congruence, quadratic residues.

Reference Books:

1. D. M. Burton: Elementary Number Theory, Universal Book Stall, New Delhi, Second Edition 2003.
2. C.Y. Hsiung: Elementary Theory of Numbers, Allied Publishers Ltd. 1992.
3. I. Niven, H. S. Zuckerman and H. L. Montgomery: An introduction to the Theory of Numbers, Wiley Student Edition, Fifth edition 2004.
4. K. H. Rosen: Elementary Number Theory and its Applications, Addison- Wesley, 1986.
5. T. M. Karade, J . N. Salunke, K. D. Thengane, M. S. Bendre: Lectures on Elementary Number Theory, Sonu- Nilu publication 2005.
6. K. Ireland and M. Rosen: A Classical Introduction to Modern Number Theory, GTM Volume 84, Springer-Verlag 1972
7. G. A. Jones and I. M. Jones: Elementary Number Theory, Springer, 1998
8. W. Sierpinski: Elementary Theory of Number, North- Holland, 1988, Ireland.
9. K. Rosen and M. Rosen: A Classical Introduction to Modern Number Theory, GTM Volume 94, Springer-Verlag, 1972.

Semester IV
4S Mathematics Paper- VII (Modern Algebra: groups and rings)

Unit I: Group: Definition of a group with examples, properties of a group, subgroups, cyclic groups, order of a generator of a cyclic group, permutation groups even and odd permutations.

Unit II: Cosets and normal subgroups: Cosets, Lagrange's theorem, normal subgroups, different characterization of normal subgroups, algebra of normal subgroups, quotient group.

Unit III: Homomorphism and isomorphism: Homomorphism, homomorphic image, kernel of homomorphism, isomorphism of a group, Fundamental theorem on homomorphism of a group, natural homomorphism, second isomorphism theorem, third isomorphism theorem.

Unit IV: Ring, integral domain and field: Definition, examples, properties of a ring (commutative ring, ring with unity, zero divisor, without zero divisor), subring, characterization of ring, integral domain, field, subfield and prime field.

Unit V: Ideal: Definition, left ideal, right ideal, examples, algebra of ideals, prime ideal, maximal ideal, principal ideal, quotient ring, ring homomorphism.

Reference Books:

1. I.N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. N. Jacobson : Basic Algebra ,Vol. I and II, W.H.Freeman,1980 (Hindustan PublishingCo)
3. Shanti Narayan : A Text Book Of Modern Abstract Algebra, S. Chand and Co., New Delhi
4. K.B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi, 2000
5. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal : Basic Abstract Algebra (IInd Edition) Cambridge University Press Indian Edition,1997
6. K. Hoffman and R. Kunze : Linear Algebra ,IInd Edition Prentice Hall, Englewood Cliffs, New Jersey, 1971.
7. S.K. Jain, A Gunawardhana and P.B. Bhattacharya : Basic Linearalgebra with MATLAB, Key College Publishing (Springer- Verlag)2001
8. S. Kumaresan : Linear Algebra, A Geometric Approach, P Prentice Hall of India Pvt.Ltd., New Delhi, 2000
9. Vivek Sahai and Vikas Bisht : Algebra, Narosa Publishing House ,1997.
- 10.D.S. Malik, J .N. Mordeson and M.K.Sen :Fundamentals of Abstract Algebra, McGrawHill International Edition 1997
- 11.T.M. Karade, J .N. Salunke, K.S. Adhav, S.D. Katore, Rekha Rani: Modern Algebra (group-rings). Sonu-Nilu Publication.Nagpur (Ist Publication), 2014.

Semester IV
4S Mathematics Paper- VIII (Classical Mechanics)

Unit I: Constraints, generalized coordinates, D'Alembert's principle and Lagrange's equations of motion.

Unit II: Central force motion: Areal velocity, equivalent one body problem, central orbit, Virial theorem, Kepler's laws of motion.

Unit III: Calculus of variation: functional, extremals, Euler's differential equation, Brachistochrone problem, invariance of Euler's equation, Euler- Poisson equations for a functional dependent on higher derivatives, Euler- Ostrogradsky equations.

Unit IV: Hamilton's principle, Lagrange's equations for non-holonomic system, Routh's procedure, least action principle.

Unit V: Rigid body, generalized co- ordinates of a rigid body, Eulerian angles, Euler's theorem, finite rotations, infinitesimal rotations.

Reference Books :

1. A. S. Gupta : Calculus of Variations with Applications, Prentice- Hall of India, 1997.
2. I. M. Gelfand and S. V. Fomin : Calculus of Variations, Prentice- Hill Englewood Cliffs(New Jersey), 1963.
3. H. Goldstein: Classical Mechanics (2nd edition) Narosa publishing house, New Delhi, 1998.
4. D. A. Wells: Lagrangian Dynamics, McGraw Hill, 1967.
5. T.M. Karade, Maya S. Bendre: Lectures on Classical mechanics, Einstein Foundation International, 2001
6. J. L. Synge, B.A. Griffith: Principles of Mechanics, McGraw Hill, 1959.
7. M. R. Spiegel: Theoretical Mechanics, McGraw Hill, 1983.
8. L. D. Landau, E. M. Lifschitz: Mechanics, Pergamon Press, 1976.
9. B. R. Gossick: Hamilton's Principle and Physical Systems, Academic Press, 1967.
10. S. L. Loney : An Elementary Treatise on the Dynamics of a particle and of rigid bodies, Cambridge University Press, 1956.
11. P. K. Mittal: Mathematics for Degree Students, S. Chand & Co Ltd, New Delhi, 2011.
