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 oddpermutations.

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, principle ideal, quotient ring, ring homomorphism.

Reference Books:

1. I.N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. N. Jocobson : 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'stheorem, 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 (2^{nd} 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, EinsteinFoundation 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.

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