KRISHNA UNIVERSITY
MACHILIPATNAM

M.Sc. PHYSICS (I SEMESTER)

Paper I : **MATHEMATICAL PHYSICS** PHY 1.1

Unit-I

Special Functions: : solution by series expansion:Legendre, Associated Legendre, Bessel, Hermite and Lagaurre equations: physical applications: Generating functions: orthogonality properties and recursion relations.

Unit-II

Integral Transforms, Laplace transform; first and second shifting theorems: Inverse Laplace transforms by partial fractions; Laplace transform of derivative and integral of a function

Unit- III

Fourier series; Fourier series of arbitary period; Half-wave expansions; Partial sums; Fourier n integral and transformations; Fourier transform of delta function.

Unit-IV

Complex Variables: Complex, Algebra, Cauchy – Riemann Conditions, Analytic functions, Cauchy's integral theorem, Cauchy's integral formula, Taylor's Series, Laurent's expansion, Singularities, Calculus of Residues, Cauchy's Residue theorem, Evaluation of Reisdues , Evaluation of contour integrals.

Unit-V

Tensor Analysis: Introduction, Transformation of Co-ordinates, Contravariant, Covariant and Mixed tensors, Addition and multiplication of tensors, contraction and Quotient Law. The line element, fundamental tensors.

Text and reference books:

1. Mathematical Methods for Physics. By G.Arfken
2. Laplace and Fourier Transforms"-by Goyal and Gupta. Pragati Prakashan Meerut
3. Matrices and Tensors for Physicists.by A W.Joshi
4. Mathematical Physics " by B.D.Gupta. Vikas Publishing House, New Delhi
5. Complex Variables " Schaum Series"
6. Vector and Tensor Analysis "Schaum Series"

NOTE : Question paper contains 5 questions of equal marks with internal choice to be set from each unit.

KRISHNA UNIVERSITY
MACHILIPATNAM

M.Sc. PHYSICS (I SEMESTER)

Paper II : CLASSICAL MECHANICS **PHY 1.2**

Unit-I

1. Mechanics of a particle: Conservation laws, Mechanics of a system of particles: Conservation laws.
2. Constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation, Generalized potential.

Unit-II

3. Generalized momentum and Cyclic Coordinates, Hamilton function H and conservation of energy, Derivation of Hamilton's equations, Simple applications of the Hamilton Formulation.

4. Reduction to the equivalent one body problem. The equation of motion and first Integrals, The equivalent One – Dimensional problem and classification of orbits, The differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force, The motion in time in the Kepler problem, Scattering in a central force field.

Unit-III

5. Hamilton's principle, Deduction of Hamilton's equations form modified Hamilton principle, Derivation of Lagrange's equations from variational Hamilton's principle, Simple applications of the Hamilton principle Formulation, Principle of Least Action.

6. Legendre transformations, Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the poisson bracket formulation, the angular momentum poisson bracket relations.

Unit-IV

7. Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton –Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom.

8. One dimensional oscillator, Two coupled oscillations, solutions, normal coordinates

and normal modes, kinetic and potential energies in normal coordinates, vibrations of linear triatomic molecule.

Unit-V

9. Independent coordinates of rigid body, The Euler angles, infinitesimal rotations as vectors (angular velocity), components of angular velocity, angular momentum and inertia tensor, principal moments of inertia, rotational kinetic energy of a rigid body.

10. Symmetric bodies, Euler's equations of motion for a rigid body, Torque-free motion of a rigid body, Gyroscope The Coriolis Effect.

TEXT BOOKS :— Classical Mechanics by H.Goldstein (Addison-Wleley, 1st & 2nd ed).

:— Classical Mechanics by J.C. Upadhyaya.

REFERENCE :—Classical Dynamics of Particles and Systems- by J.B.Marion.

NOTE : Question paper contains 5 questions of equal marks with internal choice to be set from each unit.

KRISHNA UNIVERSITY
MACHILIPATNAM

M.Sc. PHYSICS (I SEMESTER)

Paper III : QUANTUM MECHANICS I PHY 1.3

Unit-I (Schrödinger wave equation and potential problems in one dimension)

Why QM? Revision; Inadequacy of classical mechanics; Schrodinger equation; continuity equation; Ehrenfest theorem; admissible wave functions; Stationary states. One-dimensional problems, wells and barriers. Harmonic oscillator by Schrodinger equation.

Unit-II (Vector spaces)

Linear Vector Spaces in Quantum Mechanics: Vectors and operators, change of basis, Dirac's bra and ket notations. Eigen value problem for operators. The continuous spectrum. Application to wave mechanics in one dimension. Hermitian, unitary, projection operators. Positive operators. Change of orthonormal basis. Orthogonalization procedure.

Unit-III (Angular momentum and three dimensional problems)

Angular momentum: commutation relations for angular momentum operator. , Angular Momentum in spherical polar coordinates, Eigen value problem for L^2 and L_z, L_+ and L_ operators Eigen values and eigen functions of Rigid rotator and Hydrogen atom

Unit-IV (Time-independent perturbation)

Time-independent perturbation theory: Non-degenerate and degenerate cases; applications to a)normal helium atom b) Stark effect in Hydrogen atom. Variation method. Application to ground state of Helium atom. WKB method.

Unit V (Time dependent perturbation)

Time dependent perturbation: General perturbations, variation of constants, transition into closely spaced levels –Fermi's Golden rule. Einstein transition probabilities, Interaction of an atom with the electro magnetic radiation. Sudden and adiabatic approximation.

TEXT AND REFERENCE BOOKS:

Merzbecher, Quantum Mechanics
L I Schiff, Quantum Mechanics (Mc Graw-Hill)
J J Sakural, Modem Quantum Mechanics
Mathews and Venkatesan Quantum Mechanics
Quantum Mechanics" by R.D. Ratna Raju

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MACHILIPATNAM

M.Sc. PHYSICS (I SEMESTER)

Paper IV : ELECTRONICS (General) PHY 1.4

UNIT I

Operational Amplifiers

Differential Amplifier –circuit configurations - dual input, balanced output differential amplifier – DC analysis – Ac analysis, inverting and non inverting inputs CMRR - constant current bias level translator .

Block diagram of a typical Op-Amp-analysis. Open loop configuration inverting and non-inverting amplifiers. Op-amp with negative feedback- voltage series feedback – effect of feedback on closed loop gain input resistance output resistance bandwidth and output offset voltage- voltage follower.

UNIT-II

Practical Op-amps

Input offset voltage- input bias current-input offset current, total output offset voltage, CMRR frequency response.

DC and AC amplifier- summing, scaling and averaging amplifiers, instrumentation amplifier, integrator and differentiator.

Oscillators principles – oscillator types – frequency stability – response – The phase shift oscillator, Wein bridge oscillator – LC tunable oscillators – Multivibrators- Monostable and astable –comparators – square wave and triangular wave generators.

Voltage regulators – fixed regulators – adjustable voltage regulators switching regulators.

UNIT III

Communication Electronics

Amplitude modulation – Generation of AM waves – Demodulation of AM waves – DSBSC modulation. Generation of DSBSC wages., coherent detection of DSBSC waves, SSB modulation, Generation and detection of SSB waves. Vestigial side band modulation, Frequency division multiplexing (FDM).

UNIT IV

Digital Electronics

Combinational Logic- Decoder- encoders- Multiplexer(data selectors)-application of multiplexer - De multiplexer(data distributors) –

Sequential Logic- Flip-Flops: A 1 bit memory – the R-S Flip – Flop, JK Flip-Flop – JK master slave Flip-Flops – T- Flip – Flop – D Flip – Flop – Shift registers – synchronous and asynchronous counters – cascade counters.

UNIT V

Microprocessors

Introduction to microcomputers – memory – input/output –interfacing devices
8085 CPU -Architecture – BUS timings – Demultiplexing the address bus – generating control signals – instruction set – addressing modes – illustrative programmes – writing assembly language programmes –looping, counting and indexing – counters and timing delays – stack and subroutine.

Introduction to micro controllers-8051 micro controllers-architecture & pin description-Parallel I/O ports – memory organization.

Text and Reference Books

Electronic devices and circuit theory by Robert Boylested and Louis Nashlsky PHI 1991

Op-Amps & Linear integrated circuits by Ramakanth A.Gayakwad PHI 1991

Semi Conductor Electronics by A.K.Sharma New Age International Publishers.

Fundamentals of Digital Circuits by A.Ananda Kumar,PHI,New Delhi.

Digital principles and applications by A.P.Malvino and Donald P.Leech TMH 1993

Microprocessor Architecture, Programming and Applications with 8085/8086 by Ramesh S.Gaonkar, Wiely-Eastern 1987.

Micro Controllers: Theory and Applications by Ajay V. Deshmukh,Tata Mc Graw-Hill.New Delhi, 2005

Electronics-anlog and digital – Nagarath PHI

NOTE : Question paper contains 5 questions of equal marks with internal choice to be set from each unit.

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