ANDHRA UNIVERSITY
TRANS-DISCIPLINARY RESEARCH HUB

MODERN PHYSICS

Unit – I:

Electromagnetic Waves: Equation of continuity, Maxwell's equations, Maxwell's equations in integral and differential forms, Physical Significance, Pointing theorem, Poynting vector, The wave equation, plane Electro magnetic wave in free space, plane Electro magnetic wave in anisotropic non conducting medium, plane Electro magnetic wave in isotropic non conducting medium, plane Electro magnetic wave in conducting medium.

Unit – II:

Diffects in Solids: Introduction, classification of imperfections, point defects; vacancies, impurities, interstitials, color centues, Schottkey defects, Frenkel defects. Estimation of concentration of Schottkey defects and Frenkel defects at a given temperature. Line Defects: Edge dislocation, Screw dislocation, Burger's circuit and Burger's vector.

Unit – III:

Super conductors: Super conducting phenomenon, Zero electrical resistance, Meissner's effects, magnetic phase diagram, energy gap, isotope effect, flux quantization, Josephson effect and tunneling, SOULD, London equations, BCS theory, application of superconductors.

Unit – IV:

Photonic devices: Light emitting diodes, photo diode, solar sells, photo transistor.

Books:

1. EM Waves and Radiating Systems by Edward C.Jordon Keith G. Balmain
2. Electro magnetic theory and Electrodynamics by Satya Prasad
3. Introduction to solid state physics by C.Kittel
4. Physics of Semiconductor Devices by S.M.Sze.

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MODEL QUESTION PAPER

Answer any FIVE questions All questions carry equal marks

1.a) Derive equations for Pointing theorem and Pointing vector and also explain their physical significances.

b) Derive equation of plane Electromagnetic wave in anisotropic non conducting medium and explain its physical significance.

2.a) Derive equation of plane Electromagnetic wave in free space and explain its physical significance.

b) Derive equation of plane Electromagnetic wave in conducting medium and explain its physical significance.

3.a) Classify in detail the different types of point defects exist in crystalline solids with examples and schematic diagrams.

b) Define Frenkal defects exist in crystalline solids with schematic diagram and derive expression for the estimation of concentration of the Frenkal defects at a given temperature.

Find the equilibrium concentration of vacancies in aluminum and nickel at 300K and 900K.

4.a) Classify in detail the different types of line defects exist in crystalline solids with examples and schematic diagrams.

b) Define edge dislocations exist in crystalline solids with schematic diagram and derive expression for the estimation of force per unit length in the slip direction of edge dislocation.

c) A Burger lineage boundary in a simple cubic crystal creates a line of etch pits spaced 2×10^{-4} cm apart when crystal is etched Suppose that the lattice constant of the crystal is 4×10^{-8} cm, find the angle of misfit between the sections of the crystal on opposite sides of the lineage boundary.

5.a) Explain, in detail with equations and schematic diagrams, the Zero electricalresistance property of the superconductors.

b) Explain Josephson effect and derive the equation for DC Josephson effect.

c) Explain flux quantization in superconductors.[5+10+5]

6.a) Explain, in detail with equations and schematic diagrams, the Diamagneticproperties of the superconductors.

b) Derive London equations and explain physically, the consequences of London

equations in superconducting materials.
Explain isotope effect in superconductors.

7.a) Explain luminescence phenomenon and classy for different types of luminescenceprocesses with example for each process.

b) Explain electroluminescence process.

c) Explain Light emitting diode action with circuit and energy band structure.

8.a) Explain photo conductivity phenomenon.

b) Explain photo diode action with circuit and obtain the expression for photocurrent.
Explain photo transistor with circuit.