

Paper VII

Answer three question choosing one from each group.

Total Marks:18

Group-A:

Classical Mechanics II & Fluid Mechanics

1. Derive Lagrange's equations from D'Alembert's principle. 6
2. State Bernoulli's theorem for the streamline flow of an incompressible non-viscous fluid. Deduce Bernoulli's equation in this case from energy consideration. 6

Group-B:

Statistical Mechanics

3. Mentioning the necessary postulates of Fermi-Dirac Statistics, obtain the Fermi-Dirac distribution formula for an ensemble of fermions: 6
4. Write down Bose-Einstein distribution formula and using it deduce Planck's law of radiation. 6

Group-C:

Electronics-II

5. List the advantages of negative feedback in a transistor amplifier. Explain how non-linear distortion can be reduced by negative feedback. 6
6. Describe the procedure for the construction of an enhancement-type MOSFET and explain its operation. 6

Paper VIII

Answer three question choosing one from each group.

Total Marks:18

Group-A:

Physics Optics-II

1. Explain the difference between spontaneous and stimulated emissions. What is population inversion? Obtain a relation between Einstein's A and B coefficient. 6
2. What is optical rotation? Give Fresnel's explanation of optical rotation. Define specific rotation. 6

Group-B:

Electromagnetic theory and special theory of relativity

3. State and prove Poynting's theorem. Define Poynting's vector. 6
4. Explain stellar aberration in the light of special theory of relativity. 6

Group-C:

Solid State Physics and Electric and Magnetic Properties of Matter

5. What are Miller indices?

Derive an expression for the interplanar spacing between parallel planes with Miller indices (hkl) and show that for a simple cubic lattice of lattice constant 'a', 6

$$d_{hkl} = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$

6. What is meant by 'hysteresis' of ferromagnetic specimen? Prove that the energy loss per unit volume per cyclic magnetisation of ferromagnetic material is equal to the area of corresponding B-H loop. 6

Paper IX

Answer three question choosing one from each group.

Total Marks:18

Group-A:

Atomic Physics

1. Describe Thomson's method for the determination of specific charge (e/m) of cathod rays(electrons). What are the drawbacks of the method?
2. Describe Millikan's oil drop method for the determination of electronic charge.

Group-B:

Quantum Mechanics

3. A Particle of energy E moving in one dimension encounters a potential barrier

$$V(x) = 0 \text{ for } x < 0 \\ = V_0 \text{ for } x > 0$$

If $E > V_0$, calculate the reflection and transmission coefficients. Which aspect of result is a deviation from classical Physics. 6

4. Formulating the Schrödinger's Equation for Hydrogen atom, find the energy eigen values for the system. 6

Group-C:

Nuclear and Elementary Particle Physics

5. Establish the relation between Einstein's coefficient A and B. If the frequency of emitted photon is 10 Hz, then find the ratio of Einstein's coefficients. 4+2
6. Identify the interaction if allowed - 2+2+2

i. $\Lambda^0 \rightarrow p + e^- + \bar{\nu}_e$

ii. $\pi^- + p \rightarrow \Sigma^0 + K^0$

iii. $\Xi^- \rightarrow \Lambda^0 + \pi^-$