



TOPICS FOR INTERNAL ASSESSMENT ASSIGNMENTS (2010-11)
Programme: M.Sc. PHYSICS (Previous)

Note: Students are advised to read the separate enclosed instructions before beginning the writing of assignments.

Out of 15 Internal Assignment marks per paper, 5 marks will be awarded for regularity (attendance) to Counseling/ Contact Programme/ Practical classes pertaining to the paper. Therefore, the topics given below are only for 10 marks each paper.

Paper I: MATHEMATICAL METHODS AND CLASSICAL MECHANICS

1. a) A projectile is fired uphill over ground with slope at an angle α to the horizontal. Find the direction in which it should be aimed to achieve the maximum range. **03 marks**
- b) A particle describes the curve $r^n = a^n \cos n\theta$ under a force p towards the pole. Find the law of force? **02 marks**
2. a) Using the complex variable techniques, evaluate the real integral **03 marks**
$$\int_0^{2\pi} \frac{\sin^2 \theta}{5 - 4 \cos \theta} d\theta$$
- b) Show that if $Q_m = e^{\pm im\phi}$ is a single valued, then m is an integer. **02 marks**

Paper II: QUANTUM AND STATISTICAL MECHANICS

1. A quantum particle confined to one dimensional box of width 'a' is in its first excited state. What is the probability of finding the particle over an interval of $(a/2)$ marked symmetrically at the centre of the box. **04 marks**
2. Give the two normalized but non-orthogonal eigen function $\psi = \frac{1}{\sqrt{\pi}} e^{-r}$ and $\phi = \frac{1}{\sqrt{3\pi}} r e^{-r}$. Construct a new function ψ which is orthogonal to the first function and is normalised. **03 marks**
3. Show that the entropy at absolute zero in a canonical ensembles can be expressed as $s = k \log g_0$. Where g_0 is statistical weight of the ground state. **03 marks**

Paper III: SOLID STATE PHYSICS

1. Show that the occupation probability at $E = E_F + \Delta E$ is equal to the non-occupation probability at $E = E_F - \Delta E$ 04 marks
2. Find the carrier distribution function in the impurity level that accounts for the spin degeneracy of the impurity states. 04 marks
3. The fraction of vacancy sites in a metal is 1×10^{-10} at 500°C . What will be the fraction of vacancy sites at double the temperature? 02 marks

Paper IV: ELECTRONICS

1. Design a combinational logic circuit to convert XS3BCD code in to the standard 8421 BCD code. 04 marks
2. a) Determine the v_o and v_c with diode in the "on" state. 03 marks
3. b) The emitter bias configuration of figure has the following specification $I_{CQ} = \frac{1}{2}$, $I_{C\text{sat}} = 8 \text{ mA}$, $V_c = 18 \text{ V}$. and $\beta = 110$. Determine R_C , R_E and R_B 03 marks


