



KUVEMPU UNIVERSITY
OFFICE OF THE DIRECTOR
DIRECTORATE OF DISTANCE EDUCATION
SAHYADRI, SHANKARAGHATTA – 577 451, KARNAT



Phone: 08282-256246, 256426; Fax: 08282-256370; Website: www.kuvempuuniversitydde.org
E-mail: info@kuvempuuniversitydde.org; ssgc@kuvempuuniversitydde.org

TOPICS FOR INTERNAL ASSESSMENT ASSIGNMENTS (2009-10)

Course: **M.Sc. PHYSICS** (Final Year)

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 V: Electrodynamics, Optics and Molecular Spectroscopy

1. Calculate the potential $\phi(\mathbf{z})$ along the axis of a disk of radius R in two cases:
 - (a) The disk has an uniform layer of charge density σ , and
 - (b) The disk has an uniform dipole layer of dipole moment density $\mathbf{p} = p\hat{z}$ per unit area.

(3 marks)
2. Write down the normal electronic configuration of carbon atom ($Z=6$) and obtain the spectral terms arising from equivalent electrons. Also write down its first excited configuration and obtain the spectral terms and indicate its allowed transitions.

(4 marks)
3. In the vibrational Raman spectrum of Hydrogen Fluoride, the Raman lines are observed at wavelengths 2670\AA and 3430\AA . Find the fundamental vibrational frequency of the molecule. (Given: $c = 3.0 \times 10^{10} \text{ cm s}^{-1}$)

(3 marks)

Paper VI: Nuclear Physics, Cosmic rays and elementary particles

1. $^{52}_{25}\text{Mn}$ (Half life of 6 days) decays to stable $^{52}_{24}\text{Cr}$ (of mass 51.9571 amu) by a positron emission with maximum energy 0.58 MeV and their gamma rays in cascade. Viz. 0.73 MeV, 0.94 MeV and 1.46 MeV.
 - i. Calculate the mass of the neutral atom ^{52}Mn and sketch the decay scheme.
 - ii. Find the threshold proton bombarding energy for the reaction $^{52}\text{Cr}(p, n)^{52}\text{Mn}$.

(3+2 marks)

a For mirror nuclei which have N and Z differing by one unit, determine the mass difference. Consider A to be odd.

- b. The masses of $^{15}_7\text{N}$ and $^{15}_8\text{O}$ are 15.000108 amu and 15.003070 amu respectively. Using this data determine the coulomb co-efficient a_c in the semi-empirical mass formula. (2+3 marks)

Paper VII: Solid State Physics- I

1. Explain how the width of space-charge region decreases as the impurity concentration increases. (5 marks)
2. Find the temperature at which the number of electrons in the conduction band of a semiconductor increases by a factor of 10 over the number of electron in it at room temperature. The band gap for the semiconductor is 0.67eV at room temperature. ($K_B T = 1/40$ eV) (5 marks)

Paper VIII: Solid State Physics- II

1. The unit cell of NaCl is a cube of a side 5.6 \AA and Young's modulus in a [100] direction is $5 \times 10^{10} \text{ N/m}^2$. Estimate the wavelength at which the electromagnetic radiation is strongly reflected by the crystal. Assuming, for extension along (100), the crystal as a set of linear chain in which the parallel and the lateral forces are ignored (At. Wt of Na=23, Cl=37). (5 marks)
2. a. A Metallic surface when illuminated with light of wavelength of 3333 \AA emits electrons with energy up to 0.6eV and when illuminated with light of wavelength 2400 \AA , it emits electrons with energy up to 2.04eV. Calculate Planck's constant and work function of the metal.
b. Give the physical significance of the Nearnst-Einstien equation. (3+2 marks)
