Name of the Department	:	Physics
Name of Course	:	B.Sc. Prog. _CBCS_DSE
Semester	:	V- Semester
Name of the Paper	:	Elements of Modern Physics
Unique Paper Code	:	42227929
Question Paper Set Number	:	Set-C

Duration: 3 Hours Maximum Marks: 75

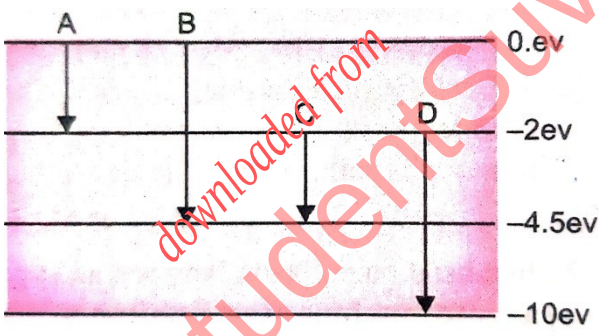
All questions carry equal marks. Attempt any four of the following questions.

Q1.(a) In what way classical electromagnetic theory of light fails to explain the basic facts of photo electricity? Give an account of Einstein's explanation of Photoelectric effect on basis of quantum theory.

(b) The Photoelectric threshold for a certain metal is $3600A^0$ when source is placed at 1m from the target. Determine the maximum energy in eV of the electron ejected by the radiation of wavelength $2000A^0$. What will be the effect (qualitatively) on stopping potential and number of ejected photo electron when source is shifted to 30cm?

Q2.(a) Explain the origin of different spectral lines of hydrogen spectrum on the basis of Bohr,s theory.

(b) The energy levels of an atom are shown in the figure given below:



i. Which of them will result in the emission of photon of wavelength 275 nm?

ii. Which transition corresponds to emission of maximum wavelength?

Q3. .(a) Derive the one dimension time dependent Schrodinger wave equation for a particle bound to a potential V(x).

(b) Explain the concept of stationary states.

(c) The operator $(x\hat{x} + xx + \frac{dd}{ddxx})$ has the eigen value λ, obtain the corresponding eigen function and normalize it. Also draw the wave function for a finite region.

Q4. State Heisenberg's uncertainty principle. Explain the two slit experiment with electrons and its outcomes. How accurately can the position of a neutron with v<<c (where v is the

velocity of the particle and c is the speed of light) be determined without giving it more than 1.5 KeV of kinetic energy?

Q5(a) For a particle which is confined in an infinite potential box show that the energy of an electron in the box varies as a square of the natural numbers. Draw wave function and probability function graphically. Find the no. of nodes for the second excited state.

(b) If an electron is confined in the potential well of width 2Å, calculate the minimum possible energy.

Q6 (a) Discuss the neutrino hypothesis for the emission of beta particles from a nucleus.

(b) A radioactive isotope decay in the following sequence: $A \xrightarrow{{}^{1}_{0}nn} A_1 \xrightarrow{\alpha} A_2$

If the mass number and atomic number of A_2 are 176 and 71 respectively, find the mass number and atomic number of A_1 and A.Which of three elements are isotopes?

(c) Two nuclei have mass number in the ratio 1:8, what is the ratio of their nuclear radii and nuclear densities?

Constants:
h= $6.6X10^{-34}$ J.s
m_e= $9.1X10^{-31}$ Kg
m_n= 939.55 MeV= 1.00866 u
m_p= 938.26 MeV = 1.00728 u