

**B. N. BANDODKAR COLLEGE OF SCIENCE, THANE**  
**USPH 202**

Duration: 2 Hrs

MARKS: 60

N.B.:1) All questions are **compulsory**.

2) Figures on the right indicate **full marks**.

3) **Non – programmable calculators** are allowed.

- Q.1) (A) Attempt any **ONE** of the following. 8
- 1) State and prove Thevenin's theorem.
  - 2) With the help of a neat labelled circuit diagram, find the expression for the frequency of the Wein Bridge.
- (B) Attempt any **ONE** of the following. 4
- 1) Distinguish between the ballistic and dead-beat galvanometer.
  - 2) Explain Schering bridge.
- (C) Attempt any **ONE** of the following. 3
- 1) Explain the concept of constant voltage source with a suitable circuit.
  - 2) De-Sauty's capacitance bridge has  $R_1 = 600 \Omega$ ,  $R_2 = 1000 \Omega$ ,  $C_1 = 0.22 \mu\text{F}$ . Find the value of the other capacitor  $C_2$  when the bridge is balanced.
- Q.2) (A) Attempt any **ONE** of the following. 8
- 1) State and prove the law of successive disintegration to obtain the number of atoms in the first two daughter elements formed in the process  $A \rightarrow B \rightarrow C$ .
  - 2) What is nuclear fission? With a suitable example, show that large amount of energy is given out in nuclear fission.
- (B) Attempt any **ONE** of the following. 4
- 1) Explain the law of exponential decay of radioactive substance with the help of graph of  $N$  Vs  $t$ .
  - 2) Explain  $\alpha$ -decay and  $\beta$ -decay with one example each.
- (C) Attempt any **ONE** of the following. 3
- 1) In a store, 10 mg of a radioactive sample is kept for 4 years. A radioactive sample has half-life period of two years. Find how much of the material remains unchanged?
  - 2) In natural carbon, the number of atoms of Carbon is  $5.59 \times 10^{10}$  and the decay constant is  $0.138 \times 10^{-7}$ /hour, calculate the activity of Carbon.
- Q.3) (A) Attempt any **ONE** of the following. 8
- 1) With the help of a neat labelled diagram, explain the set up of Davission - Germer experiment on electron diffraction.

- 2) State de Broglie hypothesis. Explain de Broglie concept of matter waves. State the characteristics of matter waves.

(B) Attempt any **ONE** of the following. 4

- 1) Determine the fractional change in the wavelength of X-rays (0.5 A.U.) that shows Compton scattering from an electron at  $90^\circ$ .
- 2) Calculate the wavelength that is scattered through an angle 180 degree when a monochromatic X-ray of wavelength 0.124 A suffers Compton shift, from a carbon block.

(C) Attempt any **ONE** of the following. 3

- 1) What is the significance of Heisenberg's uncertainty principle?
- 2) Define and derive for the phase velocity.

Q.4 (A) Attempt any **THREE** of the following. 12

- 1) Explain the Maxwell's inductance – capacity (L-C) bridge.
- 2) In a Wien bridge circuit,  $R_1 = R_2 = 2 \text{ K}\Omega$ ,  $C_1 = C_2 = 0.2 \mu\text{F}$ , and  $R_4 = 2 \text{ K}\Omega$ . Find the value of  $R_3$  and the frequency of the applied voltage needed to balance the bridge.
- 3) Write short note on : size of the nucleus.
- 4) Define mass defect and binding energy.
- 5) What is the accelerating potential to be provided to an electron of de Broglie wavelength of  $1 \text{ A}^\circ$  ?
- 6) Define gravitational red shift and write the value of an observed red shift for the white dwarf Sirius – B.

(B) Answer any **THREE** of the following in one word. 3

- 1) The corrected throw in mm on a scale one meter away caused by a charge of one microcoulomb passing through the galvanometer is called .....
- 2) The galvanometer having oscillatory behaviour is called .....
- 3) The process in which two or more light nuclei combine together to produce a single heavy nucleus is called .....
- 4) The time in which one half of the radioactive substance is disintegrated is called .....
- 5) Is the Compton shift effective in shorter wavelength region of  $\gamma$  rays or only in X – ray region?
- 6) State one point of difference between wave and particle.

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