B.Sc. (Part—III) Semester—V Examination

5S : PHYSICS

Time : Three Hours] [Maximum Marks : 80

Note :— (1) **ALL** questions are compulsory.

(2) Draw suitable and neat diagram wherever necessary.

1. (A) Fill in the blanks :

(i) The over all gain of cascaded amplifier is equal to the ..... of gain of individual stages.

(ii) Hydrogen Bomb is based on the principle of .....

(iii) Stopping potential is directly proportional to ..... of incident radiation.

(iv) Wein's law explains the black body spectrum in ..... frequency region. 2

(B) Choose the correct alternative :

(i) Raman effect is :

(a) Nuclear phenomenon (b) Molecular phenomenon

(c) Interference phenomenon (d) Ionic phenomenon

(ii) The principal quantum number 'n' determines size of :

(a) Electron (b) Proton

(c) Electron orbit (d) Atom

(iii) Range of α-particle does not depend upon :

(a) Nature of absorbing medium

(b) Initial energy

(c) Radioactive substance emitting α-particle

(d) None of above

(iv) Davission Germer experiment confirms :

(a) Value of Planck's constant (b) The value of e/m

(c) The nuclear size (d) The wave nature of electron 2

(C) Answer in ***one*** sentence :

(i) What are matter waves ?

(ii) What is thermal runaway ?

(iii) What is Packing Fraction ?

(iv) What is normalised wave function ? 4

EITHER

2. (A) Discuss γ-ray microscope thought experiment to illustrate Heisenberg's uncertainty principle. 4

(B) State and prove De-Broglie hypothesis of matter waves. 3

(C) Define group velocity and phase velocity. 2

(D) An X-ray photon of wavelength 0.35 Å is scattered through an angle 45° by loosly bound electron. Find wavelength of scattered photon ($h = 6.63\times10^{-34}$ J.sec, $C = 3\times10^{8}$ m/sec). 3

OR

3. (P) What is photoelectric effect ? State the characteristics of photoelectric effect. 4

(Q) Describe Davission-Germer experiment to verify wave nature of electron. 5

(R) Determine maximum kinetic energy of electron emitted by silver surface when illuminated by light of wavelength 2500 Å. The threshold wavelength of silver is 2762 Å. ($h = 6.63\times10^{-34}$ J.sec, $C = 3\times10^{8}$ m/sec) 3

EITHER

4. (A) Give the physical significance of wavefunction ψ. 3

(B) Obtain an expression for wavefunction for free particle in three dimensional box and show that the energy level of particle are given by : $E = \frac{\pi^2h^2}{2m}\left(\frac{n^2x}{a^2}+\frac{n^2y}{b^2}+\frac{n^2z}{c^2}\right)$ and explain the term degeneracy. 7

(C) Obtain an expression for momentum operator. 2

OR

5. (P) Explain the phenomenon of tunneling. 2

(Q) Derive Schrodinger's time independent equation for matter waves. 4

(R) Obtain an expression for wavefunction of free particle in one dimensional box. Show that energy level of particle are given by

$E = \frac{n^2\pi^2h^2}{2\,ma^2}$, and hence obtain the ground state energy of particle. 6

EITHER

6. (A) State Mosley's law and give its importance. 3

(B) Describe Stern and Gerlach experiment and discuss its result. 7

(C) In X-ray tube if an electron is accelerated by potential difference of 25 kV, find the minimum wavelength of X-rays produced. ($h = 6.63\times10^{-34}$ J.sec, $C = 3\times10^{8}$ m/sec, $e = 1.6\times10^{-19}$ C) 2

OR

7. (P) Explain L-S and j-j coupling schemes. 4

(Q) What is Raman effect ? Describe the experimental arrangement for study of Raman effect. 6

(R) What are stokes and antistokes in Raman spectrum ? 2

EITHER

8. (A) What is β-decay ? Explain three modes of β-decay. 4

(B) Explain Pauli's neutrino hypothesis in β-decay. 3

(C) Describe construction and working of nuclear reactor. 5

OR

9. (P) Define :

(i) Mass defect

(ii) Range of α-particle. 2

(Q) Discuss construction and working of GM counter. 7

(R) Distinguish between nuclear fission and nuclear fusion. 3

EITHER

10. (A) Explain, what is thermal runaway. 2

(B) What is noise ? Discuss the different types of internal noise in electronic circuits. 4

(C) Draw the circuit diagram of two stage RC coupled amplifier. 2

(D) The voltage gain of CE amplifier is –120, when resistance of i/p source is zero. If additional resistance of 10 K ohm is connected in series with source then output voltage reduces to half. What will be the gain of amplifier if a source of internal resistnace 5 K ohm is connected in input ? 4

OR

11. (P) What is distortion ? Explain frequency distortion. 2

(Q) Draw the hybrid parameter equivalent circuit of small signal CE amplifier and derive an expression for current gain and voltage gain. 6

(R) What are hybrid parameters ? State two basic equations for hybrid parameters of CE amplifier. 4

EITHER

12. (A) What is feedback ? State types of feedback. 2

(B) Derive an expression for gain of amplifier with feedback. 4

(C) Draw the circuit diagram of Hartley oscillator and explain its working. 5

(D) What is multivibrator ? 1

OR

13. (P) Draw the circuit diagram of Wein Bridge oscillator. 2

(Q) Discuss the effect of negative feedback on noise in amplifier. 3

(R) Draw the circuit diagram of monostable multivibrator and explain its working. 5

(S) The distortion in amplifier is reduced from 15% to 3% with 5% negative feedback, find the gain of amplifier with feedback. 2