

Third Year B.Sc., Degree Examination**August/Semptember 2010****DIRECTORATE OF CORRESPONDENCE COURSE****PHYSICS (Freshers)****Paper - IV: NUCLEAR PHYSICS, SOLID STATE PHYSICS
AND ELECTRONICS**

Time: 3 hrs]

[Max.Marks: 85

Instruction:

1. Answer all questions in Section – A in the first two pages of the main answer book.
2. Answer any **FIVE** questions from Section – B, any **SEVEN** questions from Section – C and any **TWO** questions from Section – D.
3. Draw neat labeled diagrams wherever necessary.
4. Take the necessary data from the tables.

SECTION – A**I. Answer ALL the questions:**

8 X 1 = 8 Marks

1. Name the type of meson absorbed by the neutron in its conversion into proton inside the nucleus.
2. What is recovery time of a G.M counter?
3. Why heavy nuclei prefer fission to fusion?
4. Give an example for face centred cubic crystal.
5. Write the expression for Debye temperature in terms of Debye frequency.
6. Graphically show the variation of magnetic susceptibility with temperature for ferromagnetic substances.
7. What is zener breakdown voltage?
8. What is a relaxation oscillator?

SECTION – B**II. Answer any FIVE questions:**

5 X 3 = 15 Marks

9. List out the facts which will require explanation when we adopt any nuclear model.
10. What are linear and cyclic accelerators? Give one example each.

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11. Explain how quark model accounts for charge and baryon number of a proton.
12. Write a short note on high temperature super conductors.
13. State super position, Thevenin's and Norton's theorems.
14. What is modulation? Explain its need in radio communication.
15. Explain how bands are formed in solids.

SECTION - C

III. Answer any SEVEN questions:

7 X 6 = 42 Marks

16. Explain construction and working of betatron. Arrive at the betatron condition.
17. Explain (a) BCS theory (b) Josephson effect.
18. Arrive at the four factor formula.
19. What are primary and secondary cosmic rays? Discuss the Latitude effect on cosmic ray intensity.
20. Obtain the relation for molar specific heat of a solid on Einstein's model. What are its merits?
21. Give the construction and working of phase shift oscillator, write the expression for frequency of oscillation.
22. What is a flip – flop? Explain J – K flip – flop and describe the different modes of operation.
23. What is Hall effect? Obtain the relation for Hall Co – efficient.
24. What are the features of diamagnetic materials? Give the Langevin's theory of paramagnetism.

SECTION - D

IV. Answer any TWO questions:

2 X 10 = 20 Marks

25. a) Obtain the expression for number of daughter atoms at a given instant of a radio active elements. Hence obtain condition for secular equilibrium. **6 Marks**
- b) A piece of an ancient wood in a boat shows an activity of C^{14} of 3.9 disintegrations per minute , per gram of carbon. Estimate the age of the boat, if the half life of C^{14} is 5568 years. Assume that the activity of fresh carbon – 14 is 15.6 disintegrations per minute per gram. **4 Marks**

Contd.....3

26. a) What are the assumptions of free electron theory? Obtain the expression for electrical conductivity of a metal on the basis of free electron theory. **6 Marks**
- b) A uniform copper wire whose diameter is 0.16 cm carries a steady current of 10 amp. Its density and atomic weight are 8920 Kg/m³ and 63.5 respectively. Calculate the current density and drift velocity of the electrons in copper. **4 Marks.**
27. a) Draw the block diagram of T.V transmitter. Describe the function each component. **6 Marks**
- b) Total power content of an AM wave is 1500 watt for a 100% modulation. Determine the power transmitted by carrier and each side band. **4 Marks**
28. a) Obtain expression for Fermi energy and average energy assuming expression for density of energy states. **6 Marks**
- b) Find the resistance of an intrinsic germanium rod which is 1 cm long, 1 mm wide and 1 mm thick at 300k. the intrinsic carrier density at 300 k is $2.5 \times 10^{19}/m^3$ and the mobilities of electron and hole are 0.39 and 0.19 m²/v/s respectively. **4 Marks**


