Third Year B.Sc., Degree Examination August / September 2009
Directorate of Correspondence Course
Physics
Paper - IV : Nuclear Physics, Solid State
Physics & Electronics

Time : 3 Hours   Max. Marks : 75

Instructions:

(1) The question paper consists of four Sections A, B, C and D.

(2) Answer all sections.

(3) Draw neat and labelled diagrams wherever necessary.

(4) Symbols used have their usual meanings.

SECTION - A

I.   **Answer ALL the questions.**   10x1=10 marks

1.   Name the field particles involved in strong nuclear interaction.

2.   Mention any one drawback of GM counter.

3.   What is a breeder reactor?

4.   Which among nuclear fission and fusion provide more energy yield per unit mass?

5.   Define unit cell.

6.   Define Fermi energy.

7.   Show graphically variation of susceptibility with temperature for paramagnetic material.

8.   What do you mean by faithful amplification?

9.   What is the role of feedback circuit in an Oscillator?

10. Name the logic gate in which output is low when all the inputs are the same.

SECTION - B

II. **Answer any FIVE questions.**   5x3=15 marks

11. What is the role of varying magnetic field in Betatron. Explain the condition for betatron action?

12. What are the merits and demerits of shell model?

13. Write a note on classification of elementary particles.

14. Distinguish between soft and hard super conductors.

15. Explain the steps involved in Thevenising the two terminal linear network containing voltage sources and resistances.

16. What is modulation ? Explain the necessity of modulation.

17. Explain the splitting of atomic energy levels into bands when a number of atoms are brought close together to form a crystal.

SECTION - C

III. **Answer any FIVE questions.**   **5x6=30 marks**

18. What are endoergic and exoergic reactions ? Write a note on the applications of radio isotopes.

19. Obtain the expression for number of second generation neutrons causing fission in the nuclear reactor fuel.

20. What are primary and secondary cosmic rays ? Explain the Bhabha - Heitler theory of cosmic ray showers.

21. Mentioning Einstein's assumptions, arrive briefly at his equation for molar specific heat of a solid at constant volume. Mention its merit and demerit.

22. Give the Bardeen, Cooper and Schrieffer theory of super conductivity. What are the uses of super conductors?

23. Determine the value of series resistor in a zener diode shunt regulator circuit given below.
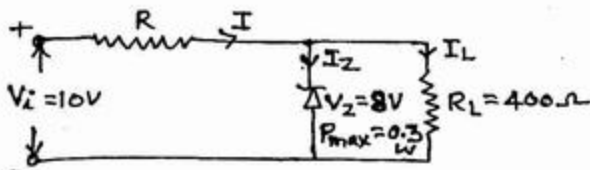
24. What is Flip-Flop ? Explain different modes of operation of R-S Flip-Flop with neat circuit diagram?

SECTION - D

IV. **Answer any TWO questions:**   **2x10=20 marks**

25. a) Give the theory of successive distintegration of a radioactive substance. Hence explain the conditions for secular and transient equilibrium.   **6 marks.**

    b) A nuclear reactor consumes 20.4 Kg of U-235 in 1000 Hrs of operation. Assuming on an average 200MeV energy is released per fission of one U-35 nucleus, determine the power developed by the reactor.   **4 marks**

26. a) Obtain expressions for Fermi energy and Average kinetic energy of electron at absolute zero, assuming equation for density of states.   **6 marks**

    b) Consider silver in the metallic state with one free electron per atom. Calculate the Fermi energy. Given density of silver is 10.5 gm/cm^3 and atomic weight 108.   **4 marks**

27. a) Draw the block diagram of a T.V. transmitter and explain the function of each part. **6 marks**

   b) For the voltage divider bias circuit given below, calculate satuation current, cut - off voltage, collector current and collector - to - emitter voltage.
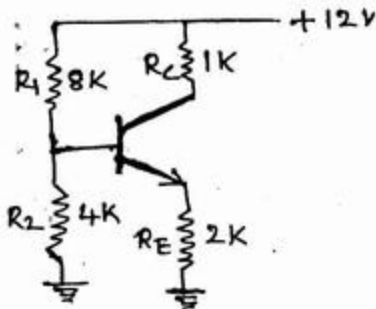
4 marks

28. a) What is Hall effect ? Obtain an expression for Hall co-efficient. **6 marks**

   b) The intrinsic carrier density of Ge at 27°C is $2.4 \times 10^{17}/m^2$. Calculate its intrinsic resistivity, if the electron and hole mobilities are $0.35m^2/V/S$ and $0.18m^2 / V / S$. **4 marks**

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