

**Third Year B.Sc., Degree Examination****Directorate of Distance Education****July / August 2011****PHYSICS****Paper IV: Nuclear Physics, Solid State Physics and Electronics**

Time: 3 hrs.]

[Max.Marks: 75/85

**Instructions to candidates:-**

1. Students who have attended 25 Marks IA Scheme will have to answer for total of 75 Marks.
2. Students who have attended 15 Marks IA Scheme will have to answer for total of 85 Marks.
3. Section E is compulsory for 85 marks scheme only.

**SECTION - A****I. Answer All questions.**

10 x 1 = 10 Marks

1. Mention the particles exchanged between proton and neutron inside the nucleus.
2. What is the resolving time of the G.M. counter?
3. At what conditions fusion process takes place?
4. Define a primitive cell.
5. Give any one drawback of classical free electron theory.
6. How does paramagnetic susceptibility varies with temperature?
7. What is a zener diode?
8. What is a harmonic oscillator?
9. Why NAND and NOR gates are known as universal gates?
10. What is Q value of the reaction.

Contd....2

## SECTION - B

II. Answer any FIVE questions.

5 x 3 = 15 Marks

11. What are the merits of liquid drop model?
12. How is energy of a particle limited in cyclotron? How is it overcome? Explain.
13. Explain how quark model account for the charge and baryon number of a  $\pi^+$  meson.
14. Write a note on type - I and type - II super conductors.
15. Explain different steps involved in Nortonising a two terminal network.
16. What are the different types of modulation? Define them.
17. Write a note on Solar cell.

## SECTION - C

III. Answer any FIVE questions.

5 x 6 = 30 Marks

18. Explain the construction and working of the cyclotron. Arrive at the expression for final energy in terms of frequency of the ion.
19. What are elementary particles? Give the classification of elementary particles.
20. What are the constituents of primary and secondary cosmic rays? Discuss the altitude effect on cosmic ray intensity.
21. What are isotope effect and Meissner effect? Give the BCS theory of superconductivity.
22. Give the construction and working of Hartley oscillator. Write the expression for frequency of Oscillation.
23. With a neat circuit diagram, describe the working of zener diode shunt voltage regulator.
24. What is a flip - flop? Explain R - S flip - flop and describe the different modes of operation.

## SECTION - D

IV. Answer any TWO questions.

2 x 10 = 20 Marks

25. (a) What are the difficulties faced in explaining  $\beta$ -ray spectrum? Give the Fermi's theory of  $\beta$ -decay.
- (b) Find the number of  $\alpha$  - decays that occur in a 1 gm. sample of thorium - 232 in one year, if the disintegration constant  $\lambda$  of thorium - 232 is  $1.58 \times 10^{-18}$  /sec.

(7 + 3 Marks)

Contd....3

26. (a) Obtain expression for Fermi energy and average energy assuming expression for density of energy states.
- (b) At what temperature we can expect a 10% probability that electrons in silver have an energy which is 1% above the Fermi energy? Fermi energy of silver is 5.5 e v (7 + 3 Marks)
27. (a) What is heterodyning? Draw the block diagram of super heterodyne radio receiver and describe the function of each component.
- (b) An amplitude modulated wave is represented by the expression  $e_m = 5 (1 + 0.8 \cos 10^4 t) \sin 220 \times 10^4 t$ . What are the minimum and maximum amplitudes of A.M. wave? What are frequency components contained in the modulated wave and upper and lower side bands. (7 + 3 Marks)
28. (a) Explain the construction and working of G M counter.
- (b) In a cyclotron, deuterons of mass  $3.34542 \times 10^{-27}$  kg describe a circle of radius 0.3m just before emerging from the dees. The frequency of the applied emf is 8 Mhz. Find the flux density of the magnetic field and velocity of deuterons emerging from the cyclotron. (7 + 3 Marks)

## SECTION – E

V. Answer any one of the following questions.  
(Compulsory question for 85 marks scheme only)

1 x 10 = 10 Marks

29. (a) Derive four factor formula.
- (b) What are nuclear forces Mention any three characteristics of nucleus forces. (6 + 4 Marks)
30. (a) Derive an expression for electrical conductivity of metals on the basis of classical theory.
- (b) State Thevenin's and Norton's Theorems. (6 + 4 Marks)

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