

Final Year B.Sc., Degree Examinations**September /October 2015***(Directorate of Distance Education.)***PHYSICS****DSC 211 : Paper IV : Nuclear Physics, Solid State Physics and Electronics***Time: 3 hrs.]**[Max.Marks:75/85*

- Instructions :*
- 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.****(10X1=10)**

1. Name the quantum of Nuclear field.
2. What is the dead time of the G.M. Counter ?
3. Define nuclear reaction cross section.
4. At what conditions fusion process takes place ?
5. What are quarks ?
6. What are Van Allen belts ?
7. What will happen to the position of Fermi level when the number of impurity atom is increased in an n-type semi conduction ?
8. What are logic gates ?
9. What is Varactor diode ?
10. What is an anharmonical oscillator ?

SECTION - B**II. Answer any FIVE questions.****(5X3=15)**

11. What are the merits of the Shell model of the nucleus ?
12. What are the differences between leptons and Baryons?
13. Give the applications of Radioisotopes.
14. Explain the procedure to find the Miller indices of a crystal.
15. Explain Langevin's theory of Paramagnetism.

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16. Explain Meissner effect with diagram.
17. What are the different types of modulation ? Define them.

SECTION - C

III. Answer any FIVE questions. (5X6=30)

18. What is successive disintegration ? Give the theory of successive disintegration of radioactive substance.
19. Describe the construction and working of Betatron with neat diagram. Obtain Betatron condition.
20. What are hard and soft components of cosmic rays ? Explain the production of cosmic showers.
21. Give the BCS theory of super conductivity and explain Type I and Type II super conductors.
22. Give the construction and working of Hartley oscillator. Write the expression for frequency of oscillation.
23. What is transistor biasing ? Explain with the help of circuit diagram the working of voltage divider method of biasing a transistor.
24. What is flip-flop ? Explain R-S flip – flop and describe the different modes of operation with truth table.

SECTION - D

IV. Answer any TWO questions. (2X10=20)

25. a) What are Nuclear forces ? Give the Meson theory of Nuclear forces.
 b) A. G.M. counter shows a count rate of 5750 counts per minute at some instant. After 5 minutes, it shows a count rate of 2700 counts per minute. Find the half life of the substance giving the counts. (6+4)
26. a) Describe the principle construction and working of scintillation counter with neat diagram.
 b) A cyclotron accelerates to 3 MeV. To what energy will the cyclotron accelerate a) α - particles and b) deuterons. Given $m_\alpha = 6.65 \times 10^{-27}$ kg, $m_d = 3.35 \times 10^{-27}$ kg, $m_p = 1.67 \times 10^{-27}$ kg. (6+4)
27. a) Obtain an expression for Fermi energy and average energy assuming expression for density of energy states.
 b) Calculate the electrical conductivity of copper from the following data. Atomic weight of copper is 63.5, density of copper = 8.94×10^3 kg m³ and relaxation time of electron = 2.48×10^{-14} sec (6+4)

Contd...3

28. a) What is heterodyning ? Draw the block diagram of super heterodyne radio receiver and describe the function of each component.
- b) For the circuit shown below determine the current through R_1 when R_1 takes 5Ω and 10Ω using Thevenin's theorem. **(6+4)**

SECTION - E

- V. Answer any ONE of the following questions. **(1X10=10)**
(Compulsory question for 85 marks scheme only)

29. a) Derive Fermi four factor formula.
- b) When an atom of U^{235} undergoes fission in a Reactor, 200 meV energy is liberated. Suppose that the power out is 800 MW. and reactor is 25% efficient, how many uranium atoms does it consume in one day ? **(6+4)**
30. a) Derive an expression for electrical conductivity of metals on the basis of classical theory.
- b) Draw the dc load line and mark the Q- point for the following circuit neglecting V_{BE} . **(6+4)**