

**Q.P. Code – 50822**

**Third Year B.Sc. Degree Examination, OCTOBER/NOVEMBER 2016**  
**(Directorate of Distance Education)**

**Physics**

**(DSC 211) Paper IV – NUCLEAR PHYSICS, SOLID STATE PHYSICS  
AND ELECTRONICS**

*Time : 3 Hours]*

*[Max. Marks : 75/85*

**Instructions to Candidates :**

- 1) *Students who have attended 25 marks I-A Scheme will have to answer for a total of 75 marks.*
- 2) *Students who have attended 15 marks I-A Scheme will have to answer for a total of 85 marks.*
- 3) *Section E is compulsory for 85-marks scheme only.*

**SECTION – A**

**I. Answer ALL questions :**

**10 × 1 = 10**

1. Write any one application of Radio Cobalt.
2. What is the role of scintillator in scintillation detectors?
3. What is a lattice?
4. Mention any one application of Josephson effect.
5. State Norton's theorem.
6. Expand RADAR.
7. Write the particle composition of secondary cosmic rays near sea level.
8. State Weidman-Franz law.
9. State Barkhausen criteria.
10. Write the quark composition of neutron.

**SECTION – B**

**II. Answer any FIVE Questions :**

**5 × 3 = 15**

11. What are miller indices? Illustrate their determination with an example.
12. Draw the logic diagram to realize the logic equation  $Y = \overline{BC} + \overline{AC}$  and write the truth table.

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13. Explain Yukawa theory of nuclear forces.
14. Write the similarities between liquid drop and nucleus.
15. Write a note on cosmic ray showers.
16. Give a brief discussion of non-sinusoidal oscillators.
17. Explain B.C.S. theory of superconductivity.

**SECTION – C**

**III. Answer any FIVE Questions :**

**5 × 6 = 30**

18. Give the theory of successive disintegration. Discuss the condition for transient equilibrium.
19. Discuss Hall effect with relevant theory.
20. Explain with the help of diagram and truth table the operation of RS flip-flop. Mention its drawbacks.
21. Explain the construction and working of G.M. counter.
22. What are thermonuclear reactions? Explain the C-N cycle of stellar energy production.
23. Explain briefly the origin of dia, para and ferro magnetism on the basis of electronic structure of atoms.
24. With a block diagram explain the functions of the various components of a super-heterodyne receiver.

**SECTION – D**

**IV. Answer any TWO Questions :**

**2 × 10 = 20**

25. (a) Discuss the construction and working of Betatron with necessary theory.  
(b) The isotopes of  $U^{238}$  and  $U^{235}$  occur in nature in the ratio 140 : 1. Assuming that at the time of earth's formation, they were present in equal ratio, make an estimation of the age of earth. Half life of  $U^{238}$  and  $U^{235}$  are  $2.5 \times 10^9$  years and  $7.13 \times 10^8$  years respectively. **7 + 3**
26. (a) Obtain Debyes formula for the atomic heat capacity.  
(b) Write the demerits of Einstein's theory of specific heat capacity. **7 + 3**

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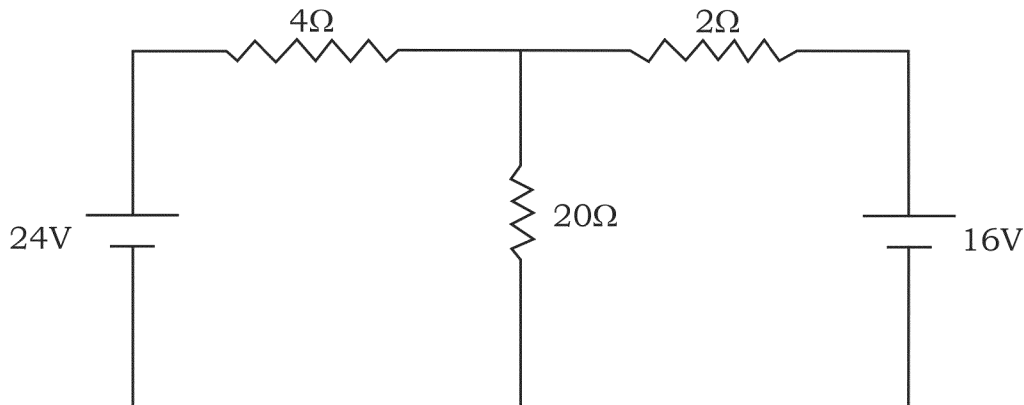
27. (a) Derive the expression Fermi energy and average energy of a metal on the basis of quantum free electron theory.
- (b) Calculate the drift velocity of free electrons in a conductor of cross sectional area  $10^{-4} \text{ m}^2$  and in which there is a current of 200 A assuming the electron density of copper is  $8.5 \times 10^{28} \text{ m}^{-3}$ . **7 + 3**
28. (a) Explain the construction of dc load line for a transistor circuit. Comment on the usefulness of dc load line.
- (b) A city requires 100 Megawatts of electrical power on the average. If this is to be supplied by a nuclear reactor of efficiency 29% using U-235 as a nuclear fuel, calculate the amount of fuel required for one day's operation. Given that the energy released per fission of U-235 nuclide is 200 MeV. **6 + 4**

**SECTION – E**

**V. Answer any ONE of the following questions :** **1 × 10 = 10**

(Compulsory Question for 85 marks scheme only)

29. (a) Explain the construction and working of Hartley oscillator.
- (b) Use Superposition theorem to find current through  $20 \Omega$  resistance of the following circuit. **6 + 4**



30. (a) Derive Langerin's theory of Diamagnetism.
- (b) What are the reasons for the failure of Langerin's theory? **6 + 4**