E 2129 (Pages : 2) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MAY 2015

Second Semester

ELECTRIC AND MAGNETIC PHENOMENA, THERMODYNAMICS, SPECIAL THEORY OF RELATIVITY

(Complementary Physics for Mathematics and Statistics)

[2013 Admission onwards]

Time : Three Hours Maximum : 60 Marks

Candidates can use Clark's tables and scientific non-programmable calculators.

Part A (Very Short Answer Questions)

Answer **all** *questions briefly.*
Each question carries 1 *mark.*

1. Explain the terms (i) dielectric constant and (ii) dielectric loss.
2. List the various mechanisms of polarization.
3. What is ferromagnetic hysteresis ?
4. Compare diamagnetism and paramagnetism.
5. What is the third law of thermodynamics ? Explain.
6. Define the term entropy. State its units and explain its physical significance.
7. There are two exactly identical twin sisters. One of the twins stays home while the other takes off on a long fast trip through space. On her return how the age of the traveller twin will be affected ? Give reason.
8. What is the time dilation in special relativity ?

(8 × 1 = 8)

Part B (Brief Answer Questions)

Answer any **six** *questions.*
Each question carries 2 *marks.*

9. Explain electrostatic shielding. What are its applications ?
10. With appropriate examples, explain how dielectric materials are classified ? What are their applications ?
11. How do you explain the occurrence of diamagnetism, paramagnetism and ferromagnetism in solids ?
12. Explain why does the acceleration of a magnet falling through a long solenoid decrease.
13. What is Carnot's theorem ? What is the message driven home from this theorem ?

Turn over

14. Write down the relationship between (i) pressure and volume ; (ii) temperature and volume ; (iii) pressure and temperature for an adiabatic change.

15. State second law of thermodynamics. Explain the meaning of first and second kinds of perpetual motion in terms of first and second laws of thermodynamics.

16. Show that the entropy is a point function of the state of the system, i.e., the change in entropy of a substance in change of state does not depend on the reversible path chosen between the two states.

17. State the fundamental postulates of special theory of relativity and deduce the Lorentz transformations.

18. Discuss the mass variation according to special theory of relativity.

(6 × 2 = 12)

Part C (Problems/Derivations/Short Essays)

Answer any **four** *questions.*
Each question carries 4 *marks.*

19. A parallel plate capacitor has circular plates of 8.0 cm. radius and 1.0 mm. separation of air. What charge will appear on the plates if p.d. of 60 volts is applied ?

20. A circular ring of iron is wound uniformly with 1000 turns of wire. Its mean diameter is 0.2 m. and its cross-section is 4 cm^2. Determine the current which will produce of flux of 2000 lines, assuming the permeability to be 800.

21. Calculate the molar entropy change when an ideal gas expands isothermally and reversibly from an initial volume of 1L to a final volume of 2L at 298 K.

22. In a PV diagram, an adiabatic and an isothermal curve for an ideal gas intersect. Show that the absolute value of the slope of the adiabatic is γ times that of the isothermal.

23. Prove that $x^2 + y^2 + z^2 = c^2t^2$ is invariant under Lorentz transformation.

24. In the laboratory the life-time of a particle moving with speed 2.8×10^{10} cm/sec. is found to be 2.5×10^{-7} sec. Calculate the proper life-time of the particle.

(4 × 4 = 16)

Part D (Long Answer/Essay Questions)

Answer any **two** *questions in detail.*
Each question carries 12 *marks.*

25. Explain the phenomenon of polarization when a dielectric slab is subjected to an electric field; with the help of neat sketches. How this phenomenon reduces the electric field inside the dielectric ?

26. What are the characteristics of paramagnetic, diamagnetic, ferromagnetic and ferrimagnetic substances ? Explain their behaviour with the help of examples.

27. With neat sketches, discuss the carnot engine as a refrigerator and obtain an expression for its performance.

28. What is Galilean transformation ? Derive Galilean transformation equations. Prove the laws of mechanics are identical in all inertial frames.

(2 × 12 = 24)