Reg. No.. Name: ....

B.Sc. DEGREE END SEMESTER EXAMINATION MARCH 2016

SEMESTER - 2: PHYSICS (COMPLEMENTARY COURSE FOR MATHEMATICS)

COURSE: 15U2CPPHY3: ELECTRIC AND MAGNETIC PHENOMENA,
THERMODYNAMICS AND
SPECIAL THEORY OF RELATIVITY

(Common for Regular - 2015 Admission / Supplementary - 2014 Admission)

Time Three Hours   Maximum Marks: 60

PART A (Very short answer questions)

(Answer **all** questions. Each question carries 1 Mark

1. What is the significance of dielectric constant of a material?
2. What is dielectric displacement vector?
3. Distinguish between polar and non-polar dielectrics.
4. Define ferroelectricity.
5. What is meant by thermodynamic equilibrium?
6. State third law of thermodynamics
7. State the postulates of special theory of relativity.
8. Write down Galilean transformation equations.

(1 x8=8)

PART B (Short Answer)

(Answer any **six** questions. Each question carries 2 Marks)

9. Briefly explain the sources of polarization.
10. Distinguish between ferromagnetism and antiferromagnetism.
11. Explain magnetic hysteresis and its parameters.
12. Derive the relation between the slopes of isothermal and adiabatic curves.
13. Explain isothermal elasticity.
14. What is an indicator diagram? Explain its importance.
15. Explain the concept of time dilation.
16. What are inertial and non-inertial frames of references

(2x6=12)

PART - C (Problem/Derivations)

(Answer any *four* questions. Each question carries 5 Marks)

17. A solenoid of length 0.5m has 4 layers of winding 350 turns each. A current of 0.6A is passed through the solenoid. If an iron core (μ_r = 5000) is inserted into the solenoid, determine H, B, M and X inside the core.

18. The space between the plates of a parallel plate capacitor is filled with two slabs of linear dielectric material. Each slab has thickness a, so the total distance between the plates is 2a.

19. Slab 1 has dielectric constant 2 and slab 2 has dielectric constant 1.5. The free charge density on top plate is σ and on the bottom plate is – σ. Find D, E and P in each slab?

20. Derive the work done during adiabatic and isothermal processes.

21. A Carnot engine absorbs 10^4 Calories of heat from a reservoir at 627°C and rejects heat to a sink at 27°C. What is its efficiency? How much work does it perform? (1 Cal = 4.2 J)

22. Derive the relativistic length contraction and time dilation relations using Lorentz transformations.

23. A space craft A is moving at 0.9c with respect to earth. If space craft B is to pass A at relative speed 0.5c in same direction, what speed must B have with respect to earth? Comment on result obtained using Galilean transformation.   (5 x 4 = 20)

PART - D (Essay)

(Answer *two* questions. Each question carries 10 Marks)

24. Discuss the concept of polarization and field developed inside a dielectric and hence arrive at the Gauss law in the presence of a dielectric.

25. Explain the different types of magnetism. Discuss magnetic hysteresis and experiment to determine the magnetic hysteresis curve.

26. Describe the working of a Carnot engine and the different processes involved in the Carnot cycle. Determine the relation for efficiency.

27. Deduce Lorentz transformation equations and show that $x^2 + y^2 + z^2 – c^2t^2$ is invariant under Lorentz transformation.   (10 x 2 = 20)

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