

**B. Sc. DEGREE END SEMESTER EXAMINATION – JULY 2021****SEMESTER – 2: PHYSICS (COMPLEMENTARY COURSE FOR MATHEMATICS)****COURSE: 15U2CPPHY3, ELECTRIC AND MAGNETIC PHENOMENA, THERMODYNAMICS AND  
SPECIAL THEORY OF RELATIVITY***(For Supplementary 2018/2017/2016/2015/2014 admissions)*

Time: Three Hours

Max. 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 the origin of diamagnetism?
3. Give an example of paramagnetic material
4. Define ferroelectricity.
5. What is polarization?
6. Write down Lorentz transformation equations.
7. State the third law of thermodynamics.
8. Write down Einstein's mass energy relation. (1 x 8 = 8)

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

9. Distinguish between non-polar & polar dielectrics.
10. Define Gauss's law in dielectrics.
11. Explain magnetic hysteresis and its parameters.
12. Distinguish between reversible and irreversible processes. List the reasons for irreversibility of processes.
13. State the 1<sup>st</sup> law of thermodynamics and give two applications.
14. What is an indicator diagram? Explain its importance.
15. What is dielectric displacement vector?
16. State the postulates of special relativity. (2 x 6 = 12)

**PART - C (Problem/Derivations)*****Answer any four questions. Each question carries 5 Marks***

17. A magnetic material has a magnetization of 2300 A/m and produces a flux density of 0.00314 wb/m<sup>2</sup>. Calculate the magnetic permeability of the material.
18. A Carnot engine whose low temperature reservoir is at 7°C has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of high temperature reservoir be increased?

19. One mole of oxygen gas expands isothermally to four times its volume. Determine the change in entropy. Given the gas constant  $R = 8.314 \text{ J/mol/K}$ .
20. Derive the relativistic length contraction and time dilation relations using Lorentz transformations.
21. 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.
22. A rod of magnetic material  $0.2 \text{ m}$  long,  $10 \text{ mm}$  diameter and of relative permeability  $1000$  is placed inside a long solenoid wound with  $300 \text{ turns/m}$ . If a current of  $0.5 \text{ A}$  is passed through the rod, determine the magnetic moment of the rod. (5 x 4 = 20)

**PART - D (Essay)**

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

23. a) Explain the concept of polarization and its different sources with necessary theory. Also discuss the potential and field due to a dipole in a polarized material.  
b) Explain ferroelectricity and ferroelectric domains.
24. Describe the working of a Carnot engine and the different processes involved in the Carnot cycle. Determine the relation for efficiency.
25. Discuss the origin of ferromagnetic domains. What do you mean by magnetic hysteresis? Draw a typical hysteresis curve and explain the terms retentivity and coercivity. How is the area of the hysteresis curve related to the energy dissipated per unit volume of the material during each magnetic cycle?
26. What is entropy? Show that for a reversible cycle, entropy is a constant. (10 x 2 = 20)

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