This question paper contains 3 printed pages.]

5158 *Your Roll No. .....*

B.Sc. (Prog.) / II **B**

MP-202 : Thermal Physics & Electromagnetism

(Admissions of 2005 and onwards)

Time : 3 Hours *Maximum Marks : 75*

(Write your Roll No. on the top immediately on receipt of this question paper.)

*Attempt any **five** questions.*

All questions carry equal marks.

1. (a) Prove that adiabatic elasticity of a gas is $\gamma\left(=\frac{Cp}{Cv}\right)$ times the isothermal elasticity. 5

   (b) State two well known forms of second law of thermodynamics. Express this law in terms of entropy. 10

2. (a) Discuss Carnot's reversible heat engine. Derive an expression for its efficiency. 4,8

   (b) Draw temperature-entropy diagram for Carnot's cycle. 3

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3. (a) Define the following terms : 6

(a) microstate

(b) macrostate

(c) thermodynamic probability

(b) Prove that 6

$S = k \log w$

where symbols have their usual meaning.

(c) Distinguish between Bose-Einstein and Fermi-Dirac statistics. 3

4. (a) Derive an expression for the distribution function corresponding to Fermi-Dirac statistics. 9

(b) Using Fermi-Dirac distribution law obtain an expression for the mean energy of completely degenerate ideal Fermi gas. 6

5. (a) What are polar and non-polar molecules ? Explain the polarization of a dielectric in the presence of an external field. 6

(b) State and prove Gauss's law and write it in differential form. Obtain an expression for the electric field due to an infinite plane which carries a uniform surface charge σ. 5,4

6. (a) A current of I amperes is passed through a coil of self inductance L. Show that the energy stored in the magnetic field of the coil is equal to $\frac{1}{2} LI^2$. 4

(b) Write Maxwell's equations in vacuum. State the laws on which these equations are based. 5

(c) State Ampere's circuital law. Discuss how Maxwell modified this law to make it consistent with the continuity equation. 6

7. (a) State and prove Poynting theorem. 9

(b) What do you understand by linear, circular and elliptical polarisation ? 6

8. Write short notes on any **two** of the following : 7½,7½

(a) Law of equipartition of energy

(b) Maxwell's law of distribution of velocities

(c) Drude's theory of metallic conduction

(d) Skin depth

(e) Fresnel relations for reflection and refraction