COURSE CODE: 10B11PH211   MAX. MARKS: 15

COURSE NAME: PHYSICS-II

COURSE CREDITS: 04   MAX. TIME: 1 HR

Note: All questions are compulsory and carry equal marks. Carrying of mobile phone during examinations will be treated as case of unfair means.

Q1. A gas has two specific heats whereas a liquid has only one. Explain. Derive an expression for the difference between two specific heats of a perfect gas i.e., Mayer's relation; $C_p - C_v = R$.

Q2. Two Carnot engines A and B are operating in series. The first engine A receives heat at *900 K* and rejects to the reservoir at a temperature T K. The second engine B receives heat rejected by A and in turn rejects it to a reservoir at *400 K*. Calculate the temperature T for the situation when: *(i)* the work output of two engines are equal and *(ii)* the efficiency of two engines are equal.

Q3. A mass m of a liquid at temperature T_1 is mixed with an equal mass of the same liquid at a lower temperature T_2. The system is thermally insulated. Show that when the system comes in equilibrium the entropy change of the universe will be

$$2ms \ln \left[\frac{T_1 + T_2}{2\sqrt{T_1 T_2}} \right]$$

Q4. Define and explain four fundamental thermodynamic potentials; internal energy U; Helmholtz free energy F; enthalpy H; and Gibb's free energy G. Explain what happens to Helmholtz free energy during isothermal isochoric process?

Q5. Test the divergence theorem for the function $\vec{v} = xy\hat{i} + 2yz\hat{j} + 3zx\hat{k}$ for your volume a cube situated at origin with sides of length 2 units.