**CLASS TEST**
**PAPER: STATISTICAL MECHANICS**
**CLASS: B.Sc VI SEM, 2023-24**
**Maximum Marks 10**

1. Attempt any four of the following.

   (a) Calculate the number of modes in a chamber of volume $1m^3$ in the frequency range $0.6 \times 10^{14} Hz \, to \, 0.61 \times 10^{14} Hz$.

   (b) An oscillator vibrates with frequency $2.4 \times 10^{14} Hz \, at \, T = 1900K$ Calculate its average energy treating it as classical and Planck's oscillator.

   (c) What is the origin of the ultraviolet catastrophe ?

   (d) explain the concept of microstate, macrostate,and most probable macrostate on the basis of result obtained when throwing two identical 6 sided dice, each with the number 1-6 written on their faces.

   (e) Consider a system of three distinguishable particles with particle energies 0, $\epsilon$, $2\epsilon$ and $3\epsilon$. If the total energy of the system be $3\epsilon$.Enumerate all macrostates and microstates of the system.

2. A system consisting of two particles,each of which can be any one of three states of energy 0, $\epsilon$ and $3\epsilon$ is in thermal equilibrium at temperature T. write expressions for partition function if the particles obey BE,BE and FD statistics.

3. What are the different types of heat capacity of a diatomic molecules. show that at low temperature the total specific heat of a diatomic molecule is 3.5R

4. Obtain Planck's law for blackbody radiation. using this obtain Wien's constant and Stefan's constant.

5. Derive single particle partition function for an ideal monoatomic gas enclose in a volume V at temperature T.
   Find the average energy and pressure for a system of N such distinguishable particles.