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INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(MAHE, MANIPAL)

I SEMESTER B.Sc. (Applied Sciences) in Engg.

End – Semester Theory Examinations – Jan./ Feb. 2022

SUBJECT: PHYSICS –I (IPH 111)

(Branch: Common to all)

Time: 3 Hours **Date: 02 February 2022** **Max. Marks: 50**

- ✓ **Answer All questions.**
- ✓ **Missing data, if any, may be suitably assumed.**

- ✓ **Useful constants**

Planck's constant h = 6.63 x 10^{-34} Js, Velocity of light c = 3x 10^{8} ms^{-1}.
Charge on electron = 1.6x10^{-19} C. Mass of electron = 9.1 x 10^{-31} kg.
Mass of proton = 1.67 x 10^{-27} kg. Boltzmann constant: 1.38 x 10^{-23} J/K
Stefan-Boltzmann Constant: 5.67 x 10^{-8} W/m^2K^4 Avogadro's number : 6.022 × 10^{23}

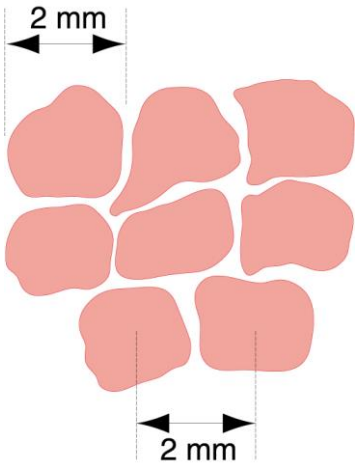
1A. Find the sum of the following quantities using phasors; **(4)**

$y_1 = 10 \sin(\omega t)$

$y_2 = 8 \sin(\omega t + 30°)$

1B. Explain the production of plane polarized light by reflection. **(3)**

1C. The painting contains small dots (≈ 2 mm in diameter) of pure pigment, as indicated in figure. The illusion of colour mixing occurs because the pupils of the observer's eyes diffract light entering them. Calculate the minimum distance an observer must stand from painting to achieve the desired blending of colour. (wavelength = 475 nm, diameter of pupil = 4.4 mm) **(3)**



2A. What is ultraviolet catastrophe and explain how it was resolved by Max Planck's quantum theory of radiation? **(5)**

2B. A phosphor atom is added to a Silicon crystal lattice. What happens to its electrical conductivity? and why? **(3)**

2C. The radius (r) of a star is known to be 7×10^8 m, and its total power output (P) is 4.24×10^{28} W. Assuming that its surface emits radiation as a black body, calculate its surface temperature (T). **(2)**

3A. Solve Schrodinger equation for the normalized wave function of a particle confined in an infinite potential well of one dimension. **(5)**

3B. Electrons with energies 0.4 eV are incident on a barrier 3 eV high and 0.1 nm wide. Find the approximate probability of reflection from the barrier for these electrons **(3)**

3C. Draw a representative graph of Resistance vs. Temperature for a superconducting and a normal material and hence explain the concept of critical temperature. **(2)**

4A. What is a LASER? Discuss the principle of working of a He-Ne laser with suitable energy level diagrams. **(5)**

4B. An electron in a hydrogen atom is in 1s state. How much more likely is this electron to be at the distance a_o than at the distance $a_o/2$. **(5)**

5A. Derive an expression for rotational energy of a diatomic molecule. Sketch schematically these rotational energy levels. Mention which region of electromagnetic spectrum does this energy fall ? **(5)**

5B. Calculate the energy of a conduction electron in silver at 800 K, assuming the probability of finding an electron in that state is 0.950. The Fermi energy is 5.48 eV at this temperature. **(3)**

5C. Sketch schematically the plot of potential energy and its components as a function of inter-nuclear separation distance for a system of two atoms. Mark also, the Binding energy and equilibrium separation between the atoms **(2)**