B. Sc. Semester VI (Honours) Examination, 2020 (CBCS)

Subject: Physics

Paper: CC-XIII

Time: 2 Hours **Full Marks: 40**

The figures in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable.

Answer any eight of the following questions (all questions carry equal marks): 5×8=40

1. Light is generally characterized by electric field vector, although it possesses magnetic field vector. Explain. What do you mean by double refraction?

2. What is a quarter wave plate? Derive an expression for its thickness.

3. What are the advantages of fibre optics communication system over the conventional one? Mention some of the important applications of optical fibre.

4. Solve Maxwell's equations in free space to show that electric field $\vec{E}$, magnetic field $\vec{H}$ and the direction of propagation $\vec{K}$ form a set of orthogonal vectors.

5. State and establish Poynting theorem.

6. Explain with necessary theory, how to obtain elliptically and circularly polarized light.

7. What do you mean by (i) optically active substance (ii) specific rotation and (iii) wave guide.

8. Two linearly polarized light waves are in phase but have different amplitudes. They are represented by $\vec{E}_1(z,t) = \hat{i}A_1Cos(kz-\omega t) + \hat{j}B_1Cos(kz-\omega t)$ and

$$\vec{E}_2(z,t) = \hat{i}A_2Cos(kz-\omega t) + \hat{j}B_2Cos(kz-\omega t)$$

Show that $\vec{E} = \vec{E}_1 + \vec{E}_2$ is also linearly polarized. Find its direction of polarization. Why red light is used for danger signals?

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9. The electric field associated with an electromagnetic wave is $\vec{E} = \hat{x}E_0 Cos(kz - \omega t) + \hat{y}E_0 Sin(kz - \omega t)$ where E_0 is a constant. Find the corresponding magnetic field $\vec{H}$.

A parallel plate capacitor has circular plates, each of radius 5 cm. It is being charged so that electric field in the gap between the plates rises steadily at the rate of $10^{12} Vm^{-1}\,\text{sec}^{-1}$. Calculate the displacement current.

10. Calculate the frequency at which skin depth in sea water is 1m. Given for sea water conductivity $\sigma = 4.3(\Omega - m)^{-1}$ and relative permeability equal to 1.

Write down the boundary conditions to be satisfied by electric field vectors $\vec{E}$ and $\vec{D}$ at an interface separating two media.