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**ST. JOSEPH’S COLLEGE (AUTONOMOUS), BANGALORE-27**

**B.Sc. PHYSICS - IV SEMESTER**

**SEMESTER EXAMINATION: APRIL 2022**

(Examination conducted in July 2022)

**PH 418: Optics and Electricity**

**Time - 1 ½ hrs Max Marks - 35**

**This paper contains two printed page and three parts**

**PART A**

**Answer any three of the following: - 3 x 8 = 24**

1. a) Explain metastable state and population inversion.
2. Distinguish between ruby laser and helium -neon laser. (4 + 4)
3. A sinusoidal alternating e.m.f.is applied to a circuit containing L-C-R in series.

Derive an expression for instantaneous current in the circuit. Discuss the

condition for resonance and deduce an expression for the resonant frequency.

1. a) Describe the working of a half- wave rectifier with necessary circuit diagram.     Derive expressions for ripple factor and efficiency of the same. (4+4)
2. a) List out the differences between step index and graded index optical fibre.

b) What is numerical aperture and derive the relation between numerical aperture     and fractional index change. (4+4)

**PART B**

**Answer any two of the following: - 2 x 4 = 8**

1. Find out if a condenser of capacity 0.2µF is discharged through an inductance of 10mH and a resistance of 250 Ω, is oscillatory. Calculate the frequency of oscillation.

**OR**

An inductance of 10 H is connected in series with a resistance of 50 Ω to a 220 V, 50 Hz ac source. Calculate the value of the capacitor to be connected in series to make the power factor unity. Also calculate current in the circuit.

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1. Calculate how many photons are emitted in each minute in a He-Ne laser source,

Which emits light at a wavelength of 6625Å? Given The output power of this source is 4mW.

**OR**

Calculate the V-number for a fibre of the core diameter 20µm and with the refractive indices of core and cladding of 1.55 and 1.50 respectively. The wavelength of propagating wave is 1425Å.Calculate the number of modes that the fibre can support.

**PART C**

**Answer any three of the following: - 3 x 1 = 3**

7. a) What happens if the refractive index of core is less than the cladding?

           b) Laser beam is nearly an ideal source of light. Justify.

         c) Why long-distance power transmission is done through conducting

wires of high voltages?

           d) Is there any change in the width of depletion region, when the p-n

junction is in reverse biased?

e) A coil has a resistance of 20 Ω and time constant 0.002 sec.

What is its inductance?

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