Reg. No. : ...........................

Name : ...................................

### Third Semester B.Sc. Degree Examination, March 2022

### First Degree Programme under CBCSS

### Physics

### Complementary Course for Mathematics

### PY 1331.1 : OPTICS, MAGNETISM AND ELECTRICITY

### (2019 & 2020 Admission)

Time : 3 Hours

Max. Marks : 80

## SECTION – A

Answer **all** the questions. **Each** carries **1** mark.

1. What is the distance between any two consecutive two dark fringes in the interference pattern?

2. What is the phase difference between the voltage and current in a capacitor in an AC circuit?

3. What is the condition of destructive interference?

4. What is fringe width?

5. Explain ferromagnetic domains.

6. What is plane transmission grating?

7. What is the principle of fibre optics?

8.  What is meant by interference of light?

9.  Define hysteresis.

10. What is step down transformers?

SECTION – B

Answer any **eight** questions. **Each** carries **2** marks.

11. What is the principle of interference?

12. Two independent sources of light cannot be coherent. Why?

13. Give two applications of ferromagnetism,

14. How magnetic susceptibility used to differentiate different type of magnetism?

15. What is step index fibre?

16. Explain metastable state.

17. For an LCR circuit, when will the Q-factor be large?

18. Give the advantages of step index fiber.

19. Define phase difference? What is the phase difference between voltage and current at resonance?

20. Explain Fraunhofer diffraction.

21. What is laser? What are the properties of laser?

22. What is stimulated absorption?

23. Give the difference between interference and diffraction.

24. What is principle of superposition of waves?

25. What are the advantages of graded index fiber?

26. The centre of the Newton's rings system seen in reflected light is dark. Why?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** carries **4** marks.

27. Explain the reason of color of thin film.

28. A plano-convex lens is placed on a plane glass plate and illuminated normally with monochromatic light of wavelength 5893 Å. The diameter of the 15th dark ring is 5.9 nm. Calculate the radius of curvature of the surface.

29. An AC main of 200 V and 50 Hz is connected to a circuit containing an inductance of 100 mH and resistance of 20 ohm in series. Calculate the power factor.

30. If the number of lines per millimetre of a grating is 600, how many orders of spectra are possible for light of wavelength $5.89 \times 10^{-7}$ m?

31. Explain the various applications of laser.

32. A rod of magnetic material, 0.5 m in length has a coil of 200 turns wound over it uniformly. If a current of 2 ampere is sent through it, calculate (a) magnetising field H and (b) the magnetic induction B of the material. Given $\chi_m = 6 \times 10^{-3}$.

33. A series RLC circuit with R = 10.0 Ω, L = 400 mH and C = 2.0 μF is connected to an AC voltage source V(t) = $V_0 \sin \omega t$ which has a maximum amplitude $V_0 = 100$ V.

    (a) What is the resonant frequency $\omega_o$?

    (b) Find the rms current at resonance.

34. A coil has an inductance of 0.1 H and a resistance of 12 ohm. It is connected to a 220 V. 50 Hz mains. Determine the (a) reactance of the coil and (b) impedance of the coil.

35. Describe various losses occurring in a transformer.

36. Estimate the critical angle when the core refractive index is 1.48 and the relative refractive index is 2%.

37. A magnetising field of 50 A/m produces a magnetic field of induction 0.024 T in a bar of length 8 cm and area of cross section 1.5 cm$^2$. Calculate (a) the magnetic permeability (b) the magnetic susceptibility.

38. Find the numerical aperture of an optical fiber having a core refractive index of 1.6 and a cladding refractive index of 1.50.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** carries **15** marks.

39. Explain the formation of Newton's rings. How can it be used to determine the wavelength of a monochromatic light?

40. Describe the phenomenon of Fraunhofer diffraction at a double slit.

41. Give the theory of plane transmission grating. How will you determine the wavelength of the monochromatic light using grating.

42. What is electron theory of magnetism? Explain different types of magnetism using electron theory.

43. Derive the relation connecting voltage and current in an AC circuit containing (a) resistance only (b) inductance only (c) capacitance only.

44. Explain the principle, construction and working of Ruby laser.

(2 × 15 = 30 Marks)

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