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Reg. No. : .....

Name : .....

**Third Semester B.Sc. Degree Examination, October 2019**

**First Degree Programme under CBCSS**

**Complementary Course for Mathematics**

**PY 1331.1 – OPTICS, MAGNETISM AND ELECTRICITY**

**(2018 Admission)**

Time : 3 Hours

Max. Marks : 80

**SECTION – A**

Answer **all** questions in **one** or **two** sentences. **Each** question carries **1** mark.

1. Write down the expression for the optical path differences for constructive and destructive interferences.
2. Which among the following has the higher bandwidth? Red or violet monochromatic light. Give reason.
3. Mention the use of diffraction grating.
4. While observing diffraction at straight edge, only few bands are seen. Why?
5. What are the components of a laser?
6. Draw the refractive index profile of a step index and graded index fibre.
7. Define magnetisation.
8. What are the components of magnetic dipole moment of an atom?

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9. What is the significance of form factor?
10. Q factor determines the degree of selectivity of the circuit while tuning. Explain why?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions, not exceeding a paragraph. **Each** question carries **2** marks.

11. Distinguish between interference due to wavefront division and amplitude division.
12. What is the correction made on optical path difference on the interference in thin films due to reflected light? Why is it necessary?
13. Briefly explain the methods for producing fringes of equal inclination and equal thickness.
14. If an opaque object is placed in the path of light, there should be illumination in the geometrical shadow region, But this not commonly observed. Explain why?
15. Compare single and double slit Fraunhofer diffraction pattern.
16. How does overlapping of spectral lines occur in diffraction gratings? How can you avoid this?
17. Explain population inversion.
18. Why cladding is necessary in optical Fibres?
19. Compare Curie temperature and Neel's temperature.
20. Why do we prefer choke coil to ohmic resistance to diminish current?
21. Briefly explain the energy losses in transformers.
22. Derive the relation connecting the relative permeability and susceptibility.

(8 × 2 = 16 Marks)

## SECTION – C

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

23. Prove that the fringe width of both bright and dark interference fringes formed by the double slit experiment is the same.
24. A soap film of refractive index 1.34 is illuminated by 600nm light incident at an angle  $45^\circ$ . Find the thickness of the film using the condition for dark fringes.
25. A single slit Fraunhofer pattern is formed with white light. For what wavelength of the light the second maximum in the diffraction pattern coincides with the third maximum in the pattern for 464.2 nm.
26. A circular aperture is illuminated by plane waves of monochromatic light of wavelength 625nm. The diffracted light is received on a distant screen which is gradually moved towards the aperture. If the centre of the circular patch of the first becomes dark when the screen is 0.2m from the aperture, find the diameter of the aperture.
27. An iron rod of 10cm long, 10mm in diameter and of relative permeability 1000 is placed inside a long solenoid wound with 100 turns/ metre. If a current of 0.1A is passed through the rod, find the magnetic moment of the rod.
28. If the critical angle for a fibre made up of silica is  $42^\circ$ , find the refractive index of it. Also find the critical angle when the fibre is immersed in water ( $n_{\text{water}}=1.33$ ).
29. Show that in an ac circuit containing inductance and resistance in series the current lags in phase behind the emf by an angle  $\tan^{-1}(L\omega/R)$ .
30. A resistance of  $100\Omega$  is joined in series with an inductance of 100mH. What capacitance must be put in series with the combination to obtain maximum current? What will be the potential drop across each element of circuit, if it is connected to 230V, 50Hz mains?
31. Find the ratio of the populations of the two states in a laser that produces a light of wavelength 628nm at  $27^\circ\text{C}$ .

**(6 × 4 = 24 Marks)**

## SECTION – D

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

32. Describe the Newton's ring experiment to determine the refractive index of a liquid. Also explain the necessary theory.
33. Give Fresnel's explanation to diffraction of light and its rectilinear propagation.
34. Compare the various magnetic materials with examples.
35. Explain the induction of emf in a coil rotating in a magnetic field, Find the mean, rms and effective value of ac current and voltage during a complete and half cycle.

**(2 × 15 = 30 Marks)**

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