



Reg. No. :

Name :

Third Semester B.Sc. Degree Examination, December 2017
First Degree Programme under CBCSS
COMPLEMENTARY COURSE FOR MATHEMATICS
PY 1331.1 : Optics, Magnetism and Electricity
(2013 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

PART - A

Answer **all** questions. Answer should **not** exceed **two** sentences. **Each** question carries 1 mark.

1. Explain the principle of superpositions.
2. What are coherent sources ?
3. Explain the terms phase difference and path difference.
4. Extremely thin films viewed in white light appear dark. Why ?
5. What is a plane transmission grating ?
6. Define the phenomenon of diffraction of light.
7. Mention the distinguishing features of Fresnel and Fraunhofer diffraction.
8. What is meant by pumping ?
9. Mention any two applications of optic fibres.
10. Define the term magnetic susceptibility.

PART - B

Answer **any 8** questions. Answer should **not** exceed **one** small paragraph. **Each** question carries 2 marks.

11. Derive an expression for the mean value of an alternating current.
12. Define the term rejector circuit.
13. Write down the properties of diamagnetic materials.
14. Establish the relation $B = \mu_0 (H + M)$.
15. Define the term Magnetic induction.
16. Write down the electron theory of magnetism.
17. How do you test the planeness of a glass plate by interference method ?
18. Explain the help of figure graded index optical fibre.
19. What is meant by dispersive power of a grating ?
20. Distinguish between stimulated emission and spontaneous emission.
21. Write down any four application of laser.
22. Mention any four advantages of optic fibre communication over any other system.



PART - C

Answer **any 6** questions. **Each** question carries **4** marks.

23. A parallel beam of monochromatic light is allowed to fall normally on a plane transmission grating having 6000 lines/cm and the first order maximum is formed at $15^\circ 10'$. Calculate the wavelength of light.
24. A grating is ruled over a width of 0.1 metre and the number of lines on the grating is 5000 per cm. Find the smallest wavelength difference which could be resolved in the region of $5000 \text{ \AA}$ in the first order.
25. Deduce the missing orders for a double slit Fraunhofer diffraction pattern, if the slit width are 0.16 mm and they are 0.8 mm apart.
26. A soap film of refractive index $4/3$ and of thickness $1.5 \times 10^{-4} \text{ cm}$ is illuminated by white light incident at an angle of 60° . The light reflected by it is examined by a spectroscope in which is found a dark band corresponding to a wavelength of $5 \times 10^{-5} \text{ cm}$. Calculate the order of interference of the dark band.
27. In Newton's rings set up, the diameters of the 5^{th} and 10^{th} rings are 0.4 and 0.6 cm respectively. If the wavelength of light used is $5460 \text{ \AA}$, Calculate the radius of curvature of the lens used.
28. An air wedge is formed between two glass plates of length 10 cms with a wire between them at one end. Using a light of wavelength $5893 \text{ \AA}$, 20 fringes/cm are seen. Calculate the radius of the wire.
29. Calculate the ratio of spontaneous emission to stimulated emission if λ of radiation is 600 nm at 2500 K, $h = 6.6 \times 10^{-34} \text{ J}$, S , $K_B = 1.38 \times 10^{-23} \text{ SI units}$. Whether laser production is possible.
30. The numerical aperture of an optic fibre is 0.295 and refractive index of core is 1.54. Calculate the refractive index of the cladding and the acceptance angle.
31. 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) the magnetic field H (b) the intensity of magnetization m (c) the magnetic induction B. Given $\chi_m = 6 \times 10^{-3}$.

PART - D

Answer **any 2** questions. **Each** question carries **15** marks.

32. With the help of a suitable diagram, explain the principle, construction and working of a Ruby laser.
33. Discuss with relevant theory, the formation of interference pattern in a thin film due to reflected light.
34. Explain the theory of transformer and discuss its working. Describe the various losses occurring in a transformer.
35. What are ferromagnetic materials? Derive the Weiss's theory of ferromagnetism.