



**MAR IVANIOS COLLEGE (AUTONOMOUS)**  
**THIRUVANANTHAPURAM**

Reg. No. :.....

Name :.....

**Third Semester B.Sc. Degree Examination, November 2015**

**First Degree Programme under CBCSS**

**Complementary Course: Physics – III (for Mathematics)**

**AUPY331.2c: Optics, Magnetism and Electricity**

Time: 3 Hours

Max. Marks: 80

**SECTION – A**

*Answer ALL questions in a word or one or two sentences.*

1. Why Newton's rings are circular ?
2. What do you meant by 'wave front' ?
3. What do you meant by 'grating element' ?
4. What is resolving power of grating ?
5. What is population inversion ?
6. Define acceptance angle.
7. What is impedance ?
8. What do you meant by time constant in an LR circuit ?
9. What is retentivity ?
10. Mention any two functions of a transformer.

**(10 × 1 = 10 Marks)**

**SECTION – B**

*Answer any EIGHT questions, not exceeding a paragraph.*

11. Why a thin film of oil on the surface of water shows different colours ?
12. Show that the diameter of dark ring in Newton's ring is proportional to the square root of the natural numbers.

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13. Distinguish between Fresnel and Fraunhofer diffraction.
14. What is meant by wattles current ?
15. Distinguish between spontaneous emission and stimulated emission.
16. Write any two methods of population inversion.
17. Distinguish between step index and graded index fibre.
18. Does an iron bar magnet retain its magnetism on melting ?
19. In what respect do the magnetic properties of iron and steel differ.
20. Distinguish between inductive reactance and capacitive reactance.
21. Find the peak voltage of an A.C. of 50Hz and 230V.
22. Explain the use of choke in an A.C. circuit.

**(8 × 2 = 16 Marks)**

### **SECTION – C**

*Short essay type / Problems : Answer any **SIX** questions.*

23. The fringes of equal thickness are formed when two glass plates are kept over each other with a small gap in between. If a parallel beam of light of wavelength 600 nm is used and fringe separation is 3 mm. What is the angle between the plates in seconds ?
24. The diameter of the  $m^{\text{th}}$  dark ring changes from 1.2 cm to 1 cm when the air space between the lens and the plates is replaced by a transparent liquid. Find the refractive index of the liquid.
25. A monochromatic light of wavelength 600 nm is incident on a plane transmission grating. If the first order is formed at  $18^{\circ}14'$ . Find the number of lines per meter in the grating.
26. With a diffraction grating at normal incidence, it is found that the spectral line of the second order spectrum coincides with a spectral line of third order spectrum of another wavelength. If the wavelength of the former is 600 nm, what is the wavelength of the later ?
27. A laser emits light at a wavelength of 694.3 nm and has a power output of 2 mW. How many photons are emitted in each second by this laser when operating ?

28. An optical fibre has core refractive index of 1.50 and a cladding refractive index of 1.47. Determine the critical angle at the core – cladding interface and the numerical aperture for the fibre.
29. An iron rod of diameter 0.25 cm is kept parallel to a magnetic field of intensity 3000 A/m. The rod acquires pole strength of 8Am. Calculate the magnetic susceptibility and permeability of the material of the rod.
30. A coil has a resistance of 20 Ohm and inductance 0.35 H. Compute its reactance and its impedance to an alternating current of 25 Hz.
31. A 1 MFD capacitor is in series with a 1 k Ohm resistor. At what frequency is their impedance exactly 2 k Ohm.

(6 × 4 = 24 Marks)

### SECTION – D

*Long essay type : Answer any TWO questions.*

32. State principle of superposition. Derive the expression for the diameter of  $m^{\text{th}}$  dark ring in Newton's ring experiment. Derive the expressions for wave length of light. Also derive an equation to find the refractive index of liquid.
33. Describe with theory Fresnel's diffraction at a straight edge. Show the intensity distribution.
34. What is pink ruby ? Explain the operation of Ruby laser with help of energy levels. Why the output of ruby laser is pulsed laser ?
35. Derive an expression for the current in an A.C. circuit having resistance, inductance and capacitance connected in series. Draw the frequency versus current graph and mark – 3dB points. Derive the equation for resonance frequency.

(2 × 15 = 30 Marks)

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