

**B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2024****SEMESTER 4 - COMPLEMENTARY PHYSICS FOR MATHEMATICS****COURSE : 19U4CPHY07 - OPTICS AND ELECTRICITY***(For Regular - 2022 Admission and Improvement / Supplementary - 2021/2020/2019 Admissions)*

Time : Three Hours

Max. Marks: 60

**PART A****Answer any 8 (2 marks each)**

1. What is meant by transit-time dispersion which is associated with Step index multimode fibre?
2. Explain resolving power of a grating?
3. Write down the expression for current in a series LCR circuit at resonance.
4. Explain what do you mean by diffraction of light.
5. What is meant by dispersive power of a grating?
6. Give the relation connecting electric displacement vector  $D$ , electric field  $E$  and electric polarization  $P$  for a linear medium.
7. What is step index monomode fibre?
8. Give any two examples of polar dielectrics.
9. Define time constant of R-C Circuit (associated with discharging)
10. Intensities of spectral lines with a grating are much less than those with a prism. Why?  
**(2 x 8 = 16)**

**PART B****Answer any 6 (4 marks each)**

11. A 2 micro farad capacitor is connected in series with 1 mega ohm resistor at 300 volts dc source. Determine the initial charging current and the final charge.
12. A ray of light is incident on a glass slab making an angle of 25 degrees with the surface. Calculate the angle of refraction in glass and velocity of light in the glass, if the refractive index of glass is 1.5.
13. The dielectric constant of a polymer is 10. The electric field in the dielectric is  $10^4$  V/m. Calculate the electric displacement vector and polarisation.
14. Find the polarizing angle for a ray of light incident from glass to water. Given refractive indices of glass and water as 1.55 and 1.33 respectively.
15. In a Young's double slit experiment with monochromatic light, fringes of width 0.3 mm are formed on a screen. When the screen is moved by 25 cm, fringes of width (1/3) mm are obtained. What is the wavelength of light used if the width of the slit is 5 mm?
16. A 4 micro farad condenser is connected to 240 volt DC source through a resistor of 0.25 mega ohms. Calculate the charge on the condenser at 1 sec after the application of the voltage. Also evaluate the potential difference across the condenser and value of current in the circuit at 1 sec.
17. What is the longest wave length that can be observed in third order spectrum with a grating having 6000 lines/cm. Assume normal incidence.
18. If refractive index of the core and cladding material on an optical fibre are 1.55 and 1.50 respectively, compute the NA and acceptance angle of the fibre.  
**(4 x 6 = 24)**

**PART C**

**Answer any 2 (10 marks each)**

19. Discuss in detail showing the plot of instantaneous current and voltage when an alternating voltage is applied across a capacitor.
20. Derive Gauss's law for a dielectric medium. Also arrive at the relation between electric polarisation, electric displacement and electric field.
21. Discuss the different components of laser.
22. Explain how circular Newton's rings are formed by reflected light. With necessary theory, give the experiment to determine the wavelength of a monochromatic source of light by the Newton's rings method.

**(10 x 2 = 20)**