



**Question 1 (15 marks)**

1-Discuss each of the following (use diagrams):

- a) Characteristics of a single slit diffraction pattern, (3 marks)
- b) Optical activity, (3 marks)
- c) Dispersion and attenuation in optical fibers, (3 marks)
- d) Set up of laser operation and Population inversion, (3 marks)
- e) Electric flux and Gauss's law. (3 marks)

**Question 2 (20 marks)**

- (a) Find the velocity of light in a medium having refractive index  $n=2$ . Which end of the Electromagnetic spectrum is more energetic? Why? (5 marks)
- (b) A soap bubble 250 nm thick is illuminated by white light. The index of refraction of the soap film is 1.36. Which colors appear strong in the reflected light? (5 marks)
- (c) Intensity of light through a polarizer and analyzer is maximum when their principle planes are parallel. Through what angle the analyzer must be rotated so that the intensity reduced to  $1/4$  of the maximum value. (5 marks)
- (d) Derive the formula for numerical aperture for a step index optical fiber. Calculate the acceptance angle for an optical fiber given that refractive index of core is 1.46 and refractive index of cladding is 1.45 (5 marks)

**Question 3 (15 marks)**

- (a) Two equal point charges  $3 \mu\text{C}$  are located 0.6 m apart. Find (i) the electric field intensity at midpoint of the line joining them. (ii) Sketch the electric field lines for this set of the two charges; (iii) What is the resultant force on a third charge  $-3 \mu\text{C}$  placed at midpoint between them. (8 marks)
- (b) Drive an expression for the electric field inside and outside an insulating sphere of radius  $R$  and total charge  $Q$ , Sketch the electric field intensity as a function of distance  $r$ . (7 marks)

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Good luck

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Prof. Abed Nasr

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