

1E2204	Roll No. _____	Total No of Pages: 4
	1E2204	
	B. Tech. II Sem. (Main/Back) Exam., May - 2019 PY - 101 Engineering Physics	

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks: 28

Instructions to Candidates:

Attempt any **five questions** including Question No. 1, which is compulsory. All questions carry **equal marks**. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly. Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

Q.1 Compulsory, Answer for each sub-question be given in about 25 words. [8×2=16]

- (a) When will you observe circular fringes in Michelson Interferometer?
- (b) What is phase retardation plate in polarization?
- (c) Define resolving power of an optical instrument.
- (d) What is Bragg's Law?
- (e) Write down Schrodinger's time dependent wave equation.
- (f) Define Coherence.
- (g) What is active medium in Laser?
- (h) Differentiate between photography and holography.

Q.2 (a) With schematic diagram, explain the construction and working of a Michelson's Interferometer. How will you use it to measure wavelength separation between two closely spaced spectral lines say D_1 and D_2 lines of sodium lamp? [2+2+2+2=8]

(b) Write short note on anti-reflection coating in interference. [4]

(c) When movable mirror in Michelson's interferometer is moved through a distance of 0.0589mm, a shift of 200 fringes is observed. What is wavelength of light used? [4]

Q.3 (a) What is plane transmission grating? Show that the intensity of light diffracted from a plane transmission grating is given by

$$I = I_0 \left(\frac{\sin \alpha}{\alpha} \right)^2 \left(\frac{\sin N\beta}{\sin \beta} \right)^2$$

Where the symbols have their usual meanings. [2+6=8]

(b) What is optical activity? Write the laws of optical activity of optically active solution. [2+2=4]

(c) Two crossed polaroids A and B are placed in the path of light beam. In between these a third polaroid C is placed whose plane of transmission makes an angle of 30° with the plane of transmission of the polaroid A. If the intensity of the unpolarized light incident on polaroid A is 32W/m^2 , then what will be the intensity of light emerging out of polaroid B? [4]

Q.4 (a) Based on bänd theory of solids, distinguish between conductors, semiconductors and insulators. [3]

(b) Explain Hall effect with suitable diagram. Show that the Hall coefficient R_H is given by $R_H = \frac{1}{ne}$ where n is number of charge carriers per unit volume. [3+4=7]

(c) The first order diffraction is found to occur at a glancing angle of 9° . Calculate the wavelength of X-ray and the glancing angle for second order diffraction if the spacing between the adjacent plane is 2.51\AA . [3+3=6]

Q.5 (a) What is Compton scattering? Explain why Compton effect is not observed experimentally for visible rays. http://www.rtuonline.com [2+2=4]

(b) Write down the Schrödinger's wave equation for a particle of mass m trapped in one-dimensional box of side a . Solve it for energy eigen values and eigen functions. [2+3+3=8]

(c) Show that the expectation values of position and momentum of a particle in 1-D box are $a/2$ and 0 respectively. Here a is the width of the box. [2+2=4]

Q.6 (a) What is spectral purity? Derive an expression for coherence length and coherence time in term of wavelength and frequency. [2+4=6]

- (b) How does an optical fibre function in transporting electromagnetic energy? Show that the numerical aperture of a step index fibre is given by -

$$NA = n_1 \sqrt{2\Delta}$$

Where the symbols have their usual meanings.

[2+4=6]

- (c) Calculate the numerical aperture and acceptance angle of optical fibre of refractive indices for core and cladding as 1.62 and 1.52 respectively.

[2+2=4]

- Q.7 (a) What is meant by holography? Discuss construction and reproduction of hologram with suitable diagrams.

[2+3+3=8]

- (b) With a suitable diagram explain the construction and working of a semiconductor laser.

[4+4=8]

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Page 4 of 4

[1E2204]