1E2204

Roll No. _____ Total No of Pages: 3

1E2204

B. Tech. I Sem. (Main) Exam., Dec. - 2017

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) What are coherent sources? How are they obtained in practice?

(b) On what factors does the dispersive power of a grating depend?

(c) What is the optic axis and the principle section of a crystal?

(d) Discuss the attenuation and dispersion of signals in optical fibre.

(e) What are the differences between spontaneous and stimulated emission?

(f) What do you understand by wave function?

(g) What is Laser? Explain its principle?

(h) Explain origin of bands in solids.

Q.2 (a) With schematic diagram, explain the working of a Michelson's Interferometer. Obtain the expression for radii of circular interference fringes. How shall you use to measure wavelength separation between two closed spaced spectral line? [8]

(b) Give a brief account of Interference filters. [4]

(c) It is required to make on antireflection coating for light of wavelength 6000 $\mathring{A}$. If a thin film of $\mu = 1.25$ is to be coated on a glass plate of $\mu = 1.50$, what will be the minimum thickness of the film for normal incidence? [4]

Q.3 (a) Derive an expression for the intensity distribution due Fraunhofer diffraction at a single slit and show that the intensity of the first subsidiary maxima is about 4.5% of that of principle maxima. [8]

(b) What is half wave plate? What is its role in Laurent's half shade device? What are the requirements to be used in the above experiment? [4]

(c) Calculate the least width of a grating having 800 lines per cm to resolve the Sodium D – lines of wavelength $\lambda_1 = 5890\,\mathring{A}$ and $\lambda_2 = 5896\,\mathring{A}$ [4]

Q.4 (a) How does monochromaticity relates to temporal coherence? Define Q factor for a spectral line. [4]

(b) Explain how light is propagated in a variable index fibre. Define numerical aperture and acceptance angle. Derive expressions for the same. [6]

(c) An optical fiber has a line width of 1.5 nm and mean wavelength 550 nm with white light incident on the filter. Calculate: [6]

(i) Coherence length

(ii) Number of wavelengths in wave train.

Q.5 (a) What are the basic requirements of a semiconductor laser? Draw its labelled diagram and explain its working with necessary theory. Write down the applications of semiconductor laser. [10]

(b) What is holographic microscopy? With illustrative diagram show outlay of a holographic interferometer and explain its working. [6]

Q.6 (a) Explain the terms, mobility charge carriers and Hall Effect. Obtain the expression of Hall coefficient in terms of current density and electronic charge. [8]

(b) What are the differences between intrinsic and extrinsic semiconductors? Discuss the conduction mechanism through them. [4]

(c) In Bragg's reflection of X – rays, a reflection was found at the glancing angle of 30° with lattice planes of spacing 1.87 A°. If this is a second order reflection, then calculate the wavelength of x – rays. [4]

Q.7 (a) Derive Schrödinger's time dependent equation. Explain the following: [12]

(i) Hamiltonian,

(ii) Physical significance of wave function, and

(iii) Normalized and orthogonal wave functions.

(b) x – rays with $\lambda = 1\,\mathring{A}$ are scattered from a carbon block. The scattered radiation is viewed at 90° to the incident beam. [4]

(i) What is the Compton shift $\Delta\lambda$?

(ii) What kinetic energy is imparted to the recoil electron?
