

1E2204

Roll No. \_\_\_\_\_

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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. NIL2. 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  $6000 \text{ \AA}$ . 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  $\lambda_1 = 5890 \text{ \AA}$  and  $\lambda_2 = 5896 \text{ \AA}$  [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]
- Coherence length
  - 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  $30^\circ$  with lattice planes of spacing  $1.87 \text{ \AA}$ . 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]
- Hamiltonian,
  - Physical significance of wave function, and
  - Normalized and orthogonal wave functions.
- (b) x – rays with  $\lambda = 1 \text{ \AA}$  are scattered from a carbon block. The scattered radiation is viewed at  $90^\circ$  to the incident beam. [4]
- What is the Compton shift  $\Delta\lambda$ ?
  - What kinetic energy is imparted to the recoil electron?