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TPH–102

B. TECH. (FIRST SEMESTER)
END SEMESTER EXAMINATION, 2018
(ALL BRANCHES)
ENGINEERING PHYSICS

Time : Three Hours

Maximum Marks : 100

Note : (i) All questions are compulsory.

(ii) Instructions on how to attempt a question are mentioned against it.

(iii) Total marks assigned to each question are **twenty**.

1. Attempt any *two* questions of choice from (a), (b) and (c). (10×2=20 Marks)

(a) What are the coherent sources ? Explain Fresnel Biprism experiment with diagram. Derive the expression for wavelength of monochromatic light.

(b) Light contracting two wavelength λ_1 and λ_2 fall normally on a plano-convex lens of radius of curvature R resting on a glass

plate. If the nth dark ring due to due to λ_1 coincide with the $(n+1)$ th dark rings due to λ_2 prove that the radius of the nth dark rings λ_1 is :

$$\sqrt{\frac{\lambda_1 \lambda_2 R}{(\lambda_1 - \lambda_2)}}$$

(c) Describe Fraunhofer diffraction due to single slit. Show that the relative intensities of successive maxima are near 1 : 1/22 : 1/61 : 1 : 121 ..... etc. or 1 : 4/9 π^2 : 4/25 π^2 : 4/49 π^2 ..... etc.

2. Attempt any *two* questions of choice from (a), (b) and (c). (10×2=20 Marks)

(a) Write short notes on the following :

(i) Spontaneous emission

(ii) Stimulated emission

(iii) Population inversion

(iv) Pumping

(b) Calculate the thickness of Crystal (half and full wave plate) if refraction indices for *o* and *e* rays are 1.5442 and 1.5441 respectively. The wavelength of incident rays in 5890 Å.

(c) What are Einstein's A and B coefficients ? Derive a relation between them.

3. Attempt any *two* questions of choice from (a), (b) and (c). (10×2=20 Marks)

(a) Derive both time dependent and time independent Schrodinger wave equation for non-relativistic particles.

(b) There are 2.0×10^{28} free electrons per cubic meter of sodium. Calculate the Fermi energy and Fermi velocity.

(c) What is free electron theory of metals ? Derive an expression for conductivity of metals on the basis Lorentz-Drude theory.

4. Attempt any *two* questions of choice from (a), (b) and (c). (10×2=20 Marks)

(a) Derive an expression for the carrier concentration in an extrinsic semiconductor. What would be the position of Fermi level ? Explain.

(b) For an intrinsic semiconductor having band gap $E_g = 0.7$ eV, calculate the density of holes and electrons at room temperature.

(c) Based on band theory of solids, distinguish between conductors, semiconductors and insulator.

5. Attempt any *two* questions of choice from (a), (b) and (c). (10×2=20 Marks)

(a) What is the nanotechnology ? Discuss the application of nanotechnology in the various fields.

(b) Define and prove that effective mas of an electron $m^* = \frac{h^2}{4\pi^2 d^2 \, E/dK^2}$.

(c) What are Brillouin zones ? Explain using E-K diagrams.

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