11502

Roll No. _____ Total No of Pages: 4

11502

B. Tech. I - Sem. (Main) Exam., Dec. - 2018

BSC

1FY2 – 02 Engineering Physics

Time: 3 Hours **Maximum Marks: 160**

Instructions to Candidates:

Part – A: Short answer questions (up to 25 words) 10 × 3 marks = 30 marks. All ten questions are compulsory.

Part – B: Analytical/Problem solving questions 5 × 10 marks = 50 marks. Candidates have to answer five questions out of seven.

Part – C: Descriptive/Analytical/Problem Solving questions 4 ×20 marks = 80 marks. Candidates have to answer four questions out of five.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may 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

PART - A

Q.1 Explain, why the surface of a soap bubble illuminated with white light exhibits many colours? [3]

Q.2 Explain, Rayleigh criterion of resolving power. [3]

Q.3 Explain, the physical significance of wave function φ [3]

Q.4 What do you mean by coherence of light? [3]

Q.5 What do you mean by Numerical Aperture of an optical fiber? [3]

Q.6 What are active medium, population inversion and pumping in reference to laser action? [3]

Q.7 Describe in brief the formation of energy bands in solids. [3]

Q.8 What are "Hall effect" and "Hall field"? [3]

Q.9 Explain the displacement current. [3]

Q.10 What do you mean by divergence and curl in reference to the static fields? [3]

PART – B

Q.1 Prove that the square of diameter of black fringe is proportional to the natural number in case of newton's rings. Why do we obtain a dark center at the newton's rings? [7+3=10]

Q.2 A grating is made of 200 wires per cm placed at equal distance apart. The diameter of each wire is 0.025 mm. Calculate the angle of diffraction for third order spectrum if the wavelength of light used is 6000 A°. Also find the absent spectra, if any. [7+3=10]

Q.3 The wave function of a particle in the ground state in one dimensional box of length L is given by $\varphi = \sqrt{\frac{2}{L}} \sin \frac{\pi x}{L}$. Calculate probability of finding the particle within an interval of 1A° at the center of the box of length L=10A° [10]

Q.4 In Michelson interferometer experiment with He-Ne laser of wavelength $\lambda = 11.5\times10^{-7}$ m., fringes are visible up to path difference spread 8 m. Determine the lower limits of the followings: [2+2+2+2+2=10]

(i) Coherence length

(ii) Coherence time

(iii) Spectral line width

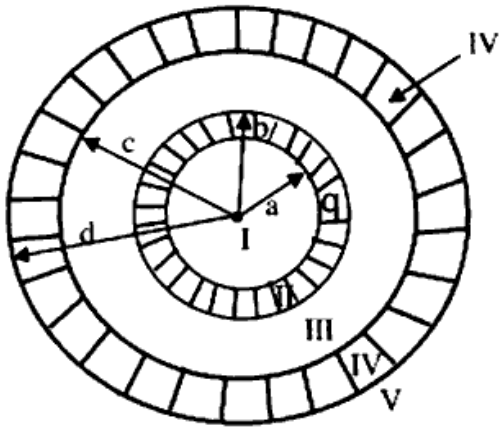
(iv) Quality factor and

(v) Band width.

Q.5 What are the essential requirements for laser action? Derive the relation for Einstein's coefficients "A" and "B", when stimulated emission dominates on the other process. [3+7=10]

Q.6 Explain the term 'mobility of charge carriers' and determine the current density in the sample of n-type semiconductor whose Hall coefficient is = 0.0125 m^3C^{-1} and an electric field of 100 V/m is applied on it (assume $\mu_n = 0.36\ m^2v^{-1}s^{-1}$). [3+7=10]

Q.7 Consider two concentric uniformly charged spherical shell with inner and outer radii 'a', 'b', 'c' and 'd' as shown in the following figure. Both the shells carry equal amount of positive charge Q. Find the electric field in different regions. [10]



PART – C

Q.1 Describe the principle, construction, theory and working of Michelson interferometer to determine the wavelength and difference in the wavelength of a given light. [2+4+5+5+4=20]

Q.2 Derive Schrodinger equation for a particle trapped in an infinitely deep cubical potential well of side 'a'. Derive an expression for its energy eigen values. What is degeneracy of second excited state? What shall happen to above degeneracy if the well is a rectangular parallelepiped with sides $a=b \neq c$? [12+4+4=20]

Q.3 Discuss with suitable and neat diagrams the principle, construction and working of Helium-Neon laser. Describe the various applications of lasers in engineering and medical sciences. [4+5+5+6=20]

Q.4 Derive an expression for the electrical conductivity of an intrinsic semiconductor. Why the electrical conductivity of an intrinsic semiconductor does increases with rise in temperature? Mention a device where this property is used. [12+6+2=20]

Q.5 What are Maxwell's equations? Derive differential form of Maxwell's equations. Discuss integral of the above equations. What are the significance of these equations to electricity and magnetism? [4+8+4+4=20]
