DEPARTMENT OF HUMANITIES & APPLIED SCIENCES

I Year II SEMESTER

1FY1-02/2FY2-02: ENGINEERING PHYSICS

Assignment Carries 10 Marks

UNIT-01/ASSIGNMENT-I

Q.No.	Question	CO	BLT
1	Derive the following expressions for plane transmission grating (i) $I = I_0 \left(\frac{\sin\alpha}{\alpha}\right)^2 \left(\frac{\sin N\beta}{\sin\beta}\right)^2$ (ii) Angular width of nth principal maxima, $2d\theta_n = 2\frac{Tan\theta_n}{nN}$	1	05
2	Show that the relative intensities of successive maxima of Fraunhofer's diffraction at a single slit are $1 : \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2} \ldots \ldots \ldots \ldots$	1	04
3	Light containing of 2 wavelengths λ_1 & λ_2 falls normally on the planoconvex lens of radius of curvature R resting on a glass plate. If the nth dark ring due to λ_1 coincides with (n+1)th dark ring due to λ_2 , then prove that the radius of nth dark ring of λ_1 is given by $r_n = \sqrt{\frac{\lambda_1 \lambda_2 R}{\lambda_1 - \lambda_2}}$	1	04
4	Diffraction grating is just able to resolve lines of $\lambda =$ 5140.34 Å and 5140.85 Å in the first order will it resolve the lines 8037.50 Å and 8037.20 Å *in second order* ?	1	03
5	In Bragg's reflection of X-rays, a reflection was found at the glancing angle of 30^0 with lattice plane of spacing 1.87 Å. If this is a 2nd order reflection then calculate the wavelength of X-rays.	1	03

*BLT: BLT shows the **Bloom's taxonomy** levels

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Assignment Carries 10 Marks

UNIT-02/ASSIGNMENT-II

Q.No.	Question	CO	BLT
1	Write down the Schrödinger's time independent wave equation for a free particle confined in one- dimensional box of size a. Obtain eigen values and normalized wave functions for this particle.	2	01
2	Derive Eigen Energy operator and Eigen Momentum operator for a particle trapped in one dimensional box hence derive Schrodinger's time dependent wave equation.	2	01
3	Answer the following questions with respect to a particle in a cubical box of side 'a'. (i) Is $n_x = n_y = n_z = 1$ State degenerate. (ii)What is the order of degeneracy for $n_x + n_y + n_z = 4$ (iii)What shall happen to the degeneracies for $n_x + n_y + n_z = 4$ if the box is not cubical but rectangular parallelepiped with side a, b and c such that $a = b \neq c$?	2	03
4	An electron is trapped in infinitely deep cubical potential well of width 1 Å. What is its first excitation energy? (Given me = 9.1 x 10-31 kg, h = 6.62 × 10-34 Js)	2	03
5	Write short note on following: - (i)Concept of degeneracy (ii) Free particle in 3-D box (iii) Normalization & orthogonal conditions (iv) Physical significance of wave function	2	04

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1FY1-02/2FY2-02: ENGINEERING PHYSICS

Each Assignment Carry 10 Marks

UNIT-03/ASSIGNMENT-III

Q.No.	Question	CO	BLT
1	Show that the numerical aperture of a step index fibre is given by NA = $n_1\sqrt{2\Delta}$, where symbols have the usual meanings.	3	03
2	What is Coherence? Explain temporal and spatial coherence. For the source to be spatial Coherent, find the condition for its size.	3	02
3	What is spectral purity? Derive an expression for coherence length and coherence time in terms of wavelength and frequency.	3	04
4	The core of fibre has $n_1 = 1.5$ with cladding to give fractional index change 0.0005. Find: (a) The refractive index of cladding (n_2) (b) The critical angle (θ_c) (c) Acceptance angle (θ_a), and (d) Numerical aperture (N.A.)	3	05
5	Calculate the refractive indices of core and cladding materials of an optical fibre if its numerical aperture is 0.22 and relative refractive index difference is 0.012.	3	05

UNIT-04/ASSIGNMENT-IV

Q.No.	Question	CO	BLT
1	Derive the relation between Einstein's coefficients and discussed the results.	4	02
2	In He-Ne laser what is the function of He atoms? Explain the answer with the help of energy level diagram for He-Ne. Describe the working of a He-Ne laser with a neat sketch.	4	04
3	Give the reason for the following properties of a LASER: (a) High intensity (b) High directionality	4	05
4	What is an optical fibre? What do you mean by numerical aperture of an optical fibre. Find an expression for N.A. of a step index fibre.	4	03
5	Write short note on following: - (a) Absorption (b) Spontaneous & Stimulated emission (c) Population inversion (d) Metastable State (e) Pumping	4	06

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I Year II SEMESTER

1FY1-02/2FY2-02: ENGINEERING PHYSICS

Assignment Carries 10 Marks

UNIT-05/ASSIGNMENT-V

Q.No.	Question	CO	BLT
1	Explain the Hall effect with a suitable diagram. Show that the Hall coefficient R_H is given by $R_H = \frac{-1}{ne}$ when n is number of charge carriers per unit volume.	5	03
2	Describe the formation of energy bands in solids and hence explain how it helps to classify the materials into conductors, semiconductors and insulators.	5	04
3	What is the difference between intrinsic and extrinsic semiconductors. Discuss the conduction mechanism through them.	5	03
4	Find the electrical conductivity and resistivity for a semiconductor and also find the expression of conductivity and resistivity on the basis of temperature.	5	03
5	The energy gap of 2 intrinsic semiconductor A & B is 0.36eV and 0.72eV respectively. Compare the intrinsic career density of A & B at 300 K. (Given $m_h = m_e \times 9 \times 10^{-31}$ kg, 2kT = 0.0520 eV)	5	05

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Assignment Carries 10 Marks

UNIT-06/ASSIGNMENT-VI

Q.No.	Question	CO	BLT
1	Derive Maxwell's equation in integral and differential form. Discuss the physical significance of these equations.	6	04
2	Derive the Poynting's theorem and give an interpretation of each term.	6	04
3	Prove that: (a) grad(1/r) = $-\frac{\vec{r}}{r^3}$ (b) $\nabla(\ln r) = \frac{\vec{r}}{r^2}$ (c) Div ($\vec{r}$) = 3 (d) Div $\frac{\vec{r}}{r^3} = 0$ (e) Div Curl $\vec{A}$ = 0 (f) Curl $\vec{r}$ = 0 (g) Div ($\vec{A} \times \vec{r}$) = 0	6	03
4	Derive Poisson's and Laplace equations for electrostatic potentials. And define the Laplacian operator.	6	06
5	(a) Write the integral form of Gauss's divergence and Stoke's curl theorem. (b) Define displacement current. (c) Define divergence and its physical significance.	6	04

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