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B. TECH.
(SEM I) THEORY EXAMINATION 2020-21
ENGINEERING PHYSICS-I

Time: 3 Hours**Total Marks: 100****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

- 1. Attempt all questions in brief. 2 x10 = 20**
- a. What are massless particles?
 - b. Is earth an inertial frame? Explain.
 - c. What do you mean by group velocity?
 - d. Give the statement of Heisenberg's uncertainty of principle.
 - e. Show that probability at the center of the 1-D potential box is minimum for first excited state.
 - f. What happen to diameter of Newton's ring, if a liquid of refractive index of μ is inserted between plano-convex lens and plane glass plate?
 - g. What do you mean by dispersive power of grating?
 - h. Define the phenomena of double refraction?
 - i. Define stimulated emission of radiation between two energy levels.
 - j. Give few important applications of laser.

SECTION B

- 2. Attempt any three of the following: 10 x 3 = 30**
- a. What was the objective of conducting the Michelson-Morley experiment? Describe the experiment. How is the negative result of the experiment interpreted?
 - b. What is the aim of Davisson-Germer experiment? Describe the experiment with conclusion in detail.
 - c. Derive the expression of the diameter for bright ring in Newton's ring experiment. How can this experiment be used to find out the wavelength of unknown light?
 - d. Describe the method to produce and detect plane, circularly and elliptically polarized light.
 - e. What do you mean by Laser? Explain its principle. Write down the conditions for production of laser beam in case of three level laser system?

SECTION C

- 3. Attempt any two parts of the following: 5 x 2 = 10**
- (a) Show that the circle, $x^2+y^2=a^2$ in frame S appears to be an ellipse in frame S', which is moving with relative to S.
 - (b) Derive Einstein's mass energy relation and give its experimental evidence.
 - (c) What is proper time? Derive an expression for time dilation.

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4. Attempt any *two* parts of the following: 5 x 2 = 10
- (a) Discuss in brief the dual nature of matter and waves. Deduce an expression for de-Broglie wavelength of helium atom having energy at temperature T K.
- (b) Prove that $v_p \times v_g = c^2$.
- (c) Calculate the energy difference between the first excited state and third excited state for an electron in a one-dimensional rigid box of length 10^{-8} cm.
5. Attempt any *two* parts of the following: 5 x 2 = 10
- (a) Two plane glass surfaces in contact along one edge are separated at opposite edge by a thin wire, If 20 interference fringes are observed between these edges in sodium light of wavelength 5890 \AA of normal incidence, find the diameter of wire.
- (b) Obtain the intensity expression of single slit diffraction pattern.
- (c) What do you mean by resolving power of grating? Derive the expression for it.
6. Attempt any *two* parts of the following: 5 x 2 = 10
- (a) Describe working of Ruby Laser.
- (b) A core diameter of multimode fibre is 70 \mu m and relative refractive index difference is of 1.5%, it operates at a wavelength 0.85 \mu m , if refractive index of core is 1.46 calculate (1) Refractive index of cladding. (2) Normalized frequency (3) Number of guided modes. Describe the construction and reconstruction of image on hologram? Also describe the
- (c) application of holography?
7. Attempt any *two* parts of the following: 5 x 2 = 10
- (a) How much does a proton gain in mass when accelerated to kinetic energy of 500 MeV?
- (b) Describe how a Nicol prism can be used as polarizer and analyzer.
- (c) Derive Schrodinger's time dependent equation for Matter waves.

Physical Constants

Rest mass of electron	m_0	$= 9.1 \times 10^{-31} \text{ kg}$
Rest mass of Proton	m_p	$= 1.67 \times 10^{-27} \text{ kg}$
Speed of light	c	$= 3 \times 10^8 \text{ m/s}$
Planck Constant	h	$= 6.63 \times 10^{-34} \text{ J-s}$
Charge on electron	e	$= 1.6 \times 10^{-19} \text{ C}$
Boltzmann Constant	k	$= 1.38 \times 10^{-23} \text{ J K}^{-1}$