

B. TECH.
(SEM-I) THEORY EXAMINATION 2019-20
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.

2x10=20

- a. Define inertial and non inertial frames of reference.
- b. Explain the concept of time dilation.
- c. Explain the conditions to obtain sustained interference.
- d. Two independent sources cannot produce interference, why?
- e. What do you mean by diffraction of light?
- f. What do you understand by optic axis?
- g. Distinguish between spontaneous and stimulated emission of radiation.
- h. Write down applications of Laser.
- i. What are the components of an optical fibre?
- j. What is a hologram?

SECTION-B

2. Attempt any *three* of the following:

10x3=30

- a. What do you understand by length contraction? Calculate the percentage contraction and orientation of a rod moving with the velocity of $0.8c$ in a direction inclined at 60° to its own length.
- b. What is missing order in N-slit arrangement? Light of wavelength 5500\AA falls normally on a slit of width 22.0×10^{-5} cm. Calculate the angular position of two minima on either side of central maxima.
- c. How can the refractive index of liquid be determined by using Newton's ring experiment? Newton's rings are observed normally in reflected light of wavelength 6000\AA . The diameter of the 10^{th} dark ring is 0.50 cm. Find the radius of curvature of the lens and the thickness of the film.
- d. What is quarter wave plate? Calculate the thickness of a doubly refracting plate capable of producing a path difference of $\frac{\lambda}{4}$ between ordinary and extra-ordinary rays with light of wavelength 5890\AA . The refractive indices of ordinary and extra-ordinary rays are 1.53 and 1.54 respectively.
- e. What is numerical aperture of a fibre? Calculate the numerical aperture, acceptance angle and critical angle of the optical fibre if the refractive index of the core is 1.50 and the refractive index of the cladding is 1.45.

SECTION-C

3. Attempt any *one* part of the following:

10 x 1 = 10

- a. What are the postulates of special theory of relativity and hence derive Lorentz transformation equations?
- b. Derive Einstein's mass - energy relation. Give some evidence showing its validity.

4. Attempt any *one* part of the following:

10 x 1 = 10

- a. Discuss the interference pattern in thin films due to reflected and transmitted monochromatic light.
- b. Explain the Fraunhofer's diffraction of light from a single slit and hence show that the ratio of intensities of successive maxima are $1: \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2} : \dots \dots \dots$

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5. Attempt any one part of the following:**10 x 1 = 10**

- a. Define resolving power and dispersive power of grating. Derive an expression for the resolving power of a plane transmission grating.
- b. What are Einstein's coefficients? Derive Einstein's relation.

6. Attempt any one part of the following:**10 x 1 = 10**

- a. What is double refraction? Explain the construction and working of Nicol prism.
- b. Explain why two level laser systems does not have any physical significance? Describe the principle and working of three-level and four-level laser systems.

7. Attempt any one part of the following:**10 x 1 = 10**

- a. Explain the basic principle of optical fibre. Discuss the optical fibre classification.
- b. What is basic principle of holography? Describe the principle of holography using the processes of construction and reconstruction of image. Give some applications also.

Physical Constants

Rest mass of electron	m_e	$= 9.1 \times 10^{-31} \text{ kg}$
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's Constant	h	$= 6.63 \times 10^{-34} \text{ J-s}$
Charge on electron	e	$= 1.6 \times 10^{-19} \text{ C}$
Boltzmann's Constant	k	$= 1.38 \times 10^{-23} \text{ J-K}^{-1}$