

B. TECH.
(SEM I) THEORY EXAMINATION 2022-23
ENGINEERING PHYSICS-I

Time: 3 Hours**Total Marks: 70****Note:** Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief. 2 x 7 = 14

- a) Is earth an inertial or non-inertial frame of reference? Explain briefly.
- b) What do you understand by time dilation?
- c) What is Bohr's quantization rule?
- d) What is the Heisenberg uncertainty principle?
- e) What do you understand by coherent sources?
- f) Define spontaneous and stimulated emissions.
- g) Differentiate between single and multi-mode optical fibers.

SECTION B

2. Attempt any three of the following: 7 x 3 = 21

- a) Show that $E^2 = m_0^2 c^4 + p^2 c^2$ where symbols have their usual meanings.
- b) Calculate the de-Broglie wavelength of an α -particle accelerated through a potential difference of 200 volts.
- c) Monochromatic light from a He-Ne laser ($\lambda = 6328 \text{ \AA}$) is incident normally on a diffraction grating 6000 lines/cm. Find the angles at which one would observe the first and second-order maxima.
- d) A quarter wave plate is meant for wavelength $5893 \text{ \AA}$. Calculate the phase retardation that the plate will show for wavelength $4358 \text{ \AA}$.
- e) The fraction change of refractive index between the core material and the cladding material of a fiber is 1%. If the refractive index of the core material is 1.46, calculate the numerical aperture and acceptance angle.

SECTION C

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

- a) What is the variation of mass with velocity? Derive a suitable expression for it.
- b) Derive the expression for the relativistic addition of velocities.

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

- a) What are the assumptions of quantum mechanics? Derive the Wein's law with the help of Planck's radiation law.
- b) What was the objective of conducting the Davisson-Germer experiment? Describe the

experiment and prove that electrons possess a wave nature.

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

7 x 1 = 7

- a) Discuss the phenomenon of interference of light due to thin films and find the conditions of maxima and minima in reflected monochromatic light.
- b) Obtain the expression for the intensity distribution due to Fraunhofer's diffraction at a single slit.

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

7 x 1 = 7

- a) Describe the construction and working of a Nicol prism. Explain how it can be used as a polarizer and analyzer.
- b) Draw a neat diagram of ruby laser. Describe its construction and working. What are the disadvantages of ruby laser?

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

7 x 1 = 7

- a) What do you understand by an optical fiber? Derive the suitable expression for numerical aperture and acceptance angle.
- b) Discuss the construction and reconstruction of an image on a hologram.

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