PAPER ID-311249

Subject Code: RAS101

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM I) THEORY EXAMINATION 2023-24
ENGINEERING PHYSICS-I

TIME: 3HRS **M.MARKS: 70**

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

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

a.	What was the objective of conducting Michelson- Morley experiment?
b.	State two difference between matter waves and electromagnetic waves.
c.	Discuss the effect of making slit narrower on the diffraction pattern due to single slit.
d.	What do you mean by phase retardation?
e.	What are the necessary condition to achieve laser action?
f.	Give the relation between numerical aperture and acceptance angle.
g.	Give at least two applications of holography in medical field.

SECTION B

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

a.	Deduce Einstein's mass- energy relation, $E= mc^2$ and discuss it. Give some evidence showing its validity.
b.	State and explain Heisenberg's uncertainty principle? Using this principal show, that electron cannot reside in an atomic nucleus.
c.	Explain the phenomenon of interference in thin films due to reflected light.
d.	Explain the phenomenon of double refraction in a calcite crystal. Describe the construction, working and use of Nicol prism.
e.	Explain the principle of holography using the construction and reconstruction of image.

SECTION C

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

(a)	Derive Lorentz transformation and use them to find out the expression for length contraction.
(b)	What do you understand by time dilation? Calculate the amount of work to be done to increase the speed of an electron from 0.6 *c* to 0.8 *c*. Given that rest energy of electron = 0.5 MeV.

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

(a)	State characteristics of wave function. Derive time independent Schrodinger wave equation for a particle. What happens if the particle is free?
(b)	What are the main conclusions of Davisson-Germer experiment? Calculate the energy difference between ground state and the first excited state for an electron in a one- dimensional rigid box of length 10^{-8} cm. (mass of electron = 9.1 *10^{-31} kg and h = 6.626 * 10^{-34} joule-sec)

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

(a)	Derive an expression for the intensity distribution due to Frauhoffer diffraction at a single slit.
(b)	What do you mean by resolving power of an optical instrument? Light of wavelength 6000 Å falls normally on a thin wedge-shaped film of refractive index 1.4 forming fringes that are 2.0 mm apart. Find the angle of wedge in seconds.

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

(a)	Discuss the construction and working of a Ruby laser, explaining the principle of population inversion.
(b)	What are Einstein's Coefficients? Obtain a relation between them.

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

(a)	Explain acceptance angle and acceptance cone of an optical fibre. What do you mean by numerical aperture? Derive expressions for them.
(b)	Compute the cut-off parameter and the number of modes supported by a fibre μ_1 =1.54 and μ_2 =1.5; core radius 25μm, and operating wavelength is 1300 nm.