PAPER ID-411328

Subject Code: KAS101

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

BTECH
(SEM I) THEORY EXAMINATION 2021-22
PHYSICS

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 x 10 = 20**

Qno.	Question	Marks	CO
a.	What is inertial and non-inertial frame of references?	2	1
b.	Show that the massless particle can exist only if they move with the speed of light and their energy E and momentum p must have the relation E= pc.	2	1
c.	Write Maxwell's equations in non-conducting medium.	2	2
d.	Define skin depth.	2	2
e.	Distinguish electromagnetic waves and matter waves?	2	3
f.	What is de-Broglie hypothesis?	2	3
g.	What are coherent sources?	2	4
h.	State Rayleigh's criterion of resolution.	2	4
i.	Explain the propagation mechanism of optical fiber.	2	5
j.	What are the main components of laser?	2	5

SECTION B

2. Attempt any *three* of the following:

Qno.	Question	Marks	CO
a.	What is length contraction? Derive the necessary expression for it. Show that $x^2+y^2+z^2- c^2t^2$ is invariant. under Lorentz transformation.	10	1
b.	Show that the radiation pressure exerted by an electromagnetic wave is equal to the energy density. For a medium, conductivity $\sigma = 58 \times 10^6$ seimen/m, ϵ_r =1. Find out the conduction and displacement current densities if the magnitude of electric field intensity is given by E = 150 sin (10^{10} t) Volt/m.	10	2
c.	Define wave function with its physical significance. Derive Schrodinger's time independent wave equation.	10	3
d.	Prove that reflection and transmission are complimentary in thin film interference.	10	4
e.	Develop the expressions for acceptance angle and numerical aperture of an optical fiber. A step index fiber has core refractive index 1.466, cladding refractive index 1.46. If the operating wavelength of the rays is 0.85 μm, calculate the cut – off parameter and the number of modes, which the fibre will support. The diameter of the core = 50 μm.	10	5

SECTION C

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

Qno.	Question	Marks	CO
a.	By using Lorentz transformation equations, derive time dilation. Show that time dilation is a real effect.	10	1
b.	Derive Einstein's mass-energy relation Calculate the amount of work to be done to increase the speed of an electron from 0.6C to 0.8C. Given that the rest mass energy of electron= 0.5 MeV.	10	1

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

Qno.	Question	Marks	CO
a.	Derive the Poynting or work-energy theorem for the flow of energy in an electromagnetic field. Also give the physical interpretation.	10	2
b.	With the help of Maxwell's equations for free space, derive electromagnetic wave equation in free space and prove that electromagnetic waves are transverse in nature.	10	2

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

Qno.	Question	Marks	CO
a.	Solve Schrodinger's wave equation for a particle in one dimensional infinite potential box. Compute the energy difference between the ground state & the first excited state for an electron in a one-dimensional rigid box of length 100 A°.	10	3
b.	Define Compton effect and apply it to find an expression for the Compton shift ($\Delta\lambda$).	10	3

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

Qno.	Question	Marks	CO
a.	Explain and describe the formation of Newton's rings in reflected light. Solve it for reflected light to prove that the diameters of dark rings are proportional to the square roots of natural numbers. Light of wavelength 6000 A^0 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.	10	4
b.	Discuss single slit Fraunhofer's diffraction and make use to show that the relative intensities of successive maximum are nearly 1: 1/22 : 1/62 : 1/121:....	10	4

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

Qno.	Question	Marks	CO
a.	With the help of diagram, classify and describe various types of optical fibers based on modes and core refractive index.	10	5
b.	With the help of diagram describe the process of spontaneous and stimulated emission of radiation. Also obtain an expression for Einstein's coefficients of spontaneous and stimulated emission of radiation. Analyze the value of population of two states in He-Ne laser that produces light of wavelength 6000 Å at 27°C.	10	5