Subject Code: KAS101

PAPER ID-311408

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

BTECH
(SEM I) THEORY EXAMINATION 2024-25
PHYSICS

TIME: 3 HRS **M.MARKS: 100**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Q no.	Question	CO	Level
a.	What is a frame of reference in physics, and why is it important?	1	K1
b.	What is the first postulate of special relativity?	1	K1
c.	What is the physical significance of the continuity equation for current density?	2	K1
d.	What is displacement current, and why is it necessary for Maxwell's equations?	2	K1
e.	What is Stefan's Law, and what physical phenomenon does it describe?	3	K1
f.	What is the Rayleigh-Jeans law?	3	K1
g.	What are coherent sources?	4	K1
h.	What is the principle of interference in a uniform thin film?	4	K1
i.	What are the main components of an optical fiber?	5	K1
j.	What happens if the incident angle of light exceeds the acceptance angle?	5	K1

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

Q no.	Question	CO	Level
a.	What is the Galilean transformation, and how is it used to convert between different inertial frames of reference? Explain briefly.	1	K1
b.	What is skin depth, and how does it affect the distribution of current in a conductor carrying alternating current (AC)? Explain briefly.	2	K1
c.	What is a black body, and why is it considered an ideal emitter of radiation?	3	K1
d.	A diffraction grating has 500 lines per mm. If light of wavelength 600 nm is incident on the grating, what is the angle for the first-order (m=1) diffraction maximum?	4	K3
e.	What is a Helium-Neon (He-Ne) laser, and how does it work? Explain briefly	5	K2

SECTION C

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

Q no.	Question	CO	Level
a.	How did the Michelson-Morley experiment attempt to detect the ether, and what was the expected outcome? Explain briefly.	1	K2
b.	Suppose a spaceship is traveling at a speed of 0.8c (80% of the speed of light) relative to an observer on Earth. The proper length of the spaceship (the length in the spaceship's rest frame) is 100 meters. What is the length of the spaceship as observed by the person on Earth?	1	K3

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

Q no.	Question	CO	Level
a.	How would the behavior of the magnetic field change if we did not include the displacement current in regions with time-varying electric fields?	2	K2
b.	What are Maxwell's equations in vacuum, and how do they describe the behavior of electric and magnetic fields in free space?	2	K1

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

Q no.	Question	CO	Level
a.	What is Planck's law? How does Planck's law explain blackbody radiation?	3	K2
b.	A photon has an energy of $E=5.0\times10^{-19}$ J. What is the wavelength of the photon?	3	K3

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

Q no.	Question	CO	Level
a.	What are Newton's Rings, and how are they formed? Why are the ring's circular, and what determines their radius?	4	K2
b.	What is Fraunhofer diffraction, and how does it differ from Fresnel diffraction? Derive the condition for the first minima in the diffraction pattern of a single slit.	4	K2

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

Q no.	Question	CO	Level
a.	Given that the refractive index of the core (n_{core}) is 1.52 and the refractive index of the cladding ($n_{cladding}$) is 1.48, calculate the numerical aperture of the optical fiber.	5	K3
b.	What is attenuation in optical fibers, and why is it important to minimize it? Explain in detail.	5	K2