PAPER ID-421047

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

BTECH
(SEM II) THEORY EXAMINATION 2021-22
ENGINEERING PHYSICS

Time: 3 Hours ***Total Marks: 100***

Notes:

- *Attempt all Sections and assume any missing data.*
- *Appropriate marks are allotted to each question, answer accordingly.*

SECTION-A	Attempt **All** of the following Questions in brief	Marks**(10X2=20)**	
Q1(a)	What is frame of reference in motion?		1
Q1(b)	Show that massless particles can exist only if the they move with the speed of light and their energy E and momentum p must have the relation E= pc.		1
Q1(c)	In an electromagnetic wave, the electric and magnetic fields are 100V/m and 0.265A/m. What is the maximum energy flow		2
Q1(d)	Define the concept of Skin depth for high and low frequency waveforms.		2
Q1(e)	What is Compton effect and Compton shift?		3
Q1(f)	Why is black the best emitter?		3
Q1(g)	Why the center of Newton's ring in reflected system is dark?		4
Q1(h)	Explain Rayleigh's criterion of resolution.		4
Q1(i)	What do you mean by acceptance angle and cone for an optical fiber?		5
Q1(j)	Differentiate spontaneous emission and stimulated emission.		5

SECTION-B	Attempt **ANY THREE** of the following Questions	Marks**(3X10=30)**	
Q2(a)	What is special theory of relativity? Derive Lorentz transformation equation.		1
Q2(b)	Assuming that all the energy from a 1000 watt lamp is radiated uniformly; calculate the average values of the intensities of electric and magnetic fields of radiation at a distance of 2m from lamp.		2
Q2(c)	Calculate the energy difference between the ground state and the first excited state for an electron in a one-dimensional rigid box of length 25Å.		3
Q2(d)	Newton's rings are observed in reflected light of wavelength $5900A^0$. The diameter of 10^{th} dark ring is 0.50cm. Find the radius of curvature of the lens.		4
Q2(e)	A step index fibre has μ_1 =1.466 and μ_2 = 1.46 where μ_1 and μ_2 are refractive indices of core and cladding respectively. If the operating wavelength of the rays is 0.85 μm and the diameter of the core = 50 μm, calculate the cut-off parameter and the number of modes which the fibre will support.		5

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	
Q3(a)	What was the object of conducting Michelson-Morley experiment? Illustrate the experiment with proper diagram and necessary mathematical derivations. Also state the outcomes.		1
Q3(b)	Deduce Einstein's mass –energy relation $E= mc^2$. Give some evidence showing its validity.		1

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	
Q4(a)	Deduce the Maxwell's equations for free space and prove that electromagnetic waves are transverse in nature.		2
Q4(b)	Define radiation pressure and momentum of electromagnetic wave. Also determine an expression for radiation pressure and momentum.		2

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SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	
Q5(a)	What is the physical significance of a wave function? Derive Schrodinger time independent wave equation.		3
Q5(b)	What is Compton effect? Deduce an expression for Compton shift.		3

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	
Q6(a)	What is Rayleigh criterion of resolution how one can increase the resolving power of a diffraction grating? Using Rayleigh criterion for just resolution show that the resolving power of grating is equal to nN, where n is the order of the spectrum, and N is total no of lines on the grating.		4
Q6(b)	Discuss the phenomena of Fraunhofer diffraction at a single slit and show that the relative intensities of the successive maximum are nearly 1: $4/9\pi^2$: $4/25\pi^2$: $4/49\pi^2$: …..		4

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	
Q7(a)	A silicon optical fibre with a core diameter large enough has a core refractive index of 1.50 and a cladding refractive index 1.47. Determine (i) the critical angle at the core cladding interface, (ii) the numerical aperture for the fibre (iii) the acceptance angle in air for the fibre.		5
Q7(b)	What do you mean by population inversion? Describe the principle and working of Ruby laser system with the help of neat diagram.		5