Paper Id: 199101 Roll No:

B. TECH.
(SEM-I) THEORY EXAMINATION 2019-20
PHYSICS

Time: 3 Hours *Total Marks: 100*

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

SECTION A

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

a.	What are inertial and non-inertial frames of reference? Is an aircraft in steady flight an inertial frame or non-inertial frame?
b.	Show that massless particle can exit only if they move with the speed of light and their energy E and momentum p must be related as $E = pc$.
c.	What do you mean by impedance of a wave?
d.	What is the difference between electromagnetic wave and matter wave?
e.	Interpret Bohr's quantization rule on the basis of de-Broglie concept of matter wave.
f.	Two independent sources could not produce interference, why?
g.	What is dispersive power of plane transmission grating?
h.	Why model dispersion is negligible in single mode fiber?
i.	Why population inversion is necessary for laser action?
j.	How can you say that He-Ne laser is superior to Ruby laser?

SECTION B

2. Attempt any *three* of the following: **10x3=30**

a.	What is time dilation? Aman leaves the earth in a rocket ship that makes a round trip to the nearest star which is 4 light years away at speed of 0.8c. How much younger will he be on his return than that of his twin brother who preferred to stay behind?
b.	The sunlight strikes the upper atmosphere of earth with energy flux 1.38kW/m^2. What will be the peak values of electric and magnetic field at the point?
c.	Calculate the de-Broglie wavelength of a neutron having kinetic energy of 1eV. (Mass of the neutron = 1.67×10^{-27} kg, h= 6.62×10^{-34} joule sec)
d.	A plane transmission grating has 16,000 lines to an inch over a length of 5 inches. Find in the wavelength region of 6000 Å, in the second order (i) the resolving power of grating and (ii) the small wavelength difference that can be resolved.
e.	Calculate the relative population of two states of the laser that produces light of wavelength 5461 Å at 300K. (Boltzmann constant K= 8.6×10^{-5} eV/K).

SECTION C

3. Attempt any *one* part of the following: **10x1=10**

a.	State the fundamental postulates of special theory of relativity and deduce the Lorentz transformation equations from them and discuss how these equations account for the phenomenon of length contraction.
b.	Derive Einstein's mass-energy relation and show that relativistic kinetic energy of a particle is given by: $k=(m-m_0)c^2=m_0c^2\left[\left(1-\frac{v^2}{c^2}\right)^{-\frac{1}{2}}-1\right]$.

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4. Attempt any *one* part of the following: 10x1=10

a.	Deduce four Maxwell equations in free space. Explain the concept of displacement current and show how it led to modification of Ampere law.
b.	State and deduce poynting theorem for the flow of energy in an electromagnetic field.

5. Attempt any *one* part of the following: 10x1=10

a.	Write down Schrodinger wave equation for particle in a one-dimensional box and solved it to find out the Eigen value and Eigen function.
b.	What is Compton Effect? How does it support the photon nature of light?

6. Attempt any *one* part of the following: 10x1=10

a.	Describe and explain the formation of Newton's rings in reflected monochromatic light. Deduce the necessary expression for bright and dark rings.
b.	Discuss the phenomenon of Fraunhofer diffraction at a single slit. Show that the intensity of the first subsidiary maximum is about 4.5% of the principal maximum.

7. Attempt any *one* part of the following: 10x1=10

a.	Explain acceptance angel and acceptance cone of a fiber? Define numerical aperture.
b.	Describe the construction and working of a Ruby laser with the help of a well labeled diagram.

Physical Constants

Rest mass of electron	m_o	$= 9.1 \times 10^{-31}$ kg
Rest mass of Proton	m_p	$= 1.67 \times 10^{-27}$ kg
Speed of light	c	$= 3 \times 10^{8}$ m/s
Planck's Constant	h	$= 6.63 \times 10^{-34}$ J-s
Charge on electron	e	$= 1.6 \times 10^{-19}$ C
Boltzmann's Constant	k	$= 1.38 \times 10^{-25}$ J-K^{-1}