Sub Code:KAS101

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 $1.38 kWm^{-2}$. What will be the peak values of electric and magnetic field at the points?
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	$=1.38 \times 10^{-23}$ J-K^{-1}

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B. Tech.
(SEM I) THEORY EXAMINATION 2018-19
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 x10 = 20**

a. Write down the postulates of special theory of relativity. [CO 1]
b. How will you show that no particle can move with a velocity greater than the velocity of light in an inertial frame? [CO 1]
c. Why Maxwell proposed that Ampere's law require modification? [CO 2]
d. What do you mean by depth of penetration? [CO 2]
e. Determine the de-Broglie wavelength of a photon. [CO 3]
f. Discuss the physical significance of a wave function. [CO 3]
g. Why two independent sources cannot be coherent? [CO 4]
h. What do you mean by resolving power of an optical instrument? [CO 4]
i. Distinguish between spontaneous and stimulated emissions. Which one is required for laser? [CO 5]
j. What is the principle of operation of an optical fiber? [CO 5]

SECTION B

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

a. Deduce the relativistic velocity addition theorem. Show that it is consistent with Einstein's second postulate. [CO 1]
b. Write the Maxwell's equations in integral as well as in differential form and explain their physical significance. Show that the velocity of plane electromagnetic wave in the free space is given by $c = 1/\sqrt{(\mu_0 \varepsilon_0)}$. [CO 2]
c. Obtain time independent and time dependent Schrodinger's wave equations. [CO 3]
d. Discuss the phenomenon of Fraunhofer diffraction at a single slit and show that the relative intensities of the successive maximum are nearly [CO 4]

$$1 : \frac{4}{9\Pi^2} : \frac{4}{25\Pi^2} : \frac{4}{49\Pi^2} \ldots\ldots\ldots$$

e. Discuss the structure of an optical fiber. What are various types of optical fibers? Explain their advantages and disadvantages. [CO 5]

SECTION C

3. Attempt any *two* parts of the following: **5 x 2 = 10**

(a) What do you mean by length contraction? Deduce the necessary expression for this. [CO 1]
(b) Obtain the volume of a cube, the proper length of each edge of which is l_0 when it is moving with velocity v along one edge of [CO 1]

the cube.

(c) Deduce an expression for the variation of mass with velocity. [CO 1]

4. Attempt any *two* parts of the following: **5 x 2 = 10**

(a) What is Poynting vector? Derive and explain Poynting theorem. [CO 2]

(b) Deduce Coulomb's law of electro-statistics from Maxwell's first equation. [CO 2]

(c) Calculate the magnitude of Poynting vector at the surface of the sun. Given that power radiated by sun is 5.4×10^{28} watt and radius of sun is 7×10^{8} m. [CO 2]

5. Attempt any *two* parts of the following: **5 x 2 = 10**

(a) A particle is in motion along a line $x = 0$ and $x = L$ with zero potential energy. At points for which $x < 0$ and $x > L$, the potential energy is infinite. Solving Schrodinger equation, obtain energy eigen values & normalized wave function for the particle. [CO 3]

(b) What is Compton effect? Derive the necessary expression for Compton shift. [CO 3]

(c) Show that $\psi(x, y, z, t) = \psi(x, y, z)e^{-iwt}$ is a wave function of a stationary state. [CO 3]

6. Attempt any *two* parts of the following: **5 x 2 = 10**

(a) Explain the formation of Newton's ring. Prove that in reflected light the diameter of dark rings are proportional to the square root of natural numbers. [CO 4]

(b) 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. [CO 4]

(c) In a grating spectrum, which spectral line in 4^{th} order will overlap with 3^{rd} order line of 5461 Å [CO 4]

7. Attempt any *two* parts of the following: **5 x 2 = 10**

(a) Describe the construction and working of Ruby Laser with neat diagram. [CO 5]

(b) Calculate the population ratio of two states in He-Ne laser that produces light of wavelength 6000Å at 27°C. [CO 5]

(c) Calculate the numerical aperture, acceptance angle, and the critical angle of the optical fiber if the refractive index of the core is 1.50 and refractive index of cladding is 1.45. [CO 5]

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B. TECH.

(SEM-II) THEORY EXAMINATION 2018-19

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

a. Explain the negative results of Michelson-Morley experiments.
b. What is length contraction?
c. Define inertial and non-inertial frames.
d. What are massless particles?
e. What is displacement current?
f. What is Poynting theorem?
g. Write the assumptions of Planck's hypothesis
h. Explain the necessity of extended sources.
i. What are the Newton's rings?
j. Define dispersive power of grating.

SECTION B

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

a. Drive an expression for time dilation. A clock measures the proper time. With what speed it should move relative to an observer so that it appears to go slow by 30s in 24 hours.
b. Discuss the phenomenon of interference of light due to thin films and find the conditions of maxima and minima. Show that the interference patterns of reflected and transmitted monochromatic light are complementary.
c. What do you understand by 3 and 4 levels LASER? What are the advantages of 3 level over 4 level LASER?
d. What do you understand by an optical fiber and discuss its classification.Calculate the numerical aperture, acceptance angle and the critical angle of the fiber from the following data: μ_1 (core refractive index) = 1.50 and μ_2 (cladding refractive index) =1.45.
e. Derive a suitable expression for continuity equation. Give its physical significance. A 100 watt sodium lamp radiating its power. Calculate the electric field and magnetic field strength at a distance of 5m from the lamp.

SECTION C

3. Attempt any *one* part of the following: 5x2=10

a. Deduce Einstein's mass-energy relation $E = mc^2$. Give some evidence showing its validity.A particle of rest mass $m_0$moves with speed $\frac{c}{\sqrt{2}}$. Calculate its mass, momentum, total energy and kinetic energy.
b. Discuss the phenomenon of Fraunhofer's diffraction at a single slit and show that the relative intensities of the successive maximum are nearly **1:** $\frac{4}{9\pi^2}$ **:** $\frac{4}{25\pi^2}$ **:** $\frac{4}{49\pi^2}$**:** **…….**

4. Attempt any *one* part of the following: 5x2=10

a. Prove that electromagnetic waves are transverse in nature.For a conducting medium, σ = 5.8 x 10^6 Siemens/m and ε_r = **1**. Find out the conduction and displacement current densities if the magnitude of electric field intensity E is given by E=150 sin (10^{10} t) Volt/m.

b. Explain the construction and working of Ruby laser.In a Ruby laser, total of Cr^{3+} ions is 2.8×10^{19}. If the laser emits radiation of wavelength 7000Å. Calculate energy of the laser pulse.

5. Attempt any *one* part of the following: 5x2=10

a. Derive Planck's law of radiation. How does it explain Wien's displacement and Rayleigh-Jeans laws?Calculate the energy of an oscillator of frequency 4.2×10^{12} Hz at 27°C treating it as (a) classical oscillator (b) Planck's oscillator.

b. Deduce four Maxwell's equations in free space. Show how the concept of Maxwell's displacement current leads to the modification of Ampere's law.

6. Attempt any *one* part of the following: 5x2=10

a. Derive a suitable expression for Momentum and radiated pressure of an EM wave.

b. What is Compton effect? Derive a suitable expression for Compton Shift $(\lambda'-\lambda = \frac{h}{m_o c}(1-\cos\phi))$. X-rays of wavelength 2Å are scattered from a black body and X rays are scattered at an angle 45°. Calculate Compton shift ($\Delta\lambda$), wavelength of the scattered Photons (λ').

7. Attempt any *one* part of the following: 5x2=10

a. Derive time-dependent and time-independent Schrodinger's wave equation.

b. What do you understand by grating? Explain its spectra. What particular spectra would be absent if the width of the transparencies and opacities of the grating are equal.Find the angular separation of 5048 Å and 5016Å wavelength in second order spectrum obtained by a plane diffraction grating having 15000 lines per inch.

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(Following Paper ID and Roll No. to be filled in your Answer Book)										
PAPER ID: 9001	**Roll No.**									

B. Tech.

(Semester-I) Theory Examination 2017 - 18

ENGINEERING PHYSICS-I

Time: 3 Hours ***Total Marks: 70***

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

SECTION A

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

a. Is earth an inertial or non-inertial frame of reference? Justify your answer.
b. What is Wien's displacement law?
c. What do you mean by group velocity?
d. Define dispersive power of a plane transmission diffraction grating.
e. Differentiate between spontaneous and stimulated emission of radiation.
f. What do you mean by specific rotation?
g. What do you mean by acceptance angle?

SECTION B

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

a. Obtain Galilean transformation equations. Show that length and acceleration are invariant under Galilean transformations.

b. Derive Planck's radiation law. Show that Planck's formula for the energy distribution in a thermal spectrum is applicable for all wavelengths.

c. Give the construction and theory of plane transmission grating. Explain the formation of spectra by it.

d. What is the advantage of four level laser systems over three level laser systems? Describe the construction and working of ruby laser.

e. What is holography? Explain the basic principle of holography using construction and reconstruction of image.

SECTION C

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

(a) Deduce the relativistic velocity addition theorem. Show that it is consistent with Einstein's second postulate.

(b) What do you mean by time dilation? Establish a relation for it. At what speed should a clock be moved so that it may appear to lose 1 min each hour?

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

(a) What is the concept of de-Broglie matter waves? Describe Davisson-Germer experiment and prove that electrons possess wave nature.

(b) Find an expression for the energy states of a particle in a one –dimensional box. Determine the probability of finding a particle trapped in a box of length L in the region from $0.45L$ to $0.55L$ for the ground state.

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

(a) Discuss the formation of interference fringes due to a wedge-shaped thin film seen by normally reflected monochromatic light and obtain an expression for the fringe width.

(b) Obtain an expression for the intensity distribution due to Fraunhofer diffraction at a single slit. A light of wavelength 6000Å falls normally on a slit of width 0.10 mm. Calculate the total angular width of the central maximum.

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

(a) Explain the phenomenon of double refraction and discuss the various characteristics of ordinary and extraordinary rays. Find the thickness of a quarter wave plate of quartz for light of wavelength 5893 Å. The refractive indices for ordinary and extraordinary rays are 1.544 and 1.553 respectively.

(b) What do you mean by optical activity? Give Fresnel's theory of optical activity and derive the necessary expression for the optical rotation.

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

(a) Explain single mode and multimode fibers. Differentiate between characteristic properties of single mode and multimode fibers.

(b) Explain dispersion and attenuation in optical fiber. The optical power, after propagating through a 500 m long fiber, is reduced to 25% of its original value. Calculate fiber loss in dB/km.