

**B. TECH.**  
**(SEM I) THEORY EXAMINATION 2022-23**  
**ENGINEERING PHYSICS**

Time: 3 Hours

Total Marks: 70

समय: 03 घण्टे

पूर्णांक: 70

**Note:**

1. Attempt all Sections. If require any missing data; then choose suitably.
  2. The question paper may be answered in Hindi Language, English Language or in the mixed language of Hindi and English, as per convenience.
- नोट: 1. सभी प्रश्नों का उत्तर दीजिए। किसी प्रश्न में, आवश्यक डेटा का उल्लेख न होने की स्थिति में उपयुक्त डेटा स्वतः मानकर प्रश्न को हल करें।
2. प्रश्नों का उत्तर देने हेतु सुविधानुसार हिन्दी भाषा, अंग्रेजी भाषा अथवा हिंदी एवं अंग्रेजी की मिश्रित भाषा का प्रयोग किया जा सकता है।

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

निम्न सभी प्रश्नों का संक्षेप में उत्तर दीजिए।

- (a) Write down the Planck's expression (formula) for spectral energy density in Black Body radiation.  
कृष्णिका विकिरण में वर्णक्रमीय ऊर्जा घनत्व के लिए प्लैंक का सूत्र लिखिए।
- (b) What do you understand by phase velocity and group velocity of waves?  
तरंगों के फेज वेग एवं समूह वेग से क्या अभिप्राय है?
- (c) Write down the expression for Continuity Equation in differential form.  
सतत समीकरण के व्यंजक को अवकल रूप में लिखें।
- (d) What do you understand by coherent sources?  
सुसंगत स्रोतों से आप क्या समझते हैं?
- (e) Define the population inversion in LASER.  
LASER में जनसंख्या व्युत्क्रमण को परिभाषित कीजिए।
- (f) Write down any two applications of the Nano materials.  
नैनो पदार्थों के कोई दो अनुप्रयोग लिखिए।
- (g) State any two differences between single mode and multi-mode step index fiber.  
सिंगल मोड और मल्टी-मोड स्टेप इंडेक्स फाइबर के बीच कोई दो अंतर बताएं।

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

निम्न में से किसी तीन प्रश्नों का उत्तर दीजिए।

- (a) Explain the physical significance of wave function given by Max Born.  
मैक्स बॉर्न द्वारा दिए गए तरंग क्रिया के भौतिक महत्व की व्याख्या करें।
- (b) What do you understand by Displacement current and skin depth?  
विस्थापन धारा और स्किन डेप्थ (skin depth) से आप क्या समझते हैं?
- (c) What do you understand by the phenomenon of Fraunhofer diffraction. Find out the ratio of intensities of successive secondary maxima compared to the intensity of the principle maximum.

फ्रानहॉफर विवर्तन की परिघटना से आप क्या समझते हैं ? अधिकतम सिद्धांत की तीव्रता की तुलना में उत्तरोत्तर द्वितीयक उच्चिष्ठ की तीव्रता का अनुपात ज्ञात कीजिए।

- (d) Describe briefly any three applications of optical fiber.  
ऑप्टिकल फाइबर के किन्हीं तीन अनुप्रयोगों का संक्षेप में वर्णन कीजिए।
- (e) Explain Type I and Type II superconductors briefly.  
टाइप I और टाइप II सुपरकंडक्टर्स को संक्षेप में समझाइए।

### SECTION C

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

7 x 1 = 7

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

- (a) Derive an expression for Compton wavelength shift ( $\Delta\lambda$ ) for a Compton scattering experiment. The wavelength of an X-ray photon is doubled on being scattered through  $90^\circ$  with a carbon block in a Compton Experiment. Find out the wavelength of the incident photon. (Electron mass  $m_e = 9.1 \times 10^{-31} \text{ kg}$ , Planck's constant  $h = 6.63 \times 10^{-34} \text{ m}^2 \text{ kg/s}$ , speed of light  $c = 3.0 \times 10^8 \text{ m/s}$ ).

कॉम्प्टन स्कैटरिंग प्रयोग में कॉम्पटन वेवलेंथ शिफ्ट ( $\Delta\lambda$ ) के लिए व्यंजक व्युत्पन्न कीजिए। एक कॉम्पटन प्रयोग में कार्बन ब्लॉक के साथ  $90^\circ$  के माध्यम से बिखरने पर एक एक्स-रे फोटॉन की तरंग दैर्घ्य दोगुनी हो जाती है। आपतित फोटॉन की तरंगदैर्घ्य ज्ञात कीजिए। (इलेक्ट्रॉन द्रव्यमान  $m_e = 9.1 \times 10^{-31} \text{ kg}$ , प्लैंक का नियतांक  $h = 6.63 \times 10^{-34} \text{ m}^2 \text{ kg/s}$ , प्रकाश की गति  $c = 3.0 \times 10^8 \text{ m/s}$ )।

- (b) Derive time independent Schrodinger wave equation. Write down the time independent Schrodinger equation for a particle in one-dimensional box (infinitely deep potential well) and find out energy eigenvalues (energy levels) and the corresponding energy eigenfunctions (normalized wavefunctions) of the particle.

समय स्वतंत्र श्रोडिंगर तरंग समीकरण को व्युत्पन्न कीजिए। एक-आयामी बॉक्स (अनंत रूप से गहरी क्षमता वाले कुएं) में एक कण के लिए समय स्वतंत्र श्रोडिंगर समीकरण लिखें और कण के ऊर्जा आइजेन मानों (ऊर्जा स्तर) और संबंधित ऊर्जा आइजेन फंक्शन (सामान्यीकृत वेवफंक्शन) को ज्ञात कीजिए।

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

7 x 1 = 7

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

- (a) Derive equation for simple plain electromagnetic wave starting from Maxwell's equations in free space. Show that the electromagnetic wave in free space is transverse in nature.

मुक्त अंतरिक्ष में मैक्सवेल के समीकरणों से प्रारंभ करते हुए सरल समतल वैद्युतचुंबकीय तरंग के लिए समीकरण व्युत्पन्न कीजिए। दिखाएँ कि मुक्त अंतरिक्ष में विद्युत चुंबकीय तरंग की प्रकृति अनुप्रस्थ होती है।

- (b) Prove the Poynting theorem in electrodynamics and explain the physical significance of each of the term appearing in the final expression of the theorem.

विद्युतगतिकी में पॉयंटिंग प्रमेय को सिद्ध कीजिए और प्रमेय के अंतिम व्यंजक में प्रकट होने वाले प्रत्येक पद के भौतिक महत्व की व्याख्या कीजिए।

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

7 x 1 = 7

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

- (a) (i) Describe the phenomenon of interference in thin film (uniform thickness) due to reflected light and write down the conditions for constructive and destructive interference.

परावर्तित प्रकाश के कारण पतली फिल्म (एकसमान मोटाई) में व्यतिकरण की

परिघटना का वर्णन कीजिए तथा रचनात्मक तथा विनाशी व्यतिकरण के लिए शर्तों को लिखिए।

(ii) A light source of wavelength  $6000 \text{ \AA}$  is used along with plano-convex lens with radius of curvature equal to  $100 \text{ cm}$  in a Newton's ring arrangement. Find out the diameter of the  $15^{\text{th}}$  dark ring.

$6000 \text{ \AA}$  तरंग दैर्घ्य का एक प्रकाश स्रोत, न्यूटन के वलय व्यवस्था में  $100$  सेमी के बराबर की वक्रता त्रिज्या के समतलीय-उत्तल लेंस का प्रयोग किया जाता है।  $15^{\text{वें}}$  अदीप्त वलय का व्यास ज्ञात कीजिए।

- (b) Explain briefly the Rayleigh criterion of resolution. Discuss the resolving power of plane transmission grating and find the relation between resolving and dispersive power of the grating.

विभेदन की रैले मानदंड को संक्षेप में समझाइए। समतल संचरण ग्रेटिंग की विभेदन क्षमता की विवेचना कीजिए और ग्रेटिंग की विभेदन क्षमता और वर्ण-विक्षेपण क्षमता के बीच संबंध स्थापित कीजिए।

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

7 x 1 = 7

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

- (a) (i) Find out the expressions for acceptance angle and numerical aperture of an optical fiber in terms of the refractive index of core and cladding.

कोर और क्लैडिंग के अपवर्तक सूचकांक के संदर्भ में एक ऑप्टिकल फाइबर के स्वीकृति कोण और संख्यात्मक एपर्चर के लिए व्यंजक ज्ञात कीजिए।

(ii) Explain briefly the attenuation in optical fiber.

ऑप्टिकल फाइबर में क्षीणन को संक्षेप में समझाइए।

- (b) Describe the absorption, spontaneous emission, stimulated emission of radiation by matter and derive the relation between Einstein's Coefficients related to three phenomena.

पदार्थ द्वारा विकिरण के अवशोषण, स्वतः स्फूर्त उत्सर्जन, तथा उत्प्रेरित उत्सर्जन का वर्णन करें और तीनों परिघटनाओं से संबंधित आइंस्टीन के गुणांकों के बीच संबंध स्थापित करें।

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

7 x 1 = 7

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

- (a) Explain the Meissner effect and persistent current in superconductivity.

अतिचालकता के संदर्भ में मीस्नर प्रभाव और दीर्घस्थायी धारा की व्याख्या कीजिए।

- (b) What are Nano materials? Explain briefly the basic concepts of Quantum Dots, Quantum wires and Quantum well.

नैनो पदार्थ किसे कहते हैं? क्वांटम डॉट्स, क्वांटम वायर्स और क्वांटम वेल की बुनियादी अवधारणाओं को संक्षेप में समझाइए।

## B. TECH.

(SEM. II) THEORY EXAMINATION 2022-23  
ENGINEERING PHYSICS

Time: 3 Hours

Total Marks: 70

समय: 03 घण्टे

पूर्णांक: 70

## Note:

1. Attempt all Sections. If require any missing data; then choose suitably.
2. The question paper may be answered in Hindi Language, English Language or in the mixed language of Hindi and English, as per convenience.

नोट: 1. सभी प्रश्नों का उत्तर दीजिए। किसी प्रश्न में, आवश्यक डेटा का उल्लेख न होने की स्थिति में उपयुक्त डेटा स्वतः मानकर प्रश्न को हल करें।  
2. प्रश्नों का उत्तर देने हेतु सुविधानुसार हिन्दी भाषा, अंग्रेजी भाषा अथवा हिंदी एवं अंग्रेजी की मिश्रित भाषा का प्रयोग किया जा सकता है।

## SECTION A

## 1. Attempt all questions in brief.

2 x 7 = 14

निम्न सभी प्रश्नों का संक्षेप में उत्तर दीजिए।

- (a) Can Compton effect be observed with visible light? Explain briefly.  
क्या दृश्य प्रकाश से कॉम्पटन प्रभाव देखा जा सकता है? संक्षेप में बताएं।
- (b) What was the objective of conducting Davisson-Germer experiment?  
डेविसन-जर्मेर प्रयोग आयोजित करने का उद्देश्य क्या था?
- (c) Differentiate between conduction current and displacement current.  
चालन धारा और विस्थापन धारा के बीच अंतर बताइये।
- (d) Why two independent light sources cannot produce interference pattern?  
दो स्वतंत्र प्रकाश स्रोत इंटरफ्रेंस पैटर्न क्यों उत्पन्न नहीं कर सकते?
- (e) What are the changes that are caused in the diffraction pattern if the number of slits are made large?  
यदि स्लिट्स की संख्या बड़ी कर दी जाए तो विवर्तन पैटर्न में क्या परिवर्तन होते हैं?
- (f) What do you understand by stimulated emission of radiation in a laser?  
लेजर में विकिरण के उत्तेजित उत्सर्जन से आप क्या समझते हैं?
- (g) What do you mean by a Quantum Well?  
क्वांटम वेल से आप क्या समझते हैं?

## SECTION B

## 2. Attempt any three of the following:

7 x 3 = 21

निम्न में से किसी तीन प्रश्नों का उत्तर दीजिए।

- (a) Discuss any three physical phenomenon which could not be explained on the basis of classical physics.  
किन्हीं तीन भौतिक घटनाओं की चर्चा करें जिन्हें क्लासिकल भौतिकी के आधार पर समझाया नहीं जा सका।
- (b) State and explain Stoke's theorem and Divergence theorem.  
स्टोक के प्रमेय और विचलन प्रमेय को बताएं और समझाएं।
- (c) Describe how Newton's ring experiment can be used to determine the refractive index of a liquid.  
वर्णन करें कि न्यूटन के वलय प्रयोग का उपयोग किसी तरल के अपवर्तनांक को निर्धारित करने के लिए कैसे किया जा सकता है।

- (d) Define the relative refractive index difference of an optical fiber. Show how it is related to numerical aperture.  
किसी ऑप्टिकल फाइबर के सापेक्ष अपवर्तनांक अंतर को परिभाषित करें। दिखाएँ कि यह संख्यात्मक एपर्चर से कैसे संबंधित है।
- (e) What do you mean by super conductivity? Discuss high temperature superconductors and some potential applications.  
अतिचालकता से आप क्या समझते हैं? उच्च तापमान वाले सुपरकंडक्टर्स और कुछ संभावित अनुप्रयोगों पर चर्चा करें।

### SECTION C

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

7 x 1 = 7

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

- (a) Distinguish between group velocity and phase velocity. Establish a relation between them in a dispersive medium. What will be relation between these velocities in non-dispersive medium?  
Group velocity और Phase velocity के बीच अंतर बताएं। उनके बीच एक dispersive medium में संबंध स्थापित करें। Non-dispersive medium में इन वेगों के बीच क्या संबंध होगा?
- (b) Solve Schrödinger equation for a free particle in one dimensional box and show that the energy eigen values are discrete. An electron is trapped in one dimensional region of length  $1.0 \text{ \AA}$ . Find the amount of energy that must be supplied to excite the electron from ground state to first excited state.  
एक आयामी बॉक्स में एक मुक्त कण के लिए श्रोडिंगर समीकरण को हल करें और दिखाएं कि ऊर्जा आइजन मान discrete हैं। एक इलेक्ट्रॉन  $1.0 \text{ \AA}$  लंबाई के एक आयामी क्षेत्र में फंसा हुआ है। ऊर्जा की वह मात्रा ज्ञात कीजिए जो इलेक्ट्रॉन को जमीनी अवस्था से प्रथम उत्तेजित अवस्था तक उत्तेजित करने के लिए आपूर्ति की जानी चाहिए।

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

7 x 1 = 7

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

- (a) Derive the electromagnetic wave equations in free space. Calculate the amplitude of electric and magnetic fields  $E_0$  and  $H_0$ , at a distance of 5m from an oscillator which radiates energy isotropically at 1000W.  
फ्री स्पेस में विद्युत चुम्बकीय तरंग समीकरण व्युत्पन्न करें। एक ओसिलेटर, जो 1000W पर आइसोट्रोपिक रूप से ऊर्जा उत्सर्जित करता है, से 5 मीटर की दूरी पर विद्युत और चुंबकीय क्षेत्र  $E_0$  और  $H_0$  के आयाम की गणना करें।
- (b) Define skin depth. Write the necessary formula for the skin depth for conducting and non-conducting media. Calculate the skin depth for silver at  $10^8$  Hz frequency. Given- for silver  $\mu = \mu_0$ ,  $\mu_0 = 4\pi \times 10^{-7} \text{ N/A}^2$ ,  $\sigma = 3 \times 10^7 \text{ mhos/m}$ .  
स्किन डेप्थ को परिभाषित करें। कंडक्टिंग और नॉन-कंडक्टिंग मीडियम में स्किन डेप्थ के लिए आवश्यक सूत्र लिखें।  $10^8$  हर्ट्ज आवृत्ति पर चांदी के लिए स्किन डेप्थ की गणना करें। दिया गया है- चांदी के लिए  $\mu = \mu_0$ ,  $\mu_0 = 4\pi \times 10^{-7} \text{ N/A}^2$ ,  $\sigma = 3 \times 10^7 \text{ mhos/m}$ .

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

7 x 1 = 7

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

- (a) (i) Obtain an expression for the fringe width in a wedge-shaped thin film and explain nature of fringe pattern.  
(ii) A light of wavelength  $6000 \text{ \AA}$  falls normally on a slit of width  $0.10 \text{ mm}$ . Calculate the total angular width of the central maximum.

- (i) एक wedge-shaped की पतली फिल्म में फ्रिंज की चौड़ाई के लिए एक व्यंजक प्राप्त करें और फ्रिंज पैटर्न की प्रकृति की व्याख्या करें।  
(ii)  $6000\text{\AA}$  तरंगदैर्घ्य का प्रकाश सामान्यतः  $0.10$  मिमी चौड़ाई की एक झिरी पर नार्मल रूप से गिरता है। केंद्रीय अधिकतम की कुल कोणीय चौड़ाई की गणना करें।

- (b) (i) What particular spectra would be absent if width of the transparencies and opacities of the grating are equal.  
(ii) A plane transmission grating has 16,000 lines to an inch over a length of 5 inches. Find in wavelength region of  $6000\text{\AA}$ , in the second order, the smallest wavelength difference that can be resolved.  
(i) यदि ग्रेटिंग कि ट्रांसपैरेंसी और ओपासिटी की चौड़ाई बराबर हों तो कौन सा विशेष स्पेक्ट्रा अनुपस्थित होगा?  
(ii) एक समतल पारेषण ग्रेटिंग में 5 इंच की लंबाई में एक इंच तक 16,000 लाइनें हैं। दूसरे ऑर्डर में  $6000\text{\AA}$  के तरंगदैर्घ्य क्षेत्र में सबसे छोटी तरंगदैर्घ्य, जिसे resolve किया जा सकता है, ज्ञात कीजिए।

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

**7 x 1 = 7**

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

- (a) What are solid state lasers? Explain construction and working of Ruby laser with suitable diagrams.  
सॉलिड स्टेट लेजर क्या हैं? उपयुक्त चित्रों के साथ रूबी लेजर के निर्माण और कार्यप्रणाली को समझाएं।  
(b) Discuss the important factors responsible for the loss of power in optical fiber. Calculate the fiber loss through the optical fiber when the mean optical power launched into a 5 km length of fiber is  $120 \times 10^{-6} \text{ W}$  and the mean optical power at receiver is  $4 \times 10^{-6} \text{ W}$ .  
ऑप्टिकल फाइबर में बिजली की हानि के लिए जिम्मेदार महत्वपूर्ण कारकों पर चर्चा करें। ऑप्टिकल फाइबर के माध्यम से फाइबर हानि की गणना करें जब 5 किमी लंबाई के फाइबर में लॉन्च की गई औसत ऑप्टिकल शक्ति  $120 \times 10^{-6} \text{ W}$  है और रिसीवर पर औसत ऑप्टिकल शक्ति  $4 \times 10^{-6} \text{ W}$  है।

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

**7 x 1 = 7**

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

- (a) Discuss the effect of external magnetic field on superconductors. The transition temperature for Pb is 7.2K, however, at 5K it loses the superconducting property subjected to a magnetic field of  $3.3 \times 10^4 \text{ A/m}$ . Find the maximum value of H which allow the metal to retain its superconductivity at 0K.  
अतिचालकों पर बाह्य चुंबकीय क्षेत्र के प्रभाव पर चर्चा करें। Pb के लिए संक्रमण तापमान 7.2K है, यद्यपि, 5K पर यह  $3.3 \times 10^4 \text{ A/m}$  के चुंबकीय क्षेत्र के अधीन अतिचालक गुण खो देता है। H का अधिकतम मान ज्ञात करें जो धातु को 0K पर अपनी अतिचालकता बनाए रखने देता है।  
(b) Discuss properties and the potential applications of nano materials. What are the risks of using nano materials to human body?  
नैनो सामग्रियों के गुणों और संभावित अनुप्रयोगों पर चर्चा करें। मानव शरीर के लिए नैनो सामग्री के उपयोग के जोखिम क्या हैं?



PAPER ID-411329

Printed Page: 1 of 2  
Subject Code: KAS101T

Roll No:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**BTECH**  
**(SEM I) THEORY EXAMINATION 2021-22**  
**ENGINEERING PHYSICS**

Time: 3 Hours

Total Marks: 100

**Note:** Attempt all the sections. If require any missing data, then choose suitably.**Section A****1. Attempt all questions in brief: 2 x 10 = 20**

Q.N.	Question	Marks	CO
a.	Differentiate between inertial and non- inertial frames.	2	1
b.	Show that the rest mass of a photon is zero.	2	1
c.	Write the similarities and dissimilarities between conduction and displacement current.	2	2
d.	Define the Poynting vector and write its unit.	2	2
e.	State the Wien's displacement law.	2	3
f.	Distinguish between modified and unmodified x-rays.	2	3
g.	The light rays from two independent bulbs do not show interference. Give the reason.	2	4
h.	State the Rayleigh criteria of resolution.	2	4
i.	What is an optical fibre? How does a light signal propagate through it?	2	5
j.	Write the essential requirements for the laser action.	2	5

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

Q.N.	Question	Marks	CO
a.	Show that $E^2 = p^2c^2 + m_0^2c^4$	10	1
b.	Find the skin depth $\delta$ at a frequency of $3.0 \times 10^6$ Hz in aluminium where $\sigma = 38.0 \times 10^6$ S/m and $\mu_r = 1$ .	10	2
c.	An electron is bound in one dimensional potential box width $2.5 \times 10^{-10}$ m. Assuming the height of the box to be infinite, calculate the lowest permitted energy values of the electron.	10	3
d.	White light is incident on a soap film at an angle $\sin^{-1}(4/5)$ and the reflected light is observed with a spectroscope. It is found that two consecutive dark bands correspond to wavelengths $6.1 \times 10^{-5}$ cm and $6.0 \times 10^{-5}$ cm. If the refractive index of the film is $4/3$ , calculate the thickness.	10	4
e.	A communication system uses a 10 km fiber having a loss of 2.5 dB/km. Compute the output power if the input power is 500 $\mu$ W.	10	5



PAPER ID-411329

Printed Page: 2 of 2

Subject Code: KAS101T

Roll No:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**BTECH**  
**(SEM I) THEORY EXAMINATION 2021-22**  
**ENGINEERING PHYSICS**

**Section C**

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

Q.N.	Question	Marks	CO
a.	State the postulates of special theory of relativity and derive the Lorentz transformation equations. When Lorentz transformation equations get reduced to Galilean transformation equations?	10	1
b.	State and prove the velocity addition theorem. Show that the theorem is consistent with the Einstein's second postulate.	10	1

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

Q.N.	Question	Marks	CO
a.	Establish the e-m waves' equations in free space and solve them to show that they travel with the speed of light in free space and are transverse in nature.	10	2
b.	State and prove the Poynting theorem. Show that $E/H = 377 \text{ Ohm}$ .	10	2

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

Q.N.	Question	Marks	CO
a.	What is the Planck's theory of black body radiations? Obtain an expression for the average energy of the oscillators and derive the Planck's radiation law.	10	3
b.	Write the Schrodinger's wave equation for a particle in one-dimensional box and solve it to obtain the eigen values and eigen functions.	10	3

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

Q.N.	Question	Marks	CO
a.	What do you mean by a wedge-shaped film? Discuss the interference due to it and obtain the expression for the fringe width.	10	4
b.	Discuss the formation of Newton's rings. Show that the diameters of the bright rings are proportional to the square root of odd natural numbers.	10	4

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

Q.N.	Question	Marks	CO
a.	What do you mean by acceptance angle and numerical aperture? Derive the expressions for acceptance angle and numerical aperture.	10	5
b.	What do you understand by the stimulated emission? Discuss the He-Ne laser by giving its construction and working. How He-Ne laser is superior to the Ruby laser?	10	5

**Physical Constants:**Rest mass of electron  $m_0 = 9.1 \times 10^{-31} \text{ kg}$ , Speed of light  $c = 3 \times 10^8 \text{ m/s}$ Planck's Constant  $h = 6.63 \times 10^{-34} \text{ J-s}$ , Charge on electron  $e = 1.6 \times 10^{-19} \text{ Coulomb}$





PAPER ID-421047

Printed Page: 1 of 2  
Subject Code: KAS201T

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 <b>All</b> 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 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 <b>ANY THREE</b> 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 5900Å. The diameter of 10 <sup>th</sup> dark ring is 0.50cm. Find the radius of curvature of the lens.	4	
Q2(e)	A step index fibre has $\mu_1 = 1.466$ and $\mu_2 = 1.46$ where $\mu_1$ and $\mu_2$ are refractive indices of core and cladding respectively. If the operating wavelength of the rays is 0.85 $\mu\text{m}$ and the diameter of the core = 50 $\mu\text{m}$ , calculate the cut-off parameter and the number of modes which the fibre will support.	5	

SECTION-C	Attempt <b>ANY ONE</b> 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 <b>ANY ONE</b> 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	



PAPER ID-421047

Printed Page: 2 of 2

Subject Code: KAS201T

Roll No:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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

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



Roll No:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**B. TECH.**  
**(SEM 1) THEORY EXAMINATION 2020-21**  
**ENGINEERING 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.	State Einstein's postulates of Special Theory of Relativity.	2	1
b.	Find the momentum of a photon having energy $1.00 \times 10^{-17}$ J.	2	1
c.	What is Displacement Current?	2	2
d.	Show that magnetic monopoles do not exist.	2	2
e.	State Wien's displacement law and Rayleigh-Jeans law.	2	3
f.	Why are matter waves associated with a particle generated only when it is in motion?	2	3
g.	Two independent sources of light cannot produce interference, why?	2	4
h.	State Rayleigh criterion of Resolution. Also define resolving power.	2	4
i.	Differentiate between spontaneous and stimulated emission.	2	5
j.	With the help of a well-labelled diagram, name the components of an optical fibre.	2	5

**SECTION B****2. Attempt any three of the following:**

Qno.	Question	Marks	CO
a.	Show that space-time interval between two events remains invariant under Lorentz transformations.	10	1
b.	Find the conduction current density and displacement current density for a solid with conductivity, $\sigma = 10^{-3}$ S/m and $\epsilon_r = 2.5$ . Electric field intensity, $E = 4.5 \times 10^{-6} \sin(10^9 t)$ .	10	2
c.	Find the two lowest permissible energy states for an electron which is confined in a one dimensional infinite potential box of width $3.5 \times 10^{-9}$ m.	10	3
d.	Calculate the thickness of a soap bubble thin film that will result in constructive interference in reflected light. The film is illuminated with light of wavelength $5000 \text{ \AA}$ and the refractive index of the film is 1.45.	10	4
e.	What do you understand by attenuation and dispersion in an optical fibre. A communication system uses a 25 km long fibre having a loss of 2.5 dB/km. The input power is 2500 $\mu$ W, compute the output power.	10	5

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

Qno.	Question	Marks	CO
a.	What do you mean by time dilation? Explain with the help of a mathematical proof. Justify with an experimental evidence to show that time dilation is a real effect.	10	1



Roll No:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

b.	Derive Einstein's mass-energy relation and show that relativistic kinetic energy of a particle is given by: $k = (m - m_0)c^2 = m_0c^2 \left[ \left( 1 - \frac{v^2}{c^2} \right)^{-\frac{1}{2}} - 1 \right]$	10	1
----	---	----	---

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

Qno.	Question	Marks	CO
a.	Write Maxwell's equations in free space. Also show that the electric and magnetic vectors are normal to the direction of propagation of the electromagnetic wave.	10	2
b.	State and deduce Poynting theorem for the flow of energy in an electromagnetic field. Discuss the physical significance of Poynting theorem.	10	2

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

Qno.	Question	Marks	CO
a.	What is wave function? Derive time independent Schrodinger wave equation.	10	3
b.	What is Compton effect? Derive an expression for Compton shift.	10	3

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

Qno.	Question	Marks	CO
a.	Describe the formation of Newton's rings in monochromatic light. Show that in reflected light, the diameters of dark rings are proportional to the square roots of natural numbers.	10	4
b.	What is a diffraction grating? Discuss the phenomenon of diffraction due to plane diffraction grating.	10	4

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

Qno.	Question	Marks	CO
a.	Illustrate the construction and working of He-Ne laser? Discuss important applications of laser.	10	5
b.	Derive expressions for acceptance angle and numerical aperture.	10	5

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**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 exist 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 modal 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 $1.38 \text{ kW m}^{-2}$ . 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 $1 \text{ eV}$ . (Mass of the neutron = $1.67 \times 10^{-27} \text{ kg}$ , $h = 6.62 \times 10^{-34} \text{ joule sec}$ )
d.	A plane transmission grating has 16,000 lines to an inch over a length of 5 inches. Find in the wavelength region of $6000 \text{ \AA}$ , 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 $5461 \text{ \AA}$ at $300 \text{ K}$ . (Boltzmann constant $K = 8.6 \times 10^{-5} \text{ eV/K}$ ).

**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: $K = (m - m_0)c^2 = m_0 c^2 \left[ \left( 1 - \frac{v^2}{c^2} \right)^{-\frac{1}{2}} - 1 \right]$

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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. <a href="https://www.aktuonline.com">https://www.aktuonline.com</a>

## Physical Constants

Rest mass of electron	$m_e$	$= 9.1 \times 10^{-31} \text{ kg}$
Rest mass of Proton	$m_p$	$= 1.67 \times 10^{-27} \text{ kg}$
Speed of light	$c$	$= 3 \times 10^8 \text{ m/s}$
Planck's Constant	$h$	$= 6.63 \times 10^{-34} \text{ J-s}$
Charge on electron	$e$	$= 1.6 \times 10^{-19} \text{ C}$
Boltzmann's Constant	$k$	$= 1.38 \times 10^{-23} \text{ J-K}^{-1}$

**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 x 10 = 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  $c = 1/\sqrt{\mu_0\epsilon_0}$ . [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]

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

- 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-statics 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  $5.4 \times 10^{28}$  watt and radius of sun is  $7 \times 10^8$  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  $\psi(x, y, z, t) = \psi(x, y, z)e^{-i\omega t}$  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  $6000 \text{ \AA}$  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<sup>th</sup> order will overlap with 3<sup>rd</sup> order line of  $5461 \text{ \AA}$  [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  $6000 \text{ \AA}$  at  $27^\circ\text{C}$ . [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]