Total No. of Questions : 4]

SEAT No. :

P1269

[Total No. of Pages : 2

OCT/FE/INSEM-2
F.E. (Phase - I)
ENGINEERING PHYSICS
(2019 Pattern)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Solve any one question out of Q.1 or Q.2 and Q.3 or Q.4.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of electronic calculator allowed.***
5) ***Assume suitable data.***

Q1) a) Derive an expression for resultant amplitude and resultant intensity between the diffracted waves in Fraunhofer diffraction due to a single slit. **[6]**

b) Write the expression of path difference between the waves reflected in wedge shaped thin film. State the conditions for maxima and minima. Explain the application of wedge shaped thin film for testing of optical flatness. **[5]**

c) Polarizer and analyser are arranged so that amount of light transmitted them is maximum. What will be the percentage reduction in intensity of transmitted light when the analyser is rotated through i) 30°, ii) 90°. **[4]**

OR

Q2) a) What is polarised and unpolarised light? Explain how the phenomenon of polarisation of light is used in liquid crystal displays (LCD). **[6]**

b) Whis is diffraction? What are its types? Find the half angular width of the central principal maxima in the Fraunhofer diffraction pattern due to a single slit having width 12×10^{-5} cm when illuminated by light of wavelength 6000Å. **[5]**

c) A parallel beam of sodium light strikes a film of oil floating on water, when viewed at an angle of 30° from the normal, 8^{th} dark band is seen. Determine the thickness of the film.

(Given - R.I of Oil = 1.46, λ = 5890A°) **[4]**

P.T.O.

Q3) a) With the help of energy band diagram explain construction and working of single hetero-junction semiconductor laser. **[6]**

b) Define criticle angle. A step index fibre has core and cladding refractive indices 1.65 and 1.48 respectively. Calculate the values of numerical aperture and acceptance angle if it is placed in air. **[5]**

c) Explain stimulated emission of radiations. Explain its significance in production of laser. **[4]**

OR

Q4) a) What is laser? State characteristics of laser. Explain in brief any one industrial application of laser. **[6]**

b) State factors for attenuation and losses in optical fibre, explain any two factors in brief. **[5]**

c) A step index fibre has core refractive index 1.46 an a numerical aperture of 0.65. Calculate the refractive index of cladding and maximum angle at entrance when fibre is placed in air. **[4]**

Total No. of Questions : 4]

SEAT No. :

P2

[Total No. of Pages : 2

FE/Insem./APR - 2
F.E. (Common)
107002 : ENGINEERING PHYSICS
(2019 Pattern) (Semester - II)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Solve either Q. No. 1. or Q. No. 2. and Q. No. 3. or Q. No. 4.***
2) ***Neat diagrams must be drawn whenever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logrithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***
6) ***All questions carry equal marks.***

Q1) a) Explain with neat diagram interference in thin parallel film in reflected system. calculate the total path difference. Obtain the condition of maximum and minimum. **[6]**

b) Explain with diagram how principle of interference is used to design antireflection coating. Derive the expression for thickness. **[5]**

c) Polarizer and Analyzer are adjusted in such a way that, they transmit maximum light. Calculate the angle of analyzer for which Intensity reduces
i) 2/3
ii) 1/5 of the original Intensity. **[4]**

OR

Q2) a) Define diffraction grating. How it is prepared? Calculate the angular width of central maximum, when it is diffracted from single slit of width 0.01 nm. $\lambda = 5500 A^{\circ}$. **[6]**

b) Define double refraction. Explain Huygen's theory of double refraction. **[5]**

c) Calculate the minimum thickness of a soap film which will appear dark and bright when it is illuminated by a light of wavelength 6000A° normally. Data given $\mu = 1.43$. **[4]**

P.T.O.

Q3) a) Describe construction and working of CO_2 LASER with the help of energy level diagram. **[6]**

b) Define critical angle, acceptance angle and numerical Aperture for optical Fibre. Explain different types of mode of fibre optics communication with diagram. **[5]**

c) Calculate the maximum value of angle of incidence such that light ray can travel through the fibre. Data given : $n_1 = 1.6$, $n_2 = 1.5$. **[4]**

OR

Q4) a) When light travels denser to rarer medium, calculate the critical angle for the medium. Define acceptance angle, acceptance cone and Numerical aperture. **[6]**

b) Explain applications of LASER in industry and medical field. Discuss any one of them in details. **[5]**

c) What is Hologram. Explain the process of reconstruction of Hologram with Diagram. **[4]**

Total No. of Questions : 09]

SEAT No. :

P6486

[Total No. of Pages : 4

[5868]-102
F.E. (Semester - II)
Engineering Physics
(2019 Pattern) (Paper - II) (107002)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question No. 1 is compulsory.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

Physical Constants :-

1)	***Planck's constant***	$h = 6.63 \times 10^{-34}$ ***J–S***
2)	***Mass of electron***	$m_e = 9.1 \times 10^{-31}$ ***kg***
3)	***Charge on electron***	$e = 1.6 \times 10^{-19}$ ***C***

Q1) Write the correct option with answer for the following : **[10]**

i) The wavelength λ associated with a particle of mass m moving with velocity v is given by

a) $\lambda = \frac{h}{mv}$ b) $\lambda = \frac{mv}{h}$

c) $\lambda = \frac{hv}{m}$ d) $\lambda = \frac{m}{hv}$

ii) The equation of motion of matter wave was derived by

a) Heisenberg b) Bohr

c) De Broglie d) Schrodinger

iii) In metals the band gap energy / forbidden energy gap is

a) 0 eV b) 0.7 eV

c) 1.12 eV d) > 5 eV

P.T.O.

iv) A solar cell work on the principle of

a) Photoelectric effect
b) Photoluminescence effect
c) Photovoltaic effect
d) Photocombustion effect

v) The relative permeability can be expressed by

a) $\mu_r = 1 + \mu_0$
b) $\mu_r = 1 + x$
c) $\mu_r = x / \mu_0$
d) $\mu_r = \mu_0 + \mu_a$

vi) Superconductivity is the phenomenon in which _____ of materials suddenly disappears below critical temperature.

a) Capacitance
b) Conductivity
c) Inductance
d) Resistance

vii) Ultrasonic waves have frequency

a) Less than 20 H_z
b) 20 H_z to 20 kH_z
c) Greater than 20 kH_z
d) None of the above

viii) In nanomaterials which of the following statement is correct.

a) Surface to volume ratio is very small
b) Surface to volume ratio is large
c) Surface to volume ratio is 1 (unity)
d) None of the above

Q2) a) Derive an equation for energy of a particle enclosed in 1D rigid box or in an infinite potential well. **[6]**

b) What is wave function Ψ? Write mathematical conditions of well behaved wave function. **[5]**

c) An electron is accelerated by a potential difference of 10 kV. What is De Broglie wavelength associated with this electron. **[4]**

OR

Q3) a) Starting from De Broglie hypothesis, derive Schrodinger's time independent wave equation. **[6]**

b) State Heisenberg's Uncertainly principle. Explain it using the concept of narrow and broad wave packet. **[5]**

c) Lowest energy of an electron in a potential well is 38 eV. Calculate the width of well. **[4]**

Q4) a) Derive an expression for conductivity of intrinsic, and extrinsic semiconductors. **[6]**

b) What is fermi level in a semiconductor? With the neat labelled diagram, draw the position of fermi level in N Type & P Type semiconductor at 0º K. **[5]**

c) A coper strip 2.0 m wide, 1.0 mm thick is placed in a magnetic field of 1.5T. If a current of 200 A is set up in the strip, calculate the Hall voltage that appears across the strip. **[5]**

Assume $R_H = 6 \times 10^{-7}$ m^3/C.

OR

Q5) a) State Hall effect. Derive an equation of Hall voltage. **[6]**

b) Define fermi level in conductors and semiconductors. Draw the position of fermi level in intrinsic, N - type & P - type semiconductors. **[5]**

c) Calculate the number of acceptors to be added to germanium sample to obtain the resistivity of 10Ωm. **[4]**

Q6) a) Explain the following terms in superconductivity : **[6]**

i) Critical Magnetic field.

ii) Meissner effect

b) Define : **[5]**

i) Magnetic induction (B)

ii) Magnetic field strength (H)

iii) Magnetization (M) and state the relation between B, M & H.

c) Explain DC & AC Josephson effect in brief. **[4]**

OR

Q7) a) Differentiate between Diamagnetism, paramagnetism and ferromagnetism. (Any Three points) **[6]**

b) What is superconductivity? Distinguish between Type I and Type II superconductors. (any four points) **[5]**

c) The transition temperature for lead is 7.2 K. However at 5K it losses the superconductivity property if subjected to magnetic field of 3.3×10^4 A/m. Find the maximum value of magnetic field which will allow the metal to retain its superconductivity at 0K. **[4]**

Q8) a) What is echo sounding technique? Using this technique explain non destructive testing for the measurement of thickness of metal sheet using ultrasonic waves. **[6]**

b) What are nanoparticles? What is nanotechnology? Explain the optical property of nanoparticle. **[5]**

c) Distinguish between Destructive and Non Destructive testing (any two points) **[4]**

OR

Q9) a) What are applications of nanoparticles? Explain any two applications of nanoparticles in brief. **[6]**

b) Explain in brief Acoustic Emission Technique of NDT and its application. **[5]**

c) Explain electrical property of nanoparticles. **[4]**

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Total No. of Questions : 4]

SEAT No. :

PA-1679

[Total No. of Pages : 2

[5931]-1002
F.E. (Common)
ENGINEERING PHYSICS
(2019 Pattern) (Semester - I) (107002)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2 and Solve Q.3 or Q.4.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) What is Fraunhofer diffraction. State the equations for resultant amplitude and resultant intensity between the diffracted waves in Fraunhofer diffraction due to a single slit. State the conditions of maximum and minimum intensity. **[6]**

b) State and explain Malus law with proof. **[5]**

c) White light falls at an angle of 45° on a thin film of soap bubble having refractive index 1.33. At what minimum thickness of the film it will appear bright yellow of wave length 5896 A° in the reflected light. **[4]**

OR

Q2) a) What is double refraction? Explain Huygen's theory of double refraction. **[6]**

b) What is interference of light? Explain the use of thin film as antireflection coating. **[5]**

c) What is the highest order spectrum that is visible with light of wavelength 6000 A° by means of grating having 5000 lines per centimeter. **[4]**

P.T.O.

Q3) a) Explain the construction and working or a carbon dioxide laser. **[6]**

b) What are optical fibres? Distinguish between step index optical fibre and graded index optical fibre. (Any 4 pts) **[5]**

c) Calculate the numerical aperture and acceptance angle of an optical fibre having core refractive index 1.49 and cladding refractive index 1.44. **[4]**

OR

Q4) a) What are optical fibres? Draw a neat labelled diagram of cross section of optical fibre showing total internal reflection. State the advantages of optical fibre communication over the conventional communication system. (Any 4 pts.) **[6]**

b) What is holography? Explain recording of a hologram using laser. **[5]**

c) What is LASER? State the important characteristics of LASER. **[4]**

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Total No. of Questions : 4]

SEAT No. :

PB3

[Total No. of Pages : 2

[6267]-3
F.E. (All Branches) (Insem)
ENGINEERING PHYSICS
(2019 Pattern) (Semester - II) (107002)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Answer Q1 or Q2 and Q3 or Q4.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data, jf necessary.***

Q1) a) What is wedge shaped thin film? Draw a neat and labelled diagram showing interference in wedge shaped thin film. Explain its use to test optical flatness. **[6]**

b) For a single slit, diffraction, write down the expression for resultant amplitude. Using this expression derive the condition for : **[5]**

i) Principal maxima

ii) Minima

c) Polarizer and analyzer are set with their polarizing axes parallel so that intensity of transmitted light is maximum. Through what angle should either be turned so that intensity of transmitted light becomes. **[4]**

i) 50%

ii) 25% of the maximum intensity

OR

Q2) a) What is double refraction? Explain Huygen's theory of double refraction for uniaxial crystal. **[6]**

b) Explain application of interference as anti-reflection loading. Derive the condition for minimum thickness of the anti-reflection loading. **[5]**

c) A grading has 6000 lines km. For a wave length 4500A°. What is the maximum order that is visible. **[4]**

P.T.O.

Q3) a) Explain principle, construction and working of CO_2 laser. **[6]**

b) What is optical fiber? Distinguish between SHP index and graded index optical fiber. (Any 4 points) **[5]**

c) Calculate numerical aperture and acceptance angle for an optical fiber whose core and cladding has refractive indices 1.59 and 1.54 respectively. **[4]**

OR

Q4) a) Explain the process of fiber optic communication system with block diagram. State any two advantages of optical fiber communications. **[6]**

b) What is holography? Explain recording of hologram using laser. **[5]**

c) State and explain any four characteristics of laser. **[4]**

Total No. of Questions : 4]

SEAT No. :

PC374

[Total No. of Pages : 2

[6358]-102

F.E. (Common) (Insem)
ENGINEERING PHYSICS
(2019 Pattern) (Semester - I) (107002)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) For a single slit, state the equations for resultant amplitude and resultant intensity when rays are diffracted at an angle θ. Starting from these equations derive the conditions for principal maxima and minima of diffraction pattern. Draw intensity distribution curve. **[6]**

b) What are electromagnetic radiations? State one application for any four regions in the electromagnetic spectrum. **[5]**

c) The axes of polarizer and analyzer are kept parallel to each other so that light is transmitted with maximum intensity. By what angle should either polarizer or analyzer be rotated so that intensity of transmitted light is (i) 42% and (ii) 68% of the original intensity. **[4]**

OR

Q2) a) What is double refraction? Draw a neat and labelled diagram showing double refraction in a birefringent crystal. Explain in brief properties of o-ray and e-ray. **[6]**

b) What is anti-reflection coating (ARC)? Explain with a neat & labelled diagram how the principle of interference is used to design ARC. Derive the equation for thickness of ARC. **[5]**

c) A plane diffraction grating has 5000 lines/cm. A light of wavelength 558 nm incident normally over it. Determine the highest order spectrum that is visible. **[4]**

P.T.O.

Q3) a) With the help of an energy level diagram, explain construction and working of CO_2 laser. **[6]**

b) What is Holography? Why laser is preferred in holography? With a suitable diagram, explain the process of recording a hologram by using laser. **[5]**

c) In a certain optical fiber, the angle of acceptance is 34.8º and refractive index of cladding is 1.52. Calculate the values of numerical aperture and refractive index of core. **[4]**

OR

Q4) a) In an optical fiber, Explain in brief why refractive index of cladding should be slightly less than that of the core. Differentiate between step index and graded index fiber (any four points). **[6]**

b) What is acceptance angle? In an optical fiber, core and cladding has refractive indices 1.61 and 1.42 respectively. Calculate the values of acceptance angle and numerical aperture. **[5]**

c) In laser, explain in brief : **[4]**

i) Spontaneous emission

ii) Stimulated emission

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Total No. of Questions : 9]

SEAT No. :

PB3587

[Total No. of Pages : 4

[6260]-2
F.E. (Common)
ENGINEERING PHYSICS
(2019 Credit Pattern) (Semester - I/II) (107002)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Q. 1 is compulsory. Answer Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagram must be drawn wherever necessary.***
4) ***Use of non-programmable Electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Physical Constants:

- ***Plank's constant, $h = 6.63 \times 10^{-34}$ J.S***
- ***Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg***
- ***Charge on electron = 1.6×10^{-19} C***

Q1) Write the correct option with answers for the following questions (1mark each) **[10]**

a) De Broglie wavelength for matter waves associated with a matter particle is _____its Energy.

i) Inversely proportional to square of

ii) Directly proportional to

iii) Inversely proportional to the square root of

iv) Directly proportional to the square root of

b) A well behaved wave function satisfies which mathematical conditions.

i) Finite ii) Single valued

iii) Normalizable iv) All of the above

c) According to Heisenberg Uncertainty principle, in a narrow wave packet of de Broglie wavelength _____of a particle can be predicted correctly.

i) Position

ii) Momentum

iii) Position and momentum both

iv) Neither position nor momentum

P.T.O.

d) At absolute zero (T = 0 k), a semiconductor would be

i) Perfect semiconductor ii) Insulator

iii) Conductor iv) Intrinsic semiconductor

e) The Hall effect is true for

i) Semiconductors only and not metals

ii) Metals only and not semiconductors

iii) Both metals and semiconductors

iv) Insulators

f) The relation between magnetization (M), susceptibility (χ) and Magnetic field strength (H) is

i) $\chi = M \times H$ ii) $\chi = H/M$

iii) $\chi = M+H$ iv) $\chi = M/H$

g) The relation between magnetic induction (B), Magnetic flux (ϕ), area (A) and is

i) $\phi = B/A$ ii) $\phi = BA$

iii) $\phi = B - A$ iv) $\phi = A/B$

h) The expulsion of magnetic flux from within the superconductor below Critical temparature is know as

i) Magnetic effect ii) Expulsion effect

iii) Meissner effect iv) Josephson effect

i) X rays or gamma rays are used in radiography testing technique due to which of their property.

i) High frequency ii) High wavelength

iii) High velocity iv) Low frequency

j) A quantum dot (nanoparticle) has all dimensions in the range of

i) 100 nm to 1μm ii) 1 - 100 nm

iii) 1 μm to 100 μm iv) 100 μm and above

Q2) a) Derive schrodinger's time independent equation. **[6]**

b) What is the Heisenberg uncertainty Principle/ Explain it using narrow and broad wave packets. **[5]**

c) The lowest energy of an electron trapped in a potential well is 4.2 eV. Determine the width of the potential well in AU. **[4]**

OR

Q3) a) For a particle enclosed in a rigid box of infinite potential well, derive the equation for energy of the particle. Why is this energy quantized? **[6]**

b) What is the de Broglie hypothesis? Explain in brief properties of matter waves (any four). **[5]**

c) An electron is confined to a potential well of length 1.5 AU. Calculate the minimum uncertainty in its velocity (assume product of uncertainities equal to 'h'). **[4]**

Q4) a) With a neat and labeled diagram explain the Hall effect. Derive expression for Hall voltage. **[6]**

b) Difine Fermi level for a semiconductor. Draw a neat and labeled energy diagram for a PN junction diode showing Fermi levels when it is in **[5]**

(i) Zero bias (equilibrium)

(ii) Forward bias

c) A sample of intrinsic germanium has a carrier concentration of 4.41×10^{22} / cm^3. If the donor impurity is added in the ratio $1:10^7$ atoms / cm^3, determine resistivity of the sample. [Given, mobility of electrons, $\mu_e = 3800$ cm^2/V.s. **[4]**

OR

Q5) a) Derive the expression for electrical conductivity of a semiconductor. Discuss how this equation is modified for intrinsic, N-type and p-type semiconductors. **[6]**

b) Define efficiency of solar cell. Explain any four ways by which the efficiency of solar cell can be improved. **[5]**

c) An n-type semiconductor has a thickness of 0.15 mm and a current of 1mA is flowing along its length. Calculate Hall voltage developed along its width if a magnetic field of 2T is applied perpendicular to its thickness. [Hall coefficient, $R_H = 3.68\times10^{-4} m^3/C$]. **[4]**

Q6) a) Differentiate between diamagnetic, paramagnetic and ferromagnetic materials. (Any three points). **[6]**

b) What is super conductivity? Explain any two applications of superconductors in brief. **[5]**

c) For Lead, the critical magnetic field at 0K , Hc (0) is 8×10^5 A/m. and it has a transition temparature (Tc) of 7.26 K. In a certain application, Lead has to be used as a superconductor subjected to a magnetic field of Hc(T) = 4×10^4 A/m. At what maximum temperature it can be operated? **[4]**

OR

Q7) a) What is the Meissner effect? Discuss the reason why it is observed? Showthat superconductors exhibit perfect diamagnetism below the critical temparature. **[6]**

b) Explain the process of recording and retrieving (reading) data in magnetic storage devices. **[5]**

c) Explain brief:

i) Magnetic Susceptibility (χ)

ii) Absolute permeability (μ) **[4]**

Q8) a) What is echo sounding? Using this technique, explain how ultrasonic waves can be used for flaw detection. **[6]**

b) What is quantum confinement? On its basis explain why nanoparticles exhibit different properties than corresponding bulk materials. **[5]**

c) State applications of nanotechnology in the field of electronics (any four). Explain any one application in brief. **[4]**

OR

Q9) a) Explain optical and electrical properties of nanoparticles. **[6]**

b) State the objectives of Non-Destructive Testing. Differentiate between destructive and non-destructive testing (any two points). **[5]**

c) An ultrasonic pulse of frequency 100 kHz is sent through a block of aluminum with velocity 6320 m/s and. The echo is recorded after 1.45 microseconds. Calculate the thickness of the block and the wavelength of the ultrasonic pulse. **[4]**

Total No. of Questions : 9]

SEAT No. :

PE-896

[Total No. of Pages : 4

[6581]-1902

F.E. (Common)

ENGINEERING PHYSICS

(2019 Pattern) (Semester - I/II) (107002)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Q. 1 is compulsory, Answer Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Use of Electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Physical Constants: -

- ***Plank's constant h = 6.63 × 10^{-34} J.S***
- ***Mass of electron m_e = 9.1 × 10^{-31} Kg***
- ***Charge on electron e = 1.6 × 10^{-19} C***

Q1) Write the correct option with answer for the following (1 mark each) : **[10]**

i) Which of the following is the basic unit of information in quantum computing?

a) Bit b) Qubit

c) Byte d) Terabyte

ii) Which pair of variables is applicable to Heisenberg's uncertainty principle?

a) wavelength and energy b) position and momentum

c) charge and displacement d) atomic radius and time

iii) The concept of matter wave was suggested by

a) Heisenberg b) de Broglie

c) Schrodinger d) Laplace

P.T.O.

iv) Which is the correct ordering of the band gap energy?

a) Diamond > silicon > copper b) Diamond < silicon < copper

c) Diamond < silicon > copper d) Diamond = silicon < copper

v) Hall effect is true for

a) P-type semiconductors only

b) N-type Semiconductors only

c) metals only

d) both for Metals and semiconductors

vi) In the ferromagnetic materials, relative permeability is _____.

a) Less than 1 b) Just greater than 1

c) Significantly greater than 1 d) None of these

vii) In a Josephson junction, two superconductors are joined by a _____ of a few angstroms thickness.

a) Superconductor material b) Insulating material

c) Conducting material d) Magnetic material

viii) Below _____ temperature, superconducting material shows zero resistivity.

a) Inversion b) Conversion

c) Critical d) Superconducting

ix) A quantum wire has _____ dimensions less than 100 nm size.

a) 0 b) 1

c) 2 d) 3

x) X - ray or gamma rays are passed through a material and their absorption and scattering are analysed in

a) Acoustic emission technique

b) Ultrasonic testing

c) Radiographic techniques

d) All of the above

Q2) a) Starting from de Broglie wave equation, derive Schrodinger's Time Independent wave equation. **[6]**

b) State de Broglie hypothesis. Derive the equation of de Broglie wavelength in terms of Kinetic Energy of a particle. **[5]**

c) A neutron is trapped in infinite potential well of width 10^{-14} m. Calculate its first energy eigen value in eV. (Mass of neutron = 1.675×10^{-27} kg) **[4]**

OR

Q3) a) Derive the equation for the energy of particle is enclosed in a one-dimensional rigid box. **[6]**

b) What is Heisenberg's uncertainty Principle? Obtain Heisenberg's uncertainty relation in terms of energy and time. **[5]**

c) Calculate the De-Broglie wavelength of an electron accelerated through potential difference of 10,000 V. **[4]**

Q4) a) Derive an expression for the conductivity in an intrinsic and extrinsic Semiconductor. **[6]**

b) Define a Fermi level in semiconductor. Using Fermi-Dirac probability distribution function, show that the position of Fermi energy level in the intrinsic semiconductor is midway of the forbidden energy gap. **[5]**

c) Calculate the mobility of charge carriers in doped silicon whose conductivity is 100 $(\Omega\text{-m})^{-1}$ and the Hall coefficient is 3.6×10^{-4} m^3/coulomb. **[4]**

OR

Q5) a) State and Explain Hall Effect. Derive the equation of Hall voltage and Hall coefficient. **[6]**

b) What is photovoltaic effect? Explain the construction and working of solar cell. **[5]**

c) A sample of intrinsic germanium at room temperature has a carrier concentration of 4.41×10^{22} cm^3. Donor impurity is added in the ratio 1 donor atom per 10^8 atoms/cm^3. Determine the resistivity of the material. [mobility of electrons is 3800 cm^2/V. s] **[4]**

Q6) a) Explain the process of data is recording, retrieving and erase in magneto-optical recording devices. **[6]**

b) State and explain Meissner effect. Show that superconductors are perfect diamagnetic in nature. **[5]**

c) Calculate the critical magnetic field of wire of lead having a diameter of 1 mm at 4.2 K. The critical temperature for lead is 7.18 K and critical magnetic field at 0K is 6.5×10^4 A/m. **[4]**

OR

Q7) a) State and explain the term superconductivity. Differentiate between type I and type II superconductors (any 04 points). **[6]**

b) Define the terms Magnetic Susceptibility, Relative Permeability and obtain relation between them. **[5]**

c) Define the terms and give its SI units : **[4]**

i) Magnetic field strength (H)

ii) Magnetic flux density (B)

Q8) a) State various types of non-destructive techniques. Explain Acoustic Emission Technique in brief with applications. **[6]**

b) What is nanotechnology? Explain how quantum confinement and change in surface area to volume ratio affects the properties of nanoparticles. **[5]**

c) State different application of Nanotechnology and Explain applications of nanoparticles in targeted drug delivery. **[4]**

OR

Q9) a) Explain Optical and electrical properties of nanoparticles in details. **[6]**

b) What is NDT? Differentiate between destructive testing and non-destructive testing (any 04 points). **[5]**

c) An ultrasonic pulse of frequency 130 kHz is sent through a block of steel. The echo pulse is received after 1.695 microseconds. If velocity of ultrasonic wave in steel is 5900 m/s, calculate the thickness of the steel block and the wavelength of the pulse. **[4]**

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Total No. of Questions : 11]

SEAT No. :

PC5148

[Total No. of Pages :4

[6351]-112

F.E.

BSC-102-BES : ENGINEERING PHYSICS

(2024 Pattern) (Semester-I) (Credit System)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question No. 1 is compulsory.***
2) ***Questions No. 2 to No. 11 carry equal marks.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***
5) ***Use of an electronic calculator is allowed.***

Physical Constants:

- Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg
- Charge on electron, $e = 1.6 \times 10^{-19}$ C
- Planck's constant, $h = 6.63 \times 10^{-34}$ J-sec

Q1) Multiple choice questions. **[10×1=10]**

a) The process of raising the atoms from a lower energy state to a higher one to create population inversion is called:

i) Pumping ii) Stimulated emission

iii) Spontaneous emission iv) Absorption

b) The main principle of optical fiber is:

i) Total internal reflection ii) Total internal refraction

iii) Total internal dispersion iv) None of the above

c) The full form of STM is:

i) Scientific technical microscope

ii) Scanning tunneling microscope

iii) Super tensile microscope

iv) None of the above

P.T.O.

d) The wavelength of a matter wave is ____ to the velocity of the particle:

i) Equal
ii) Inversely proportional
iii) Directly proportional
iv) Independent

e) The condition for a dark fringe in a reflected system for a uniform thickness thin film is:

i) $2\mu t \cos r = n\lambda$
ii) $2\mu t \sin r = n\lambda$
iii) $2\mu t \cos r = (2n \pm 1))\lambda/2$
iv) $2\mu t \sin r = (2n \pm 1)\lambda/2$

f) In a positive crystal, the velocity of the O-ray is:

i) half of velocity of the E-ray
ii) Less than the velocity of the E-ray
iii) Greater than the velocity of the E-ray
iv) None of the above

g) Pure semiconductors are known as:

i) Compound
ii) Extrinsic
iii) Doped
iv) Intrinsic

h) Hall Effect is true for:

i) Metals only
ii) Semiconductors only
iii) N-type semiconductors only
iv) Both metals and semiconductors

i) Superconductors are perfectly:

i) Paramagnetic
ii) Ferromagnetic
iii) Diamagnetic
iv) All of the above

j) Nanostructures have sizes between:

i) 1-100 Å
ii) 1 - 100 nm
iii) 100 - l000nm
iv) None of the above

Q2) a) With a neat labelled diagram, explain the construction, and working of a CO2 laser. **[6]**

b) If an optical fiber has a core refractive index of 1.55 and a cladding refractive index of 1.46, calculate the Numerical Aperture of the fiber. **[3]**

c) Define the following terms: **[3]**

i) Metastable state

ii) Population inversion

iii) Stimulated emission

OR

Q3) a) What is attenuation in optical fibers? Discuss in brief the various internal and external factors responsible for attenuation. **[6]**

b) What is a LASER? State important characteristics of a laser. **[3]**

c) Differentiate between step index and graded index fibers. (Any three points) **[3]**

Q4) a) Derive the Schrödinger's Time-Independent Wave Equation. **[6]**

b) For an electron accelerated by a potential difference V, derive the expression for its de Broglie wavelength. **[3]**

c) Find the lowest energy of an electron confined to a box of length 1 Å. **[3]**

OR

Q5) a) With a neat labelled diagram, explain the principle, construction, and working of a Scanning Tunnelling Microscope (STM). **[6]**

b) State the properties of matter waves (Any three). **[3]**

c) If the de Broglie wavelength is 0.72 AU, then find the momentum of the particle. **[3]**

Q6) a) State the phenomenon of double refraction. Hence, explain Huygens's wave theory of double refraction. **[6]**

b) Explain the application of interference in: **[3]**

Antireflection coating

c) How should the Polarizer and Analyzer be oriented to reduce the intensity of the beam to ½ of its original intensity. **[3]**

OR

Q7) a) Derive the conditions for brightness and darkness for the thin parallel film of thickness t and refractive index μ. **[6]**

b) State and explain Malus's Law. **[3]**

c) A beam of monochromatic light of wavelength 5.82×10^{-7}m falls normally on a glass wedge of angle 20 sec. If the refractive index (RI) of glass is 1.5, find the bandwidth. **[3]**

Q8) a) Explain the classification of solids into conductors, semiconductors, and insulators on the basis of band theory. **[6]**

b) State the any three properties of ultrasonic waves. **[3]**

c) An ultrasonic pulse is sent through a block of copper. The echo pulse is recorded after 4 μs. If the velocity of ultrasonic waves in copper is 5000 m/s, calculate the thickness of the copper block. **[3]**

OR

Q9) a) With a neat labelled diagram, explain the principle, construction, and working of a Piezoelectric Oscillator. **[6]**

b) Write the formula for the Fermi-Dirac probability distribution function, specifying the meaning of each symbol. **[3]**

c) For a P-N junction diode, draw an energy band diagram showing the position of the Fermi level in: **[3]**

Forward bias mode

Q10)a) Explain the Optical and Mechanical properties of nanoparticles. **[6]**

b) State and Explain the Meissner effect. Show that superconductors exhibit perfect diamagnetism. **[6]**

OR

Q11)a) What are the types of superconductors? Distinguish between them. **[6]**

b) What is quantum confinement? How does it affect the properties of nanoparticles? Explain the ball milling method for the synthesis of nanoparticles. **[6]**

Total No. of Questions : 11]

SEAT No. :

PD-4035

[Total No. of Pages : 4

[6401]-2402

F.E.

BSC-102-BES : ENGINEERING PHYSICS

(2024 Pattern) (Semester - I/II)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Q.1 is compulsory.***
2) ***Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9, and Q.10 or Q.11.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data, if necessary.***

Physical Constants :

- Mass of electron $m_e = 9.1 \times 10^{-31}$kg
- Charge on electron, $e = 1.6 \times 10^{-19}$ C
- Planck's constant, $h = 6.63 \times 10^{-34}$ J-sec

Q1) Choose the correct answer and rewrite it. **[10]**

i) Carbon dioxide laser emits wavelength in _____

a) Visible region b) Ultraviolet region

c) Infrared region d) None of the Above

ii) In optical fiber, acceptance cone is ____ the acceptance angle

a) Equal b) Double

c) Half d) One Third

iii) The mater waves are ____

a) Electromagnetic waves

b) Mechanical Waves

c) ultrasonic waves

d) Neither Electromagnetic nor Mechanical Waves

P.T.O.

iv) Wave function Ψ of a particle is

a) a real quantity b) a complex quantity

c) an imaginary quantity d) none of these

v) The points of constructive interference of light are,

a) Always bright b) May be bright or dark

c) Always dark d) Neither bright nor dark

vi) The Plane-polarized light, vibrations of particles in medium are in the direction .... to direction propagation of light.

a) Parallel b) perpendicular

c) Antiparallel d) None

vii) The energy band gap size for semiconductors is in the range__ eV.

a) 1-2 b) 2-3

c) 3-4 d) > 4

viii) The Frequency range for ultrasonic is

a) less than 20Hz b) 20 Hz to 20 KHz

c) Greater Than 20 KHz d) None of the above

ix) The minimum magnetic field required to destroy superconductivity is called _____

a) Critical magnetic field b) Applied magnetic field

c) External magnetic field d) None

x) Nanotechnology studies for the size of particles

a) 100-1000 nm b) more than l00 nm

c) 1-100 nm d) None

Q2) a) With the help of an energy level diagram, explain the construction and working of CO_2 laser. **[6]**

b) Differentiate between step index and graded index fibers. (Any three points) **[3]**

c) Calculate the numerical aperture and acceptance angle of an optical fiber having n_1= 1.48 and n_2 = 1.45 **[3]**

OR

Q3) a) What is attenuation in optical fibers? Discuss in brief the various internal and external factors responsible for attenuation. **[6]**

b) State characteristics of a laser. Explain any one of them in brief. **[3]**

c) What is stimulated emission? Explain its significance in the production of lasers. **[3]**

Q4) a) Starting from de Broglie equation, derive Schrodinger's Time Independent wave equation. **[6]**

b) State de Broglie hypothesis. Derive the equation of de Broglie wavelength by analogy with radiation. **[3]**

c) Lowest energy of an electron trapped in potential well is 38 eV. Calculate the width of well. **[3]**

OR

Q5) a) For a particle trapped in a one-dimensional rigid box, derive the equation for its energy. **[6]**

b) Differentiate between classical and quantum computing (any three). **[3]**

c) Compute the wavelength of the De Broglie waves associated with a proton moving at 5% of the velocity of light. Proton has 1856 times the mass of one electron. (Given: $m_e = 9.1 \times 10^{-31}$kg, $c = 3 \times 10^8$m/s). **[3]**

Q6) a) Explain interference in thin parallel film in the reflected system with a neat & labelled diagram. Calculate the total path difference. Obtain the condition of maximum and minimum. **[6]**

b) Differentiate between positive and negative crystal. **[3]**

c) Obtain the intensity of light transmitted by the analyzer if the angle between the polarizer and analyzer is 45°. **[3]**

OR

Q7) a) What is double refraction? Explain Huygens' theory of double refraction. **[6]**

b) Explain the application of interference as an antireflection coating. **[3]**

c) The wedge-shaped film with a refractive index of 1.5, is illuminated by the light of wavelength 5890A°, If the angle of the wedge is 30 seconds, Calculate the fringe width. **[3]**

Q8) a) With the help of a neat, labelled diagram, explain the Hall effect. Derive the equation of Hall voltage and Hall coefficient. **[6]**

b) What are ultrasonic waves? State characteristics of ultrasonic wave. (any four) **[3]**

c) An ultrasonic pulse is sent through a steel block, an echo is recorded after 1.512 microseconds, calculate the thickness of steel block if the velocity of ultrasonic waves is 5900 rn/s. **[3]**

OR

Q9) a) What is an echo sounding technique? Using this technique explain the method for flaw detection using ultrasonic waves. **[6]**

b) Define Fermi level for metal. Write the formula for Fermi-Dirac distribution function and explain terms involved in it. **[3]**

c) In a semiconductor with a Hall coefficient of 145 cm^3/C having a width of 2 cm and a thickness 0.2 cm with a magnetic field induction of 2T along the smaller dimension with a current of 150 mA. Calculate hall voltage. **[3]**

Q10)a) Explain the process of manufacturing nanoparticles using Physical Vapor Deposition. State advantages and limitations of this method. **[6]**

b) What is Critical magnetic field? Write its equation and explain the terms involved in it. A superconductor has a critical temperature of 3.7 K. At 0 k the critical magnetic field is 0.0306 Tesla. What is the critical magnetic field at temperature 2 K. **[6]**

OR

Q11)a) Explain the Meissner effect. What is the cause of the Meissner effect? Show that superconductors exhibit perfect diamagnetism. **[6]**

b) Explain electrical and optical properties of nanoparticles. **[6]**

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