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18PHY12/18PHY22

First Semester B.E. Semester End Examination, Dec./Jan. 2019-20

APPLIED PHYSICS

Time: 3 Hours   Max. Marks: 100

Instructions: 1. *Answer anyone full question from each of the UNITS*

2. *Physical constants: Velocity of light $c = 3x10^8$ m/s, mass of electron $m = 9.1x10^{-31}$ kg, Boltzmann constant $k = 1.38x10^{-23}$ J/K, electron charge $e = 1.6x10^{-19}$ C, Avogadro's number $N_A = 6.025x10^{23}$ /mole, Planck's constant $h = 6.63x10^{-34}$ Js, mass of proton $m_p = 1.67x10^{-27}$ kg*

		UNIT - I	L	CO	PO	M
1	a.	What is interference? Derive an expression for the condition of maximum and minimum for reflected light in case of thin transparent film of uniform thickness.	(2)	(1)	(1,12)	(07)
	b.	Explain the generation of ultrasonic waves using piezoelectric effect	(2)	(1)	(1,12)	(08)
	c.	In Newton's rings experiment, diameter of 10^{th} dark ring was observed to be 0.5cm. Calculate the radius of curvature of the lens, if the wavelength of incident light is 6000A°.	(2)	(1)	(1,12)	(05)
		OR				
2	a.	What are stationary waves? Explain the difference between stationary waves and travelling waves.	(2)	(1)	(1,12)	(06)
	b.	Derive an expression for diameter of nth dark ring in Newton's ring's pattern.	(2)	(1)	(1,12)	(08)
	c.	Fringes of equal thickness are observed in a thin glass wedge of refractive index 1.50. The fringe spacing is 0.2mm and the wavelength of light being 5893 A°. Calculate the wedge angle.	(3)	(1)	(1,12)	(06)
		UNIT – II	L	CO	PO	M
3	a.	Derive an expression for velocity of electromagnetic waves using Maxwell's equations.	(2)	(2)	(1,12)	(08)
	b.	Discuss the construction and working of semiconductor laser with energy level diagram.	(2)	(2)	(1,12)	(07)
	c.	The angle of acceptance of an optical fiber is 300 when kept in air. Calculate the angle of acceptance when it is in a medium of refractive index 1.33.	(3)	(2)	(1,12)	(05)
		OR				
4	a.	Derive an expression for energy density of radiation in terms of Einstein coefficients.	(2)	(2)	(1,12)	(08)
	b.	Discuss the types of optical fibers.	(2)	(2)	(1,12)	(06)
	c.	A pulsed laser emits photons of wavelength 790nm with 20mW average power/pulse. Calculate the number of photons contained in each pulse if the pulse duration is 20ns	(3)	(2)	(1,12)	(06)
		UNIT - III	L	CO	PO	M
5	a.	Explain de Broglie hypothesis.	(2)	(3)	(1,12)	(05)
	b.	Apply Schrodinger wave equation to a particle in 1D potential well of infinite height and obtain the expression for Eigen function and Eigen value.	(3)	(3)	(1,12)	(09)

c. An electron and 200g base ball are travelling at 250 m/s measured to an accuracy of 0.055%. Calculate uncertainty in position of each and interpret the result.

(3) (3) (1,12) (06)

OR

6 a. State and explain Heisenberg's uncertainty principle.

(1) (3) (1,12) (05)

b. Define phase velocity and group velocity. Obtain the relation between them.

(2) (3) (1,12) (08)

c. Calculate the lowest three energy states for (i) an electron confined in the infinite potential well of width 10 A^o and (ii) a grain dust of mass 10^{-6}g moving in a potential well of width 0.1mm.

(3) (3) (1,12) (07)

UNIT - IV

L CO PO M

7 a. With a neat diagram, explain the band formation in diamond and silicon.

(2) (4) (1,12) (07)

b. Derive an expression for conductivity in an intrinsic semiconductor.

(2) (4) (1,12) (08)

c. If the critical current passing through a 0.4mm diameter superconducting wire is 20 A^o, estimate the critical magnetic field for the superconductor.

(3) (4) (1,12) (05)

OR

8 a. Discuss the dependence of Fermi factor on temperature and energy.

(2) (4) (1,12) (07)

b. Explain BCS theory of superconductivity.

(2) (4) (1,12) (08)

c. The hall co-efficient and conductivity of an n-type silicon specimen are 2.65x10-3 m3/C and 102 /Ωm respectively. Calculate the charge carrier density and electron mobility.

(2) (4) (1,12) (05)

UNIT -V

L CO PO M

a. Discuss density of states for various quantum structures.

(2) (5) (1,12) (06)

b. Describe the construction and working of a scanning electron microscope.

(2) (5) (1,12) (09)

c. The maximum path radius of a cyclotron is 0.3 m and it has a magnetic field strength of magnitude 1.5 Wb/m2 as the cyclotron is used to accelerate the protons , calculate the frequency of the alternating voltage applied to the dees and maximum particle energy.

(2) (5) (1,12) (05)

OR

a. Explain the construction and working of GM counter

(2) (5) (1,12) (09)

b. Explain top down and bottom up approaches of synthesis of nano materials.

(2) (5) (1,12) (06)

c. A G. M. counter collects 10^6 electrons per discharge when the counting rate is 600 counts/min Calculate the average current in the circuit.

(2) (5) (1,12) (05)

Note: L (Level), CO (Course Outcome), PO (Programme Outcome), M (Marks)

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18PHY12

First Semester B.E. Makeup Examination, January 2020

APPLIED PHYSICS

Time: 3 Hours | Max. Marks: 100

Instructions: 1. *Answer any one full question from each unit.*
2. *Physical constants: Velocity of light $c = 3x10^{8}$ m/s, mass of electron $m = 9.1x10^{-31}$ kg, Boltzmann constant $k = 1.38x10^{-23}$ J/K, electron charge $e = 1.6x10^{-19}$ C, Avogadro's number $N_A = 6.025x10^{23}$ /mole, Planck's constant $h = 6.63x10^{-34}$ Js, mass of proton $m_p = 1.67x10^{-27}$ kg*

UNIT - I

		L	CO	PO	M
a.	Deduce the conditions for maxima and minima in the interference pattern of reflected light from a thin transparent film of uniform thickness.	(2)	(1)	(1,12)	(10)
b.	Discuss piezoelectric method of generating ultrasonic waves.	(2)	(1)	(1,12)	(05)
c.	A monochromatic light of wavelength 5000Å is incident on a plane diffraction grating with grating constant $5.0x10^{5}$ cm. Calculate the maximum order of spectrum that can be observed.	(3)	(1)	(1,12)	(05)

OR

		L	CO	PO	M
a.	Derive an expression for resolving power of a plane transmission grating.	(2)	(1)	(1,12)	(06)
b.	With a neat diagram discuss the construction and working of Michelson's interferometer.	(2)	(1)	(1,12)	(09)
c.	In a Newton's ring experiment the diameter of the 12^{th} ring was found to be 5.146cm and that of the 4^{th} ring was 5.007cm. If the radius of the plano-convex lens is 75 cm, calculate the wavelength of light used.	(3)	(1)	(1,12)	(05)

UNIT – II

		L	CO	PO	M
a.	With relevant diagrams, explain the construction and working of a semiconductor laser.	(2)	(2)	(1,12)	(07)
b.	Derive the expression for velocity of electromagnetic waves using Maxwell equations.	(2)	(2)	(1,12)	(08)
c.	In an optical fiber the refractive index of the core and cladding are 1.55 and 1.49 respectively. Calculate the numerical aperture, angle of acceptance and fractional index change.	(3)	(2)	(1,12)	(05)

OR

		L	CO	PO	M
a.	Obtain an expression for energy density of radiation under thermal equilibrium condition interms of Einstein's co-efficient.	(2)	(2)	(1,12)	(08)
b.	What does numerical aperture signify? Derive the expression for numerical aperture of an optical fiber.	(2)	(2)	(1,12)	(07)
c.	A pulsed laser emits photons of wavelength 7500 Å with 30 mW average power/pulse. Calculate the number of photons contained in each pulse if the pulse duration is 8 ns.	(3)	(2)	(1,12)	(05)

UNIT - III

		L	CO	PO	M
a.	Define phase velocity and group velocity. Obtain the relation between them.	(2)	(3)	(1,12)	(07)
b.	Explain Heisenberg's Uncertainty principle and give its elementary proof.	(2)	(3)	(1,12)	(07)

c. An electron is bound in a one dimensional potential well of width 20A0, but of infinite height. Calculate its energy value in the ground state and also in the first two excited states.

(3) (3) (1,12) (06)

OR

6 a. Set up Schrodinger's time independent one dimensional wave equation.

(2) (3) (1,12) (09)

b. Explain the elementary operators in quantum mechanics.

(2) (3) (1,12) (05)

c. An electron and 100g base ball are travelling at 200 m/s measured to an accuracy of 0.05%. Calculate uncertainty in position of each and interpret the result.

(3) (3) (1,12) (06)

UNIT - IV

L CO PO M

7 a. With neat diagram explain the energy band formation in case of silicon and diamond.

(2) (4) (1,12) (09)

b. Write a note on Maglev vehicle.

(2) (4) (1,12) (06)

c. The hall co-efficient and conductivity of an n-type silicon specimen are 3.66×10^{-3} m^3/C and 105 $/\Omega m$ respectively. Calculate the charge carrier density and electron mobility.

(3) (4) (1,12) (05)

OR

8 a. Show that Fermi level lies in the middle of the forbidden gap in case of an intrinsic semiconductor.

(2) (4) (1,12) (07)

b. Explain BCS theory of superconductivity.

(2) (4) (1,12) (07)

c. Calculate the critical current of a material having a diameter of 2 mm at 4.2 K. The critical temperature of a material is 6.98 K and critical magnetic field at 0 K is 5.38×10^4 A/m.

(3) (4) (1,12) (06)

UNIT -V

L CO PO M

9 a. Explain the density of states for various quantum structures.

(2) (5) (1,12) (08)

b. Describe the working of a scanning electron microscope (SEM).

(2) (5) (1,12) (07)

c. In a linear accelerator, proton accelerated thrice by a potential 40KV leaves a tube and enters an accelerating space of length 30cmbefore entering the next tube. Calculate the frequency of the r.f. voltage and length of the tube entered by the proton.

(3) (5) (1,12) (05)

OR

10 a. Explain top down and bottom up approaches of synthesis of nanomaterials.

(2) (5) (1,12) (06)

b. Discuss the construction and working of linear accelerator.

(2) (5) (1,12) (08)

c. A G. M. counter collects 10^6 electrons per discharge when the counting rate is 600 counts/min Calculate the average current in the circuit.

(3) (5) (1,12) (06)

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15PHY22/16PHY22/18PHY22

Second Semester B.E. Semester End Examination, May/June 2018-19

ENGINEERING PHYSICS / APPLIED PHYSICS

me: 3 Hours Max. Marks: 100

Instructions: 1. *Unit-II and Unit-V are compulsory.*
2. *Answer any one full question from each of the other units.*
3. *Physical Constants: Velocity of light $c = 3x10^8 m/s$, mass of electron $m=9.1x10^{-31} kg$, Boltzmann constant $k=1.38x10^{-23} J/K$, electron charge $e= 1.6 x10^{-19}$ C, Avogadro's number $N_A=6.025x10^{23}$/mole*

UNIT - I

Q.No.		Question	L	CO	PO	M
1	a.	Explain the term group velocity. Show that group velocity is same as particle velocity.	(2)	(1)	(1)	(06)
	b.	Give the Max Born interpretation of wave function. Derive an expression for energy eigen values for a particle in a one dimensional potential well of infinite height.	(2)	(1)	(1)	(10)
	c.	A particle of mass $0.80 MeV/c^2$ has a kinetic energy of 100eV. Find the de Broglie wavelength of the particle.	(3)	(1)	(1)	(04)

OR

Q.No.		Question	L	CO	PO	M
2	a.	Describe the Davisson – Germer experiment to confirm the wave nature of electrons.	(2)	(1)	(1)	(09)
	b.	Set up Schrodinger's time independent wave equation in one dimension.	(2)	(1)	(1)	(06)
	c.	An electron is confined to a potential well of width 12nm.Calulate the minimum uncertainty in its velocity.	(3)	(1)	(1)	(05)

UNIT – II (Compulsory)

Q.No.		Question	L	CO	PO	M
3	a.	Discuss the Kronig Penney Model and explain the origin of energy bands in solids.	(2)	(2)	(1)	(08)
	b.	Show that Fermi level lies in the middle of the forbidden gap in case of an intrinsic semiconductor	(2)	(2)	(1)	(07)
	c.	The resistivity and Hall coefficient of a silicon sample are $8.9 \times 10^{-3} \Omega m$ and $3.6x10^{-4} m^3/C$ respectively. Calculate the charge carrier density and mobility.	(3)	(2)	(1)	(05)

UNIT - III

Q.No.		Question	L	CO	PO	M
4	a.	With the neat schematic diagram, explain the mechanism of flaw detection in a solid by NDT using ultrasonic waves.	(2)	(3)	(1)	(06)
	b.	Deduce an expression for path difference in case of interference due to the light reflected by a plane parallel thin film. Mention the conditions for maxima and minima.	(2)	(3)	(1)	(09)
	c.	When a light of wavelength 633nm undergoes diffraction at a plane diffraction grating, it results into a second order maximum at an angle of 50^o.Evaluate the grating constant.	(3)	(3)	(1)	(05)

OR

Q.No.		Question	L	CO	PO	M
5	a.	Discuss the construction and working of Michelson's interferometer. Mention its applications.	(2)	(3)	(1)	(10)

Note: L (Level), CO (Course Outcome), PO (Programme Outcome), M (Marks)

b. Derive an expression for resolving power of a plane transmission grating.

(2) (3) (1)

c. In a Newton's rings experiment, with a wavelength of the light 655nm, the diameter of t ring and 3rd ring is observed to be 0.6cm and 0.34cm respectively. Calculate radius of curva the plano-convex lens used.

(3) (3) (1)

L CO PO

UNIT - IV

6 a. What is attenuation in a fiber? Discuss the factors contributing to the attenuation.

(2) (4) (1)

b. Explain the construction and working of a CO_2 laser with neat diagrams.

(2) (4) (1)

c. Calculate the numerical aperture and acceptance angle for an optical fiber having refra indices 1.53 and 1.49 for the core and cladding respectively.

(2) (4) (1)

OR

7 a. With neat diagrams, discuss the different types of optical fibers.

(2) (4) (1)

b. Write the Maxwell's equations for free space. Hence show that velocity of light in vacuur equal to 3×10^8 m/s.

(2) (4) (1)

c. Calculate the ratio of population densities of two energy states in a material that produces a la beam of wavelength 6328A° at an ambient temperature of 27°C.

(3) (4) (1)

L CO PO

UNIT –V (Compulsory)

8 a. Give a qualitative account of BCS theory of superconductivity.

(2) (5) (1) (0

b. With the relevant diagrams explain a) Meissner effect and
b) Type-I and Type-II superconductors.

(2) (5) (1) (0

c. A Josephson junction with a voltage difference of 635μV radiates electromagnetic radiation Calculate frequency of the electromagnetic waves.

(3) (5) (1) (04

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Second Semester B.E. Makeup Examination, May/June 2018-19

APPLIED PHYSICS

ime: 3 Hours Max. Marks: 100

Instructions: 1. *Questions from Unit-II and Unit-V are compulsory.*
2. *Answer any one full question from each of the other units.*
3. *Max. Marks will be scaled to 50 marks for SGPA & CGPA.*
4. *Physical Constants: Velocity of light $c= 3x10^8 m/s$, mass of electron $m=9.1x10^{-31} kg$, Boltzmann constant $k=1.38x10^{-23} J/K$, electron charge $e= 1.6x10^{-19} C$, Avogadro's number $N_A=6.025x10^{23}/mole$*

UNIT – I	L	CO	PO	M
a. Define Phase velocity and Group velocity. Derive the relation between them.	(2)	(1)	(1)	(07)
b. Set up Schrodinger's time independent wave equation in one dimension for matter waves.	(2)	(1)	(1)	(07)
c. An electron is confined to a box of width 0.16nm. Calculate the energy eigen values and de-Broglie wavelengths corresponding to the first two allowed energy states.	(3)	(1)	(1)	(06)
OR				
a. State Heisenberg's uncertainty principle. Give its elementary proof using the concept of de Broglie wave packet.	(2)	(1)	(1)	(06)
b. Obtain Eigen values and eigen functions for a particle in a one dimensional box of infinite height.	(2)	(1)	(1)	(10)
c. Estimate the potential difference required to accelerate an electron, so that its de-Broglie wavelength will be equal to 1.65A°.	(3)	(1)	(1)	(04)

UNIT – II (Compulsory)	L	CO	PO	M
a. Explain the term Fermi energy. Discuss the variation of Fermi factor with energy and temperature.	(2)	(2)	(1)	(07)
b. With neat diagrams explain the energy band formation in case of lithium and silicon and discuss their electrical conductivity.	(2)	(2)	(1)	(09)
c. The Hall coefficient of a material is -3.68 x 10^{-5} m^3/C. Evaluate the carrier concentration in the material and comment on the type of charge carriers.	(3)	(2)	(1)	(04)

UNIT – III	L	CO	PO	M
a. Discuss the technique of non destructive testing of materials using ultrasonic waves.	(2)	(3)	(1)	(06)
b. Explain the construction and working of Michelson's interferometer with relevant diagrams.	(2)	(3)	(1)	(10)
c. In a Newton's rings experiment, diameter of 4^{th} and 14^{th} dark rings was found to be 0.35cm and 0.56cm respectively. If radius of the plano convex lens is 90cm, compute wavelength of the light incident.	(3)	(3)	(1)	(04)
OR				
a. Define the term diffraction of light. Distinguish between Fresnel diffraction and Fraunhofer diffraction.	(2)	(3)	(1)	(07)

Note: L (Level), CO (Course Outcome), PO (Programme Outcome), M (Marks)

Q. No.		Question	L	CO	PO	M
	b.	Obtain an expression for the fringe width in the interference pattern of a wedge shaped film.	(2)	(3)	(1)	(09)
	c.	For a plane diffraction grating, second order diffraction maximum is observed at a certain angle for the light of wavelength 650nm. If the grating constant is 1.67×10^{-4}cm, evaluate the angle of diffraction.	(3)	(3)	(1)	(04)

UNIT – IV

Q. No.		Question	L	CO	PO	M
6	a.	Elaborate the construction and working of Nd-YAG laser with suitable diagrams.	(2)	(4)	(1)	(08)
	b.	Write down the Maxwell's equations for free space and hence obtain the expression for velocity of light.	(2)	(4)	(1)	(08)
	c.	Calculate the numerical aperture and acceptance angle of an optical fiber, if the refractive indices of core and cladding are 1.45 and 1.42 respectively.	(3)	(4)	(1)	(04)

OR

Q. No.		Question	L	CO	PO	M
7	a.	Explain the terms numerical aperture and fractional index change. Derive the expression for numerical aperture of an optical fiber.	(2)	(4)	(1)	(08)
	b.	What is meant by LIDAR? Describe how it works in determining pollutants in the atmosphere.	(2)	(4)	(1)	(06)
	c.	A laser source is emitting a light beam of wavelength 694.3 nm with an average output power of 5 mW. Calculate the number of photons emitted per second by the laser source.	(3)	(4)	(1)	(06)

UNIT –V (Compulsory)

Q. No.		Question	L	CO	PO	M
8	a.	Discuss any two properties of superconductors. Distinguish between Type I and Type-II superconductors.	(2)	(5)	(1)	(10)
	b.	Write a note on Maglev vehicle	(2)	(5)	(1)	(05)
	c.	Calculate the critical current for a lead wire of diameter 0.5mm at 4.2K. The critical temperature for lead is 7.18 K and critical field at 0 K is 6.5×10^4 A/m.	(3)	(5)	(1)	(05)

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18PHY12/16PHY12/PHY12/15PHY22

First Semester B.E. Semester End Examination, Dec/Jan 2018-19

APPLIED PHYSICS/ENGINEERING PHYSICS

Time: 3 Hours   Max. Marks: 100

Instructions:
1. *Unit II and V are compulsory.*
2. *Answer any one question from units I, III and IV.*
3. *Maximum marks will be scaled to 50 for SGPA and CGPA calculation.*
4. *Physical constants: Speed of light, $c=3.0\times10^{8}$ m/s; Plank's constant $h=6.63\times10^{-34}$ Js; Mass of electron $m_e=9.1\times10^{-31}$ Kg; Charge of electron $e=1.6\times10^{-19}$ C; Boltzmann constant $K=1.38\times10^{-23}$ J/K*

UNIT - I

L CO PO M

a. Define group velocity and phase velocity. Derive the relation between them. (2) (1) (1) (06)

b. Discuss Davisson-Germer experiment to confirm the wave nature of electrons. (2) (1) (1) (10)

c. An electron is confined to a box of length $10A^0$. Calculate the minimum uncertainty in the velocity. (2) (1) (1) (04)

OR

a. Set up one - dimensional time independent Schrodinger's wave equation. (2) (1) (1) (07)

b. Explain Max Born interpretation of wave function and normalization condition. (2) (1) (1) (07)

c. An electron is bound in one dimensional infinite potential well of width 0.12 nm. Find the energy values in the ground state and also the first two excited states in eV. (3) (1) (1) (06)

UNIT – II

L CO PO M

a. Discuss the temperature dependence of Fermi Dirac distribution. (2) (2) (1) (06)

b. With a neat diagram, describe band formation in Silicon and Diamond. Discuss why silicon is semiconductor and diamond is insulator. (2) (2) (1) (08)

c. In Hall effect experiment, 250 mA current flows through a sample of thickness 1 mm and 5 cm wide. The Hall voltage of -0.20 mV was recorded for a magnetic field of 0.3 Tesla. Calculate i) current density ii) carrier concentration iii) Hall coefficient. (3) (2) (1) (06)

UNIT - III

L CO PO M

a. Explain the terms a) Geometrical path b)optical path & c) phase difference (1) (3) (1) (06)

b. What is interference? Explain the interference due to thin film. (2) (3) (1) (09)

c. In Newton's rings experiment, diameter of 10^{th} dark ring due to wavelength $6000A^0$ in air is 0.5cm. Find the radius of curvature of the lens. (3) (3) (1) (05)

OR

a. Explain the non destructive testing of materials using ultrasonic waves. (2) (3) (1) (06)

b. With a neat diagram, discuss construction and working of Michelson interferometer. (3) (3) (1) (10)

Note: L (Level), CO (Course Outcome), PO (Programme Outcome), M (Marks)

b. Obtain an expression for the fringe width in the interference pattern of a wedge shaped film. (2) (3) (1) ([illegible])

c. For a plane diffraction grating, second order diffraction maximum is observed at a certain angle for the light of wavelength 650nm. If the grating constant is 1.67×10^{-4} cm, evaluate the angle of diffraction. (3) (3) (1) (04)

	L	CO	PO	M

UNIT – IV

6 a. Elaborate the construction and working of Nd-YAG laser with suitable diagrams. (2) (4) (1) (08)

b. Write down the Maxwell's equations for free space and hence obtain the expression for velocity of light. (2) (4) (1) (08)

c. Calculate the numerical aperture and acceptance angle of an optical fiber, if the refractive indices of core and cladding are 1.45 and 1.42 respectively. (3) (4) (1) (04)

OR

7 a. Explain the terms numerical aperture and fractional index change. Derive the expression for numerical aperture of an optical fiber. (2) (4) (1) (08)

b. What is meant by LIDAR? Describe how it works in determining pollutants in the atmosphere. (2) (4) (1) (06)

c. A laser source is emitting a light beam of wavelength 694.3 nm with an average output power of 5 mW. Calculate the number of photons emitted per second by the laser source. (3) (4) (1) (06)

	L	CO	PO	M

UNIT –V (Compulsory)

8 a. Discuss any two properties of superconductors. Distinguish between Type I and Type-II superconductors. (2) (5) (1) (10)

b. Write a note on Maglev vehicle (2) (5) (1) (05)

c. Calculate the critical current for a lead wire of diameter 0.5mm at 4.2K. The critical temperature for lead is 7.18 K and critical field at 0 K is 6.5×10^4 A/m. (3) (5) (1) (05)

Note: L (Level), CO (Course Outcome), PO (Program...

18PHY12/16PHY12/PHY12/15PHY22

First Semester B.E. Semester End Examination, Dec/Jan 2018-19

APPLIED PHYSICS/ENGINEERING PHYSICS

e: 3 Hours — Max. Marks: 100

Instructions:
1. *Unit II and V are compulsory.*
2. *Answer any one question from units I, III and IV.*
3. *Maximum marks will be scaled to 50 for SGPA and CGPA calculation.*
4. *Physical constants: Speed of light, c=3.0 ×10^{8} m/s; Plank's constant h= 6.63×10^{-34} Js; Mass of electron m_e=9.1×0^{-31} Kg; Charge of electron e= 1.6 ×10^{-19} C; Boltzmann constant K=1.38×10^{-23} J/K*

	UNIT - I	L	CO	PO	M
a.	Define group velocity and phase velocity. Derive the relation between them.	(2)	(1)	(1)	(06)
b.	Discuss Davisson-Germer experiment to confirm the wave nature of electrons.	(2)	(1)	(1)	(10)
c.	An electron is confined to a box of length 10A^{0}. Calculate the minimum uncertainty in the velocity.	(2)	(1)	(1)	(04)
	OR				
a.	Set up one - dimensional time independent Schrodinger's wave equation.	(2)	(1)	(1)	(07)
b.	Explain Max Born interpretation of wave function and normalization condition.	(2)	(1)	(1)	(07)
c.	An electron is bound in one dimensional infinite potential well of width 0.12 nm. Find the energy values in the ground state and also the first two excited states in eV.	(3)	(1)	(1)	(06)

	UNIT – II	L	CO	PO	M
a.	Discuss the temperature dependence of Fermi Dirac distribution.	(2)	(2)	(1)	(06)
b.	With a neat diagram, describe band formation in Silicon and Diamond. Discuss why silicon is semiconductor and diamond is insulator.	(2)	(2)	(1)	(08)
c.	In Hall effect experiment, 250 mA current flows through a sample of thickness 1 mm and 5 cm wide. The Hall voltage of -0.20 mV was recorded for a magnetic field of 0.3 Tesla. Calculate i) current density ii) carrier concentration iii) Hall coefficient.	(3)	(2)	(1)	(06)

	UNIT - III	L	CO	PO	M
a.	Explain the terms a) Geometrical path b)optical path & c) phase difference	(1)	(3)	(1)	(06)
b.	What is interference? Explain the interference due to thin film.	(2)	(3)	(1)	(09)
c.	In Newton's rings experiment, diameter of 10th dark ring due to wavelength 6000A^{0} in air is 0.5cm. Find the radius of curvature of the lens.	(3)	(3)	(1)	(05)
	OR				
a.	Explain the non destructive testing of materials using ultrasonic waves.	(2)	(3)	(1)	(06)
b.	With a neat diagram, discuss construction and working of Michelson interferometer.	(3)	(3)	(1)	(10)

Note: L (Level), CO (Course Outcome), PO (Programme Outcome), M (Marks)

			L	CO	PO	M
	c.	The sodium yellow doublet has wavelengths $5890A^0$ and $5896A^0$. Calculate the resolving power of grating.	(3)	(3)	(1)	(04)

UNIT - IV

			L	CO	PO	M
6	a.	What is physical significance of divergence and curl? Derive expression for speed of light using Maxwell's equations.	(2)	(4)	(1)	(08)
	b.	With a neat diagram, describe the construction and working of Nd:YAG laser.	(2)	(4)	(1)	(06)
	c.	Calculate numerical aperture and acceptance angle for an optical fiber with core and cladding indices 1.52 and 1.48 respectively.	(3)	(4)	(1)	(06)

OR

			L	CO	PO	M
7	a.	Why do we need material of higher refractive index for the core of an optical fiber? Obtain an expression for numerical aperture of an optical fiber.	(2)	(4)	(1)	(07)
	b.	Prove the following relations for Einstein coefficients. $\frac{A_{21}}{B_{12}} = \frac{8\pi h\nu^3}{c^3}$ and $B_{12} = B_{21}$.	(2)	(4)	(1)	(08)
	c.	The average output power of laser source emitting a laser beam of wavelength 620nm is 10mW. Calculate the number of photons emitted per second by the laser source.	(3)	(4)	(1)	(05)

UNIT -V

			L	CO	PO	M
8	a.	Explain BCS theory of superconductivity.	(2)	(5)	(1)	(08)
	b.	Explain the types of superconductors.	(2)	(5)	(1)	(06)
	c.	What is SQUID? Describe its working.	(2)	(5)	(1)	(06)

Note: L (Level), CO (Course Outcome), PO (Programme Outcome), M (Marks)

USN

PHY12/22/15PHY22/16PHY22

Second Semester B.E. Semester End Examination, May / June 2018

ENGINEERING PHYSICS/APPLIED PHYSICS

Time: 3 Hours | Max. Marks: 100

Instructions:
1. *Unit III and Unit V are compulsory*
2. *Answer any one full question from each of the remaining units.*
3. *Max. Marks will be scaled down to 50 marks for SGPA and CGPA.*
4. *Physical constants: Speed of light $c = 3.0 \times 10^{8} m/s$; Plank's constant $h = 6.63 \times 10^{-34} Js$; Mass of electron $m = 9.1 \times 10^{-31} kg$; Charge of electron $e = 1.6 \times 10^{-19} C$; Boltzmann constant $k = 1.38 \times 10^{-23} J/K$*

UNIT - I

a. State Heisenberg's uncertainty principle. On the basis of Heisenberg's uncertainty principle, show that electron do not exist inside the nucleus. — 08 M
(Level [3], CO [1], PO [1])

b. Evaluate the eigen function and eigen value for a particle in a box of infinite height. — 08 M
(Level [3], CO [1], PO [1])

c. Estimate the potential difference through which an electron is needed to be accelerated so that its de Broglie wavelength becomes equal to 30 Å. — 04 M
(Level [2], CO [1], PO [1])

OR

a. Set up one-dimensional time independent Schrodinger wave equation. — 08 M
(Level [2], CO [1], PO [1])

b. Mention the properties of matter waves and properties of wavefunction. — 06 M
(Level [2], CO [1], PO [1])

c. Electrons with energy of 0.5eV are incident on a potential barrier of 3.0 eV high and 0.1nm wide. Find approximate probability for these electrons to penetrate the barrier. — 06 M
(Level [3], CO [1], PO [1])

UNIT – II

a. Define the Fermi factor. Discuss the variation of Fermi factor with energy and temperature. — 07 M
(Level [2], CO [1], PO [a])

b. Define Hall Effect. Derive an expression for Hall Coefficient. — 07 M
(Level [3], CO [1], PO [a])

c. Calculate the Fermi velocity and the mean free path for the conduction electrons in silver, given that its Fermi energy is 5.5eV and the relaxation time for electrons is 3.83×10^{-14}s. — 06 M
(Level [3], CO [1], PO [a])

OR

a. Explain the merits of quantum free electron theory. — 06 M
(Level [2], CO [2], PO [a])

b. Derive an expression for Fermi level in an intrinsic semiconductor. — 08 M
(Level [2], CO [2], PO [a])

c. The Hall co-efficient of a specimen of doped silicon is found to be 3.66 $X10^{-4}$ m^3/coulomb. The resistivity of the specimen is 9.93 $X10^{-3}$ ohm–m. find the mobility and density of the charge carrier assuming single carrier conduction. 06 M

(Level [3], CO [2], PO [a])

UNIT – III

5 a. Derive an expression for interplanar spacing in terms of Miller indices. 07 M

(Level [1,2], CO [3], PO [1])

b. Describe the construction and working of Bragg's X-ray diffractometer. 07 M

(Level [3], CO [3], PO [1])

c. Draw the following planes in a cubic unit cell (1 2 2), (1 0 0), ($\bar{2}$ 1 3) 06 M

(Level [3], CO [3], PO [1])

UNIT – IV

6 a. Derive an expression for Energy Density of radiation in terms Einstein's coefficients. 08 M

(Level [3], CO [4], PO [a])

b. Explain the construction and working of LIDAR 06 M

(Level [2], CO [4], PO [a])

c. Assume that light signal of power 100 mW passes through 500 m length optical fiber and only 80 mW power is detected at other end. Calculate the fiber loss. 06 M

(Level [3], CO [4], PO [a])

OR

7 a. With necessary diagrams explain the construction and working of CO_2 laser. 09 M

(Level [3], CO [4], PO [a])

b. With neat ray diagram derive the condition for propagation of light in an optical fiber. 06 M

(Level [2], CO [4], PO [a])

c. A pulsed laser emits photons of wavelength 780 nm with 20mW average power per pulse. Calculate the number of photons contained in each pulse if the pulse duration is 10 ns. 05 M

(Level [3], CO [4], PO [a])

UNIT –V

8 a. What are ultrasonic waves? With a neat diagram explain any one of the method for generation of ultrasonic waves. 06 M

(Level [2], CO [5], PO [1])

b. Describe the construction and working of Transmission electron microscope with neat diagram. 08 M

(Level [2], CO [5], PO [1])

c. Explain two methods of synthesis of nanomaterials. 06 M

(Level [2], CO [5], PO [1])

USN

15/16PHY12/PHY12

First Semester B.E. Semester End Examination, Dec/Jan 2017-18

APPLIED PHYSICS

Time: 3 Hours Max. Marks: 100

Instructions: 1. *Unit III and Unit V are compulsory.*
2. *Answer any one full question from each of the remaining units.*
3. *Maximum marks will be scaled to 50 marks for SGPA and CGPA.*
4. *Physical constants: Speed of light $c=3.0\times10^{8}$ m/s ; Plank's constant $h= 6.63\times10^{-34}$ Js ; Mass of electron $m= 9.1\times10^{-31}$ kg ; charge of electron $e = 1.6\times10^{-19}$ C; Boltzmann constant $k= 1.38\times10^{-23}$ J/K*

UNIT– I

a. A ball (0.15 kg) and an electron are moving along X-axis with a velocity of 30 m/s. Find the uncertainty in position of both objects if the uncertainty in velocity for both objects is 5%. 06 M
(Level [3],CO [1], PO [1])

b. Using Schrödinger's time independent wave equation and normalization condition for a particle in an infinite potential well of width L, show that $\psi = \sqrt{\frac{2}{L}}\sin\left(\frac{n\pi x}{L}\right)$ 10 M
(Level [2], CO [1], PO [1])

c What are the conditions for allowed wave functions? 04 M
(Level [2], CO [1], PO [1])

OR

a. A particle is in the second excited state of an infinite potential well of width 'a'. Calculate the probability of finding the particle in between $x = \frac{a}{3}$ and $x = \frac{2a}{3}$. 06 M
(Level [3], CO [1], PO [1])

b. Show that an electron cannot exist in the nucleus of an atom using Uncertainty principle. 06 M
(Level [2], CO [1], PO [1])

c. Explain the phenomenon of tunneling through a potential barrier. Discuss one of its applications in brief. 08 M
(Level [2], CO [1], PO [1])

UNIT – II

a. Fermi energy of silver is 5.5 eV. Estimate the energy of the level whose probability of occupancy is (i) 0.89 and (ii) 0.11 at 300 K. 06 M
(Level [3], CO [2], PO [1])

b Describe the formation of energy bands in case of carbon and silicon with neat diagrams and discuss why carbon is an insulator and silicon is a semiconductor. 08 M
(Level [2], CO [2], PO [1])

c For intrinsic semiconductor, show that Fermi energy lies at the center of band gap. 06 M
(Level [2], CO [2], PO [1])

OR

4 a. State the assumptions of quantum free electron theory. 04 M
(Level [2], CO [2], PO [1])

b. Show that energy levels below Fermi level are completely filled and those above Fermi level are completely empty at absolute zero temperature. 08 M
(Level [3], CO [2], PO [1])

c. What is Hall effect? Show that for an n-type semiconductor, $n = \frac{IB}{Vte}$, where n is carrier concentration, I- current through semiconductor, B- applied magnetic field, V- Hall voltage, t - thickness of semiconductor and e- the charge of an electron. 08 M
(Level [2], CO [2], PO [1])

UNIT – III

5 a. First order diffraction in a cubic crystal is observed for X-rays of wavelength 1.5A° at the glancing angle of 30°. Compute the lattice constant, if the Miller indices of the plane causing diffraction are (110). 06 M

(Level [3], CO [3], PO [1])

b. Draw the crystal planes in a cubic unit cell for the Miller indices (330), (040) and (222). 06 M

(Level [2], CO [3], PO [1])

c. Define the term atomic packing fraction. Calculate the atomic packing fraction for BCC and FCC crystal structures. 08 M

(Level [1, 2], CO [3], PO [1])

UNIT – IV

6 a. Explain the terms stimulated absorption, spontaneous emission and stimulated emission with suitable energy level diagrams. 06 M

(Level [2], CO [4], PO [1])

b. Obtain an expression for energy density of radiation in terms of Einstein's coefficients. 08 M

(Level [2], CO [4], PO [1])

c. What is the critical angle at the core-cladding boundary, if the refractive indices of core and cladding are 1.563 and 1.498 respectively? Find the numerical aperture and angle of acceptance of the fiber. 06 M

(Level [3], CO [4], PO [1])

OR

7 a. Discuss the types of Optical fibers and modes of propagation with relevant diagrams. 08 M

(Level [2], CO [4], PO [1])

b. A laser emits light of power 1mW and operates at a wavelength of 6328 A°. How many photons are emitted per second by the laser? 05 M

(Level [3], CO [4], PO [1])

c. Explain the technique of measurement of atmospheric pollutants using a laser. 07 M

(Level [2], CO [4], PO [1])

UNIT – V

8 a. How does the density of states vary for various nanostructures? 08 M

(Level [2], CO [5], PO [1])

b. Elaborate the two methods of generation of ultrasonic waves. 06 M

(Level [2], CO [5], PO [1])

c Explain the construction and working of a transmission electron microscope with a suitable diagram. 06 M

(Level [2], CO [5], PO [1])