Guru Nanak Dev Engineering College, Ludhiana			
Department of Information Technology			
Program	B.Tech.(MEA, MEB, ITA, ITB)	**Semester**	2
Subject Code	BSC-101	**Subject Title**	Physics
Mid Semester Test (MST) No.	1	**Course Coordinator(s)**	Dr. Harpreet Kaur, Dr. Randhir Singh, Dr. Paramjit Singh, Dr. Amarjot Kaur
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	15May, 2023	**Roll Number**	2717026

Note: Attempt all questions

Q. No.		Question	COs, RBT level	Marks
Q1		Differentiate Between Spontaneous and stimulated emission.	CO1, L2	2
Q2		What is difference between Step index and Graded index optical fibre?	CO1, L2	2
Q3		Explain in detail principle, construction and working of Ruby laser. **OR** Discuss different types of losses in an optical fibre.	CO1, L3	4
Q4	(i)	The light gathering ability of an optical fibre is 0.479.The fractional refractive index between core and cladding is 0.0005. Calculate the refractive index of the cladding, outside medium is air.	CO1, L3	2
	(ii)	Find the diameter of the core for single mode transmission at wavelength $8500X10^{-10}$ m, whose refractive indices for core and cladding are 1.48 and 1.47 respectively.		2
Q5	(i)	What is the significance of critical temperature (T_c) and critical magnetic field (H_c)for superconductor?	CO1, L3	2
	(ii)	The transition temperature of a superconducting material is 8.0K. Calculate the maximum value of critical magnetic field {Hc(0)} required to change superconducting state into the normal conducting state. Given that critical magnetic field of 10^4 tesla is required at a temperature of 4.0K		2
Q6	(i)	Derive London's first and second equation and discuss how its solution leads to Meissner effect.	(a) CO5, L3	4
	(ii)	What is an optical fibre? What are main sections of an optical fibre? Describe the function of each section.	(b) CO5, L3	2
	(iii)	The critical field for superconducting material is $2X10^4$ A/m at 10K and $4X10^4$A/m at 0K. Calculate critical temperature of the material.		2

Course Outcomes (CO): *Students will be able to*

1	Solve the problems in the fields of electromagnetism lasers and fibre optics.
2	Apply the knowledge acquired from the study of semiconductors to identify their use in latest technology.
3	Recognise the inadequacy of classical mechanics for certain physical problems and thus find the solutions of these problems using principles of quantum physics.
4	Comprehend the concept of oscillations and hands to implement the same in the theory of machines.
5	Understand the basic characteristics of materials relevant to engineering and technology applications.
6	Apply multi disciplinary knowledge of science complex problems from different angles perspectives and to find the best possible solution model.

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

Physics

Guru Nanak Dev Engineering College Ludhiana			
Department of Applied Sciences			
Program	**B.Tech. 1st ECE A**	**Semester**	**2nd**
Subject Code	**BSC- 101**	**Subject Title**	**Physics**
Mid Semester Test (MST) No.	**1st**	**Class Teacher**	**Dr. Harpreet Kaur Grewal**
Max. Marks	**24**	**Time Duration**	**1 Hr. 30 Mins**
Date of MST	**April 01, 2023**	**Roll Number**	

Note: Attempt all questions.

Q. No.	Question	COs, RBT level	Marks
Q1	Show that isolated poles do not exist in nature.	CO1, L3	2
Q2	Explain the concept of divergence of a vector field. Write condition for the vector field to be solenoidal.	CO1, L2	2
Q3	What are EM waves? Derive Maxwell's wave equation for the propagation of EM waves through free space. Also find speed of EM waves in free space.	CO1,6; L5	4
Q4	Given $\vec{A} = x^2yz\,\hat{\imath} - xy^2z\,\hat{\jmath} + xyz^2\,\hat{k}$. Find divergence and curl of $\vec{A}$ at point $(1,1,-1)$. Comment on the nature of A, whether it is source/ sink field, rotational/ irrotational/ solenoidal/ conservative field.	CO1,6; L4	4
Q5	What would be the de-Broglie wavelength associated with (*i*) a 2000 kg car having a constant speed of 25 m/s, (*ii*) an 80 kg scooter having a speed of 10 m/s, (*iii*) an electron moving with a speed of 500 m/s and (*iv*) a proton moving with a speed of 250 m/s. Given $h = 6.62 \times 10^{-34}\ Js$. Draw conclusions.	CO3, L6	4
Q6	Explain the concept of Meissner effect. (a) Based on Meissner effect, give classification of superconductors. Also write some applications of superconductors. **(4 marks)** (b) At zero magnetic field, a superconductor has a critical temperature of 3.7 K. At 0 K, the critical magnetic field is 0.306 T. Calculate critical magnetic field at 2.0 K and 5.0 K. **(4 marks)**	CO5,6, L3	8

Course Outcomes (CO)

Students will be able to

1	Solve the problems in the fields of electromagnetism, lasers and fiber optics.
2	Apply the knowledge acquired from the study of semiconductors to identify their use in latest technologies.
3	Recognize the inadequacy of classical mechanics for certain physical problems and thus find the solutions of these problems using principles of quantum physics.
4	Comprehend the concept of oscillations and hence to implement the same in the theory of machines.
5	Understand the basic characteristics of materials relevant to engineering and technological applications.
6	Apply multidisciplinary knowledge of science for reviewing complex problems from different angles/perspectives and to find the best possible solution/model.

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number			L3	L4	L5	L6
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

Super computer

Guru Nanak Dev Engineering College, Ludhiana			
Department of Applied Sciences			
Program	B.Tech.(ME, IT, EC)	**Semester**	2
Subject Code	BSC-101	**Subject Title**	Physics
Mid Semester Test (MST) No.	2	**Course Coordinator(s)**	Dr. Harpreet Kaur, Dr. Randhir Singh, Dr. Paramjit Singh, Dr. Amarjot Kaur
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	26 May, 2023	**Roll Number**	

Note: Attempt all questions

Q. No.		Question	COs, RBT level	Marks
Q1		Differentiate between drift current and diffusion current.	CO2, L4	2
Q2		What is the physical significance of divergence and curl of a vector field?	CO6, L1	2
Q3		Differentiate intrinsic and extrinsic semiconductors. Discuss the position of Fermi level in both cases. **OR** Write a brief note on LED and Solar cell.	CO2, L4	4
Q4	(i)	Write the Maxwell's equations in differential and integral form.	CO3, L1	2
	(ii)	Calculate the energy of the neutron in eV if its de Broglie wavelength is 3×10^{-10} m. mass of neutron=1.66×10^{-27}kg 3.53×10^{-7}eV ✗		2
Q5		Derive the differential equation for harmonic oscillator. Also show that total energy of the harmonic oscillator is constant at any instant of time.	CO4, L3	4
Q6	(i)	Derive expression for time independent Schrodinger wave equation.	(i) CO3, L3	4
	(ii)	Calculate the de-Broglie wavelength associated with electrons, which are accelerated by a voltage of 50keV. Where h= 6.63×10^{-34} joule sec. and Mass of electron=9.1×10^{-31}Kg. $\lambda = 0.549\times10^{-11}$m ✓	(ii) CO3, L1	2
	(iii)	Calculate the velocity and de Broglie wavelength of a proton having energy 10^5eV. Given that: mass of proton=1.66×10^{-27}kg. $v = 1.097\times10^{7}$ m/s	(iii) CO3, L1	2
				16

Course Outcomes (CO): *Students will be able to*	
1	Solve the problems in the fields of electromagnetism lasers and fibre optics.
2	Apply the knowledge acquired from the study of semiconductors to identify their use in latest technology.
3	Recognise the inadequacy of classical mechanics for certain physical problems and thus find the solutions of these problems using principles of quantum physics.
4	Comprehend the concept of oscillations and hands to implement the same in the theory of machines.
5	Understand the basic characteristics of materials relevant to engineering and technology applications.
6	Apply multi disciplinary knowledge of science complex problems from different angles perspectives and to find the best possible solution model.

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

Physics

Guru Nanak Dev Engineering College, Ludhiana			
Department of Applied Sciences			
Program	B.Tech.(CE34)	**Semester**	2
Subject Code	BSC-18101	**Subject Title**	Physics
Mid Semester Test (MST) No.	1	**Course Coordinator(s) Subject Expert**	Dr Harpreet Kaur Grewal Dr Randhir Singh
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	23rd Feb, 2019	**Roll Number**	

Note: Attempt all questions

Q. No.	Question	Marks
Q1	A vector field is given as : $\vec{A} = xy\hat{i} + yz\hat{k}$. Find $\vec{\nabla} \times \vec{A}$ and tell whether the field is conservative or not.	2
Q2	Define Poynting vector. Give its significance.	2
Q3	Define Meissner effect and differentiate type-I, type-II superconductors.	4
Q4	Derive London equations and give their significance.	4
Q5	The critical magnetic field for a superconductor at absolute zero is $9\times10^4\ Am^{-1}$ and at 6K is $5\times10^4\ Am^{-1}$. Find the critical temperature and energy required to break Cooper pair at absolute zero.	4
Q6	(i) Show that for plane electromagnetic waves propagating in vacuum, electric field is perpendicular to magnetic field as well as to direction of propagation.	5
	(ii) Write Maxwell's equations and give their significance.	3

GURU NANAK DEV ENGINEERING COLLEGE
GILL PARK, GILL ROAD, LUDHIANA
MST-I

Subject Name:-Physics (BSC-18101) *Max. Marks: 24*
Section:- PE12 *Semester-2nd* *Time: 90 Minutes*

Note:- (i) All questions are compulsory.
(ii) Marks for each question are shown in the brackets.
(iii) Use of calculator is allowed.

Q.1. What is meant by Inverted Population in laser? *(2)*

Q.2. Calculate the de-Broglie wavelength of a virus particle accelerated by a potential difference of 30,000V. *(2)*

Q.3. Describe the construction and working of Helium Neon laser. *(4)*

Q.4. Show that how group velocity is related to phase velocity. *(4)*

Q.5. Write a note on attenuation & propagation loss mechanisms in fibres. *(4)*

Q.6 (i) Define acceptance angle for an optical fibre. Show that it is related to numerical aperture. *(5)*

(ii) An optics fibre is made of glass with refractive index 1.55 and is clad with another glass of refractive index 1.51. The fibre has a core of diameter 50μm and is used at a light wavelength of 0.8 μm. Determine:
(a) Numerical aperture (b) Acceptance angle (c) V-number for the fiber. *(3)*

Guru Nanak Dev Engineering College, Ludhiana			
Department of Applied Sciences			
Program	B.Tech.(ME1,ME2, ME5,ME6)	**Semester**	2
Subject Code	BSC-18101	**Subject Title**	Engg. Physics
Mid Semester Test (MST) No.	1	**Course Coordinator(s)**	Dr Harpreet Kaur Grewal
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	23rd February, 2019	**Roll Number**	

Note: Attempt all questions

Q. No.	Question	Marks
Q1	Differentiate Stimulated Emission and Spontaneous emission?	2 F
Q2	In LASER, in place of 'A', it should be 'O' Why?	2 F
Q3	Explain the terms Acceptance angle and Figure of Merit. What do you mean by single mode and multimode fiber?	4
Q4	An optical fiber has NA of 0.15 and cladding refractive index is equal to 1.50.Find NA of the fiber in a liquid of refractive index 1.30.	4
Q5	Discuss the variation of Fermi Level with temperature for extrinsic semiconductor.	4
Q6	(a) Explain the energy level diagram of He- Ne Laser and what is the role of helium in He-Ne Laser?	6 F
	(b) What do you mean by Extrinsic Semiconductor?	2

GURU NANAK DEV ENGINEERING COLLEGE
GILL PARK, GILL ROAD, LUDHIANA

MST-I

Subject Name:-Physics (BSC-18101) *Max. Marks: 24*
Section:- CE12,CE56 *Semester-2nd* *Time: 90 Minutes*

Note:- (i) All questions are compulsory.
(ii) Marks for each question are shown in the brackets.
(iii) Use of calculator is allowed.

Q.1. Write Maxwell's Electromagnetic equations for vacuum. *(2)*

Q.2. What makes laser light different from normal? *(2)*

Q.3. A step-index fiber has a core index of refraction 1.425. The cut-off angle for light entering the fiber from air is found to be 8.50°.
(a) What is the numerical aperture of the fiber?
(b) What is the index of refraction of its cladding?
(c) Find the Fractional Refractive Index change.
(d) If the fiber were submersed in water, what would be the new cut-off angle at the launching end of fiber? *(4)*

Q.4. Explain the working of a Continuous Wave (CW) laser. *(4)*

Q.5. Derive Maxwell's Electromagnetic equation from Faraday's Law of EM Induction. *(4)*

Q.6. (a) Write the statements of Gauss Divergence Theorem and Stoke's Curl Theorem. *(2)*
(b) Give brief significance of Einstein coefficients and show how they are related. *(3)*
(c) What causes most fiber optic attenuation and propagation losses? *(3)*

Physics

Guru Nanak Dev Engineering College, Ludhiana			
Department of Information Technology			
Program	B.Tech.	**Semester/Section**	1st / EEA, CEA, CSA
Subject Code	BSC-101	**Subject Title**	PHYSICS
Mid Semester Exam (MSE) No.	1	**Course Coordinator(s)**	Dr. Randhir Singh Dr. Harpreet Kaur Grewal
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	17-11-2022(9.00-10.30am)	**Roll Number**	2210053

Note: Attempt all questions

Q. No.	Question	COs, RBT level	Marks
Q1	With a neat diagram, explain the structure of an optical fibre.	CO1, L1	2
Q2 (a)	Find the intensity of a laser beam of 10mW power having laser beam diameter as 1cm.	CO1, L3, L4, L5	2
	OR		
(b)	Newton's law of universal gravitation is represented by $\vec{F}=(\frac{GMm}{r^2})\hat{r}$, where **F** is the magnitude of the gravitational force exerted by one object on another, **M** and **m** are the masses of the objects, and **r** is a distance. Find the curl of gravitational field?		
Q3	Explain the construction and working of He-Ne laser with appropriate energy level diagram.	CO1, L1, L2	4
Q4	How does a laser work? Explain active medium, population inversion, optical pumping and optical cavity resonators.	CO1, L2, L4	4
Q5	Calculate, div $(\vec{r}/r^2)$, *where* $\vec{r}=x\hat{\imath}+y\hat{\jmath}+z\hat{k}$?	CO1, L2, L4, L5	4
	OR		
	Calculate the refractive indices of the core and the cladding material of a fiber, if numerical aperture is 0.22 and fractional refractive index change is 0.012.		
Q6 (a)	Explain with necessary ray theory, the propagation of light in optical fibres. Derive an expression for numerical aperture.	CO1, L3, L4, L6	8
	OR		
(b)	Obtain the relation between transition probabilities of spontaneous and stimulated emissions. Mention characteristic properties of a laser beam.		

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

In this pumping
In pumping
active medium
Pumping
optical Resonator

emission In the Process

Cross Product of electric & magnetic field

$\vec{S} = \vec{E} \times \vec{H}$

Physics $\nabla \times \vec{H} = \frac{\partial \rho}{\partial t} + \vec{J}$

Guru Nanak Dev Engineering College, Ludhiana			
Department of Applied Sciences			
Program	B.Tech.	**Semester/Section**	**1st / CE A, CSA**
Subject Code	BSC-101	**Subject Title**	PHYSICS
Mid Semester Exam (MSE) No.	2	**Course Coordinator(s)**	Dr. Randhir Singh Dr. Harpreet Kaur Grewal
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	23-12-2022 (9.30-11.00 am)	**Roll Number**	

Note: Attempt all questions

Q. No.	Question	COs, RBT level	Marks
Q1	What are semiconductors? Write two ways to increase the conductivity of intrinsic semiconductors.	CO2, L2	2
Q2	Differentiate n type and p type semiconductors.	CO2, L4	2
Q3	Classify magnetic materials based on their behavior in an external magnetic field and compare their properties.	CO5, CO6, L2, L4	4
Q4	Write four Maxwell equations and give their significance.	CO1, L2	4
Q5	Given critical magnetic field of material at 0K (i.e., $H_c(0)$) is 15×10^{-3} A/m. Calculate critical magnetic field at temperature 5K (i.e., $H_c(5K)$) for the same material. Given Tc=7K.	CO6, L4	4
Q6 (A)	Using Maxwell equations, deduce Maxwell's em wave equation for free space.	CO1, L4	4
Q6 (B)	Given $\mathbf{E} = 3x^2\,\mathbf{i} - 6xy\,\mathbf{j} + 12z^2xy\,\mathbf{k}$. Find divergence of the given vector field and comment on its nature whether field is converging or diverging.	CO1, L4	3
Q6 (C)	Define Poynting vector.	CO1, L1	1

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

$3x^2\hat{i} - 6xy\hat{j} + 12z^2y\hat{k}$

$\vec{S}$ = magnetic

Donor energy — acceptor

$T = 5$

$T_C = 7K$

$15 \times 10^{-3} \left(1 - \frac{5}{7}\right)$

$\times 10^{-3}$

(7)

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Guru Nanak Dev Engineering College, Ludhiana

Department of Applied Sciences

Program	B.Tech.	Semester/Section	1st / CE A, CSA
Subject Code	BSC-101	Subject Title	PHYSICS
Mid Semester Exam (MSE) No.	2	Course Coordinator(s)	Dr. Randhir Singh Dr. Harpreet Kaur Grewal
Max. Marks	24	Time Duration	1 hour 30 minutes
Date of MST	23-12-2022 (9.30-11.00 am)	Roll Number	

Note: Attempt all questions

Q. No.	Question	COs, RBT level	Mark
Q1	What are semiconductors? Write two ways to increase the conductivity of intrinsic semiconductors.	CO2, L2	2
Q2	Differentiate n type and p type semiconductors.	CO2, L4	2
Q3	Classify magnetic materials based on their behavior in an external magnetic field and compare their properties.	CO5, CO6, L2, L4	4
Q4	Write four Maxwell equations and give their significance.	CO1, L2	4
Q5	Given critical magnetic field of material at 0K (i.e., $H_c(0)$) is 15×10^{5} A/m Calculate critical magnetic field at temperature 5K (i.e., $H_c(5K)$) for the same material. Given Tc=7K.	CO6, L4	4
Q6	(A) Using Maxwell equations, deduce Maxwell's em wave equation for free space.	CO1, L4	4
	(B) Given $\mathbf{E} = 3x^2\,\mathbf{i} - 6xy\,\mathbf{j} + 12z^2xy\,\mathbf{k}$. Find divergence of the given vector field and comment on its nature whether field is converging or diverging.	CO1, L4	3
	(C) Define Poynting vector.	CO1, L1	1

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

3. What is the principle of working of optical fiber?

. What are the various conditions for acceptability of wave function?

What do you understand by numerical aperture & acceptance angle of an optical fibre. Also derive expressions for ~~these~~ same.

4. Difference between step index fibre and graded index fibre? Use suitable diagrams.

5. With relative Permeability $\mu_r = 1$ & relative permittivity $\varepsilon_r = 3$ has an electric field intensity $E_V = 6$ V/M. Find the impedence of the medium.

6. Write Maxwell's equations in differential form and discuss in brief physical significance of each.

Physics

Guru Nanak Dev Engineering College, Ludhiana			
Department of Information Technology			
Program	B.Tech.	**Semester/Section**	1st / EEA, CEA, CSA
Subject Code	BSC-101	**Subject Title**	PHYSICS
Mid Semester Exam (MSE) No.	1	**Course Coordinator(s)**	Dr. Randhir Singh Dr. Harpreet Kaur Grewal
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	17-11-2022(9.00-10.30am)	**Roll Number**	2216062

Note: Attempt all questions

Q. No.		Question	COs, RBT level	Marks
Q1		With a neat diagram, explain the structure of an optical fibre.	CO1, L1	2
Q2	a	Find the intensity of a laser beam of 10mW power having laser beam diameter as 1cm.	CO1, L3, L4, L5	2
	b	***OR*** Newton's law of universal gravitation is represented by $\vec{F}=(\frac{GMm}{r^2})\hat{r}$, where F is the magnitude of the gravitational force exerted by one object on another, M and m are the masses of the objects, and r is a distance. Find the curl of gravitational field?		
Q3		Explain the construction and working of He-Ne laser with appropriate energy level diagram.	CO1, L1, L2	4
Q4		How does a laser work? Explain active medium, population inversion, optical pumping and optical cavity resonators.	CO1, L2, L4	4
Q5		Calculate, div $(\vec{r}/r^2)$, *where* $\vec{r}=x\hat{i}+y\hat{j}+z\hat{k}$?	CO1, L2, L4, L5	4
	OR	***OR*** Calculate the refractive indices of the core and the cladding material of a fiber, if numerical aperture is 0.22 and fractional refractive index change is 0.012.		
Q6	a	Explain with necessary ray theory, the propagation of light in optical fibres. Derive an expression for numerical aperture.	CO1, L3, L4, L6	8
	b	***OR*** Obtain the relation between transition probabilities of spontaneous and stimulated emissions. Mention characteristic properties of a laser beam.		

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

(10)

Guru Nanak Dev Engineering College, Ludhiana			
Department of Applied Sciences			
Program	B.Tech.	**Semester**	**CS D, CE B**
Subject Code	BSC-101	**Subject Title**	PHYSICS
Mid Semester Examination (MSE) No.	2	**Course Coordinator(s)**	Dr. Randhir Singh Dr. Harpreet Kaur Grewal
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	23-12-2022	**Roll Number**	

Note: Attempt all questions

Q. No.	Question	COs, RBT level	Marks
Q1	Define Fermi level and give its physical significance.	CO2, L3	2
Q2	What are Matter waves? Write expression of their wavelength.	CO3, L2	2
Q3	Define Phase velocity and group velocity. Prove that particle velocity is equal to group velocity for non-relativistic speeds.	CO3, L4	4
Q4	Differentiate (i) intrinsic and extrinsic semiconductors (ii) n type and p type semiconductors	CO2, L4	2+2
Q5	An electron and a proton are moving with same speed of 300 m/s. Compare the magnitude of de-Broglie wavelength for these particles. Given mass of an electron = 9.1×10^{-31} kg, mass of a proton = 1.67×10^{-27} kg and Planck's Constant h = 6.62×10^{-34} Js.	CO3, L4	
Q6	(A) Calculate energy eigen values of a particle moving in 1-D box having width L. (B) Derive time independent Schrodinger wave equation for 1-D motion of a free particle.	CO3, L4, L2	4+4

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

Guru Nanak Dev Engineering College, Ludhiana

Department of Applied Sciences

Program	B.Tech.(ME34)	Semester	2
Subject Code	BSC-18101	Subject Title	Physics
Mid Semester Test (MST) No.	1	Course Coordinator(s)	Dr Harpreet Kaur Grewal
		Subject Expert	Dr Randhir Singh
Max. Marks	24	Time Duration	1 hour 30 minutes
Date of MST	23rd Feb, 2019	Roll Number	

Note: Attempt all questions

Q. No.	Question	Marks
Q1	A vector field is given as : $\vec{A} = xy\hat{i} + yz\hat{k}$. Find $\vec{\nabla} \times \vec{A}$ and tell whether the field is conservative or not.	2
Q2	Define Poynting vector. Give its significance.	2
Q3	Define stress and strain and give their types.	4
Q4	Discuss briefly, the motion of a lightly damped oscillator.	4
Q5	The displacement of a particle executing SHM is changing with time as $x=A\cos\omega_0 t$. Find the displacement at which kinetic energy of the particle is equal to its potential energy.	4
Q6	(i) Show that for plane electromagnetic waves propagating in vacuum, electric field is perpendicular to magnetic field as well as to direction of propagation.	5
	(ii) Write Maxwell's equations and give their significance.	3

Guru Nanak Dev Engineering College, Ludhiana

Department of Information Technology

Program	B.Tech.(MEA, MEB, ITA, ITB)	Semester	2
Subject Code	BSC-101	Subject Title	Physics
Mid Semester Test (MST) No.	1	Course Coordinator(s)	Dr. Harpreet Kaur, Dr. Randhir Singh, Dr. Paramjit Singh, Dr. Amarjot Kaur
Max. Marks	24	Time Duration	1 hour 30 minutes
Date of MST	01 April, 2023	Roll Number	

Note: Attempt all questions

Q. No.	Question	COs, RBT level	Marks
Q1	Differentiate stimulated and spontaneous emission.	CO1, L3	2
Q2	Explain the concept of total internal reflection and give examples based on daily life	CO1, L2	2
Q3	Derive relationship amongst three Einstein's coefficients and right conditions necessary for lasing action to take place OR Explain the construction and working of helium neon laser. Draw well labelled diagrams wherever necessary.	CO1, L3	4
Q4	Define and give physical significance of acceptance angle and numerical aperture. Derive expressions for acceptance angle and numerical aperture. Also express numerical aperture in terms of Δ, that is fractional change in a refractive index of fibre.	CO1, L3	4
Q5	Step index fibre has numerical aperture of 0.26 a core of refractive index 1.5 and diameter 100μm. Calculate refractive index of planting angle of acceptance and critical angle at core clad interface, fractional change in a refractive index and cut off wavelength that can be passed through optical fibre with minimum loss.	CO1, L3,L4	4
Q6	(a) Explain the concept of Meissner effect and hence differentiate type-I and type-II superconductors. Also write some applications of superconductors. (b) The critical temperature of a superconductor at zero applied magnetic field is 3.7K. At 0K, the critical magnetic field is 0.306T. Calculate critical magnetic fields of the superconductor at 2K and 5K.	(a) CO5, L3 (b) CO6, L3,L5	(4+4=8)

Course Outcomes (CO): *Students will be able to*

1	Solve the problems in the fields of electromagnetism lasers and fibre optics.
2	Apply the knowledge acquired from the study of semiconductors to identify their use in latest technology.
3	Recognise the inadequacy of classical mechanics for certain physical problems and thus find the solutions of these problems using principles of quantum physics.
4	Comprehend the concept of oscillations and hands to implement the same in the theory of machines.
5	Understand the basic characteristics of materials relevant to engineering and technology applications.
6	Apply multi disciplinary knowledge of science complex problems from different angles perspectives and to find the best possible solution model.

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

410 Copies

Guru Nanak Dev Engineering College, Ludhiana

Department of Information Technology

Program	B.Tech.(ME, EC, EE and CE)	**Semester**	1
Subject Code	BSC-101	**Subject Title**	Physics
Mid Semester Test (MST) No.	2	**Course Coordinator(s)**	Dr. Harpreet Kaur, Dr. Randhir Singh, Dr. Paramjit Singh, Dr. Amarjot Kaur, Akshdeep Kaur
Max. Marks	24	**Time Duration**	1 hour 30 minutes
Date of MST	8,November, 2023	**Roll Number**	

Note: Attempt all questions

Q. No.	Question	COs, RBT level	Marks
Q1	Write the concept of de-Broglie hypothesis.	CO3, L1	2
Q2	Compare type-I and type-II superconductors.	CO5, L5	2
Q3	(a) Determine the critical magnetic field of lead at temperature 5K. The critical temperature for Pb is 8K and critical magnetic field is 2×10^4 A/m at 0K. (b) The critical magnetic field for a superconductor at absolute zero is 9×10^4 Am^{-1} and at 6K is 5×10^4 Am^{-1}. Find the critical temperature.	CO5, L3 CO5, L3	(2+2=4)
Q4	Derive Maxwell's Electromagnetic equation from Faraday's Law of EM Induction and write its physical significance.	CO1, L3	4
Q5	(a) Figure out the value of q at point P (-1,0,1) if the given vector is solenoidal. $A = qx^2 + 3y^3 + 12$. (b) What will be the electric field vector for the electric potential V (x, y, z) = $4x^3 + 3y^2 - 9z^2$ and its magnitude at point P (-1,2,1).	CO1, L4 CO1, L4	(2+2=4)
Q6	(a) Support with examples that Newton's laws fail for motion of subatomic particles. Hence obtain expression for time independent Schrodinger wave equation and give its importance. (b) An electron is confined to one dimensional potential box of length 3Å. Calculate the energies corresponding to the first and second quantum states in eV. (c) Estimate the de-Broglie wavelength of an electron accelerated by a potential difference of 300V.(h= 6.626×10^{-34} Js, mass of an electron= 9.1×10^{-31} kg).	CO3, L5 CO3, L3 CO3, L5	(1+3+2+2=)

Course Outcomes (CO): *Students will be able to*

1	Solve the problems in the fields of electromagnetism. lasers and fiber optics.
2	Apply the knowledge acquired from the study of semiconductors to identify their use in latest technology.
3	Recognise the inadequacy of classical mechanics for certain physical problems and thus find the solutions of these problems using principles of quantum physics.
4	Comprehend the concept of oscillations and hands to implement the same in the theory of machines.
5	Understand the basic characteristics of materials relevant to engineering and technology applications.
6	Apply multidisciplinary knowledge of science for reviewing complex problems from different angles/perspectives and to find the best possible solution/model.

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
RBT Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

Physics

(1)

Please check that this question paper contains 9 questions and 3 printed pages within first ten minutes.

EVENING

[Total No. of Questions: 09] 29 JUN 2022 [Total No. of Pages: 03]

Uni. Roll No. .....

Program: B.Tech. (Batch 2018 onward)
Semester: .....1,2.....
Name of Subject: .....Physics.....
Subject Code: .....BSC-101.....
Paper ID: .....15925.....
Scientific calculator is Allowed

charged of $e = 1.6 \times 10^{-19}$ C

-0.02 C

Detail of allowed codes/charts/tables etc. .....NA

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A **[Marks: 02 each]**

Q1.

a) Define acceptance angle and numerical aperture of an optical fibre.

b) State Gauss law of electrostatics and Gauss law of magnetostatics in integral form. EMW

c) Discuss the effect of temperature on conductors and semiconductors in terms of conductivity.

d) Find the extension in spring having spring constant 1000N/m when a force of 5N is applied to it. force

e) Calculate the potential difference through which an electron should be accelerated to achieve a speed of 1600m/s and also find the wavelength of the matter waves associated with the moving electron. Potential difference $= \frac{mv^2}{2e}$

f) Enlist the peculiar properties of nanomaterials.

wavelength $= \frac{h}{mv}$

M E&C EE
3 + 4 3

10
11

P.T.O.

EVENING

29 JUN 2022

Part – B [Marks: 04 each]

Q2. (a) What are intrinsic semiconductors? Name the ways by which we can enhance the conductivity of intrinsic semiconductors. Discuss in detail the extrinsic semiconductors.

(b) Stating the principle of solar cell, briefly explain its working.

Q3. Compare any four properties of diamagnetic, paramagnetic and ferromagnetic substances.

Q4. Given that wavefunction $\psi(x) = \sqrt{\frac{2}{L}} \sin(n\pi x/L)$ is the solution of time independent Schrodinger equation for a particle moving in a 1-D box, find the expression for its energy. Hence find the energy of an electron in a box of width 1Å in the ground state.

Q5. On what factors do the rate of stimulated absorption and the rate of stimulated emission depend? Calculate the ratio of stimulated absorption to stimulated emission for a material at 300K if the population density of an excited state is 1000 times that of a ground state.

Q6. Given $\mathbf{E} = x^2y\,\mathbf{i} + y^2x\,\mathbf{j} + z^2y\,\mathbf{k}$ (letters typed in bold represent vector quantities). Find the divergence and curl of this vector field.

Q7. Using the equation $x = A\sin(\omega t + \theta)$ for natural vibrations of a stretched spring in horizontal plane, show that the total energy of a vibrator is a constant quantity.

Part – C [Marks: 12 each]

Q8. (a) Write differential form of Maxwell's four equations and give their significance. (4)

(b) Discuss the construction and working of any four-level gaseous state laser. (6)

(c) Show that isolated poles do not exist in nature. (2)

OR

(a) Write the principle of optical fibre. Explain its working and hence find expression for numerical aperture and acceptance angle. (5)

(b) If the wavelength of carrier waves for a step index fiber is 800nm and V number is 4.5, then calculate the diameter of the fiber, if the refractive index of core and clad is 1.50 and 1.49 respectively. (4)

(c) Define Poynting vector, write its expression and give its significance. (3)

EVENING

29 JUN 2022

Q9. (a) What is the difference between undamped and damped oscillations. Derive the equation of damped oscillations. Write the conditions for lightly damped, critically damped and heaviiy damped oscillations. Discuss the motion of lightly damped case in detail. Comment whether lightly damped oscillations are simple harmonic or not. (12)

OR

(a) Derive London's equations and give their significance. (6)

(b) An electron is accelerated with low accelerating voltage V. Show that the expression for wavelength of the matter waves associated with the electron is given by $12.27\text{Å}/\sqrt{V}$. (3)

(c) What are type-I and type-II superconductors? How can these be differentiated on the basis of Meissner effect? (3)

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[Total No. of Questions: 09]

[Total No. of Pages: ..1]

Uni. Roll No. .....

Program: .....BTech.....

Semester:.....2.....

Name of Subject: .....Physics....

Subject Code: .....BSC-101.....

Paper ID: .....15925....

24-01-2022(E)

Time Allowed: 02 Hours Max. Marks: 60

NOTE:

1) Each question is of 10 marks.
2) Attempt any six questions out of nine
3) Any missing data may be assumed appropriately

1. (a) Derive the Maxwell equation for modified form of Ampere's law. (5)
   (b) Give the physical significance of all the Maxwell equations. (5)
2. (a) Illustrate phase velocity & group velocity and find the relationship between two. (5)
   (b) Find the de-Broglie wavelength corresponding to the ground state energy for the particle trapped in a 1-dimensional box of length 5 nm. (5)
3. (a) The electric potential given by $V(x,y,z) = (4x^2 + 3y^2 + 9z^2)$. Calculate the associated electric field at point (1,1,0). (5)
   $E = -\nabla V$
   (b) Find the energy eigen values for particle in a box problem. (5)
4. (a) Illustrate the position of Fermi level in intrinsic semiconductors. (5)
   (b) Discuss the working of a LED with proper energy band diagram. (5)
5. (a) A glass clad fibre is made with core glass of refractive index 1.5 and cladding is doped to give the index difference of 0.05. Determine the refractive index of the cladding, numerical aperture of the fibre, critical angle of reflection and critical acceptance angle. (5)
   (b) Classify the various types of optical fibres with proper diagram. (5)
6. Give a detailed description of spontaneous and stimulated emission and hence derive the relation for the Einstein coefficients for the same. (10)
7. Describe the BCS theory to explain the phenomena of superconductivity. (10)
8. Derive the differential equation for the damped mechanical oscillator. Discuss about the types of Damped oscillations. (10)
9. (a) Lead in superconducting state has critical temperature of 7 K at zero magnetic field and critical field of 8.5 T at 0 K. Determine the critical field at 4 K. (4)
   (b) Describe the classification of nanomaterials on the basis of dimensionality. (6)

Physics

Paramagnetic —

2203347

[Total No. of Questions: 09] [Total No. of Pages: 03]

Uni. Roll No. 2203347

Program/Course: B.Tech.
(Sem. – 1st /2nd)
Name of Subject: Physics
Subject Code: BSC-101
Paper ID: 15925
Scientific calculator is allowed

Time Allowed: 3 Hours **Max. Marks: 60**

NOTE:

1) Part A and Part B are compulsory.
2) Part C has two questions Q8 and Q9. Both are compulsory, but with internal choice.
3) Any missing data may be assumed appropriately.

Part – A **[Marks: 02 each]**

Q1.

(a) Define numerical aperture of an optical fibre and give its physical significance.
(b) Differentiate damped and undamped oscillations.
(c) Define Fermi level. How it varies with temperature in intrinsic semiconductors?
(d) What is wave function? Give the physical significance of wave function.
(e) Find divergence and curl of position vector **r**.
(f) What is hysteresis? Based on it, differentiate hard and soft magnetic materials.

Part – B **[Marks: 04]**

Q2. Derive Maxwell's electromagnetic wave equation for free space and show that speed of em waves in free space is 3×10^8 m/s. Also comment on the nature of em waves.

Q3. Differentiate spontaneous and stimulated emission. Discuss on what factors the rate of stimulated absorption per unit volume (R_a) and rate of stimulated emission per unit volume (R_{st}) depend. Write their mathematical expressions. Hence find condition when rate of stimulated emission per volume will be more than rate of stimulated absorption per unit volume.

Q4. What is the difference between intrinsic and extrinsic semiconductors? Explain two types of extrinsic semiconductors.

Q5. (i) Compare any four properties of paramagnetic and ferromagnetic substances.

P.T.O.

(ii) Discuss briefly the factors responsible for change in properties when we move from bulk to nanomaterial.

Q6. Calculate the de-Broglie wavelength of an electron whose kinetic energy is 50 eV. Given h= 6.62×10^{-34} joule-sec, m_e= 9.1×10^{-31} kg, 1eV = 1.6×10^{-19} joule.

Q7. Establish the equation of a simple harmonic oscillator. Using $x(t) = A\sin(\omega t+\phi)$ with symbols having their usual meaning. Find kinetic energy and potential energy associated with SHM. Hence show that total energy of a simple harmonic oscillator is constant any instant of time. (4)

Part– C **[Marks: 12]**

Q8.

(a) Describe the principle, construction and working of any gaseous state laser with the help of neat diagrams. (4)
(b) Write four Maxwell equations both in integral form and differential form. Explain physical significances of each equation. (4)
(c) A step index fibre with a large core diameter compared with the wavelength of the transmitted light has an acceptance angle in air of 30^0 and fractional refractive index difference of 0.03. Determine (i) numerical aperture of the fibre (ii) the critical angle at the core cladding interface (iii) necessary core radius for fiber to be multimode if the wavelength of transmitted light is 950nm. (4)

OR

(a) What is the structure of an optical fibre? Explain the principle of propagation of light within a fibre. Find mathematical expression of acceptance angle of an optical fibre and also define it. (4)
(b) Derive mathematical relationship between electric field vector E and electric potential V. Also find curl of E if E is electrostatic. (4)
(c) A step index fibre has normalized frequency V=26.6 at 1300nm wavelength. If the core radius is 25μm, calculate the numerical aperture and hence find the value of acceptance angle. (4)

Q9.

(a) For a given superconducting sample, values of critical magnetic field corresponding to 14K and 13K respectively are 2.8×10^5 A/m and 5.6×10^5 A/m. Find critical temperature T_c and critical magnetic field value at 0K. (4)
(b) Derive London equations and discuss their significance. (5)

(c) An electron is confined to a one-dimensional potential box of length 0.1nm. Calculate the difference in energies corresponding to the ground state and first excited state in eV. Given $m_e = 9.1 \times 10^{-31}$ kg, $h = 6.626 \times 10^{-34}$ Joule-sec. (3)

OR

(a) For a given superconducting sample, the values of critical magnetic field corresponding to 0K and 5K respectively are 10×10^5 A/m and 5×10^6 A/m. Find wavelength of a photon required to break Cooper pairs in the superconductor. Given Boltzmann's constant $k = 1.38 \times 10^{-23}$ J/K. (4)

(b) Define critical magnetic field $[H_c(T)]$ associated with the phenomenon of superconductivity and give its significance. Explain Meissner effect and hence differentiate type I and type II superconductors. (5)

(c) An electron is confined to a one-dimensional potential box of length $2A^0$. Calculate the energies corresponding to the second and fourth quantum state in eV. ($m_e = 9.1 \times 10^{-31}$ kg, $h = 6.626 \times 10^{-34}$ Joule-sec.) (3)

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7

[Total No. of Questions: 09] [Total No. of Pages: 02]

Uni. Roll No. .....

Program: B.Tech,
Semester: 1st
Name of Subject: Physics
Subject Code: BSC-101
Paper ID: 15925

17-02-2022(M)

Time Allowed: 02 Hours **Max. Marks: 60**

NOTE:

1) Each question is of 10 marks.
2) Attempt any six questions out of nine
3) Any missing data may be assumed appropriately

1. Derive the differential form of four Maxwell equations of electromagnetism considering the uniform charge density ρ and steady current density J. Also give physical significance of each equation. (10)
2. Explain the concept of damped oscillations. Deduce the differential equation governing the mechanics of the damped mechanical oscillator and hence discussthree types of damped oscillations. (10)
3. Giving a detailed description of spontaneous and stimulated emission find mathematical relation amongst various Einstein coefficients. (10)
4. Derive London's equations and discuss how these equations lead to Meissner effect and flux penetration. (10)
5. (a) Illustrate briefly the working of a light emitting diode (LED) with energy band diagram. (5)
   (b) How the fermi level of a semiconductor would change with temperature? Explainwith the help of necessary diagrams. (5)
6. Distinguish between phase velocity and group velocity. Discuss the formation of a wave packet and show that group velocity is equal to particle velocity. (10)
7. (a) The electric potential in a given region is given by $V(x,y,z) = (4x^2 + 3y^2 + 9z^2)$ Volts. Using the concept of gradient of a scalar field, calculate the associated electric field at point (1,1,0) located in the given region. (5)
   (b) Calculate the wavelength of the photon which will be required to break a Copper pair in superconducting Zr with $T_c = 0.56$ K. (5)
8. (a) An optical fibre has numerical aperture of 0.2 and cladding refractive index of 1.59. Determine (i) acceptance angle for the fibre in liquid with refractive index 1.42 and (ii) critical angle between core-clad interface. (5)
   (b) Find the probability of finding a particle trapped in a 1-dimensional box of length L between 0.45L & 0.55L. Assume the particle to be in ground state. (5)
9. (a) The angular frequency of vibration of a spring mass system is 5 rad/s. When this oscillator is placed in a dissipating medium, then angular frequency of vibration reduces to 3rad/s. If mass of

the oscillating body is 100g, then calculate dissipation constant 'b' and resistive factor 'r' of the medium with appropriate units. (5)

(b) Compare the properties of diffusion current and drift current in semiconductors. (5)

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[Total No. of Questions: 09]
Uni. Roll No. .....

[Total No. of Pages: 1]

Program: B.Tech.
Semester: 1,2 (2018)
Name of Subject: Physics
Subject Code: BSC-101
Paper ID: 15925

Time Allowed: 02 Hours

Max. Marks: 60

NOTE:

1. Each question is of 10 marks.
2. Attempt any six questions out of nine
3. Any missing data may be assumed appropriately

06-07-21(M)

1. (i)What are Maxwell's equations? (2)
(ii)Write down Maxwell's equations and state physical significance of each equation. (8)

2. (i)What is active medium, population inversion and optical pumping? (5)
(ii)Give their importance in study of lasers. Why Helium is mixed with Neon in He-Ne laser? (5)

3. (i)Describe briefly the construction and working of an optical fibre. (5)
(ii)What are the various kinds of losses, a light suffers while propagating through a fibre? (5)

4. (i)Distinguish between intrinsic and extrinsic semiconductors. (5)
(ii)Discuss the location of Fermi levels under suitable limiting conditions with necessary theory. (5)

5. (a) (i) Differentiate between group and phase velocities. Show that the group velocity of particle is equal to the velocity of the particle. (6)

(b) (ii)Calculate the velocity and de Broglie wavelength of a proton energy 10^5eV. Given that: mass of proton=$1.66 \times 10^{-34} g$; Planck's constant=$6.6\times 10^{-27} erg\, sec$; and charge on electron= $4.8\times 10^{-10} e.s.u.$ (4)

6. Define a simple harmonic motion and derive a relation for velocity and acceleration of a particle executing S.H.M. (10)

7. Describe properties of diamagnetic, paramagnetic and ferromagnetic materials. (10)

8. Explain Meissner effect? Write some important applications of nanotechnology. (10)

9. (i)What do you understand by gradient of a scalar field? (4)
(ii)Show that curl of grad ø =0, where ø is any scalar function. (6)

MORNING

13 MAR 2021

Please check that this question paper contains_____ questions and _____ printed pages within first ten minutes.

[Total No. of Pages: 2]

[Total No. of Questions: 09]

Uni. Roll No. .....

Program: B.Tech. (Batch 2018 onward)
Semester: 1
Name of Subject: Physics
Subject Code: BSC-101
Paper ID: 15925

Max. Marks: 60

Time Allowed: 03 Hours

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A [Marks: 02 each]

Q1.

a) What you understand by simple harmonic motion? Give examples.
b) What is the Physical signification of wave function ?
c) Differentiate between intrinsic and extrinsic semiconductors.
d) Write Maxwell's equations in differential form.
e) Describe how Laser radiation is different from ordinary light ?
f) What is the concept of displacement current?

Part – B [Marks: 04 each]

Q2. Solve the Schrodinger equation for one dimensional motion of a particle in a box of side L and show that its eigenvalues is inversely proportional to the square of side L.

Q3 Compare the properties of diamagnetic, paramagnetic and ferromagnetic materials.

Q4. Calculate the value of $\vec{\nabla} \cdot (r^3 \vec{r})$ where $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$.

Q5. Prove by mathematical analysis that the mechanical energy of free oscillations of a simple harmonic oscillator is conserved.

Q6. Discuss the propagation mechanism of light waves in optical fiber.

Q7. Define damped harmonic oscillations. Solve its differential equation and discuss special cases of oscillatory motion.

P.T.O.

MORNING

12 MAR 2021

Part – C

[Marks: 12 each]

Q8. (i) Describe the Constuction and working mechanism of ruby laser. Also explain why He-Ne laser is superior to a ruby laser?

(ii) Calculate the refractive indices of the core and cladding material of a fiber from the following data: NA=0.22, relative refractive index is 0.012, where NA is numerical aperture.

OR

b (i) Deduce maxwell's equations using basic laws of electricity and magnetism.

(ii) Given $\vec{A} = x^2y\,\hat{i} + (x-y)\hat{k}$. Find $\vec{\nabla} \times \vec{A}$ and $\vec{\nabla} \cdot \vec{A}$

Q9. (i) Show that Fermi level in case of intrinsic semiconductor lies in the middle of conduction and valence band. Also explain its variation with temperature.

(ii) The wave function of a certain particle is $\Psi = A\cos^2 x$ for $-\Pi/2 < x < \Pi/2$. Find the value of A. Also find the probability that a particle be found between x=0 and $x=\Pi/4$.

(iii) What do understand by damped and undamped Oscillations

OR

(i) Explain the terms Meissner effect and London penetration depth in superconductors. Also discuss some applications of Meissner effect.(HOTS)

(ii) Write some important applications and risks of nano materials.

(iii) Determine the penetration depth in mercury at 0K , if the critical temperature of mercury is 4.2K and the penetration depth is 57 nm at 2.9K.

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12

Please check that this question paper contains 09 questions and 02 printed pages within first ten minutes.

MORNING

[Total No. of Questions: 09]

30 NOV 2019

[Total No. of Pages: 02]

Uni. Roll No. .....

Program: B.Tech. (Batch 2018 onward)
Semester: 1st /2nd
Name of Subject: Physics
Subject Code: BSC-101
Paper ID: 15925

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A

[Marks: 02 each]

Q1.

a) Write Maxwell's equations in differential form.

b) What is the need to achieve population inversion ?

c) Differentiate between undamped oscillator and damped oscillator.

d) Write short note on extrinsic semiconductors.

e) Why the quantum number n=0 is not possible for particle moving in one dimensional box?

f) What are the conditions for a material to be superconductor?

Part – B

[Marks: 04 each]

Q2. Deduce London equations and define London penetration depth.

Q3. Define acceptance angle and derive mathematical expression for the same.

Q4. Find the constants a,b and c such that the vector field

$\vec{F} = (x+2y+az)\,\hat{i} + (bx-3y-2)\,\hat{j} + (4x+cy+2z)\,\hat{k}$ is irrotational.

Q5. A damped oscillator is subjected to a damping force proportional to its velocity. Set up the differential equation of the oscillation. Discuss the case of critically damped motion.

P.T.O.

MORNING

12 MAR 2021

Part – C

[Marks: 12 each]

Q8. (i) Describe the Constuction and working mechanism of ruby laser. Also explain why He-Ne laser is superior to a ruby laser?

(ii) Calculate the refractive indices of the core and cladding material of a fiber from the following data: NA=0.22, relative refractive index is 0.012, where NA is numerical aperture.

OR

(i) Deduce maxwell's equations using basic laws of electricity and magnetism.

(ii) Given $\vec{A} = x^2 y\,\hat{i} + (x - y)\hat{k}$. Find $\vec{\nabla} \times \vec{A}$ and $\vec{\nabla} \cdot \vec{A}$

Q9. (i) Show that Fermi level in case of intrinsic semiconductor lies in the middle of conduction and valence band. Also explain its variation with temperature.

(ii) The wave function of a certain particle is $\Psi = A\cos^2 x$ for $-\Pi/2 < x < \Pi/2$. Find the value of A. Also find the probability that a particle be found between x=0 and $x=\Pi/4$.

(iii) What do understand by damped and undamped Oscillations

OR

(i) Explain the terms Meissner effect and London penetration depth in superconductors.Also discuss some applications of Meissner effect.(HOTS)

(ii) Write some important applications and risks of nano materials.

(iii) Determine the penetration depth in mercury at 0K , if the critical temperature of mercury is 4.2K and the penetration depth is 57 nm at 2.9K.

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14

Please check that this question paper contains 09 questions and 02 printed pages within first ten minutes.

MORNING

[Total No. of Questions: 09] 30 NOV 2019 [Total No. of Pages: 02]

Uni. Roll No. .....

Program: B.Tech. (Batch 2018 onward)
Semester: 1st /2nd
Name of Subject: Physics
Subject Code: BSC-101
Paper ID: 15925

Time Allowed: 03 Hours Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A [Marks: 02 each]

Q1.

a) Write Maxwell's equations in differential form.
b) What is the need to achieve population inversion ?
c) Differentiate between undamped oscillator and damped oscillator.
d) Write short note on extrinsic semiconductors.
e) Why the quantum number n=0 is not possible for particle moving in one dimensional box?
f) What are the conditions for a material to be superconductor?

Part – B [Marks: 04 each]

Q2. Deduce London equations and define London penetration depth.

Q3. Define acceptance angle and derive mathematical expression for the same.

Q4. Find the constants a,b and c such that the vector field

$\bar{F} = (x+2y+az)\,\hat{i} + (bx-3y-2)\,\hat{j} + (4x+cy+2z)\,\hat{k}$ is irrotational.

Q5. A damped oscillator is subjected to a damping force proportional to its velocity. Set up the differential equation of the oscillation. Discuss the case of critically damped motion.

P.T.O.

Q6. Apply time independent Schrondinger equation to study the motion of a particle confined in a one dimensional box of length L. Hence find energy eigen values associated with the motion.

Q7. Drive an expression for Fermi energy in intrinsic semiconductor. What is the effect of temperature on Fermi level in an intrinsic semiconductor.

[Marks: 12 each]

Part – C

Q8. (i) Derive mathematical relationship amongst Einstein coefficients and discuss the results thus obtained. Also find the ratio of rate of spontaneous emission to rate of stimulated emission at 300K corresponding to emission of green light photon with λ = 550 nm.

(ii) A manufacturer wishes to make a silica core, step index fiber with V= 75 and numerical aperture NA=0.30 to be used at 820nm. If n_1=1.458, what should the core size and cladding index be? Also find the value of critical angle and acceptance angle of the given fiber.

OR

(i) Deduce em wave equation for free space and prove that the electromagnetic waves are transverse in nature.

(ii) In an electric field the electric potential is given by $V(x,y,z) = (4x^2 + 3y^2 + 9z^2)^{-1/2}$. Calculate the electric field at point (1,1,1).

Q9. (i) Distinguish between the phase velocity and group velocity. Derive dispersion relation and discuss various cases possible.

(ii) Find the probability that a particle in a box L wide can be found between 0.45L and 0.55L for the ground and first excited states.

(iii) What do you understand by free oscillations and forced oscillations?

OR

(i) State and explain Meissner effect using London equations.

(ii) Write some important applications and risks of nanomaterials.

(iii) Penetration depth for a sample at 6K and 7K is 41.2nm and 180.3nm respectively. Calculate its transition temperature and the penetration depth at 0K.

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16

Please check that this question paper contains 09 questions and 02 printed pages within first ten minutes.

[Total No. of Questions:09]
Uni. Roll No. .....

[Total No. of Pages: 02]

MORNING
10 MAY 2019

Program/ Course: B.Tech. (Sem 1st/2nd)
Name of Subject: Physics
Subject Code: BSC-101
Paper ID: 15925

Max. Marks:60

Time Allowed: 03Hours

NOTE:

1) **Parts A and B are compulsory**
2) **Part-C** has two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately
4) Use of scientific calculator is allowed

Part – A [Marks: 02 each]

Q1.
a) Define Hooke's law.
b) Calculate energy of an electron which is moving in 1-D box of width 1 Å. Consider the electron to be in first excited state.
c) Intrinsic semiconductors behave as insulators at 0K. Comment.
d) What are nanomaterials? How can we classify them?
e) Give physical significance of Poynting vector.
f) In word LASER, A should be replaced by O. Comment.

Part – B [Marks: 04 each]

Q2. Derive time independent Schrodinger equation for the 1-D motion of a restricted particle. Also give the shortcomings of Schrodinger equation, if any.
Q3. Write short note on (i) Dielectric materials (ii) Ferromagnetic materials.
Q4. What are oscillations? Explain briefly free oscillations, damped oscillations and forced oscillations.
Q5. Show that for intrinsic semiconductors, Fermi level lies in the middle of energy gap.
Q6. In a given laser, total number of lasing particles is 2.3×10^{19}. If laser emits a wavelength of 6328 Å, then calculate the energy of one photon being emitted by the laser. If the laser beam is focused on an area equal to the square of its wavelength for 1s, find intensity of the focused beam. Assume the efficiency of laser to be 100%.
Q7. The scalar potential at a point is given by $V = 2x-4xy+3z^2$. Find electric field intensity vector and then check whether the field vector is solenoidal or not.

Part – C [Marks: 12 each]

Q8. (a) Derive the differential form of Gauss law of electrostatics and Gauss law of magnetostatics. Give significance of each equation.
(b) Derive mathematical relation amongst Einstein coefficients and find condition(s) for lasing action to take place. Also find the units of Einstein coefficients.

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(c) Enlist various losses taking place in an optical fibre.

or

(a) Derive Maxwell's electromagnetic (em) wave equation for free space and show that speed of em waves in free space is 3×10^8 m/s.

(b) Why four level laseris better than three level laser? Explain the construction and working of any four-level laser. Trace well labelled energy level diagram(s) for the same.

(c) Find acceptance angle, numerical aperture, critical angle and V-number of the optical fibre from the data given below:
Refractive index of core = 1.48, Fractional change in refractive index = 0.005, core radius 'a' = 50 μm, wavelength of radiation λ = 850 nm. Check whether the fibre is single mode or multimode.

Q9 (a) The instantaneous displacement of a particle executing SHM is given by $y=A \sin(\omega t + \phi)$. If the displacement of the particle at t=0 be y_o and the velocity at t=0 be v_o, then find the values of A and ϕ. Symbols have their usual meanings.

(b) Apply time independent Schrodinger equation to discuss the motion of a particle in 1-D box. Find eigen wavefunctions and energy eigen values of the moving particle.

(c) An electron and proton are moving with same speed. Which particle will be having large value of de-Broglie wavelength and why?

or

(a) Develop equation of motion of SHM. Find expression for time period, potential energy, kinetic energy and total energy of SHM.

(b) Derive London equations for Type I superconductors. Show that no electric field is required for steady current to flow through a superconductor. Using these equations, explain the concepts of flux penetration and flux expulsion.

(c) Find the wavelength of a photon which can break a Cooper pair if the critical temperature of a superconductor is 5K.

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[Total No. of Questions: 09] [Total No. of Pages: 02] MORNING

Uni. Roll No. .....

03 DEC 2018

Program/ Course: B.Tech. (Sem. 1/2)
Name of Subject: Physics
Subject Code: BSC-18101
Paper ID: 15925

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) **Parts A and B are compulsory**
2) **Part-C** has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately
4) Use of scientific calculator is allowed

Part – A

[Marks: 02 each]

Q1.

a) Define polarization of light. Enumerate various types of polarization.
b) Explain spiking in Ruby laser.
c) How can we increase the conductivity of intrinsic semiconductors?
d) Differentiate damped and undamped oscillations.
e) Explain factors responsible for change in properties when we change from bulk to nanoscale.
f) What is dispersion relation? Give its mathematical expression and discuss various cases of dispersion.

Part – B

[Marks: 04 each]

Q2. Write short notes on (i) Magnetic Anisotropy (ii) Magnetostriction.

Q3. Differentiate intrinsic and extrinsic semiconductors. Discuss the position of Fermi level in both cases.

Q4. Derive the differential equation for harmonic oscillator. Also show that total energy of the harmonic oscillator is constant at any instant of time.

Q5. The electric potential in a certain region of space is given by $V(x,y,z) = 20x^2+10y+5z^3$. Find the electric field intensity vector? Check the field thus obtained is (i) uniform (ii) solenoidal.

Q6. Wave function of a particle in 1-D box of length L is given as

$$\Psi(x) = \sqrt{\frac{2}{L}} \sin\left(\frac{n\pi x}{L}\right) ; n = \text{integer}$$

Show that this wave function satisfies 1-D time independent Schrodinger equation.

Given that $E = \frac{n^2\pi^2\hbar^2}{2mL^2}$ and U = 0.

Q7. Derive London equations of superconductivity. Hence explain Meissner effect and flux penetration using the same.

Part – C

[Marks: 12 each]

Q8. (i) Show that electromagnetic waves are transverse in nature.

(ii) A beam of plane electromagnetic waves is travelling in vacuum in an arbitrary direction. The magnitude of electric field component of the wave changes according to the relation $E = E_0 Sin(\omega t - \vec{k}\cdot\vec{r})$, where $E_0 = 15\times10^{-5} NC^{-1}$, $\vec{k}$ is propagation vector, $\vec{r}$ is a vector along the direction of propagation and ω is angular frequency of the electromagnetic wave. This beam is incident at an angle of 60° on a small surface having area $5\times10^{-6} m^2$. Find the amount of energy received by the surface in 3milliseconds.

OR

(i) Discuss the working of He-Ne laser and CO_2 laser using well labeled diagrams?

(ii) Define acceptance angle and numerical aperture. Find their mathematical expressions. A step index fibre having length 2km is found to have n_1=1.55 and n_2=1.50. Find acceptance angle and numerical aperture of the fiber. If the radius of the core is 15 μm and the wavelength of the carrier is 850 nm, then check whether the fiber is SMF or MMF.

Q9. (i) Discuss the formation of wave packet. Define phase velocity and group velocity and show that group velocity is always equal to the particle velocity.

(ii) Find points of maximum probability for particle moving in 1-D box of width L present in first excited state.

(iii) Define Hooke's law for a three dimensional body and give its utility in daily life.

OR

(i) What are ferrimagnetic substances, ferromagnetic substances and ferrites? Give some important applications of ferrites.

(ii) Discuss in detail applications and risks involved in the use of nanomaterials.

(iii) If the critical magnetic field for a superconductor at 0K is $10^4 A/m$ and the radius of wire is 3mm, then find the value of critical current for superconductor at 0K (Assume that there is no external magnetic field).

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Make up Exam Aug 2019 Physics.

[Total No. of Pages: 2]

[Total No. of Questions:09]
Uni. Roll No. .....

Program/ Course: B.Tech. (Sem. 2)
Name of Subject: Physics
Subject Code: BSC-101
Paper ID: 15925

Max. Marks:60

Time Allowed: 3 Hours

NOTE:

1) **Parts A and B are compulsory**
2) **Part-C** has two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately
4) Use of scientific calculator is allowed.

Part – A **[Marks: 02 each]**

Q1.

a) Write the units of Poynting vector. What is represented by this vector?
b) "Focusing of Laser light is better than the ordinary." Why?
c) What do you mean by Mechanical Impedance matching?
d) Find the de-Broglie wavelength of a 1.0 mg grain of sand blown by the wind at the speed of 20 m/sec.
e) What is the physical meaning of Fermi level?
f) How the surface to volume ratio changes with changing size of a Nanomaterial?

Part – B **[Marks: 04 each]**

Q2. With the help of necessary diagrams, explain the Energy levels for the working of any continuous wave (CW) laser.

Q3. Describe the role of fibre splicers and couplers in communication through optical fibers.

Q4. An optical fiber has a N.A. of 0.20 and a cladding refractive index of 1.59. Determine the acceptance angle for the fiber in water which has a refractive index of 1.33.

Q5. Explain the B.C.S. theory with key note of Cooper pairs in superconductors.

Q6. A wave packet propagates in a medium, which exhibits normal dispersion . Find the relationship between its phase velocity and group velocity.

Q7. Suppose an electromagnetic plane wave is moving in free space having electric field component of the form:

$\vec{E} = \hat{j}\, E_0 \gamma\left(\frac{2\pi x}{\lambda}\right)\sin \omega t$ where γ, ω and λ are constants. Determine the corresponding $\vec{H}$ field and its direction.

Part – C **[Marks: 12 each]**

Q8.

1) For a particular mass condition the position of the Fermi energy level for intrinsic semiconductor is below the center of the intermediate energy gap. Justify..

2) Show that equation of continuity $div.\vec{J} + \frac{\partial \rho}{\partial t} = 0$ is contained in Maxwell's Electromagnetic equation.

3) Compute the ratio of populations of the two states in a He-Ne laser that produces light of wavelength 6.328×10^{-5}cm at 27^0C.

or

1) An optical fiber of graded index type is made up of a core, where light travels, made of glass of refractive index $n_1 = 1.5$ surrounded by another layer of glass of lower refractive index n_2.

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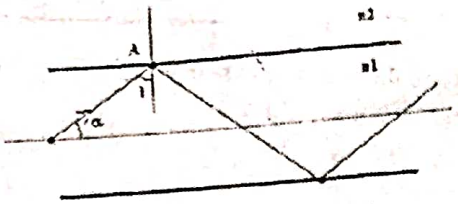

Find:

i. n_2 of the cladding so that the critical angle at the core cladding interface is 80°.

ii. Numerical Aperture of the fiber.

iii. V-parameter for core radius 50 μm and operating wavelength of 0.850 μm.

iv. Number of modes guided in the core.

2) For a three level laser system, explain the concept of transition probabilities and derive Einstein equations relating "A" and "B" coefficients.

3) Write a short note on semiconductor recombination.

Q9.

1) Consider a 1D box of length L/4 in which a particle is trapped. Find the particle wave-function and the corresponding energy for its 2nd excited state.

2) A damped oscillator is subjected to a damping force proportional to its velocity . Set up the differential equation of the oscillation. Discuss the under-damped, over-damped and critical damped motions of the oscillator.

3) What do you mean by Magnetic Domain? Using domain theory,explain why heating or dropping a magnet can cause it to lose its magnetization.

or

1) What are Nanoparticles, Nanotubes and Nanofilms? Are there any specific health or other risks from such nanoproducts?

2) At a certain time, the normalized wave function of a particle moving along X-axis has the form given by

$$\Psi(x) = \begin{cases} x+\eta \text{ for } -\eta < x < 0 \\ -x+\eta \text{ for } 0 < x < \eta \\ 0 \text{ elsewhere} \end{cases}$$

Find the value of η and probability that particle's position lies between $x = \eta/2$ and $x = \eta$.

3) What is penetration depth in superconductors? Derive the London differential equation describing the penetration of magnetic field into a superconducting surface.

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[Total No. of Questions:09] [Total No. of Pages:02]
Uni. Roll No. .....

Program/ Course: B.Tech. (Sem. 1/2)
Name of Subject: Engineering Physics
Subject Code: BTAS-17102
Paper ID:15857

Time Allowed: 03 Hours **Max. Marks:60**

NOTE:

1) **Parts A and B are compulsory**
2) **Part-C** has two sections: section C1 and section C2. Attempt one question each from the section C1 and C2.
3) Any missing data may be assumed appropriately

Part – A

[Marks: 02 each]

Q1.

a) Write down expressions for electric and magnetic potentials and give their units.
b) Differentiate between primitive and non- primitive unit cells.
c) Find surface area to volume ratio of a sphere of radius 'r'.
d) Give four advantages of optical fibers over copper wires.
e) Find de-Broglie wavelength of an electron accelerated by a potential of 1MV.
f) Find the wavelength of electromagnetic radiation that can break a cooper pair in a certain material having critical temperature of 7.1K.

Part – B

[Marks: 04 each]

Q2. What is the principle of Holography? Discuss the process of developing and reconstruction of a hologram.

Q3. Derive expression for Einstein's mass energy relation.

Q4. Discuss in detail ball milling technique for the manufacturing nanomaterials. Also give limitations of this method.

Q5. Explain why the equation $\vec{\nabla} \times \vec{B} = \mu_0 \vec{J}$ has limited applicability. Hence modify it for variable currents.

Q6. Using uncertainty principle, show that electrons cannot exist in the nucleus.

Q7. Derive relation between critical current and critical magnetic field for a cylindrical conductor in the absence of any external magnetic field and hence find maximum current that can be passed through a conductor of radius 3mm, whose critical magnetic field is $5 \times 10^3 A/m$.

Part – C

Section-C1

[Marks: 12 each]

Q8(a). (i) Show that intensity of plane electromagnetic waves is directly proportional to square of amplitude. (ii) Apply Time Independent Schrodinger equation to study the motion of a particle confined in a one dimensional box of length L and hence find eigen functions, eigen momentum and eigen energy values. (6+6)

or

Q8(b). (i) Object A is moving away from earth with velocity 0.6c. Object B is moving with velocity 0.8c at an angle of 120° w.r.t. direction of motion of object A. Find the

direction and magnitude of velocity of object B w.r.t. object A. (ii) Why X-rays are most suitable for studying crystal structure and obtain the relation that governs diffraction of X-rays from a crystal. (iii) Find the spacing between two consecutive lattice planes from a simple cubic system of lattice constant 4 Å, if Miller indices of the planes are (0 3 4). (5+5+2)

Section-C2 **[Marks: 12 each]**

Q9(a). (i) Why a material must become diamagnetic during superconducting transition? Is there any role of lattice vibrations in understanding the behaviour of superconductor? Explain in detail. (ii) The numerical aperture of a step index fiber is 0.3 and the refractive index of core is 1.50. Find refractive index of clad, acceptance angle and critical angle at the core clad interface. Assume that outside medium is air. (iii) What are various types of Carbon nanotubes? Give their applications. (5+5+2)

or

Q9(b). (i) Why a four level laser is better than a three level laser? Hence describe construction, theory and working of any four level laser. (ii) Why Pulse dispersion in optical fiber is more serious problem than attenuation? Hence discuss the types, causes and remedies of different types of pulse dispersion taking place in optical fiber. (6+6)

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[Total No. of Questions: 09] [Total No. of Pages: 03]

Uni. Roll No. .....

Program/Course: B.Tech. (Sem. 1st /2nd)
Name of Subject: Physics
Subject Code: BSC-101
Paper ID: 15925
Scientific calculator is allowed

Time Allowed: 3 Hours **Max. Marks: 60**

NOTE:

1) Part A and Part B are compulsory.
2) Part C has two questions Q8 and Q9. Both are compulsory, but with internal choice.
3) Any missing data may be assumed appropriately.

Part – A **[Marks: 02 each]**

Q1. (a) State (i) Gauss law of electrostatics (ii) Gauss law of magnetostatics.

(b) A car shocker executes simple harmonic motion and follows the equation $x(t) = 8\times10^{-2}\sin(0.6\pi t)$ m. Find amplitude, angular frequency, frequency and time period of oscillations developed in the shocker. Ignore resistive/damped forces.

(c) An electron in an orbit is moving with speed 5m/s. Find de-Broglie wavelength associated with the moving electron. Given $h = 6.63\times10^{-34}$ joule-sec, mass of electron $m_e = 9.1\times10^{-31}$kg.

(d) What are nanomaterials? Enlist the factors which are responsible for change in properties of the materials at the nanoscale.

(e) Define Fermi level and Fermi energy.

(f) Explain total internal reflection (TIR). Give examples of TIR in daily life.

Part – B **[Marks: 04 each]**

Q2. (i) Given $\vec{A} = \hat{i}\,2x + \hat{j}\,5y^2 - \hat{k}\,3z^2$. If $\vec{A}$ represents solenoidal field, then find the value of parameter S at point (1,2,1).

(ii) Find divergence and curl of the following vector field at point (2,1,0). Comment whether the vector field is solenoidal, rotational/irrotational: $\vec{A} = \hat{i}x^2 + \hat{j}y + \hat{k}z$

Q3. What is laser? Write full form of LASER. Enlist its characteristic properties. Explain three components of a laser and give their significance.

Q4. (i) Differentiate amongst conductors, insulators and semiconductors. Explain intrinsic and extrinsic semiconductors. Give examples of each type of semiconductors.

(ii) Discuss qualitatively and sketch the location of Fermi level in intrinsic semiconductors, p-type semiconductors and n-type semiconductors.

Q5. (i) What are dielectric materials? Explain polar and non-polar dielectric materials. Write their applications in engineering field.

(ii) What are magnetic materials? Give classification and examples of magnetic materials. Compare any four properties of various types of magnetic materials.

Q6. Check which particle will have higher value of de-Broglie wavelength:

(i) an electron whose kinetic energy is 100 eV.

(ii) a proton whose kinetic energy is 100 eV.

Given $h = 6.63\times10^{-34}$ Joule-sec, mass of electron $m_e = 9.1\times10^{-31}$ kg, mass of proton $m_p = 1.66\times10^{-27}$ kg, $1eV = 1.6\times10^{-19}$ Joule.

Q7. Enlist various forces acting in simple harmonic oscillator and damped oscillator. Hence develop equation of motion of a simple harmonic oscillator and a damped oscillator. Using $x(t) = A\sin(\omega t)$, where A is amplitude and ω is angular frequency, show that total energy of a simple harmonic oscillator is constant at any instant of time. (4)

Part– C **[Marks: 12 each]**

Q8. (a) Given electric scalar potential $V = x^2 + 3yz - 6xy\log(z)$. Find electric field intensity vector E and its magnitude at point (1, 0, 2). (2)

(b) A given He-Ne laser emits a pulse of energy 5J. Calculate number of photons emitted by the laser if wavelength of emitted photons is 6328Å. (2)

(c) Calculate acceptance angle, numerical aperture, fractional change in refractive index and critical angle of a given optical fiber in (i) air (ii) water (refractive index of water = 1.33) from the following data: Refractive index of core $n_1 = 1.50$, Refractive index of clad $n_2 = 1.49$. (4)

(d) The fractional change in refractive index of a step index fiber is 0.005 and numerical aperture of the fiber is 0.02. Determine refractive index of the core, refractive index of the clad, critical angle and V number of the fiber if diameter of core is 50 μm and wavelength of transmitted light is 900nm. Comment whether the fiber is SMF/MMF. (4)

OR

(a) Compare Ruby laser and He-Ne laser in terms of the following parameters: laser medium, nature of pump, optical resonator, number of levels participating in lasing action and wavelength emitted. (2)

(b) Write integral/differential forms of four Maxwell's equations. Give physical significance of each equation. (3)

(c) Derive mathematical relationship between acceptance angle and numerical aperture. (2)

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(d) Differentiate (i) SMF and MMF (ii) SI and GRIN type fibers (iii) Stimulated emission and spontaneous emission. (5)

Q9. (a) A superconducting sample has critical magnetic field value at 6K = 6.0×10^4 A/m. Calculate critical magnetic field at 0K i.e. H_c (0) if critical temperature T_c of the superconductor is 12K. Also find critical magnetic field at 9K and 3K. Plot all these values of critical magnetic field (along Y-axis) with corresponding values of temperature (along X-axis). (3)

(b) A neutron has been confined to move in a one-dimensional potential box of length 5Å. Calculate its energies corresponding to the ground state, second excited state and fifth quantum state. Given mass of neutron $m_n = 1.66 \times 10^{-27}$ kg, Planck's Constant $h = 6.63 \times 10^{-34}$ Joule-sec. (3)

(c) Bulk material consisting of bigger sphere of radius 9cm is crushed in the form of nanomaterial consisting of 27×10^9 smaller spheres. Calculate surface area to volume ratio for bigger sphere as well as for smaller spheres. Discuss the result thus obtained and hence draw conclusion that in which case chemical reactivity will be higher? (3)

(d) Find extension produced in the spring if stiffness constant is (i) 250N/m (ii) 10N/m. Take restoring force = 500N. Draw conclusions. (3)

OR

(a) Explain the concept which helps engineers to calculate energy loss/cycle while magnetizing/demagnetizing the ferromagnetic materials. (3)

(b) Explain the criteria which helps us to classify superconductors. Hence differentiate various types of superconductors. (3)

(c) Which feature of superconductors make them suitable for use in electric transmission wires/cables and why. (2)

(d) Apply time independent Schrodinger equation to calculate energy values and wavefunctions of a particle moving in a 1-D box of length L. (4)

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[Total No. of Questions: 09] Rayhan kumar

[Total No. of Pages: 02]

Uni. Roll No. 2203751

51/60

Program/Course: B.Tech. (Sem. – 1st /2nd)
Name of Subject: Physics
Subject Code: BSC-101
Paper ID: 15925
Scientific calculator is allowed

Time Allowed: 3 Hours **Max. Marks: 60**

NOTE:

1) Part A and Part B are compulsory.
2) Part C has two questions Q8 and Q9. Both are compulsory, but with internal choice.
3) Any missing data may be assumed appropriately.

Part – A **[Marks: 02 each]**

Q1.

(a) Define divergence and curl of a vector field.

(b) A swing in a park executes simple harmonic motion and follows the equation $x(t)= 12\sin(0.5\pi t+0.2\pi)$ m. Find amplitude, angular frequency, frequency, initial phase of oscillations. Ignore resistive/damped forces.

(c) A 2000kg car is moving with speed 20m/s. Find de-Broglie wavelength associated with moving car. Given $h= 6.63\times10^{-34}$ joule-sec.

(d) (i) Give Max Born's interpretation of wave function ψ. (ii) Define normalization.

(e) If $\vec{A} = \hat{\imath}px + \hat{\jmath}yz - \hat{k}z^2$ is solenoidal field, then find value of p. 2

(f) Find curl of given vector field and check whether the vector field is rotational/irrotational at point (-1,1,0):

$\vec{A} = \hat{\imath}x^2y + \hat{\jmath}xy + \hat{k}z$

Part – B **[Marks: 04]**

Q2. Derive the differential form of (i) Gauss law of electrostatics (ii) Faraday's Laws of electromagnetic induction. Give the physical significance of these equations.

Q3. Find mathematical relationship amongst three Einstein coefficients. Hence explain why laser light is usually of red colour?

Q4. What are extrinsic semiconductors? Give detailed difference between p type and n type semiconductors? Also give the location of Fermi level in these two types of extrinsic semiconductors.

Q5. What are ferromagnetic materials? Explain briefly, the following concepts in context with ferromagnetic materials

(i) B-H Curve

(ii) Domain Theory

Q6. Calculate de-Broglie wavelength of an electron whose kinetic energy is 50 eV. Given $h= 6.63\times10^{-34}$ Joule-sec, $m_e= 9.1\times10^{-31}$ kg, $1eV = 1.6\times10^{-19}$ Joule.

Q7. Differentiate damped and undamped oscillations. Establish the equation of motion of a simple harmonic oscillator and a damped oscillator. Also show that total energy of a simple harmonic oscillator is constant at any instant of time. (4)

Part– C **[Marks: 12]**

Q8.

(a) What is the role of optical resonator in a laser? (2)

(b) Discuss various losses taking place in an optical fiber. (2)

(c) Define numerical aperture. Give its physical significance. An optical fiber has core with refractive index 1.60 and clad with refractive index 1.59. Determine the numerical aperture of the fiber. Hence find the acceptance angle of the fiber in

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air, water (refractive index of water = 1.33) and kerosene oil (refractive index of kerosene oil is 1.44). (4)

(d) The fractional change in refractive index of a step index fiber is 0.002 and numerical aperture of the fiber is 0.20. Determine (i) refractive index of the core (ii) refractive index of the clad (iii) critical angle at the core cladding interface (iv) V number of the fiber if core radius of the fiber is 50 μm and the wavelength of transmitted light is 850nm. Hence check whether the fiber is SMF/MMF. (4)

OR

(a) Give the construction and working of He-Ne laser with well labelled diagrams. Compare salient features of He-Ne laser with those of Ruby laser. (4)

(b) Define gradient of a scalar field. Given electric potential $V = 3yx^2 + 5y^3 + 10xyz^2$. Find electric field intensity vector E and its magnitude at point (-1,2,3). (4)

(c) Write conditions for a vector field to be (i) solenoidal (ii) source field (iii) sink field (iv) rotational (v) irrotational and conservative. (2)

(d) Name two devices which involve the use of pn junction. Also write the principle of working of those devices. (2)

Q9.

(a) Define critical magnetic field Hc(T). How does Hc(T) vary with temperature? Given a superconducting sample with following parameters:

critical magnetic field at 12K = 2.8×10^6 A/m

critical magnetic field at 0K = 8.4×10^6 A/m

Find critical temperature T_c of the superconductor and critical magnetic field value at 10K. (4)

(b) What are superconductors? Enlist the properties which change when a given sample becomes superconductor? (2)

(c) At zero magnetic field, a superconductor has a critical temperature of 5.2K. At 0K, the critical magnetic field is 5×10^6 A/m. Calculate the critical magnetic field at 2.6 K. (2)

(d) What are nanomaterials? A big sphere of radius 6cm is divided into 1000 smaller spheres. Find radius of the smaller sphere and calculate surface area to volume ratio for bigger sphere as well as smaller sphere. Comment on the result thus obtained. (4)

OR

(a) A spring has spring constant k = 490 N/m. Find extension developed in the spring if restoring force of 10 N is acting on the spring. (2)

(b) Write short note on various types of superconductors. (2)

(c) Given a one-dimensional potential box of length equal to the de-Broglie wavelength of proton confined to move in the box with velocity 5m/s. Calculate the energies corresponding to the ground and second quantum states. (Mass of proton, $m = 1.66 \times 10^{-27}$ kg, $h = 6.63 \times 10^{-34}$ Joule-sec.) (4)

(d) Calculate energy eigen values and eigen wavefunctions of a particle moving in a 1-D box of length L. (4)

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