SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Physics
B. Tech. Minor-I Examination (Odd Semester) 2018-19

Entry No: 18BEC066 **Total Number of Pages:[01]**

Date: 02.09.2018 **Total Number of Questions: [05]**

Course Title: Engineering Physics

Course Code: PHL 1012

Time Allowed: 1.5 hours **Max Marks: [10]**

Instructions / NOTE

i. Attempt any ***Four*** questions but **Q. 1 from Section-A is compulsory.**

ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.

iii. Assume any missing data to suit the case/derivation/answer.

	Section – A		
Q. 1	**(a)** Discuss the nature of Coulomb force.	**[0.5]**	**CO1**
	(b) What is Gaussian surface?	**[0.5]**	**CO1**
	(c) What will be the electric flux through any face a cube due to a point charge +q located at its centre?	**[0.5]**	**CO2**
	(d) Give the salient features of conservative fields.	**[0.5]**	**CO1**
	(e) Under what condition the Poisson's equation reduces to Laplace's equation.	**[0.5]**	**CO2**
	Section – B		
Q. 2	Define line, surface and volume charge distributions. Find the electric field intensity at distance z above the center of the flat circular disk of radius a which carries a uniform surface charge σ.	**[2.5]**	**CO2**
Q. 3	Obtain Gauss's law in integral form. Use this law find the electric field at any point due to a uniformly charged hollow cylinder.	**[2.5]**	**CO2**
Q. 4	Define electric potential and establish the relation $\vec{E} = -\vec{\nabla} V$. A region is specified by the potential function, $V = 4x^2 + 3y^3 - 9z^2$, calculate the electric field strength at any point (3, 4, 5) in this region.	**[2.5]**	**CO2**
Q. 5	Give the expression for work done in assembling a continuous charge distribution over all space. Use this to find the potential energy of a configuration comprising of a sphere of radius R carrying a charge density $\rho(r) = kr$, where k is constant.	**[2.5]**	**CO2**

Course Outcomes

After successful completion of this course, students shall be able to:

CO1. know the vocabulary and concepts of Physics as it applies to: Electricity and Magnetism and Modern Physics.

CO2. develop the mathematical description of these concepts and principles to build up problem solving skills in Electrodynamics.

CO3. gain confidence to develop methods in Quantum Mechanics to understand Physics problems in real-life situations to benefit their future career.

CO4. apply Modern Physics concepts for understading problems related to free electron theory and band theory of solids.

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Physics

B. Tech. Major Examination (Odd Semester) 2018-19

Entry No: 1 8 B E C 0 6 6

Date: 27.11.2018

Total Number of Pages:[02]

Total Number of Questions: [06]

Course Title: Engineering Physics

Course Code: PHL 1012

Time Allowed: 3 hours **Max Marks: [50]**

Instructions / NOTE

i. Attempt questions from **both sections A** and **B**.

ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.

iii. Assume any missing data to suit the case/derivation/answer.

	Section – A [Compulsory Section]		
Q. 1	**(a)** Give the means of production and any two uses each for gamma rays and radiowaves.	[2]	CO1
	(b) In a region of space the electric field is given by $\vec{E} = 8\hat{i} + 4\hat{j} + 3\hat{k}$. What will electric flux through a surface of area 100 units in XY-plane?	[2]	CO2
	(c) An electron remains in an excited state of an atom for 10^{-8} s. What is the minimum uncertainty in the energy of the state in eV?	[2]	CO2
	(d) What is the physical significance of de Broglie wave function $\psi(\vec{r})$.	[2]	CO1
	(e) Taking $\hat{P} = \frac{d}{dx}$ and $\psi(x) = e^{-7x}$ in eigen value equation, find eigen value.	[2]	CO3
	Section – B [Attempt any four questions]		
Q. 2	**(a)** State Gauss's law in integral form. Use this law to find the electric field in the region $a \le r \le b$ for a hollow spherical shell carrying charge density $\rho = \frac{k}{r^2}$. Plot $\lvert\vec{E}\rvert$ as a function of r.	[6]	CO2
	(b) Find the work done in assembling a charge q uniformly on a spherical shell of radius r.	[4]	CO2
Q. 3	**(a)** Derive the differential form of fourth Maxwell's equation in free space. Give its physical significance.	[5]	CO1
	(b) State and prove the equation of continuity in charge dynamics.	[5]	CO1
Q. 4	**(a)** Obtain time-dependent Schrodinger wave equation for a particle moving in a potential $V(r)$.	[6]	CO3
	(b) Prove the commutation relations: (i) $[\hat{x}^2, \hat{p}_x] = 2i\hbar x$ (ii) $[\hat{L}_x, \hat{x}] = 0$	[4]	CO3
Q. 5	**(a)** A particle of mass m freely moves within a box of infinitely high walls. Find the energy levels and the normalized wave function for the particle.	[6]	CO3
	(b) Find the expectation value of the linear momentum for the wave function $\psi_n(x) = \sqrt{2/L}\sin(n\pi x/L)$, $0 \le x \le L$.	[4]	CO3
Q. 6	**(a)** Define Fermi energy E_f. Using the expression for Fermi energy for free electron gas in one-dimensional potential box at absolute zero, show that the average KE of an electron in the ground state is $(1/3)E_f$.	[6]	CO4
	(b) What were the limitations of the classical theory of the free electron gas model of metals?	[4]	CO4

Course Outcomes

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CO2. develop the mathematical description of these concepts and principles to build up problem solving skills in Electrodynamics and Modern Physics

CO3. gain confidence to develop methods in Quantum Mechanics to understand Physics problems in real-life situations to benefit their future career.

CO4. apply Modern Physics concepts for understanding problems related to free electron theory and band theory of solids.

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SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Physics

B. Tech. (CSE/ECE/ME/CE/EE) Mid-term Minor Examination (Odd Semester) 2019-20

Entry No: 19BCE031

Date: 27/09/2019

Total Number of Pages: [01]

Total Number of Questions: [04]

Course Title: Engineering Physics

Course Code: PHL 1012

Time Allowed: $01\frac{1}{2}$ Hours

Max Marks: [30]

Instructions / Note:

i. Answer any three (03) questions.
ii. All the symbols have their usual meanings.
iii. Assume an appropriate data/information, wherever necessary/missing.

Q. 1. a) If the electric field in some region is given (in spherical coordinates) by the expression $\vec{E}(\vec{r}) = \frac{A\hat{r}+B\sin\theta\cos\phi\ \hat{\phi}}{r}$, where A and B are constants. What is the charge density? [5] CO1

b) A current I flows down a wire of radius a. If it is distributed in such a way that the volume current density is inversely proportional to the distance from the axis, what is J? [5] CO1

Q. 2. a) Prove that the energy of a continuous charge distribution is given by the expression $W = \frac{\varepsilon_0}{2}\int_{all\ space} E^2 d\tau$. [5] CO1

b) Prove that (*i*) $\vec{\nabla}.\vec{B} = 0$; and (*ii*) $\vec{\nabla}\times\vec{B} = \mu_0\vec{J}$. [5] CO1

Q. 3. a) Four charges are situated at the corners of a square (side a), as shown in **Fig. 1**. How much work does it take to assemble the whole configuration of four charges. [5] CO1

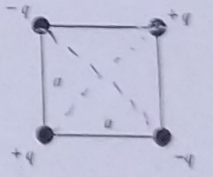

Fig. 1

b) Derive the expression for equation of continuity. [5] CO1

Q. 4. a) Write only the differential and integral forms of Gauss's law. Using Gauss's law, find the electric field a distance r from an uniformly long straight wire which carries uniform line charge λ. [5] CO1

b) A large co-axial cable (as shown in **Fig. 2**) carries a uniform volume charge density ρ on the inner cylinder (radius a) and a uniform surface charge density on the outer cylindrical shell (radius b). This surface is negative and of just right magnitude so that cable as a whole is electrically neutral. Find the potential difference between a point on the axis and a point on the outer cylinder. [5] CO1

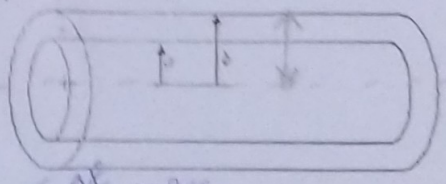

Fig. 2

Course Outcomes:

After successful completion of the course, the students will be able to:

CO1: know the vocabulary and concepts of Physics as it applies to: Electricity and Magnetism and Modern Physics;

CO2: develop the mathematical description of these concepts and principles to build up problem solving skills that will benefit their future career;

CO3: apply an understanding of these concepts to develop various modern systems, structures, technology and devices;

CO4: gain confidence to apply mathematical methods to understand Physics problems in real-life situations.

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Physics

B. Tech. (CSE/ECE/ME/CE/EE) Major Examination (Odd Semester) 2019-20

Entry No: 1 9 B C E 0 3 1 | Total Number of Pages: [01]

Date: 04/12/2019 | Total Number of Questions: [06]

Course Title: Engineering Physics

Course Code: PHL 1012

Time Allowed: 03 Hours | Max Marks: [50]

Instructions / Note:

i. **Answer any five (05) questions.**
ii. All the symbols have their usual meanings.
iii. Assume an appropriate data/information, wherever necessary/missing.

Q. 1.	a)	Explain, how the experimental findings of photoelectric effect were explained by Einstein's quantum theory of light? Calculate the work function, stopping potential and maximum velocity of photoelectrons for a light of wavelength 4350 $\AA$ when it incidents on sodium surface. Consider the threshold wavelength of photoelectrons to be 5420 $\AA$.	[5]	CO1
	b)	Derive the relation for Compton scattering $\lambda' - \lambda = \Delta\lambda = \frac{h}{m_0 c}(1 - cos\phi)$, where ϕ is the angle between initial and scattered photons.	[5]	CO2
Q. 2.	a)	Prove the time dependent form of Schrodinger's equations.	[5]	CO2
	b)	Derive the relation between the relation between group velocity (v_g) and phase velocity (v_p). And explain why the group velocity is less than velocity of light ($v_g < c$).	[5]	CO2
Q. 3.	a)	Derive the expression of energy of a particle confined in one dimensional box (infinite potential well). Compute the energy of the lowest three levels for a particle in a square well of width 3 $\AA$.	[5]	CO3
	b)	What are Bohr's postulates? Hydrogen atoms in states of higher quantum number have been created in the laboratory and observed in space. (*i*) Find the quantum number of the Bohr orbit in a hydrogen atom whose radius is 0.0100 *nm*, (*ii*) what is the energy of a hydrogen atom in this state?	[5]	CO3
Q. 4.	a)	For a particle in one dimensional box show that the wave function for states defined by ψ_n *and* ψ_m are orthogonal using the orthogonality condition $\int \psi_m^*(x)\,\psi_n(x)dx = 0$, where *m* and *n* are integers.	[5]	CO4
	b)	Distinguish metals, semiconductors and insulators on the basis of band theory of solids.	[5]	CO4
Q. 5.	a)	A long straight solid cylinder metal wire of radius *R* carries a total current *I* uniformly distributed over its circular cross-section. Find the magnetic field intensity inside as well as outside the wire.	[5]	CO1
	b)	The electric potential of some configuration is given by an expression (in spherical coordinates) $V(r) = \frac{Ae^{-\lambda r}}{r}$, where *A* and λ are constants. Find the electric field.	[5]	CO4
Q. 6.	a)	Explain Maxwell's modifications in Ampere's law to prove $Curl\,\vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$, where $\vec{D}$ is the electric displacement vector.	[5]	CO5
	b)	Write Rayleigh-Jeans and Planck's radiation formulas for black body radiation. Discuss the Planck's radiation formula for higher and lower frequencies.	[5]	CO5

Course Outcomes:

After successful completion of the course, the students will be able to:

CO1: know the vocabulary and concepts of Physics as it applies to: Electricity and Magnetism and Modern Physics,
CO2: develop the mathematical description of these concepts and principles to build up problem solving skills that will benefit their future career,
CO3: apply an understanding of these concepts to develop various modern systems, structures, technology and devices,
CO4: gain confidence to apply mathematical methods to understand Physics problems in real-life situations.