END Semester Examination

Programme: B.Tech	Semester: Autumn 2019-20
Course Code:PH-16001	Course Name: Foundation of Physics
Branch: Direct Second year (All Branches)	Academic Year: 2019-2020
Duration: 3 hours	Max Marks: 60

Student PRN No.

Instructions: --

1.Figures to the right indicate the full marks.**2.** Mobile phones and programmable calculators are strictly prohibited.**3.** Writing anything on question paper is not allowed.**4.** Exchange/Sharing of stationery, calculator etc. not allowed.**5.** Write your PRN Number on Question Paper.

			Marks	CO
Q 1	a	Simple Harmonic motion is given by the equation $F = -kx$, where $'k'$ stands for the force constant and 'x' being the displacement. Derive the expression for the total work done by this force during a displacement from $x = 0\ to\ x = x$.	3	1
	b	A particle executes SHM of amplitude 'A' along the X-axis. At $t = 0$ the position of the particle is $x = A/2$ and it moves along the positive X direction. Find the phase constant δ if the equation is written as $x = A\sin(\omega t + \delta)$.	3	1
	c	A light wave given by $y = A\sin(kx - \omega t)$ propagating along the positive X axis. Prove the relation $\dfrac{\partial^2 y}{\partial x^2} = \dfrac{1}{\vartheta^2}\dfrac{\partial^2 y}{\partial t^2}$,where 'ϑ' stands for the velocity of that wave in that medium.	4	1

OR

	c	For an optical fibre; incident ray is launch from air medium i.e. $n_0 = 1$. Prove the relation for acceptance angle θ_0 given by $\theta_0 = \sin^{-1}\sqrt{n_1^2 - n_2^2}$ where $n_2 < n_1$	4	1
Q 2	a	What is mass defect and packing fraction in case of atomic nucleus?	3	2
	b	Explain in detail any THREE characteristics of Nuclear force.	3	2
	c	A radioactive sample initially contains 4.00mg of U_{92}^{234}.How much of it will remain unchanged after 62000years? (Given:$T = 2.48 \times 10^5$ $and\ \lambda = 8.88 \times 10^{14}\ s^{-1}$)	4	2

Q 3   **a**   State any THREE characteristics of lines of force of an Electric field **E**.   3   3

     b   State and Prove Gauss's law in Electrostatics with the help of a neat and correct labelled diagram.   3   3

     c   Find the electric field at a distance $'r'$ from an infinitely long ($L \gg r$) straight wire which carries uniform line charge λ.   4   3

     OR

     c   Find the potential at the centre of a $1.0\ m$ square having charges $q, -2q, 3q, 2q$ at its corner.   ($q = 1.0 \times 10^{-8} C$).   4   3

Q.4   **a**   Define magnetic flux $\emptyset$ through a surface S of a magnetic field of strength **B**. What is its SI unit? What is the value of $\emptyset$ if a normal to that surface S is along the direction of **B**?   3   4

     b   A square coil of side $'d'$ carries a current $'I'$. Calculate the magnetic induction at the centre of a coil using Biot-Savart's Law.   3   4

     c   State and Prove with a net labelled diagram Ampere's Law in Magnetostatics.   4   4

Q.5   **a**   Derive the expression for a thermodynamic work done by the gas as its volume changes from V_1 to V_2 in isothermal condition.   4   5

     b   Define thermal efficiency of a heat engine. Show that its always less than 100 % even if it is ideal engine.   3   5

     c   State first law of thermodynamics in correct Scientific words. Show that for an isolated system the change in an internal energy is Zero.   3   5

Q.6   **a**   Derive a correct expression for De-Broglie wavelength of an electron of charge 'e' accelerated through a potential difference of 'V' volts.   3   6

     b   Discuss: Planck's quantum hypothesis.   3   6

     c   State explain any four condition for a function ψ to be an acceptable wave function.   4   6

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