



# COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)

## 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.

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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 $\delta$ 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 $\frac{\partial^2 y}{\partial x^2} = \frac{1}{v^2} \frac{\partial^2 y}{\partial t^2}$ , where 'v' 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 $\theta_0$ 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 62000 years? (Given: $T = 2.48 \times 10^5$ and $\lambda = 8.88 \times 10^{14} \text{ s}^{-1}$ )	4	2



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Q.3	a	State any THREE characteristics of lines of force of an Electric field <b>E</b> .	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 $\lambda$ .	4	3
OR				
		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 $\Phi$ through a surface $S$ of a magnetic field of strength <b>B</b> . What is its SI unit? What is the value of $\Phi$ if a normal to that surface $S$ is along the direction of <b>B</b> ?	3	4
	b	A square coil of side ' $d$ ' carries a current ' <b>I</b> '. Calculate the magnetic induction at the centre of a coil using Biot-Savart's Law.	3	4
	c	State and Prove with a neat 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 $\psi$ to be an acceptable wave function.	4	6