SCHEME OF VALUATION

COURSE : Engineering Physics-II
CODE : 2003
VERSION : 2015 Scheme

Question no.		Scoring Indicators	Split Score	Sub total	Total
I	1	• Angular velocity - definition • SI unit- rad/s	1 1	2	10
	2	• W=F.S=F S cos θ, θ=90 • W=F S cos 90=0	1 1	2	
	3	• Geostationary satellite-definition • Any two uses	1 1	2	
	4	• Diagram with Eq. V=V1+V2 • I R=I R$_1$+I R$_2$, R=R$_1$+R$_2$	1 1	2	
	5	• Any four sources: Hydroelectric power, Wind energy, Solar energy, Thermoelectric power, Nuclear energy, etc.	2	2	
II	1	• Parallel axes theorem-diagram • Statement • Expression • Perpendicular axes theorem-diagram • Statement • Expression	1 1 1 1 1 1	6	
	2	• Banking of curve- Description • Component of normal reaction contributes to centripetal force in addition to friction • Speed limit-explanation • Equation: $\tan\theta = \dfrac{v^2}{r\,g}$	1 2 2 1	6	
	3	Period $T = 2\pi\sqrt{\dfrac{(R+h)^3}{gR^2}}$ Proper substitution and simplification T= 96.80 minutes or 1Hr 37 minutes	2 2 2	6	30
	4	• Escape velocity - Definition • PE of mass $m =-\dfrac{GMm}{R}$, • When mass escape from gravitational field, PE should be zero. • $\square\ \dfrac{1}{2}mv_e{}^2 = \dfrac{GMm}{R}$ • $v_e = \sqrt{\dfrac{2GM}{R}}$ • $v_e = \sqrt{2gR}$	1 1 1 1 1 1	6	

	5	• Biot-Savart law: Statement • Biot-Savart law: Expression • $B = \frac{\mu_0 i}{4\pi a^2} \times \sum dl$ • $\sum dl = 2\pi a$, $B = \frac{\mu_0 i}{2\pi a}$ • For n turns, $B = \frac{\mu_0 n i}{2 a}$	1 1 1½ 1½ 1	6	
	6	• Statement • Laws with explanation	2 4	6	
	7	• Nuclear fission-statement • Fission reaction of Uranium $^{235}_{92}U + ^{1}_{0}n \rightarrow ^{141}_{56}Ba + ^{92}_{36}Kr + 3^{1}_{0}n + Energy$ • Explanation for energy release • Two fissionable isotopes	2 2 1 1	6	
III	a	• Definition • Expression	2 1	3	15
	b	• Rotational KE$=\frac{1}{2}I\omega^2$ $I = \frac{1}{2}MR^2$, $\omega = \frac{v}{R}$ Rotational KE$=\frac{1}{4}Mv^2$ • Translational KE$=\frac{1}{2}Mv^2$ • Total KE=rotational+ translational $=\frac{3}{4}Mv^2$ • Rotation KE$=\frac{1}{3}$(Total KE)	2 1 2 1	6	
	c	• Initial angular velocity $\omega_0 = 50\ rpm = 50 \times \frac{2\pi}{60} = \frac{5\pi}{3} rad/s$ Final angular velocity $\omega = 0$ • $\omega = \omega_0 + \alpha t$ • $0= 5\pi/3 + \alpha \times 60$ $\alpha = -\pi/36\ rad/s^2$ • torque $= I\alpha = \pi/18\ Nm$	1 2 1 2	6	
IV	a	• Definition • Expression: $k = \sqrt{\frac{I}{M}}$ • SI Unit: meter	1 1 1		15
	b	• Figure • Derivation of MI of ring: If total mass of disc is M and radius R, MI of ring of radius x and width $dx = \frac{2Mx^3 dx}{R^2}$ • Derivation: M.I of the disc $I = \int_0^R \frac{2M}{R^2}x^3 dx = \frac{1}{2}MR^2$	1 2 3	6	
	c	• $I = \frac{1}{2}MR^2 = 0.125\ Kgm^2$	2	6	

		• $\omega = 10 \times \dfrac{2\pi}{5} = 4\pi \; rad/s$	2			
		• $KE_{rot} = \dfrac{1}{2} I\omega^2$	1			
		• $KE_{rot} = \dfrac{1}{2} \times 0.125 \times (4\pi)^2 = 9.8 \, J$	1			
V	a	• Definition of g	1	3	15	
		• Definition of G	1			
		• G- Universal gravitational const. g-value varies from place to place	1			
	b	• Force experienced by a body towards the center of the earth $\dfrac{GMm}{R^2} = mg$, Value of g at the surface $g = \dfrac{GM}{R^2}$	1	6		
		• If the body is at a height h above the earth $g_h = \dfrac{GM}{(R+h)^2}$	1			
		• $g_h = \dfrac{g}{\left(1+\frac{h}{R}\right)^2} \approx g\left(1-\dfrac{2h}{R}\right)$	1			
		• If ρ is the density of earth, value of g at the surface $g = \dfrac{4}{3}\pi G\rho R$	1			
		• If the body is at a depth d $g_d = \dfrac{4}{3}\pi G\rho(R-d)$ $= \dfrac{4}{3}\pi G\rho R\left(1-\dfrac{d}{R}\right)$	1			
		• $g_d = g\left(1-\dfrac{d}{R}\right)$	1			
	c	• $g_h = \dfrac{g}{\left(1+\frac{h}{R}\right)^2}$	2	6		
		• Solving the equation	3			
		• $h = 241.6 \; km$	1			
VI	a	• Statement of Newton's law	2	3	15	
		• Equation	1			
	b	• Centripetal force=Gravitational force, $v = \sqrt{\dfrac{GM}{R+h}}$	2	6		
		• Close to earth, $h=0$				
		• $v_0 = \sqrt{\dfrac{GM}{R}} = \sqrt{gR}$	1			
		• Time=distance/velocity				
		• $T = 2\pi\sqrt{\dfrac{(R+h)^3}{GM}} = 2\pi\sqrt{\dfrac{(R+h)^3}{gR^2}}$	2			
		• Close to earth, $h=0$				
		• $T_0 = 2\pi\sqrt{\dfrac{R^3}{GM}} = 2\pi\sqrt{\dfrac{R}{g}}$	1			
	c	• $T = 2\pi\sqrt{\dfrac{(R+h)^3}{gR^2}}$	1	6		
		• $h = \left(\dfrac{gR^2 T^2}{4\pi^2}\right)^{\frac{1}{3}} - R$	2			

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		• Substitution and simplification	2		
		• $h = 35954000m = 35954 Km$	1		
VII	a	Kirchoff's law			15
		• Current law-statement, expression, figure	1	3	
		• Voltage law- statement, expression, figure	2		
	b	• Figure	2	6	
		• KCL and KVL Equations for loops	2		
		• Balancing condition $i_g = 0$	1		
		• Balancing condition $$\frac{P}{X} = \frac{R}{S}$$	1		
	c	• For loop ABEFA $4 i_2 + 3(i_1 + i_2) = 12$ Or $\quad 3 i_1 + 7i_2 = 12$	2	6	
		• For loop BCDEB $2 i_1 - 4i_2 = -5$	2		
		• Solving above equations	1		
		• $i_1 = 0.5\,A, i_2 = 1.5\,A \,\&\, i = 2A$	1		
VIII	a	• $B_x = \frac{\mu_0 n i a^2}{2(a^2 + x^2)^{3/2}}$	1		15
		• Explanation	1		
		• Graphical representation	1		
	b	• Figure	1	6	
		• Principle	1		
		• Construction	2		
		• Working	2		
	c	• Conductivity $\sigma = \frac{1}{\rho}$	1	6	
		• $\sigma = \frac{l}{\pi r^2 R}$	1		
		• Substitution $$\sigma = \frac{1.5}{\pi(1 \times 10^{-3})^2 \times 5}$$	2		
		• $\sigma = 9.554 \times 10^4 \Omega^{-1} m^{-1}$	2		
IX	a	• Spontaneous emission	1½		15
		• Stimulated emission	1½	3	
	b	• Characteristics of laser- Monochromatic, coherence, less divergence, high intensity	2	6	
		• Diagram-Ruby Laser	1		
		• Working	3		
	c	• $h\frac{c}{\lambda} = h\frac{c}{\lambda_0} + \frac{1}{2}mv^2$	1	6	
		• $\frac{1}{2}mv^2 = h\frac{c}{\lambda} - h\frac{c}{\lambda_0} = 6.63 \times 10^{-19} J$	2		

		• $v = \sqrt{\dfrac{2 \times 6.63 \times 10^{-19} J}{m}}$	2			
		• $v = 1.26.63 \times 10^6 m/s$	1			
X	a	• Principle-Nuclear fusion	1	3	15	
		• Composition and temperature of sun	1			
		• Fusion of hydrogen nuclei	1			
	b	• Reaction $_1^2H + _1^2H \rightarrow _2^4He + Energy$ Total mass before reaction: 2.0147+2.0147=4.0294u Total mass after reaction=4.0026u	2	6		
		• Change in mass=0.0268 u	1			
		• 1u=931 MeV	1			
		• Energy released= 0.0268 × 931	1			
		• E = 24.95 MeV	1			
	c	• Nuclear reactor-definition	1	6		
		• Description of essential components with examples for each: Fuel, Moderator, Control rods, Coolant, Containment structure	5			

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