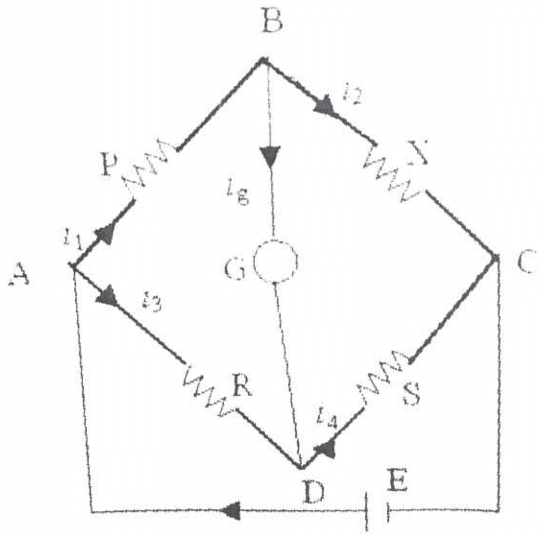
SCHEME OF VALUATION
(SCORING INDICATORS)

Revision : 2015 | **Course Code : 2003**

Course Title : ENGINEERING PHYSICS – II

Qst. No.	Scoring indicator	Split up score	Sub Total	Total
	PART A			
I(1)	Definition	1	2	
	$I = Mk^2$;$k = \sqrt{\frac{I}{M}}$	1		
I(2)	Definition	1	2	
	$$F = G\frac{m_1 m_2}{d^2}$$	1		10
I(3)	Definition of junction rule/ (Fig + Equation)	1	2	
	Definition of loop rule/ (Fig + Equation)	1		
I(4)	Definition of optical pumping	1	2	
	Definition of population inversion	1		
I(5)	Definition of nuclear fusion	1	2	
	Definition of nuclear fission	1		
	PART B			
II(1)	Fig + Explanation of figure	2	6	
	Component of velocity at B, parallel to OA =V$\sin\theta$	2		
	Acceleration towards the center of circle = (V$\sin\theta$)/t			
	t≈small; $\sin\theta \to \theta$; centripetal acceleration, a = Vθ/t			
	a= vω; since $\omega = \theta$/t	2		
	a= v^2/r; since ω = v/r			
II(2)	Fig +	2	6	
	Area of disc = πR^2; mass/area of disc = M/πR^2			
	Area of small ring = $2\pi x dx$; mass of small ring =	2		
	$2Mxdx/R^2$; MI of ring = $2Mx^3dx/R^2$			
	Integrating within the limits 0 to R; I =$MR^2/2$	2		

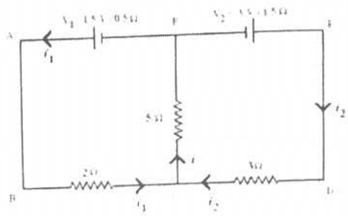
SCHEME OF VALUATION
(SCORING INDICATORS)

II(3)	Centripetal force = MV^2/R; gravitational force = GMm/R^2			
	$V^2 = GM/R$;	3		
	$V = \sqrt{\frac{GM}{R}} = \sqrt{gR}$ (since $g = \frac{GM}{R^2}$		6	
	Velocity			
	$V = \frac{2\pi R}{T}$; $T = \frac{2\pi R}{V} = 2\pi\sqrt{\frac{R}{g}}$	3		
II(4)	$g_h = g\left(1 - \frac{2h}{R}\right) = 9.8\left(1 - \frac{2\times50}{6400}\right) = 9.647\ m/s^2$	3	6	
	$g_d = g\left(1 - \frac{d}{R}\right) = 9.8\left(1 - \frac{100}{6400}\right) = 9.67\ m/s^2$	3		
II(5)		2	6	42
	Junction rule at B and D,	2		
	Loop rule at ABDA and BCDB			
	$I_g = 0$,			
	$\frac{i_1 P}{i_2 Q} = \frac{i_3 R}{i_4 S} = \frac{P}{Q} = \frac{R}{S}$; $Q = \frac{P\times S}{R}$	2		
II(6)	Statement + (Fig/Equation)	3		
	$B = \frac{\mu_0 n i}{2r}$;	3	6	
	$n = \frac{12.56\times10^{-4}\times5}{4\pi10^{-5}} = 50$ turns			
II(7)	Fig	2		
	Description of parts	2	6	
	Working principle	2		

SCHEME OF VALUATION
(SCORING INDICATORS)

	PART C			
III(a)	$\tau = I\alpha = I\frac{\omega_2-\omega_1}{t} = \frac{L_2-L_1}{t} = \frac{dL}{dt}$	3		
III(b)	Fig+ statement of parallel axes theorem	3		
	Fig+ statement of perpendicular axes theorem	3		
III(c)	Initial angular velocity ω_0 = 50 rpm = 50 x 2π/60 = 5π/3 rad/s Final angular velocity ω = 0 $\omega = \omega_0 + \alpha t$ $0 = \pi/3 + \alpha \times 60$ $\alpha = -\pi / 36$ rad / s^2 The torque that can produce an angular retardation π / 36 is $\tau = I \times \pi/36 = (\pi / 18)$ N m.	6	15	
IV(a)	Definition of center of mass	3		
IV(b)	Fig	2		
	$KE_{Rotational} = \frac{I\omega^2}{2} = \frac{Mv^2}{4}$	2		
	$Total\ KE = KE_{Rotational} + KE_{Translational} = \frac{3Mv^2}{4}$	2	15	120
IV(c)	M = 1 kg ; R = 0.5 m Moment of inertia I = ½ MR^2 = ½ x 1 x (0.5)^2 = 1/8 kg m Angular velocity ω = 10 x 2 π / 5 = 4 π rad/s. Rotational kinetic energy = ½ $I\omega^2$ = ½ x 1/8 x (4π)^2 = 9.8 J	6		
V(a)	Definition of gravitational potential	3		
V(b)	$F = G\frac{Mm}{R^2}; mg = G\frac{Mm}{R^2}$ Acceleration due to gravity at the surface of earth, $g = \frac{GM}{R^2}$	6		
V(c)	$F = G m_1 m_2/d^2$. $G = F d^2/(m_1 m_2)$ $m_1 = m_2 = (4/3)\pi r^3 \rho$ r = 0.5 m; ρ= 8000 kg/m^3. Substituting these values, $m_1 = m_2$ = 4186.7 kg Hence G = 2.923 x 10^{-4} x 2^2/(4186.7)^2. = 6.67 x 10^{-11} SI unit	6	15	

SCHEME OF VALUATION
(SCORING INDICATORS)

VI(a)	Definition + equation	3		
VI(b)	Acceleration due to gravity at the surface of earth, g = $\frac{GM}{R^2}$ Mass = volume x density = $\frac{4\pi R^3 \rho}{3}$ Therefore $g = \frac{4\pi G R \rho}{3}$	6	15	
VI(c)	We know g = $\frac{GM}{R^2}$, Therefore Mass M= $\frac{gR^2}{G}$ = 7.44× 10^{22} kg	6		
VII(a)	Statement + equation	3		
VII(b)	Fig of meter bridge	2		
	Description of meter bridge	2		
	Explanation based on Wheatstone's bridge	2		
VII(c)	The directions of currents are arbitrarily assigned as shown in the diagram.  Applying junction rule at C. $i = i_1 + i_2$ (i) Applying loop rule for circuit *ABCFA*. $\frac{1}{2} i_1 + 2i_1 + 5i = 1.5$ (ii) That is. $\frac{1}{2} i_1 + 2 i_1 + 5(i_1+i_2) = 1.5$ Or. $7.5 i_1 + 5 i_2 = 1.5$ (iii) Applying loop rule for *CDEFC*. $3 i_2 + 5 i + 1.5 i_2 = 3$ Or. $5 i_1 + 9.5 i_2 = 3$ (iv) Solving Equations (iii) and (iv). i_1 = -0.0162 A i_2 = 0.3243 A $i = i_1 + i_2$ = 0.3081 A The negative sign for i_1 shows that the actual direction of i_1 is just the reverse of what is shown in the figure.	6	15	
VIII(a)	Definition of resistivity and conductivity	3		
VIII(b)	Conversion of galvanometer into ammeter: Fig+ equations	3	15	
	Conversion of galvanometer into voltmeter: Fig+ equations	3		

SCHEME OF VALUATION
(SCORING INDICATORS)

VIII(c)	To convert the galvanometer into an ammeter, a shunt resistance has to be connected parallel to it. The value of the shunt S can be obtained from the relation $i_g = \frac{iS}{(S+G)}$ Current $i = 0.3$ A; $i_g = 2 \times 10^{-3}$ A and $G = 30\ \Omega$ Substituting these values $S = 0.2013\ \Omega$.	3		
	To convert the galvanometer into a voltmeter, a high resistance has to be connected in series to it. The value of R can be determined from the equation $i_g = \frac{E}{(G+R)}$ That is $2 \times 10^{-3} = 0.2 / (R+30)$ Solving we get $R = 70\Omega$.	3		
IX (a)	Definitions of spontaneous emission and stimulated emission	3		
IX(b)	• Photoelectric effect is frequency dependent. • The intensity of light affects only the number of ejected electrons. • Photoelectric effect is an instantaneous process.	3		
	Energy incident = work function + kinetic energy $h\upsilon = \varphi + \frac{1}{2} mV^2 = h\upsilon_0 + \frac{1}{2} mV^2$	3		
IX(c)	Work function $\varphi = 2.8$ eV $= 2.8 \times 1.6 \times 10^{-19}$ J $= 4.48 \times 10^{-19}$ J If λ_0 is the threshold wave length. $\varphi = \frac{hc}{\lambda_0}$ $4.48 \times 10^{-19} = \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{\lambda_0}$ Simplifying, $\lambda_0 = 444 \times 10^{-9}$ m $= 444$ nm	3	15	
	Threshold frequency $= C/\lambda_0 = 6.76 \times 10^{14}$ Hz	3		
X(a)	Any three applications of laser	3		
X(b)	Nuclear fuel + Moderator	2	15	
	Control rods + Coolant	2		

SCHEME OF VALUATION
(SCORING INDICATORS)

X(c)	Containment structure: Instrumentation + Protective mechanism	2		
	Work function $\varphi = 2.8\ eV = 2.8 \times 1.6 \times 10^{-19}\ J$ $= 4.48 \times 10^{-19}\ J$ If λ_0 is the threshold wave length, $\varphi = \dfrac{hc}{\lambda_0}$ $4.48 \times 10^{-19} = \dfrac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{\lambda_0}$ Simplifying, $\lambda_0 = 444 \times 10^{-9} m = 444\ nm$	6		

MASTER COPY SCHEME UNCLEAR