SCHEME OF VALUATION.

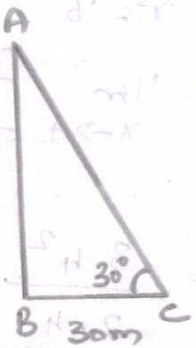
Scoring Indicators.

1002B(15)

Revision : 2015 | Course Code : 1002

Course Title : ENGINEERING MATHEMATICS - I

Qst. No.	Scoring Indicator	Split up Score	Sub total	Total
	PART A.			
I 1.	$\cos 330 = \cos(360-30)$			
	$= \cos 30$	1	2	
	$= \sqrt{3}/2$	1		
I 2.	$\Delta = \frac{1}{2} ab \sin C$	1	2	
	$= \frac{1}{2} ab \cdot \frac{c}{2R} = \frac{abc}{4R}$	1		
	$4R\Delta = abc$			
I 3.	$\lim_{x \to 4} \frac{x^3 - 64}{x^2 - 16}$			
	$= \lim_{x \to 4} \frac{\frac{x^3-64}{x-4}}{\frac{x^2-16}{x-4}}$	1	2	
	$= \frac{3.4^2}{2.4} = \frac{48}{8} = 6$	1		
I 4.	$y = 2\cos x - 5\sec x.$			
	$\frac{dy}{dx} = 2.\frac{d}{dx}\cos x - 5.\frac{d}{dx}\sec x$	1	2	
	$= -2\sin x - 5\sec x \tan x$	1		

Qst No.	Scoring Indicator	Split up Score	Sub Total	Total
I 5.	$y = 4x^2 - 12x + 7$.			
	$\frac{dy}{dx} = 8x - 12$	1	2	
	$\frac{dy}{dx} < 0 \Rightarrow 8x - 12 < 0 \Rightarrow x < \frac{12}{8} = \frac{3}{2}$	1		
	PART B .			
II 1.	$\sqrt{\frac{1-\sin x}{1+\sin x}} = \sqrt{\frac{1-\sin x}{1+\sin x} \cdot \frac{1+\sin x}{1+\sin x}}$.	1		
	$= \sqrt{\frac{(1-\sin x)^2}{1-\sin^2 x}}$	1		
	$= \sqrt{\frac{(1-\sin x)^2}{\cos^2 x}}$	1	6	
	$= \frac{1-\sin x}{\cos x}$	1		
	$= \frac{1}{\cos x} - \frac{\sin x}{\cos x} = \sec x - \tan x$	2.		
II 2.	height of the tree = AB + AC 	1.		
	$\cos 30^\circ = \frac{BC}{AC} = \frac{30}{AC}$	2.	6	
	$\Rightarrow AC = \frac{60}{\sqrt{3}}$			
	$\tan 30 = \frac{AB}{BC} = \frac{AB}{30}$	2.		
	$\Rightarrow AB = \frac{30}{\sqrt{3}}$			
	$AB + AC = \frac{90}{\sqrt{3}}$	1.		

Q. No	Scoring Indicators	Split up Score	sub total.	Total.
II 3.	$\cos\frac{\pi}{8}+\cos\frac{3\pi}{8}+\cos\frac{5\pi}{8}+\cos\frac{7\pi}{8}$			
	$=2\cos\frac{\pi}{4}\cos\frac{\pi}{8}+2\cos\frac{3\pi}{4}\cos\frac{\pi}{8}$	2.		
	$=2\cos\frac{\pi}{8}\left[2\cos\frac{\pi}{2}\cdot\cos\frac{\pi}{4}\right]$	2	6.	
	$=0$	2		
II 4.	$(a-b)\cos\frac{C}{2}=(2R\sin A-2R\sin B)\cos\frac{C}{2}$	1		
	$=2R\left(2\cos\frac{A+B}{2}\sin\frac{A-B}{2}\right)\cos\frac{C}{2}$	1.		
	$=4R\cos\left(90-\frac{C}{2}\right)\sin\frac{A-B}{2}\cos\frac{C}{2}$	1		
	$=4R\sin\frac{C}{2}\sin\frac{A-B}{2}\cos\frac{C}{2}$	1	6	
	$=2R\sin C\sin\frac{A-B}{2}$	1		
	$=c.\sin\frac{A-B}{2}$	1		
II 5	$y=f(x)=\sqrt{x}$.			
	$\frac{dy}{dx}=\lim_{h\to0}\frac{f(x+h)-f(x)}{h}$	1		
	$=\lim_{h\to0}\frac{\sqrt{x+h}-\sqrt{x}}{h}$	1		
	$=\lim_{h\to0}\frac{(x+h)-x}{h(\sqrt{x+h}+\sqrt{x})}$	2	6	
	$=\lim_{h\to0}\frac{h}{h(\sqrt{x+h}+\sqrt{x})}$	1		
	$=\frac{1}{2\sqrt{x}}$.	1		
II 6.	$\frac{dy}{dx}=\frac{(1+\log x)(e^x\sin x+e^x\cos x)-e^x.\sin x.\frac{1}{x}}{(1+\log x)^2}$.	3		
	$=\frac{e^x\left[(1+\log x)(\sin x+\cos x)-\frac{\sin x}{x}\right]}{(1+\log x)^2}$	3.	6.	

Q. No	Scoring Indicators.	Split up score	Sub total	Total
II 7.	$y^2 = 4ax \Rightarrow 2y \cdot y' = 4a \Rightarrow y' = \frac{2a}{y}$	2		
	equation of tangent is $y - y_1 = m(x - x_1)$			
	$\Rightarrow y - 2at = \frac{2a}{2at}(x - at^2)$	1		
	$\Rightarrow ty - x - at^2 = 0$.	1	6	
	equation of normal is $y - y_1 = \frac{-1}{m}(x - x_1)$			
	$\Rightarrow y - 2at = \frac{-1}{1/t}(x - at^2)$	1		
	$\Rightarrow y + tx - 2at - at^3 = 0$	1		
	Part C.			
III a.	$\cot A = \frac{-15}{8} \Rightarrow \operatorname{cosec} A = \frac{-17}{8}$	1		
	$\Rightarrow \sin A = \frac{-8}{17}$	1		
	$\Rightarrow \cos A = \frac{15}{17}$, $\sec A = \frac{17}{15}$	2	5	
	~~Cot~~ $\tan A = -\frac{8}{15}$	1		
III b.	$3\sin x - 4\cos x = R(\sin x \cos\alpha - \cos x \sin\alpha)$	1		
	$\Rightarrow 3 = R\cos\alpha$, $4 = R\sin\alpha$.	1	5	
	$\Rightarrow R = \pm 5$	1		
	$\alpha = \tan^{-1}(4/3)$	2		

Q. No	Scoring Indicators	Split up Score	Sub total	Total
III c.	$\tan 15^\circ = \tan(45^\circ - 30^\circ)$	1		
	$= \frac{\tan 45^\circ - \tan 30^\circ}{1 + \tan 45^\circ \cdot \tan 30^\circ}$	1		
	$= \frac{1 - \frac{1}{\sqrt{3}}}{1 + \frac{1}{\sqrt{3}}} = \frac{\sqrt{3}-1}{\sqrt{3}+1} \cdot \frac{\sqrt{3}-1}{\sqrt{3}-1}$	1	5	
	$= \frac{3+1-2\sqrt{3}}{3-1} = 2-\sqrt{3}$	2		
IV a.	$\sin A = \frac{-3}{5}$ $\quad \sin B = \frac{12}{13}$			
	$\cos A = \frac{-4}{5}$ $\quad \cos B = \frac{-5}{13}$	1+1		
	$\sin(A-B) = \sin A \cdot \cos B - \cos A \sin B$			
	$= \frac{-3}{5} \cdot \frac{-5}{13} - \frac{-4}{5} \cdot \frac{12}{13}$		5	
	$= \frac{63}{65}$	2		
	$\cos(A-B) = \cos A \cos B + \sin A \sin B$			
	$= \frac{-4}{5} \cdot \frac{-5}{13} + \frac{-3}{5} \cdot \frac{12}{13}$			
	$= \frac{-16}{65}$	2		
IV b.	$\frac{-\sin A \cdot \sec A \cdot -\tan A}{\sec A \cdot -\sin A \cdot -\tan A}$	4	5	
	$= 1$	1		
IV c.	$\sin A + \sin\frac{2\pi}{3} \cdot \cos A + \cos\frac{2\pi}{3} \sin A + \sin\frac{4\pi}{3} \cos A + \cos\frac{4\pi}{3} \sin A$	1		
	$= \sin A + \frac{\sqrt{3}}{2}\cos A - \frac{1}{2}\sin A - \frac{\sqrt{3}}{2}\cos A - \frac{1}{2}\sin A$	2	5	
	$= \sin A - \sin A = 0$	2		

Q. No	Scoring Indicators.	Split up Score	Sub total	Total.
	Unit II.			
V a.	$\sin 33^\circ + \cos(90^\circ - 27^\circ)$	1		
	$= \sin 33^\circ + \sin 27^\circ$	1/2		
	$= 2 \sin 30^\circ \cdot \cos 3^\circ$	3	5	
	$= \cos 3^\circ$.	1/2		
V b.	$\frac{\tan\theta + \sec\theta - (\sec^2\theta - \tan^2\theta)}{\tan\theta - \sec\theta + 1}$	1		
	$\frac{(\tan\theta + \sec\theta)(1 - \sec\theta + \tan\theta)}{\tan\theta - \sec\theta + 1}$.	3	5	
	$= \tan\theta + \sec\theta = \frac{1 + \sin\theta}{\cos\theta}$	1		
V c.	$C = 90^\circ$	1/2		
	$\frac{a}{\sin 30^\circ} = \frac{b}{\sin 60^\circ} = \frac{13}{\sin 90^\circ}$	2	5	
	$a = \frac{13}{2}$	1/2		
	$b = \frac{13\sqrt{3}}{2}$	2		
VI a.	$\frac{\sin 3A}{\sin A} - \frac{\cos 3A}{\cos A}$			
	$= \frac{3\sin A - 4\sin^3 A}{\sin A} - \frac{4\cos^3 A - 3\cos A}{\cos A}$.	3		
	$= 3 - 4\sin^2 A - 4\cos^2 A + 3$.	1/2	5	
	$= 6 - 4$	1		
	$= 2$	1/2		

Q. No	Scoring Indicators.	Split up Score	Sub total	Total
VI b.	$\theta = 18^\circ$			
	$\cos 3\theta = \cos 54^\circ = \sin 36 = \sin 2\theta$	1		
	$4\cos^3\theta - 3\cos\theta - 2\sin\theta\cos\theta = 0$	1/2		
	$\Rightarrow 4\cos^2\theta - 2\sin\theta - 3 = 0$.	1		
	$\Rightarrow 4\sin^2\theta + 2\sin\theta - 1 = 0$.	1/2	5	
	$\Rightarrow \sin\theta = \frac{-2 \pm \sqrt{20}}{8} = \frac{-1+\sqrt{5}}{4}$	1		
	$\Rightarrow \sin 18^\circ = \frac{\sqrt{5}-1}{4}$	1		
VI c.	$2\cos 60^\circ . \sin(-10^\circ) + \cos 80^\circ$	2		
	$= \cos 80^\circ - \sin 10^\circ$	1		
	$= \cos(90^\circ - 10^\circ) - \sin 10^\circ$	1/2	5	
	$= \sin 10^\circ - \sin 10^\circ$	1		
	$= 0$	1/2		
	Unit-III			
VII a.	$y' = \frac{\sin x \cdot 0 - 1 \cdot \cos x}{\sin^2 x}$ $\quad y = \frac{1}{\sin x}$.	2		
	$= \frac{-\cos x}{\sin x \cdot \sin x}$	1	5	
	$= -\operatorname{cosec} x \cdot \cot x$.	2		
VII b.	$\frac{dy}{dx} = \frac{1}{\sec x + \tan x} \cdot (\sec x \tan x + \sec^2 x)$	2		
	$= \frac{\sec x (\sec x + \tan x)}{\sec x + \tan x}$.	2	5	
	$= \sec x$	1		

Q No.	Scoring Indicators.	Split up Score	Sub total	Total.
VII c.	$\frac{dy}{dx} = (x^3-1)^2 \cdot -\operatorname{Cosec}^2 11x \cdot 11 - \cot 11x \cdot \frac{2(x^3-1)\cdot 3x^2}{(x^3-1)^4}$	2.		
	$= -\frac{(x^3-1)^2 11\operatorname{cosec}^2 11x - 6x^2 \cot 11x}{(x^3-1)^3}$	2	5	
	$= \frac{-11x^3\operatorname{Cosec}^2 11x + 11\operatorname{cosec}^2 11x - 6x^2\cot 11x}{(x^3-1)^3}$	1.		
VIII a.	(i) $\frac{dx}{dt} = a\left(1-\frac{1}{t^2}\right)$, $\frac{dy}{dt} = a\left(1+\frac{1}{t^2}\right)$	1		
	$\frac{dy}{dx} = \frac{a\left(1+\frac{1}{t^2}\right)}{a\left(1-\frac{1}{t^2}\right)} = \frac{t^2+1}{t^2-1}$	1½		
	(ii) $\frac{dy}{dx} = (1+x^2)\frac{d}{dx}\cot^{-1}x + \cot^{-1}x \cdot \frac{d}{dx}(1+x^2)$	1	5	
	$= 1+x^2 \cdot \frac{-1}{1+x^2} + (\cot^{-1}x)\,2x$	1		
	$= -1 + 2x\cot^{-1}x$.	½		
VIII b.	$x^2y^2 = x^3+y^3+3xy$.			
	$x^2 \cdot 2yy' + y^2 \cdot 2x = 3x^2 + 3y^2\cdot y' + 3(xy'+y)$	2		
	$(2x^2y - 3y^2 - 3x)y' = 3x^2 + 3y - 2xy^2$	1	5	
	$y' = \frac{3x^2+3y-2xy^2}{2x^2y-3y^2-3x}$.	2.		

Q. No	Scoring Indicators.	Split up Score	Sub total	Total.
VIII c.	$y' = ae^x + 2be^{2x}$	2		
	$y'' = ae^x + 4be^{2x}$	2		
	$y'' - 3y' + 2y = ae^x + 4be^{2x} - 3ae^x - 6be^{2x}$	1/2	5	
	$+ 2ae^x + 2be^{2x}$.	1/2		
	$= 0$.			
IX a.	$\frac{dy}{dx} = \frac{(1-x)^2 \cdot 1 - x \cdot 2(1-x)(-1)}{(1-x)^4}$	2		
	$= \frac{1+x}{(1-x)^3}$	1½	5	
	$m=0 \Rightarrow x = -1$.	1½		
	Tangent will be Parallel to $x-ax$ is if $x = -1$.	1/2		
IX b.	$v = \frac{ds}{dt} = 3t^2 - 12t + 8$.	1		
	$a = \frac{dv}{dt} = 6t - 12$	1	5	
	$a = 12 \Rightarrow 6t - 12 = 12 \Rightarrow t = 4$.	1		
	$v_{/t=4} = 8 \text{ cm/s}$.	2		
IX c.	$y' = 3x^2 - 6x - 9$	1		
	$y' = 0 \Rightarrow 3x^2 - 6x - 9 = 0$.	2	5	
	$\Rightarrow x = -1, 3$.			
	$x = -1 \Rightarrow y = 10$.	1/2		
	$x = 3 \Rightarrow y = -22$.	1/2		
	Stationary Points are $(-1, 10)$ & $(3, -22)$	1		

Q. No	Scoring Indicators.	Split up Score	Sub total	Total.
X a.	$A = \pi r^2$.	1		
	$\frac{dA}{dt} = 2\pi r \cdot \frac{dr}{dt}$	1		
	$\frac{dA}{dt} = 6 \Rightarrow \frac{dr}{dt} = \frac{3}{\pi r}$.	1	5	
	when $r = 2$, $\frac{dr}{dt} = \frac{3}{2\pi}$ cm/min.	2		
X b.	$y' = 3x^2 - 6x + 6$.	1		
	$= 3(x^2 - 2x + 2)$			
	$= 3(x^2 - 2x + 1 + 1)$	1/2		
	$= 3[(x-1)^2 + 1] > 0$	2	5	
	$y' > 0$ $\forall$ real values of x	1		
	$\therefore$ y is increasing for all real values of x.	1/2		
X c	Let x & y denotes the length and breadth of a rectangle.			
	Perimeter $= 2x + 2y = k$, k is a constant.	1/2		
	$y = \frac{1}{2}(k - 2x)$			
	Area $A = xy = \frac{x}{2}(k - 2x) = \frac{kx}{2} - x^2$.	1		
	$\frac{dA}{dx} = \frac{k}{2} - 2x$.	1	5	
	$\frac{dA}{dx} = 0 \Rightarrow x = \frac{k}{4}$.	1/2		
	$\frac{d^2A}{dx^2} = -2 < 0$	1		
	$\therefore$ Area is maximum when $x = \frac{k}{4} = y$.	1		