SCORING INDICATORS

COURSE NAME : MATHEMATICS II

COURSE CODE : REV (21) – 2002 QID : 2106220099(A)

Qn. No.	Scoring Indicators	Split Score	Sub Total	Total Score
	PART A			9
I.1	$\sec^2\theta - \tan^2\theta = 1$		1	
I.2	$A+B = \begin{bmatrix} 1 & -2 \\ -1 & 2 \end{bmatrix}$		1	
I.3	$\hat{i}+2\hat{j}+4\hat{k}$ or $-\hat{i}-2\hat{j}-4\hat{k}$		1	
I.4	$\sqrt{2^2+(-1)^2+2^2} = 3$		1	
I.5	$-\cos x + C$		1	
I.6	$\frac{x^3}{3} + 3x + C$		1	
I.7	$\left[\frac{3x^2}{2}\right]_0^1 = 3/2$		1	
I.8	Order = 2, degree = 1		1	
I.9	$dy = x^2dx$, $y = \frac{x^3}{3}+C$		1	
	PART B			24
II.1	$x^2-36=0$, $x^2=36$, $x=\pm 6$	1+1+1	3	
II.2	$A^T = \begin{bmatrix} 3 & 0 \\ 1 & 1 \\ -1 & 2 \end{bmatrix}$	1	3	
	$AA^T = \begin{bmatrix} 3\times3+1\times1+-1\times-1 & 3\times0+1\times1+-1\times2 \\ 0\times3+1\times1+2\times-1 & 0\times0+1\times1+2\times2 \end{bmatrix} = \begin{bmatrix} 11 & -1 \\ -1 & 5 \end{bmatrix}$	1+1		
II.3	$\text{adj}\,A = \begin{bmatrix} 2 & -3 \\ 1 & 3 \end{bmatrix}$, $\lvert A\rvert = 9$, $A^{-1} = \frac{\begin{bmatrix} 2 & -3 \\ 1 & 3 \end{bmatrix}}{9}$	1+1+1	3	
II.4	$\bar{a}\times\bar{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 2 & -1 \\ 6 & -3 & 2 \end{vmatrix} = \hat{i}(4-3)-\hat{j}(4+6)+\hat{k}(-6-12)$ $= \hat{i}-10\hat{j}-18\hat{k}$	1+1 1	3	
II.5	Displacement $\overline{AB} = \hat{i}+\hat{j}+3\hat{k}$ Work done $= \bar{F}\cdot\overline{AB} = (\hat{i}+2\hat{j}+\hat{k})\cdot(\hat{i}+\hat{j}+3\hat{k})$ $= 6$ units.	1 1 1	3	
II.6	$\overline{OP} = \hat{i}+2\hat{j}+3\hat{k}$, $\overline{OQ} = 3\hat{i}+5\hat{j}+6\hat{k}$ $\overline{PQ} = \overline{OQ}-\overline{OP} = 2\hat{i}+3\hat{j}+3\hat{k}$ $\lvert\overline{PQ}\rvert = \sqrt{2^2+3^2+3^2} = \sqrt{22}$	1 1 1	3.	
II.7	$\int\cos^2x\,dx = \int\left(\frac{1+\cos 2x}{2}\right)dx$ $= \frac{1}{2}\left[\int 1\,dx + \int\cos 2x\,dx\right]$ $= \frac{1}{2}\left(x+\frac{\sin 2x}{2}\right)+C$	1 1 1	3	

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II.8	$\int x \sin x\,dx = x\int \sin x\,dx - \int\left[\frac{d}{dx}(x)\cdot\int \sin x\,dx\right]dx$	1		
	$= x(-\cos x) - \int 1\cdot(-\cos x)\,dx$	1	3	
	$= -x\cos x + \sin x + c$	1		
II.9	$\int_0^1 \frac{1}{1+x^2}\,dx = [\tan^{-1}x]_0^1$	1		
	$= \tan^{-1}(1) - \tan^{-1}(0)$	1	3	
	$= \pi/4 - 0 = \pi/4$ (or 45°)	1		
II.10	$\frac{dy}{dx} = e^{3x}\cdot e^{y}$	1		
	$e^{-y}\,dy = e^{3x}\,dx$.	1	3	
	Integrating $-e^{-y} = \frac{e^{3x}}{3} + c$	1		
	PART C			42
III.1	$\Delta = \begin{vmatrix} 1 & 2 & -1 \\ 3 & 1 & 1 \\ 1 & -1 & 2 \end{vmatrix} = -3$, $\Delta_1 = \begin{vmatrix} -3 & 2 & -1 \\ 4 & 1 & 1 \\ 6 & -1 & 2 \end{vmatrix} = -3$	1+1		
	$\Delta_2 = \begin{vmatrix} 1 & -3 & -1 \\ 3 & 4 & 1 \\ 1 & 6 & 2 \end{vmatrix} = 3$ $\Delta_3 = \begin{vmatrix} 1 & 2 & -3 \\ 3 & 1 & 4 \\ 1 & -1 & 6 \end{vmatrix} = -6$	1+1	7	
	$x = \frac{\Delta_1}{\Delta} = 1$, $y = \frac{\Delta_2}{\Delta} = -1$, $z = \frac{\Delta_3}{\Delta} = 2$	1+1+1		
III.2	a) Equating corresponding elements,			
	$a = 2$,	1		
	$a + b = 3$, $\therefore b = 1$	1 } 4		
	$2a - c = 7$, $c = -3$	2	7	
	b) $A^T = \begin{bmatrix} 1 & 2 \\ -1 & -3 \end{bmatrix}$	1 } 3		
	$A + A^T = \begin{bmatrix} 1 & -1 \\ 2 & -3 \end{bmatrix} + \begin{bmatrix} 1 & 2 \\ -1 & -3 \end{bmatrix} = \begin{bmatrix} 2 & 1 \\ 1 & -6 \end{bmatrix}$	1+1		
III.3	a) $\bar{a}\cdot\bar{b} = 2\times -2 + 1\times 2 + 1\times -3$	1 } 2		
	$= -4 + 2 - 3 = -5$	1		
	b). $\overline{BA} = \bar{r} = \hat{i} + \hat{j} + 4\hat{k}$	1		
	$\overline{BA}\times\bar{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 1 & 4 \\ 4 & 0 & -3 \end{vmatrix} = \hat{i}(-3-0) - \hat{j}(-3-16) + \hat{k}(0-4)$	1+1 } 5	7	
	$= -3\hat{i} + 19\hat{j} - 4\hat{k}$	1		
	moment $= \lvert\overline{BA}\times\bar{F}\rvert = \sqrt{(-3)^2 + 19^2 + (-4)^2} = \sqrt{386}$ units	1		

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III.4	a) $\bar{a}+\bar{b} = 3\hat{i}-2\hat{j}+\hat{k}$ $\lvert\bar{a}+\bar{b}\rvert = \sqrt{3^2+(-2)^2+1^2} = \sqrt{14}$ unit vector $= \frac{\bar{a}+\bar{b}}{\lvert\bar{a}+\bar{b}\rvert}$ $= \frac{3\hat{i}-2\hat{j}+\hat{k}}{\sqrt{14}}$	1 1 1 1 } 4	7	
	b) $\bar{a}+\bar{b} = 3\hat{i}$ $\bar{a}-\bar{b} = -\hat{i}+2\hat{j}+2\hat{k}$ $(\bar{a}+\bar{b})\cdot(\bar{a}-\bar{b}) = -3$	1 1 1 } 3		
III.5	a) since, given vectors are $\perp^r$, their dotproduct $=0$ ie, $8+p+2=0$ $\therefore p=-10$	1 1 1 } 3	7	
	b) $\bar{a}\times\bar{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 2 \\ -1 & 1 & -1 \end{vmatrix}$ $= -\hat{i}-\hat{j}$ $\lvert\bar{a}\times\bar{b}\rvert = \sqrt{2}$ unit vector $= \frac{\bar{a}\times\bar{b}}{\lvert\bar{a}\times\bar{b}\rvert} = \frac{-\hat{i}-\hat{j}}{\sqrt{2}}$	1 1 1 1 } 4		
III.6	a) $2\bar{a} = 2\hat{i}+2\hat{j}+2\hat{k}$ $3\bar{b} = 6\hat{i}-3\hat{j}-3\hat{k}$ $2\bar{a}\cdot 3\bar{b} = 12-6-6 = 0$	1 1 1 } 3	7	
	b) $\overline{AB}\times\overline{BC} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 3 \\ -3 & -2 & 1 \end{vmatrix} = \hat{i}(2+6)-\hat{j}(1+9)+\hat{k}(-2+6)$ $= 8\hat{i}-10\hat{j}+4\hat{k}$ $\lvert\overline{AB}\times\overline{BC}\rvert = \sqrt{180}$ Area $= \frac{1}{2}\lvert\overline{AB}\times\overline{BC}\rvert = \frac{1}{2}\sqrt{180}$ sq.units.	1 1 1 1 } 4		
III.7	a) put $u = x+\cos x$ $du = (1-\sin x)dx$ $\int\frac{1-\sin x}{x+\cos x}dx = \int\frac{du}{u}$ $= \log u + C = \log(x+\cos x)+C$	1 1 1 1 } 4	7	
	b) $\int_0^{\pi/2}\sin 2x\,dx = \left(-\frac{\cos 2x}{2}\right)_0^{\pi/2}$ $= -\frac{\cos\pi}{2}+\frac{\cos 0}{2} = -\frac{-1}{2}+\frac{1}{2}$ $= 1$	1 1 1 } 3		

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Qn. No.	Scoring Indicators	Split Score	Sub Total	Total Score
III.8	a) $\int x^2 \log x\, dx = \int \log x \cdot x^2 dx$ $= \log x \cdot \int x^2 dx - \int \frac{1}{x} \cdot \frac{x^3}{3} dx$ $= \frac{x^3 \log x}{3} - \frac{x^3}{9} + c$	1 1 1 } 3	7	
	b) $\int \sec x\, dx = \int \frac{\sec x(\sec x + \tan x)}{(\sec x + \tan x)} dx$ Put $u = \sec x + \tan x$ $du = \sec x(\sec x + \tan x) dx$. $\therefore \int \sec x\, dx = \int \frac{du}{u} = \log u + c = \log(\sec x + \tan x) + c$	1 1 1 1 } 4		
III.9	a) $\int \frac{3\cos x + 4}{\sin^2 x} dx = \int \left(\frac{3\cos x}{\sin^2 x} + \frac{4}{\sin^2 x}\right) dx$ $= 3\int \left(\frac{1}{\sin x} \cdot \frac{\cos x}{\sin x}\right) dx + 4\int \frac{1}{\sin^2 x} dx$ $= 3\int \operatorname{cosec} x \cot x\, dx + 4\int \operatorname{cosec}^2 x\, dx$ $= -3\operatorname{cosec} x - 4\cot x + c$	1 1 1 1 } 4	7	
	b) $\int_0^{\pi/2} \sin x\, dx = (-\cos x)_0^{\pi/2}$ $= -\cos(\pi/2) - -\cos 0$ $= -0 + 1 = 1$	1 1 1 } 3		
III.10	a) put $u = \sin x$ $du = \cos x\, dx$ $\int \sin^3 x \cos x\, dx = \int u^3 du$ $= \frac{u^4}{4} + c = \frac{\sin^4 x}{4} + c$	1 1 1 1 } 4	7	
	b) $\int_1^2 \log x\, dx = (x \log x - x)_1^2$ $= (2\log 2 - 2) - (1 \log 1 - 1)$ $= 2\log 2 - 1$	1 1 1 } 3		

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III.11	Intersecting points of parabola and x-axis is given by $y=0$	1		
	ie $x^2-x-2=0$	1		
	$x=-1, 2$	1		
	$\therefore$ Area $= \int_{-1}^{2}(x^2-x-2)=0$	1	7	
	$= \left(\frac{x^3}{3}-\frac{x^2}{2}-2x\right)_{-1}^{2}$	1		
	$= \left(\frac{8}{3}-\frac{4}{2}-4\right)-\left(\frac{-1}{3}-\frac{1}{2}+2\right)$	1		
	$= -9/2$.			
	Area $= 9/2$ sq. units.	1		
III.12	Equation is of the form $\frac{dy}{dx}+Py=Q$	1		
	$P=\tan x$	1		
	I.F. $= e^{\int P dx}$	1		
	$= e^{\int \tan x dx}$	1		
	$= e^{\log(\sec x)} = \sec x$.	1		
	Multiply by I.F., the equation becomes		7	
	$\frac{d}{dx}(y\sec x) = \cos^2 x \sec x\, dx = \cos x$.	1		
	Integrating both sides w.r.to x,			
	$y\sec x = \int \cos x\, dx$			
	$y\sec x = \sin x + C$	1		