1

SCHEME OF VALUATION (Scoring Indicators)

Revision: 2010 Course Code: 1002

Course Title: TECHNICAL MATHEMATICS-I

Qst No.	Scoring Indicator	Split up Score	Sub Total	Total
	PART-A			
I	1. $\sin\theta.\sin\theta - -\cos\theta.\cos\theta$	1	2	2
	$\sin^2\theta + \cos^2\theta = 1$	1		
	2. $11+7$	1	2	2
	$= 18$	1		
	3. $\cancel{\sin A}.\frac{1}{\cancel{\cos A}}.\frac{\cancel{\cos A}}{\cancel{\sin A}}$	1	2	2
	$= 1$	1		
	4 $m = \frac{y_2-y_1}{x_2-x_1}$	1	2	2
	$= \frac{9-5}{6-4} = \frac{4}{2} = 2$	1		
	5. $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$	2	2	2
				10
	PART-B			
II	1. $\Delta = 16 \quad \Delta_1 = 32 \quad \Delta_2 = 16 \quad \Delta_3 = -16$	4	6	6
	$x = \frac{\Delta_1}{\Delta} = 2 \quad y = \frac{\Delta_2}{\Delta} = 1 \quad z = \frac{\Delta_3}{\Delta} = -1$	2		
2	$(A+A^T)^T = A^T + (A^T)^T = A^T + A$, symmetric	2	6	6
	$(A-A^T)^T = A^T - (A^T)^T = A^T - A$, skew-symmetric	2		
	$\frac{A+A^T}{2} + \frac{A-A^T}{2} = \frac{2A}{2} = A$	2		
3	$t_{r+1} = {}^{12}C_r\,(x^2)^{12-r}.\left(\frac{1}{x}\right)^r$	1	6	6
	$= {}^{12}C_r\,x^{24-3r}$	2		
	$24-3r = 0 \quad r = 8, \quad t_9 = {}^{12}C_8$	2+1		

Q	Solution	Marks		
4	$\tan 75 = \tan(45+30)$	1		
	$= \dfrac{\tan 45 + \tan 30}{1 - \tan 45 \cdot \tan 30} = \dfrac{1+\sqrt{3}}{1-\sqrt{3}}$	2	6	6
	$\cot 75 = \dfrac{1-\sqrt{3}}{1+\sqrt{3}}$			
	$\tan 75 + \cot 75 = \dfrac{1+\sqrt{3}}{1-\sqrt{3}} + \dfrac{1-\sqrt{3}}{1+\sqrt{3}}$	1		
	$= 4$	2		
5.	$L.H.S = 2\left(bc \cdot \dfrac{b^2+c^2-a^2}{2bc} + ca \cdot \dfrac{c^2+a^2-b^2}{2ca} + ab\,\dfrac{a^2+b^2-c^2}{2ab}\right)$	3		
	$= b^2+c^2-a^2+c^2+a^2-b^2+a^2+b^2-c^2$	2	6	6
	$= \underline{\underline{a^2+b^2+c^2}}$	1		
6	$a = 3b$	1		
	Equation is $\dfrac{x}{a} + \dfrac{y}{b} = 1$			
	$\dfrac{x}{3b} + \dfrac{y}{b} = 1$	1	6	6
	$x + 3y = 3b$	1		
	This line passes through $(-6, 3)$			
	$-6 + 3 \cdot 3 = 3b$	1		
	$b = 1$	1		
	$a = 3$			
	$\therefore \dfrac{x}{3} + \dfrac{y}{1} = 1$	1		
	$\underline{x + 3y - 3 = 0}$			
7	$\Delta = \begin{vmatrix} 3 & 1 \\ 2 & -1 \end{vmatrix} = -5$	1		
	$\Delta_1 = \begin{vmatrix} 2 & 1 \\ 3 & -1 \end{vmatrix} = -5$	1		
	$\Delta_2 = \begin{vmatrix} 3 & 2 \\ 2 & 3 \end{vmatrix} = 5$	1	6	6
	$x = 1 \quad y = -1$	1		
	Third line is $kx + 2y - 3 = 0$	1		
	$k = 5$	1		

PART-C

Q.	Answer	Marks		
III 1.	$\Delta = 4$,	1		
	Cofactor matrix $= \begin{bmatrix} 0 & 2 & -2 \\ -2 & 4 & -2 \\ 2 & -2 & 4 \end{bmatrix}$	1		
	Adjoint matrix $\begin{bmatrix} 0 & -2 & 2 \\ 2 & 4 & -2 \\ -2 & -2 & 4 \end{bmatrix}$	1	5	5
	$A^{-1} = \dfrac{\text{Adj } A}{\lvert A \rvert}$	1		
	$= \dfrac{\begin{bmatrix} 0 & -2 & 2 \\ 2 & 4 & -2 \\ -2 & -2 & 4 \end{bmatrix}}{4}$	1		
2.	$BC = \begin{bmatrix} 1+6 & 2+0 & 3-6 & -4-3 \\ 0+4 & 0+0 & 0-4 & 0-2 \\ -1+8 & -2+0 & -3-8 & 4-4 \end{bmatrix}$	3	5	5
	$= \begin{bmatrix} 7 & 2 & -3 & -7 \\ 4 & 0 & -4 & -2 \\ 7 & -2 & -11 & 0 \end{bmatrix}$	2		
3.	$3(6-18) - 1(6x-6x^2) + 9(6x-2x^2) = 0$	1		
	$-12x^2 + 48x - 36 = 0$	1		
	$x^2 - 4x + 3 = 0$	1	5	5
	$(x-1)(x-3) = 0$	1		
	$x = 1$ or $x = 3$	1		
IV 1.	$\begin{vmatrix} k & 3 & -5 \\ 5 & -1 & 3 \\ 7 & k & -2 \end{vmatrix} = 0$	1		
	$3k^2 + 23k - 58 = 0$	2	5	5
	$k = 2$	2		
2.	$A^T = \begin{bmatrix} 3 & 0 \\ 1 & 1 \\ -1 & 2 \end{bmatrix}$	1		
	$A \cdot A^T = \begin{bmatrix} 11 & -1 \\ -1 & 5 \end{bmatrix}$	2	5	5
	$(A \cdot A^T)^T = \begin{bmatrix} 11 & -1 \\ -1 & 5 \end{bmatrix} = A \cdot A^T$	2		

3.	$A^2 = \begin{bmatrix} 8 & 4 & 1 \\ -2 & 3 & 5 \\ 11 & 17 & 19 \end{bmatrix}$	2		
	$3A = \begin{bmatrix} 9 & 3 & 0 \\ -3 & 3 & 3 \\ 6 & 9 & 12 \end{bmatrix}$	1		
	$2I = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$	1	5	5
	$A^2 - 3A + 2I = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 2 \\ 5 & 8 & 9 \end{bmatrix}$	1		
IV	1. $\left(x^2 - \frac{1}{x}\right)^5 = (x^2)^5 - {}^5C_1 (x^2)^4 \cdot \frac{1}{x} + {}^5C_2 (x^2)^3 \cdot \left(\frac{1}{x}\right)^2$			
	$- {}^5C_3 (x^2)^2 \cdot \left(\frac{1}{x}\right)^3 + {}^5C_4 (x^2)^1 \cdot \left(\frac{1}{x}\right)^4 - \left(\frac{1}{x}\right)^5$	2		
	$= x^{10} - 5 \cdot x^8 \cdot \frac{1}{x} + 10\, x^6 \frac{1}{x^2} - 10\, x^4 \cdot \frac{1}{x^3}$	2	5	5
	$+ {}^5C_4\, x^2 \cdot \frac{1}{x^4} - \frac{1}{x^5}$			
	$= x^{10} - 5x^7 + 10x^4 - 10x + \frac{5}{x^2} - \frac{1}{x^5}$	1		
2	${}^nC_2 = 210$			
	$\frac{n(n-1)}{1 \cdot 2} = 210$	1		
	$n^2 - n - 420 = 0$	2	5	5
	$(n-21)(n+20) = 0$	1		
	$\Rightarrow n = 21$ or $n = -20$	1		
3.	$\frac{\sin^2 a + (1+\cos a)^2}{(1+\cos a)\sin a}$	1		

	$= \dfrac{\sin^2\alpha + 1 + 2\cos\alpha + \cos^2\alpha}{(1+\cos\alpha)\sin\alpha}$	1		
	$= \dfrac{(\sin^2\alpha + \cos^2\alpha) + 1 + 2\cos\alpha}{(1+\cos\alpha)\sin\alpha}$	1	5	5
	$= \dfrac{2(\cancel{1+\cos\alpha})}{(\cancel{1+\cos\alpha})\sin\alpha}$	1		
	$= \dfrac{2}{\sin\alpha} = \underline{2\,\mathrm{cosec}\,\alpha}$	1		
VI 1.	7^{th} term is the middle term	1		
	$(r+1)^{th}$ term $= (-1)^r\, {}^{n}C_{r}\, (2a)^{12-r} \cdot \left(\frac{b}{3}\right)^r$	2	5	5
	7^{th} term $= (-1)^6 \cdot {}^{12}C_6 (2a)^6 \left(\frac{b}{3}\right)^6$	2		
2.	$\tan A = \dfrac{-8}{15}$	1		
	$\sin A = -\dfrac{8}{17}$	1		
	$\mathrm{cosec}\, A = \dfrac{-17}{8}$	1	5	5
	$\cos A = \dfrac{15}{17}$	1		
	$\sec A = \dfrac{17}{15}$	1		
3.	$L.H.S = \dfrac{1 - \frac{1}{\sqrt{3}}}{1 + \frac{1}{\sqrt{3}}}$	1		
	$= \dfrac{\sqrt{3}-1}{\sqrt{3}+1}$	1	5	5
	$= \dfrac{(\sqrt{3}-1)^2}{3-1}$	2		
	$= 2-\sqrt{3}$	1		

VII	1.	$\tan(A+B) = \tan\frac{\pi}{4} = 1$	1		
		$\frac{\tan A + \tan B}{1 - \tan A \cdot \tan B} = 1$	1	5	5
		$\tan A + \tan B = 1 - \tan A \cdot \tan B$	1		
		$\tan A \cdot \tan B + \tan A + \tan B = 1$			
		$1 + \tan A \tan B + \tan A + \tan B = 2$	1		
		$(1+\tan A)(1+\tan B) = 2$	1		
	2	$\tan^2\frac{A}{2} = \frac{1-\cos A}{1+\cos A}$	1		
		$\tan^2 22\frac{1}{2}^\circ = \frac{1-\cos 45}{1+\cos 45}$	1		
		$= \frac{1-\frac{1}{\sqrt{2}}}{1+\frac{1}{\sqrt{2}}} = \frac{\sqrt{2}-1}{\sqrt{2}+1}$	1	5	5
		$= \frac{(\sqrt{2}-1)^2}{2-1}$	1		
		$= (\sqrt{2}-1)^2$			
		$\tan 22\frac{1}{2}^\circ = \sqrt{2}-1$	1		
	3.	$\tan\left(\frac{A-B}{2}\right) = \frac{a-b}{a+b} \cdot \cot\frac{C}{2}$	1		
		$\frac{a-b}{a+b} = \frac{2R\sin A - 2R\sin B}{2R\sin A + 2R\sin B}$	1		
		$= \frac{\sin A - \sin B}{\sin A + \sin B}$			
		$= \frac{2\cos\left(\frac{A+B}{2}\right)\cdot\sin\left(\frac{A-B}{2}\right)}{2\sin\left(\frac{A+B}{2}\right)\cdot\cos\left(\frac{A-B}{2}\right)}$	1		

$$= \cot\left(\frac{A+B}{2}\right) \cdot \tan\left(\frac{A-B}{2}\right)$$

$$\tan\left(\frac{A-B}{2}\right) = \left(\frac{a-b}{a+b}\right) \cdot \tan\left(\frac{A+B}{2}\right)$$ 1 | 5 | 5

$$= \left(\frac{a-b}{a+b}\right) \cdot \cot\frac{C}{2}$$ 1

VIII 1.

$$\cos A = \frac{-4}{5}$$ 1

$$\sin A = \frac{-3}{5}$$ 1

$$\cos B = \frac{-12}{13}$$ 1 | 5 | 5

$$\sin(A-B) = \sin A \cos B - \cos A \sin B = \frac{36}{65}$$ 1

$$\cos(A+B) = \cos A \cos B - \sin A \sin B = \frac{63}{65}$$ 1

2.

$$\cos 20 \cdot \cos 40 \cdot \cos 80 = \frac{1}{2}(2\cos 40 \cdot \cos 20)\cos 80$$ 1

$$= \frac{1}{2}(\cos 60 + \cos 20)\cos 80$$ 1

$$= \frac{1}{4}\cos 80 + \frac{1}{2}\cos 80 \cos 20$$

$$= \frac{1}{4}\cos 80 + \frac{1}{4}(2\cos 80 \cos 20)$$ 1 | 5 | 5

$$= \frac{1}{4}\cos 80 + \frac{1}{4}(\cos 100 - \cos 60)$$ 1

$$= \frac{1}{4}\cos 80 - \frac{1}{4}\cos 80 + \frac{1}{8} = \frac{1}{8}$$ 1

3.

$$L.H.S = ab^2\cos A + ac^2\cos A + bc^2\cos B + ba^2\cos B + ca^2\cos C + cb^2\cos C$$ 1

$$= ab(b\cos A + a\cos B) + ac(c\cos A + a\cos C) + bc(c\cos B + b\cos C)$$ 2 | 5 | 5

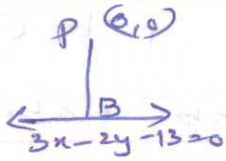
$$= abc + abc + abc = \underline{3abc}$$ 2

IX 1.

$$A = \cos^{-1}\left(\frac{b^2+c^2-a^2}{2bc}\right) = \cos^{-1}(0.8286) = 34^0 03'$$ 2

$$B = \cos^{-1}\left(\frac{a^2+c^2-b^2}{2ac}\right) = \cos^{-1}(0.7143) = 44^0 25'$$ 2 | 5 | 5

$$C = 180 - (A+B) = 101^0 32'$$ 1

	2. $m = \tan\theta = \tan 135^\circ = -1$	1		
	$(x_1, y_1) = (3, -4)$			
	Equation is $y - y_1 = m(x - x_1)$	1	5	
	$y - \cancel{4} = -1(x-3)$	1		5
	$y + 4 = -x + 3$	1		
	$\underline{x + y + 1 = 0}$	1		
	3. ∴ Point of Intersection $(-1, 0)$	2		
	Any line parallel to $x + y - 6 = 0$ is	1		
	$x + y + k = 0$		5	5
	it passes through $(-1, 0)$			
	$-1 + 0 + k = 0$	1		
	$k = 1$			
	∴ The equation is $\underline{x + y + 1 = 0}$	1		
X	1. $\tan\left(\frac{A-B}{2}\right) = \frac{a-b}{a+b} \cdot \cot\frac{C}{2}$			
	$A - B = 38^\circ 16'$	2		
	$A + B = 110^\circ$			
	$A = 74^\circ 08'$	1	5	5
	$B = 35^\circ 52'$	1		
	$\frac{a}{\sin A} = \frac{c}{\sin C}$			
	$c = \underline{84.99\text{ cm}}$	1		
	2. $2x - 3y + 5 = 0 \rightarrow ax + by + c = 0$	1		
	Slope $= \frac{-a}{b} = \frac{-2}{-3} = \frac{2}{3}$	2	5	5
	x-intercept $= -c/a = -5/2$	1		
	y-intercept $= -c/b = -5/-3 = 5/3$	1		
	3. Any line ⊥r to $3x - 2y - 13 = 0$			
	is $2x + 3y + k = 0$ 	1		
	This line passes through $(0, 0)$	1		
	∴ $2x + 3y + k = 0$			
	∴ $k = 0$			
	Point of Intersection of			
	$3x - 2y - 13 = 0$ and $2x + 3y = 0$	3	5	5
	is $(3, -2)$			