I/II Semester Diploma Examination, February-2023

Course Name: Engineering Mathematics Course Code: 20SC01T

MODEL ANSWERS

Q.No.	Answers	Q.No.	Answers
1(a)	Square matrix: - It is a matrix with equal number of Rows and Columns Example: $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ OR Given $A = \begin{bmatrix} 4 & 5 \\ 3 & 2 \end{bmatrix}, B = \begin{bmatrix} 3 & 4 \\ 2 & 1 \end{bmatrix}$ 3A-2B=3 $\begin{bmatrix} 4 & 5 \\ 3 & 2 \end{bmatrix} - 2\begin{bmatrix} 3 & 4 \\ 2 & 1 \end{bmatrix}$ =$\begin{bmatrix} 12 & 15 \\ 9 & 6 \end{bmatrix} - \begin{bmatrix} 6 & 8 \\ 4 & 2 \end{bmatrix}$ =$\begin{bmatrix} 6 & 7 \\ 5 & 4 \end{bmatrix}$	1(b)	$(1-\lambda)(3-\lambda)-8=0$ $\lambda^2 - 4\lambda - 5 = 0$ $\lambda^2 - 5\lambda + \lambda - 5 = 0$ $\lambda(\lambda - 5) + 1(\lambda - 5) = 0$ $\lambda=5$ & $\lambda=-1$
		1(c)	x+y=1 & 2x+y=2 $\Delta = \begin{vmatrix} 1 & 1 \\ 2 & 1 \end{vmatrix} = 1 - 2 = -1$ $\Delta_x = \begin{vmatrix} 1 & 1 \\ 2 & 1 \end{vmatrix} = -1$ $\Delta_y = \begin{vmatrix} 1 & 1 \\ 2 & 2 \end{vmatrix} = 2 - 2 = 0$ $x = \frac{\Delta_x}{\Delta} = \frac{-1}{-1} = 1 \& y = \frac{\Delta_y}{\Delta} = \frac{0}{-1} = 0$
1(b)	Given A=$\begin{bmatrix} 3 & 2 \\ 1 & 2 \end{bmatrix}$ $then$ detA=$\begin{vmatrix} 3 & 2 \\ 1 & 2 \end{vmatrix} = 6 - 2 = 4$ adjA=$\begin{bmatrix} 2 & -2 \\ -1 & 3 \end{bmatrix}$ $A^{-1} = \frac{adjA}{detA} = \frac{1}{4}\begin{bmatrix} 2 & -2 \\ -1 & 3 \end{bmatrix}$ OR A=$\begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$ Characteristic equation is $\lvert A - \lambda I \rvert = 0$ $\left\lvert \begin{pmatrix} 1 & 2 \\ 4 & 3 \end{pmatrix} - \lambda \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \right\rvert = 0$ $\begin{vmatrix} 1-\lambda & 2 \\ 4 & 3-\lambda \end{vmatrix} = 0$	1(c)	OR $J = \begin{pmatrix} 45 & 30 \\ 35 & 25 \\ 20 & 18 \end{pmatrix}, F = \begin{pmatrix} 42 & 28 \\ 36 & 20 \\ 22 & 16 \end{pmatrix}$ $D = \begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix}, M = \begin{pmatrix} 2 \\ 5 \\ 2 \end{pmatrix}$

1(d)	$A=\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}, B=\begin{bmatrix}2 & 1\\3 & 4\end{bmatrix}$ $AB=\begin{bmatrix}2+6 & 1+8\\6+12 & 3+16\end{bmatrix}=\begin{bmatrix}8 & 9\\18 & 19\end{bmatrix}$ $(AB)^T=\begin{bmatrix}8 & 18\\9 & 19\end{bmatrix}$	2(b)	OR Given points are (2,3) & (4,6) Two-point form is $\frac{y-y_1}{x-x_1}=\frac{y_2-y_1}{x_2-x_1}$ (or) $\frac{y-3}{x-2}=\frac{3}{2}$ $2y-6=3x-6(\,or)\,3x-2y=0$
1(d)	OR $A=\begin{bmatrix}3 & 1\\5 & 2\end{bmatrix}$ $\lvert A\rvert=\begin{vmatrix}3 & 1\\5 & 2\end{vmatrix}=6-5=1$ $\lvert A\rvert.I=1.\begin{bmatrix}1 & 0\\0 & 1\end{bmatrix}=\begin{bmatrix}1 & 0\\0 & 1\end{bmatrix}=L.H.S$ $A.adjA=\begin{bmatrix}3 & 1\\5 & 2\end{bmatrix}\begin{bmatrix}2 & -1\\-5 & 3\end{bmatrix}$ $=\begin{bmatrix}6-5 & -3+3\\10-10 & -5+6\end{bmatrix}$ $=\begin{bmatrix}1 & 0\\0 & 1\end{bmatrix}=R.H.S$	2(c)	Intercepts form is $\frac{x}{a}+\frac{y}{b}=1$ Given $x-int.=3\ \&\ y-int.=2$ Then $\frac{x}{3}+\frac{y}{2}=1$ Therefore, the equation is $2x+3y-6=0$ OR Slope of x-y+4=0 is $m_1=1$, $Slope$ of 2x-y+5=0 is $m_2=2$, Formula Ɵ=$\tan^{-1}\left(\frac{m_2-m_1}{1+m_2.m_1}\right)$ $=\tan^{-1}\left(\frac{2-1}{1+2.1}\right)=\tan^{-1}\left(\frac{1}{3}\right)$
2(a)	$Equation\ of\ line\ is\ 3x+4y+7=0$ $Slope=\frac{-a}{b}=\frac{-3}{4}$ $X-int.=\frac{-c}{a}=\frac{-7}{3}$ OR General form of straight line is $ax+by+c=0$ One-point form is $(y-y_1)=m(x-x_1)$	2(d)	Ɵ=45^0, $m=\tan 45^0$, $y-int.=C=5$ Equation of line is y=mx+c i.e., y=1.x+5 or x-y+5=0 **(OR)** Parallel condition is $m_1=m_2$ Slope of 2x+y-4=0 is $m_1=\frac{-2}{1}=-2$ Slope of 6x+3y+10=0 is $m_2=\frac{-6}{3}=-2$, $There\ fore\ m_1=m_2$
2(b)	2x-3y+1=0, Slope $m_1=\frac{-a}{b}=\frac{-2}{-3}=\frac{2}{3}$, $m_2=\frac{2}{3}$(II) One-point form is $(y-y_1)=m(x-x_1)$ $(y-2)=\frac{2}{3}(x-1)\ \&\ \ 2x-3y+4=0$	3(a)	40^0=40X1^0 =40X$\frac{\pi^c}{180}$=$\frac{2\pi^c}{9}=0.6981^c$ and $\frac{8\pi^c}{7}$=$\frac{8\pi}{7}$X$\frac{180^0}{\pi}$ $=(205.42)^0$ $=205^0 42^I 51^{II}$

3(a)	OR $$\tan(45^0 - A) = \frac{\tan 45^0 - \tan A}{1 + \tan 45^0 . \tan A}$$ $= \frac{1-\tan A}{1+\tan A}$	3(d)	Given $\frac{\sin 6\theta+\sin 2\theta}{\cos 6\theta+\cos 2\theta}=\frac{2\sin\left(\frac{6\theta+2\theta}{2}\right)\cos\left(\frac{6\theta-2\theta}{2}\right)}{2\cos\left(\frac{6\theta+2\theta}{2}\right)\cos\left(\frac{6\theta-2\theta}{2}\right)}$ $=\frac{\sin 4\theta}{\cos 4\theta} = \tan 4\theta$ OR $\frac{1-\cos 2\theta+\sin 2\theta}{1+\cos 2\theta+\sin 2\theta}$ $=\frac{1-(1-2sin^2\theta)+2\sin\theta\cos\theta}{1+2cos^2\theta-1+2\sin\theta\cos\theta}=\frac{2sin^2\theta+2\sin\theta\cos\theta}{2cos^2\theta+2\sin\theta\cos\theta}$ $= \frac{2\sin\theta(\sin\theta+\cos\theta)}{2cos\theta(\cos\theta+\sin\theta)}$ =tanΘ
3(b)	Simplify $\frac{\sin(360^0+A)\tan(180^0+A)}{\cos(90^0-A)\cot((270^0-A))}=\frac{\sin A.\tan A}{\sin A.\tan A}$=1 OR Given $\tan\theta = \frac{3}{4}$, $Then\ hypotenuse = 5$ Therefore $\sin\theta = \frac{3}{5}$, $\cos\frac{4}{5}$ $5\sin\theta + 5\cos\theta = 5\left(\frac{3}{5}\right) + 5\left(\frac{4}{5}\right)$=7	4(a)	Given $y = \tan x + 4e^x - 6 + \sqrt{x}$ $\frac{dy}{dx} = sec^2x + 4e^x - 0 + \frac{1}{2\sqrt{x}}$ OR $$\frac{d(x^2.e^x)}{dx} = x^2e^x + e^x.2x$$
3(c)	$\cos(A+B) = \cos A\cos B - \sin A\sin B$ $\cos(75^0) = \cos(45^0 + 30^0)$ $= \cos 45^0\cos 30^0 - \sin 45^0\sin 30^0$ $= \frac{1}{\sqrt{2}}\frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}}\frac{1}{2} = \frac{\sqrt{3}}{2\sqrt{2}} - \frac{1}{2\sqrt{2}} = \frac{\sqrt{3}-1}{2\sqrt{2}}$ OR Let$\frac{sin2A}{sinA} - \frac{\cos 2A}{\cos A}$ $= \frac{\sin 2A\cos A - \cos 2A\sin A}{\sin A\cos A}$ $= \frac{\sin(2A-A)}{\sin A\cos A} = \frac{\sin A}{\sin A\cos A} = \frac{1}{\cos A} = \sec A$	4(b)	$y = \frac{(1+\tan x)}{(1-\tan x)}$ $\frac{dy}{dx} = \frac{(1-\tan x)sec^2x - (1+\tan x)(-sec^2x)}{(1-\tan x)^2}$ $=\frac{sec^2x-\tan x sec^2x+sec^2x+\tan x sec^2x}{(1-\tan x)^2}=\frac{2sec^2x}{(1-\tan x)^2}$ OR $y = 2x^4 - 3x^2 - 2x^2 + x - 1$ $\frac{dy}{dx} = 8x^3 - 9x^2 - 4x + 1$ $\frac{d^2y}{dx^2} = 24x^2 - 18x - 4 , at\ x = 0 ,\frac{d^2y}{dx^2} = -4$

4(c)	S=$2t^3 - t^2 + 5t - 6$ V=$\frac{ds}{dt} = 6t^2 - 2t + 5$ a=$\frac{dv}{dt} = 12t - 2$ At t=2 , V=25 At t=2 , a=22 OR $Y = 2x^3 - 3x^2 - 36x + 10$, $\frac{dy}{dx} = 6x^2 - 6x - 36$, $\frac{d^2y}{dx^2} = 12x - 6$ Let $x^2 - x - 6 = 0$, $x^2 - 3x + 2x - 6 = 0$, $(x-3)(x+2) = 0$, x=3 or x= -2 Put x=3 in $\frac{d^2y}{dx^2}$ and its value is 30(+ve) Function has minimum at x=3 Put x=-2 in $\frac{d^2y}{dx^2}$ and its value is -30(-ve) Function has maximum at x=-2 Maximum value is (x=-2 in given eqn.) 54 Minimum value is (x=3 in given eqn.) -71	5(a)	$\int e^x + \frac{1}{1+x^2} - \sin x + x^3$.dx $= e^x + \tan^{-1} x + \cos x + \frac{x^4}{4}$+C OR $\int x^2\,(1+x).dx$ $= \int x^2 + x^3.dx$ $= \frac{x^3}{3} + \frac{x^4}{4} + c$
4(d)	If $y = x^2$, $\frac{dy}{dx} = 2x$, $\frac{d^2y}{dx^2} = 2$ Let $x\ \frac{d^2y}{dx^2} - \frac{dy}{dx}$ $x(2) - 2x$ =0 OR $y = x^2 + x - 1$, One-point form is $\frac{dy}{dx} = 2x + 1$, $(y - y_1) = m(x - x_1)$ Slope m(at x=1)=3 $(y - y_1) = m(x - x_1)$ $(y-1) = 3(x-1)$ i.e. 3x-y-2=0	5(b)	$\int cos^2x.dx = \int \frac{1+\cos 2x}{2}.dx$ = $\frac{1}{2}\left(x + \frac{\sin 2x}{2}\right) + c$ OR $\int_0^{\frac{\pi}{4}} tan^2x sec^2x.dx$ Put tanx = t $\int_0^{\frac{\pi}{4}} t^2.dt = \left[\frac{t^3}{3}\right]$ = $\frac{tan^3x}{3}$ sec^2x .dx=dt where limits are 0 to $\frac{\pi}{4}$ then answer is $\frac{1}{3}$

5(c)	Area=$\int_a^b y.dx = \int_0^1 x^3 - 2.dx = \left[\frac{x^4}{4} - 2x\right]$ *with limits* 0 *to* 1 $= \left(\left(\frac{1^4}{4} - 2(1)\right)\right) - 0$ Answer is $\frac{-7}{4}$ OR Volume=$\pi \int_a^b y^2 . dx = \pi \int_2^5 x + 2.dx$ $= \pi \left[\frac{x^2}{2} + 2x\right]$with limits 2 to 5 Answer is $\frac{33\pi}{2}$		
5(d)	$\int x.e^x.dx = x \int e^x.dx - \int \frac{d}{dx}x. \int e^x.dx.dx$ $= x \int e^x.dx - \int 1.e^x.dx$ $= xe^x - e^x + c$ OR $\int_0^1 \frac{e^x}{1+e^x}.dx = \int_0^1 \frac{dt}{t}$=$[logt] = [\log(1 + e^x)]$ With limits 0 to 1 Put 1+$e^x = t$ $log(1 + e) - \log(1 + 1)$ $e^x.dx = dt$ $= log\frac{(1+e)}{2}$		
Note: - Give equal weightage for alternate answers			

Certified that the model answers prepared by me for code 20SC01T are from prescribed textbook and model answers and scheme of valuation prepared by me are correct.