Code: 20BS1101

I B.Tech - I Semester – Regular / Supplementary Examinations
FEBRUARY - 2023

CALCULUS AND LINEAR ALGEBRA
(Common for ALL BRANCHES)

Duration: 3 hours   Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level   CO – Course Outcome

			BL	CO	Max. Marks
		UNIT-I			
1	a)	By reducing it to Normal form find the rank of the following matrix. $$\begin{bmatrix} 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 6 \\ 4 & 5 & 6 & 7 \\ 9 & 10 & 11 & 12 \end{bmatrix}$$	L3	CO2	7 M
	b)	Investigate for what values of a, b the equations $x+y+z=6, x+2y+3z=10,$ $x+2y+az=b$ have (i) no solution (ii) a unique solution (iii) many solutions.	L4	CO4	7 M
		OR			

2	a)	By reducing it to Echelon form find the rank of the following matrix. $$\begin{bmatrix} 5 & 6 & 7 & 8 \\ 6 & 7 & 8 & 9 \\ 11 & 12 & 13 & 14 \\ 16 & 17 & 18 & 19 \end{bmatrix}$$	L3	CO2	7 M
	b)	Solve the system of equations $x + y + 2z = 4,\ 2x - y + 3z = 9,$ $3x - y - z = 2$	L3	CO4	7 M
UNIT-II					
3	Verify Cayley –Hamilton theorem for the matrix A = $\begin{bmatrix} 1 & 2 & -1 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$. Calculate A^4 and A^{-1} using Cayley-Hamilton theorem.		L3	CO2	14 M
OR					
4	a)	How would you find eigen values and eigen vectors of the matrix $\begin{bmatrix} 3 & 2 & 2 \\ 1 & 2 & 2 \\ -1 & -1 & 0 \end{bmatrix}$	L4	CO4	7 M
	b)	Calculate $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ where $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$	L3	CO2	7 M
UNIT-III					
5	a)	How would you confirm Rolle's theorem for $f(x) = e^x(sinx - cosx)\ in\ \left[\frac{\pi}{4}, \frac{5\pi}{4}\right]$	L3	CO5	7 M

	b)	Discover 'c' of Cauchy's mean value theorem for $f(x) = e^{x}, \quad g(x) = e^{-x}$ $in\ [a, b], \quad 0 < a < b$	L3	CO5	7 M
OR					
6	a)	Prove that $\frac{\pi}{6} + \frac{1}{5\sqrt{3}} < \sin^{-1}\left({}^{3}/_{5}\right) < \frac{\pi}{6} + \frac{1}{8}$	L3	CO6	10 M
	b)	Obtain the Maclaurin's series expansion of $sinx$.	L3	CO6	4 M
UNIT-IV					
7	a)	If $u=\frac{yz}{x}$, $v=\frac{zx}{y}$, $w=\frac{xy}{z}$ then calculate $\frac{\partial(u,v,w)}{\partial(x,y,z)}$	L3	CO3	7 M
	b)	Discover the extreme values of the function $x^4+ y^4-2x^2+4xy-2y^2$	L3	CO5	7 M
OR					
8	Calculate the volume of the greatest rectangular parallelepiped that can be inscribed in the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$		L3	CO3	14 M
UNIT-V					
9	a)	Appraise $\int_0^{\frac{\pi}{4}} \int_0^{asin\theta} \frac{r\,drd\theta}{\sqrt{a^2-r^2}}$	L4	CO5	7 M
	b)	Change the order of integration and evaluate $\int_0^{4a} \int_{\frac{x^2}{4a}}^{2\sqrt{ax}} dydx$	L4	CO3	7 M
OR					

10	a)	Solve $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)$dydxdz.	L3	CO5	7 M
	b)	By concluding the limits of integration find the area bounded by the parabolas $y^2 = 4ax$ and $x^2 = 4ay$	L4	CO3	7 M