PVP 23

Code: 23BS1101

I B.Tech - I Semester – Regular / Supplementary Examinations
DECEMBER 2024

LINEAR ALGEBRA & CALCULUS
(Common for ALL BRANCHES)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	Define Rank of a matrix.	L1	CO1
1.b)	Describe consistency conditions for Non - Homogeneous Linear system of equations.	L1	CO1
1.c)	If $A=\begin{bmatrix}-1 & 2 & 3\\ 0 & 3 & 5\\ 0 & 0 & -2\end{bmatrix}$, then find the eigen values of A^3.	L3	CO2
1.d)	Calculate the sum and product of the eigen values of $\begin{bmatrix}1 & 0 & 0\\ 0 & 3 & -1\\ 0 & -1 & 3\end{bmatrix}$.	L3	CO2
1.e)	State Lagrange's mean value theorem.	L1	CO5
1.f)	Write the Maclaurin's series of $f(x) = e^x$	L3	CO3
1.g)	If $u = e^{xyz}$, find the value of $\frac{\partial^3 u}{\partial x \partial y \partial z}$	L3	CO3

1.h)	Find the stationary points of $f(x,y)=x^3+y^3-3axy$.	L2	CO5
1.i)	Compute $\int_0^a\int_0^b\int_0^c x^2y^2z^2\,dxdydz$.	L3	CO3
1.j)	State the formula for area in polar coordinates.	L2	CO3

PART – B

			BL	CO	Max. Marks
		UNIT-I			
2	a)	By reducing into Normal form find the rank of the matrix $\begin{bmatrix}1&2&3&0\\2&4&3&2\\3&2&1&3\\6&8&7&5\end{bmatrix}$	L3	CO2	5 M
	b)	Solve $3x+2y+z=0,\ x+4y+z=0,\ 2x+y+4z=0$	L3	CO4	5 M
		OR			
3	a)	Find rank of A= $\begin{bmatrix}2&-1&3&1\\1&4&-2&1\\5&2&4&3\end{bmatrix}$ by reducing into Echelon form.	L3	CO2	5 M
	b)	Solve x+y+z = 8 2x+3y+2z = 19 4x+2y+3z = 23 by Gauss elimination method.	L3	CO4	5 M
		UNIT-II			
4	a)	Calculate Eigen values and Eigen vectors of A= $\begin{bmatrix}3&-1&1\\-1&5&-1\\1&-1&3\end{bmatrix}$	L3	CO2	5 M

	b)	Verify Cayley-Hamilton theorem for A= $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and hence find A^{-1} and A^4.	L3	CO2	5 M
OR					
5	Reduce the quadratic form $3x^2+3y^2+3z^2+2xy+2xz-2yz$ in to canonical form by orthogonal transformation method and find its rank, index, signature and nature.		L3	CO4	10 M
UNIT-III					
6	a)	Verify Rolle's theorem for the function $f(x)=x^2-6x+8$ in the interval $[2,4]$.	L3	CO5	5 M
	b)	Expand $\sin x$ by Maclaurin's series up to the term containing x^5	L3	CO3	5 M
OR					
7	a)	Verify Lagrange's mean value theorem for the function $f(x)=x^3-x^2-5x+3$ in $[0,4]$.	L3	CO5	5 M
	b)	Verify Cauchy's mean value theorem for the function $f(x)=\sin x, g(x)=\cos x$ in the interval $\left[0,\frac{\pi}{2}\right]$.	L3	CO5	5 M
UNIT-IV					
8	a)	If $z=\log(e^x+e^y)$ then show that $\left(\frac{\partial^2 z}{\partial x^2}\right)\left(\frac{\partial^2 z}{\partial y^2}\right)=\left(\frac{\partial^2 z}{\partial x\partial y}\right)^2$	L2	CO3	5 M
	b)	A rectangular box open at the top is to have volume of 32 cubic feet. Find the dimensions of the box required in least material for its construction.	L4	CO5	5 M

OR					
9	a)	If $z = f(x+ay)+g(x-ay)$ then show that $\frac{\partial^2 z}{\partial y^2} = a^2 \frac{\partial^2 z}{\partial x^2}$	L3	CO3	5 M
	b)	Show that the functions $u = xy + yz + zx$, $v=x^2 + y^2 + z^2, w=x+y+z$ are functionally dependent. Find the relation between them.	L3	CO3	5 M
UNIT-V					
10	a)	Evaluate $\iint_R r\sin\theta\, dr\, d\theta$ where R is the cardiod $r = a(1-\cos\theta)$ above the initial line.	L3	CO5	5 M
	b)	*Evaluate* $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}\, dz\, dy\, dx$	L3	CO5	5 M
OR					
11	a)	Evaluate $\iint_A xy\, dx\, dy$, where A is the domain bounded by x-axis, ordinate $x=2a$ and the curve $x^2 = 4ay$.	L4	CO5	5 M
	b)	Calculate the area common to the circles $r = a\sin\theta$ *and* $r = a\cos\theta$ by double integration.	L3	CO5	5 M