

RV College of Engineering[®] Mydete Roled RV Vidyaniki ton Post, Bengaluro - 000039, Kamataka India

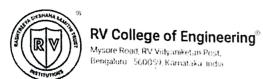
DEPARTMENT OF MATHEMATICS

Course: Fundamentals of Linear Algebra, Calculus	CIE-2	Maximum marks: 10+50
and Statistics	First semester 2024-2025	2 00 PM 4 00 PM
Course code: MA211TC	Chemistry Cycle Branch: CI, BT, CD, CS, CY, IS	Time: 2.00 PM - 4.00 PM Date: 11/12/2024

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	Answer all questions	М	вт	СО	-
,	PART A				
.1	The Cartesian form of the polar curve $r = 2(\sin \theta - \cos \theta)$ is	2	1	1	Ĺ
.2	The radius of curvature at (x, y) of the curve $y = \frac{c}{2} \left(e^{x/c} + e^{-x/c} \right)$ is	2	2	2	
.3	The coefficient of $\left(x - \frac{\pi}{2}\right)^2$ in the Taylor's series expansion of $\cos x$ about the point $x = \frac{\pi}{2}$ is	2	1	2	2
.4	If $z = x^2y$ where $x = at$, $y = 2at$ then $\frac{dz}{dt} =$	2	1		1
1.5	Given that $\cos^y x = \sin^x y$, then $\frac{dy}{dx} = $	2	1		1
	PART B				
1	Determine the angle of intersection of the pair of curves $r = \frac{a\theta}{1+\theta}$ and $r = \frac{a}{1+\theta^2}$.	10) 2	2	2
2	Show that the circle of curvature at the origin of the curve $x + y = ax^2 + by^2 + cx^3$ is	10) 3	3	3
	$(a+b)(x^2+y^2) = 2(x+y).$				_
3a	Obtain the angle between the radius vector and tangent for the curve $r \cos^2\left(\frac{\theta}{2}\right) = a^2$ at $\theta = \frac{2\pi}{3}$.	4		2	1
3b		6		2	-
4	Use Maclaurin series up to fourth degree term to evaluate the approximate value of the integral	1	0	3	
	$\int_0^1 e^{x \sin x} dx.$				_
5	ia If $f(x, y) = x e^{xy}$, then verify that $f_{xy} = f_{yx}$.		5	2	
4	The temperature function for a bird in flight is given by		5	4	
	$T(x,y,z) = 0.09x^2 + 1.4xy + 95z^2.$				
	Use differential dT to approximate change in temperature when head wind x increases from	1			
	meter per second to 2 meters per second, bird heart rate y increases from 50 beats per minute t	0			
	55 beats per minute and flapping rate z increases from 3 flaps per second to 4 flaps per second.				

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Partic	ulars	CO1	CO2	CO3	CO4	LI	1.2	L3	L4	L5	L6
	Test	Max Marks	4	21	20	5	0	25	20	5	-	-
	Quiz	Max Marks	6	4			8	2				



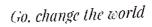
DEPARTMENT OF MATHEMATICS

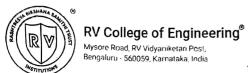
Course: Fundamentals of Linear Algebra, Calculus		
and Statistics Course code: MA211TC	CIE-1 First semester 2024-2025	Maximum marks: 50+10
Course code, MAZITIC	Chemistry Cycle Branch: CI, BT, CD, CS, CY, IS	Time: 2.00PM - 4.00PM Date: 04/11/2024

	Dianen. Ci, B1, CD, CS, CY, IS Date: 04/1	1/202	4	
Q.No	Answer all questions	М	ВТ	СО
	PART A	141	ы	CO
1.1	If the matrix $B = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 6 & 9 \\ 0 & 2 & 4 \end{bmatrix}$, then the rank of its transpose is	2	1	1
1.2	Rank of a matrix of order 6 × 7 whose all minors of order 6 are zero is	_		
1.3		1 2	1	1
1.4	By Gauss Jordan method the augmented matrix $\begin{bmatrix} 1 & 1 : & 3 \\ 2 & 3 : & 2 \end{bmatrix}$ reduces to	2	1	2
1.5	If A is an invertible matrix of order 5×5 and X is matrix of unknowns of order 5×1 , then the system $AX = 0$ has solution.	1	1	1
1.5	The solution of the given system of equations $x + y + z = 0$, $y - z = 0$, $x + 2y = 0$ is	2	2	2
1.6	If $\begin{bmatrix} \frac{4}{3} \\ 1 \end{bmatrix}$ is the eigenvector of $\begin{bmatrix} 2 & 4 \\ 3 & 1 \end{bmatrix}$. The associated eigenvalue is	2	2	2
	PART B			
1a)	Find the values of b such that the rank of the matrix $A = \begin{bmatrix} 1 & 5 & 4 \\ 0 & 3 & 2 \\ b & 13 & 10 \end{bmatrix}$ is 2.	4	2	1
1b)	Investigate for what values of λ and μ the system of simultaneous equations $x + y + z = 6$, $2x + 4y + 6z = 20$, $3x + 6y + \lambda z = \mu$ has (i) no solution (ii) unique solution (iii) infinite number of solutions,	6	3	3
2	Solve the following system of linear equations by Gauss-Elimination method	10		
	$4x_1 - x_2 + 2x_3 - x_4 = 2$, $x_1 - 2x_2 - 3x_3 + x_4 = 4$, $x_4 + 4x_5 - x_5 + x_4 = 2$, $x_4 - 4x_5 - x_5 + x_4 = 2$	10	2	2
3	$4x_1 - x_2 + 2x_3 - x_4 = 2, x_1 - 2x_2 - 3x_3 + x_4 = 4, x_1 + 4x_2 - x_3 + x_4 = 2, x_2 - 4x_4 = 0.$ Apply Gauss Jordan method to find the inverse of the matrix $=\begin{bmatrix} 3 & 0 & 1 \\ -2 & 1 & 0 \\ -1 & 2 & 4 \end{bmatrix}$. Hence solve the system of equation AX $=$ B where B $=\begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$.	10	3	3
4(a)	The current in the branches of an electrical network follows the system of linear equations of the form $5i_1 + 2i_2 + 12i_3 = 36$, $10i_1 - 3i_2 + 2i_3 = 10$, $3i_1 + 11i_2 - i_3 = 23$. Find an approximate solution for the above system of equations using Gauss-Seidel method. Perform 3 iterations (consider four decimal places).	5	3	4
4(b)	Find the eigenvalues and the corresponding eigenvectors of the Matrix $B = \begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$.	5	1	2
5	In analysing connectivity between pages, Google's PageRank algorithm uses eigenvalues and eigenvectors to determine the importance of pages. For a simplified network analysis, identify the dominant eigenvalue and corresponding eigenvector of the matrix $A = \begin{bmatrix} 3 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 3 \end{bmatrix} \text{ by Rayleigh's power method with the initial approximation } \begin{bmatrix} 1 & 0 & 0 \end{bmatrix}^T. \text{ Perform } 5 \text{ iterations.}$	10	2	4

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		C01	CO2	СОЗ	CO4	Li	1.2	1.3	L4	L5	L6
	Test	Max Marks	4	15	16	15	6	23	21	-		-
	Quiz	Max Marks	4	6			6	4				





Department of Mathematics Academic Year 2024-2025 (Odd Semester 2024)

Date	02/01/2025	Time	2:00 PM to	4 PM
Test	Improvement CIE (Quiz & Test)	Maximum Marks	10+50=	
Course Title	Fundamentals of linear Algebra, Calculu	is and Statistics	Course Code	MA211TC
Semester	I	Programs	B.E. (AIML, BT, CD,	CS, CY, IS)

PART - A

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S.No.	Questions	M	BT	CO
1	Let $x = r \cos \theta$ and $y = r \sin \theta$. Then Jacobian of x, y with respect to r, θ is	2	1	1
2	Given the data points $(1, 2)$, $(3, 5)$ and $(7, 11)$. The slope of the line $y = mx$ that fits the data is	2	1	1
3	The following data regarding the heights (y) and the weights (x) of twelve college students are given $\sigma_x = 16.8$, $\sigma_y = 10.8$, $\sum (x - \bar{x})(y - \bar{y}) = 2020$. For the given data the regression coefficient of x on y is	2	2	2
4	Given $f(x,y) = x^3 + y^3 - 63(x+y) + 12xy$, $f_{xx} = 6x$, $f_{yy} = 6y$ and $f_{xy} = 12$. Which of the critical points $(-7, -7)$ and $(-1, 5)$ are saddle points?	2	1	1
5	In a partially destroyed laboratory record of an analysis of a correlation data, the following results were noted: variance of $x = 9$, equations of lines of regression of y on x is $4x - 5y + 33 = 0$ and x on y is $20x - 9y = 107$. For the given data the value of correlation coefficient is and the standard deviation of y is	2	2	2

PART - B

SI.No.	Questions	М	BT	СО			
la	Calculate $\frac{\partial(x,y,z)}{\partial(u,v,w)}$ if $u=\frac{2yz}{x}$, $v=\frac{3zx}{y}$ and $w=\frac{4xy}{z}$.	5	2	2			
16	Using the concept of Jacobians, determine whether the following functions are functionally dependent or not. If functionally dependent, find the functional relation between them. $u = x_1 + x_2 - x_3, v = x_1 - x_2 + x_3, w = x_1^2 + x_2^2 + x_3^2 - 2x_2x_3.$						
2	 For the given function, f(x,y) = x² + y² - 4x - 4y. Determine the following: i) The extreme values of f(x, y). ii) The extreme values of f(x, y) on the circle x² + y² = 9. iii) The extreme values of f(x, y) on the open disk x² + y² < 9. 	10	2	3			
3a	A rectangular box without a lid is to be made from $12m^2$ of cardboard. Find the maximum volume of such a box using Lagrange's multiplier method.	6	3	4			
3b	Use the method of least squares to fit the data points, $(1, 1.8)$, $(2, 5.1)$, $(3, 8.9)$ and $(4, 14.1)$ to a straight line of the form $y = mx + c$.						
5	The following pair of observations was noted in an experimental work on cosmic rays. Find by the method of least squares the best values of a and b for the equation $y = ax^b$ which fits the following data. Also extrapolate the value of y when $x = 7$. x <	10	3	3			
3	Marks obtained by 6 students in mathematics papers are given below: Paper I 60 65 68 70 75 85 Paper II 62 64 65 70 74 88 i) Determine the equations of lines of regressions and hence the coefficient of correlation for the given data. ii) Obtain the angle between the lines of regression.	10	2	2			

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

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Marks Distribution	Partie	culars	COI	CO2	CO3	CO4	Ll	L2	L3	L4	L5	L6
	Test	Max Marks	4	20	20	6	4	30	16	-	-	-
	Quiz	Max Marks	6	4	F.,	<u>-</u>	6	4		-	-	- ·