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RV Educational Institutions ®
RV College of Engineering ®

Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi | Approved by AICTE, New Delhi

Academic year 2021-2022 (Odd semester 2021)

DEPARTMENT OF MATHEMATICS				
Date	15 November 2021	Time	10 : 00 AM to 11: 30 AM	
Test	I	Maximum Marks	50	
Course Title	LINEAR ALGEBRA, LAPLACE TRANSFORM AND COMBINATORICS		Course Code	18MA31A
Semester	III	Programs	CSE & ISE	

Sl. No.	Questions	M	BT	CO
1.	a) Obtain the frequency domain function for the signal described by the function $f(t) = \begin{cases} 1 & ; 0 < t < \pi \\ e^t & ; \quad t \geq \pi \end{cases}$	4	1	1
	b) Evaluate $\int_0^\infty e^{-2t} \frac{\sin^2(t)}{t} dt$ using Laplace transform technique.	6	2	2
2.	a) Convert the time domain function of the signal h (t) = $\left(\sqrt{t} - \frac{1}{\sqrt{t}}\right)^3 + t\sinh(kt)$ into the frequency domain function using Laplace transform technique.	4	1	1
	b) Determine the inverse Laplace transform of the function $\frac{1}{(s^2+4)(s+1)^2}$ using convolution theorem.	6	2	2
3.	Evaluate the time response of a system for the following transfer functions: (i) $\frac{s+3}{(s+2)(s^2+3s+5)}$ (ii) $\ln\left[\left(\frac{s^2-1}{s(s-3)}\right)\right]$.	10	2	3
4.	Obtain the Laplace transform of a saw tooth wave function of period T given by $f(t) = -a + 2a\frac{t}{T}$; $0 \leq t < T$. Also sketch the waveform of f (t).	10	3	2
5.	Apply the Laplace transform technique to compute the solution y (t) of the second order differential equation $ty'' + 2y' + ty = 4$ with initial conditions $y(0) = 0, y'(0) = 1$.	10	3	4

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

Marks Distribution	COS / BT	CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Max Marks	08	22	10	10	8	22	20	-	-	-

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Academic year 2021-2022 (Odd semester 2021)

DEPARTMENT OF MATHEMATICS				
Date	03 January 2021	**Time**	10 : 00 AM to 11: 30 AM	
Test	II	**Maximum Marks**	50	
Course Title	**LINEAR ALGEBRA, LAPLACE TRANSFORM AND COMBINATORICS**	**Course Code**	18MA31A	
Semester	III	**Programs**	CSE & ISE	

Sl. No.	Questions	M	BT	CO
1.	Verify whether the following sets forms a subspace or not. Justify your answer. a) $P = \{ a_0 + a_1x + a_2x^2 + a_3x^3$, set of polynomials of degree 3 for which $a_0 = 0\}$. b) $M = \{M_{2\times 2}$, the set of all 2 x 2 matrices such that $\|A\| = 0\}$. c) $S = \{(x, y)$ such that either $x = 0$ or $y = 0\}$ in R^2. d) $F = \{$The set of all polynomials f's such that $f(0) = 1\}$. e) $S = \{(x, y, z): x^2 + y^2 + z^2 \leq 1\}$ in R^3.	10	1	1
2.	a) Determine a value for q such that the following vectors are linearly independent $\{(1, 1, 2, 1), (2, 1, 2, 3), (1, 4, 2, 1), (-1, 3, 5, q)\}$.	4	1	1
	b) Is there a linear transformation $T: R^2 \to R^3$ such that $T(1, 1) = (1, 0, 2)$ and $T(2, 3) = (1, -1, 4)$? If so compute $T(0, 0)$ and $T(8, 11)$.	6	2	2
3.	Let $\Phi: R^4 \to R^3$ be a linear mapping such that $\Phi(x, y, z, w) = (x + y + 2z + 3w, x + z - w, x + 2y)$. Compute the kernel and image of Φ. What are dim (ker (Φ)) and dim (image (Φ)) relative to the bases $B_1 = \{(1, 1, 1, 2)\ (1, -1, 0, 0)\ (0, 0, 1, 1)\ (0, 1, 0, 0)\}$, $B_2 = \{(1, 2, 3)\ (1, -1, 1)\ (2, 1, 1)\}$.	10	3	3
4.	Let $A = \begin{bmatrix} 1 & 2 & 3 & -1 \\ 2 & -1 & -4 & 8 \\ -1 & 1 & 3 & -5 \\ -1 & 2 & 5 & -6 \\ -1 & -2 & -3 & 1 \end{bmatrix}$ (a) Determine the basis and dimension for row space and column space of A. (b) Determine the basis and the dimension for the set of solutions of $Ax = 0$. (c) Verify rank – nullity theorem.	10	2	2
5.	Apply the Gram-Schmidt process to construct an orthonormal basis for the subspace $W = \text{span}(x_1, x_2, x_3)$ of R^4, where $x_1 = \begin{bmatrix} 1 \\ -1 \\ 1 \\ -1 \end{bmatrix}, x_2 = \begin{bmatrix} 5 \\ 1 \\ 1 \\ 1 \end{bmatrix}, x_3 = \begin{bmatrix} 2 \\ 3 \\ 4 \\ -1 \end{bmatrix}$.	10	3	4

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

Marks Distribution	COS / BT	CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Max Marks	14	16	10	10	14	16	20	-	-	-

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Academic year 2021-2022 (Odd semester 2021)

DEPARTMENT OF MATHEMATICS				
Date	14 March 2022	Time	10:30 AM to 12:00 PM	
Test	III	Maximum Marks	50	
Course Title	LINEAR ALGEBRA, LAPLACE TRANSFORM AND COMBINATORICS		Course Code	18MA31A
Semester	III	Programs	CSE & ISE	

Sl. No.	Questions	M	BT	CO
1	Three measurements are made on each of two individuals in a random sample from a population. The matrix of the observation vectors is $M = \begin{bmatrix} 3 & 2 \\ 2 & 3 \\ 2 & -2 \end{bmatrix}$. Obtain a singular value decomposition of M.	10	3	4
2	Use the inclusion-exclusion principle to count the number of integers in S = {1, 2, 3,..., 2000} in the following cases: a) Divisible by 9 or 11 or 13. b) Divisible by at least two of 9, 11, 13. c) Divisible by exactly two of 9, 11, 13.	10	2	2
3	Given the public key $(e, n) = (7, 55)$, encrypt plain text **M I T**, where the alphabets $\{A, B, C, \ldots X, Y, Z\}$ are assigned the numbers $\{5, 6, \cdots, 29, 30\}$. Give the cipher text. Obtain the private key d.	10	3	4
4a	By using the Euclidean algorithm, find the greatest common divisor d of 1819 and 3587 and then find the integers x and y to satisfy $1819\,x + 3587\,y = d$.	6	2	2
4b	Compute all the solutions of the linear congruence $6x \equiv 15 \ (mod\ 21)$.	4	1	1
5a	Four fruits $\{F_1, F_2, F_3, F_4\}$ are to be distributed to four people $\{P_1, P_2, P_3, P_4\}$. P_1 and P_2 do not wish to have fruit F_1, P_3 does not want F_2 or F_3 and P_4 refuses F_4. Using rook polynomial determine the number of ways the distribution can be made so that none of them displeased.	6	3	3
5b	Obtain the number of positive divisors and sum of all positive divisors of 810 and also determine the Euler's Phi function $\phi(810)$.	4	1	1

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

Marks Distribution	COS / BT	CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Max Marks	08	16	06	20	08	16	26	-	-	-

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