DEPARTMENT OF MATHEMATICS

Course: DIFFERENTIAL EQUATIONS & NUMERICAL METHODS	CIE-I (QUIZ & TEST)	Maximum marks: 10+50=60
Course code:21MA21	Second semester 2021-2022	Time: 120 Minutes Date: 26-09-2022

Instructions to candidates:

i. *Part A must be answered within the first two pages of the Booklet.*
ii. *Answer all questions.*

Q.No	PART - A	M	BT	CO
1.1	If A is an invertible matrix, then rank of A is _____.	1	1	1
1.2	If 1, 2, -3 are the eigenvalues of a matrix A, then eigenvalues of the matrix $(A^{-1})^3$ are________________	1	2	3
1.3	In solving $n \times n$ nonhomogeneous system of equations $AX = B$, using Gauss elimination method, the coefficient matrix A is reduced to _________.	1	1	2
1.4	The rank of the matrix $A = \begin{bmatrix} 4 & 5 & 6 & 7 & 8 \\ 5 & 6 & 7 & 8 & 9 \\ 3 & 4 & 5 & 6 & 7 \\ 1 & 2 & 3 & 4 & 5 \end{bmatrix}$ is ____________	1	2	2
1.5	For the square matrix $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$ the eigenvalue corresponding to the eigenvector $\begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$ is ____________.	2	1	3
1.6	If $y_c = e^x(c_1 \cos 2x + c_2 \sin 2x)$ is complementary solution of a differential equation, then corresponding differential equation is ___________.	2	2	1
1.7	The particular integral of the differential equation $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 2x = e^{x/2}$ __________.	2	1	1

Q.No	PART- B	M	BT	CO
1(a)	The concept of rank of a matrix is used in the field of communication complexity. The rank of the communication matrix of a function gives bounds on the amount of communication needed for two parties to compute the function. Find the rank of one such matrix A using the elementary row transformations. $$A = \begin{bmatrix} 2 & 3 & -2 & 4 \\ -2 & -2 & 1 & 2 \\ -3 & --2 & -3 & -4 \\ -2 & 4 & 0 & 5 \end{bmatrix}$$	5	2	1
1(b)	Investigate the values of a and b for which the following system of equations $$x + 2y + 4z = 6, \quad x + 3y + 7z = 6, \quad 2x + 5y + az = b$$ have (i) No Solution (ii) Unique Solution (iii) Infinetly many Solution	5	2	2

2	System of linear equations can be found in the resistive circuit, x_1, x_2, x_3, x_4 represent node voltages as functions of input voltages and input current. Compute x_1, x_2, x_3, x_4, by using Gauss –Seidel method, with initial approximations (0,0,0,0) for the following equations. $$x_1 + x_2 + 6x_3 + 10x_4 = 30.9$$ $$10x_1 + 8x_2 + x_3 = 16.4$$ $$2x_1 + 10x_3 + 2x_4 = 36.9$$ $$x_1 + 10x_2 + 2x_3 + 4x_4 = -3.8$$ Carry out five iterations.	10	2	3
3(a)	The Eigenvalues give the displacement of an atom or a molecule from its equilibrium position and the direction of displacement is given by eigen vectors. Use the Rayleigh's power method to estimate the dominant eigen value and corresponding eigenvector of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ with initial vector $X^{(0)} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$. Carry out five iterations.	6	3	3
3(b)	For what values of k the following system of equations $x + y + 3z = 0,\ 4x + 3y + kz = 0,\ 2x + ky + 2z = 0$ has non-trivial solution.	4	3	2
4(a)	Solve the following system of equations by Gauss –Jordon method $$x + 2y + z = 3$$ $$2x + 3y + 3z = 10$$ $$3x - y + 2z = 13$$	6	3	2
4(b)	If $A = \begin{bmatrix} -1 & 2 \\ 2 & -1 \end{bmatrix}$, then compute the eigenvalues of and corresponding eigenvectors of the matrix A.	4	2	3
5(a)	Find the particular solution of the initial value problem $y'' + 4y' + 13y = 18e^{-2x}$ given $y(0) = 0$ and $y'(0) = 4$.	6	2	4
5(b)	If $F(D) = (D^4 - 1)$, where D is the linear differential operator, with $D = \frac{d}{dx}$, obtain the general solution of $F(D)y = 0$.	4	3	2

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

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Test	Max Marks	11	17	23	6	6	34	20	--	-	-

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R V COLLEGE OF ENGINEERING

(An autonomous institution affiliated to VTU, Belagavi)

DEPARTMENT OF MATHEMATICS

EVEN SEMESTER 2018-19
SECOND SEMESTER, TEST- I
CHEMISTRY CYCLE SECTIONS (A-I)

COURSE : ENGINEERING MATHEMATICS -II — **COURSE CODE : 18MA21**

DATE : 05-02-2019 — **TIME : 2:00-3.30pm**

MARKS : 50

Q.NO	*Answer all questions*	MARKS	CO	BTL
1.a	Find the value of 'k' such that the rank of the matrix $A=\begin{bmatrix}1 & 2 & 1\\ 4 & 3 & k\\ 1 & 4 & k^2\end{bmatrix}$ is equal to two by reducing it to echelon form.	6	1	2
1.b	Check for consistency and obtain the solution, if consistent: $3x_1+2x_2+x_3=3,\ 2x_1+x_2+x_3=0,\ 6x_1+2x_2+4x_3=6,$	4	2	1
2	Solve the following system of equations by Gauss-Jordan elimination method: $x+2y+z-w=-2,\quad 2x+3y-z+2w=7,$ $x+y+3z-2w=-6,\quad x+y+z+w=2.$	10	2	3
3.a	Compute the largest eigenvalue and the corresponding eigenvector of the matrix $A=\begin{bmatrix}25 & 1 & 2\\ 1 & 3 & 0\\ 2 & 0 & -4\end{bmatrix}$ by Rayleigh's Power method using $\begin{bmatrix}1\\0\\0\end{bmatrix}$ as initial eigenvector, carry out five iterations.	5	3	4
3.b	Diagonalize the matrix $A=\begin{bmatrix}-5 & 9\\ -6 & 10\end{bmatrix}$, hence verify $P^{-1}AP=D$, where 'D' is the diagonal matrix.	5	4	4
4.	The temperatures u_1, u_2, u_3 and u_4 of a square metal plate, under some circumstances are given by: $13u_1+5u_2-3u_3+u_4=18,$ $2u_1+12u_2-u_3-u_4=13,$ $3u_1-4u_2+10u_3+u_4=29,$ $2u_1+u_2-3u_3+9u_4=31$ Solve for the temperatures, using Gauss-Seidel iterative method. Carry out seven iterations.	10	3	3
5. a	A state of linear dynamical system is given by $\frac{d^2y}{dt^2}-10\frac{dy}{dt}+25y=0$, determine the response $y=y(t)$ of the system under the conditions $y(0)=1,\ y(1)=0$.	5	4	3
5. b	Solve: $(D^3-D^2+100D-100)y=0$	5	2	3

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Course Outcomes:

1. Demonstrate the understanding of rank of a matrix, classification and types of solution of higher order linear ODE and PDE, necessity of numerical methods and few basic definitions.
2. Solve system of equations using Gauss elimination and Gauss Jordan methods, homogeneous linear differential equations & Lagrange linear PDE, interpolate data using finite differences and use intermediate value property.
3. Apply acquired knowledge to solution of equations using Gauss-Seidel method, derivatives and integrals of numerical data and solve differential equations numerically.
4. Estimate the solutions of problems involving applications of differential equations using both analytical and numerical methods.