CO3- Solve linear ordinary and partial differential equations of higher orders
CO4- Classify the linear partial differential equations as elliptic, parabolic, and hyperbolic
CO5- Apply Laplace transform to Engineering problems using properties
CO6- Apply Inverse Laplace transform to Engineering problems

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Mid Term Examination, Even Semester 2022-23
B.Tech. Year - I, Semester - II
BMAS 1105: Matrices, Differential Equations and Laplace transform

Time: 2 Hours **Maximum Marks: 30**

Section – A

Attempt All Questions. 3 X 5 = 15 Marks

No.	Detail of Question	Marks	CO	BL	KL
1	Obtain the complete solution of the following linear differential equation : $(D^2 - 2D + 1)^2 y = 0,$ where, $D \equiv \frac{d}{dx}$ OR, Explore the complete solution of the second order linear differential equation, $\frac{d^2y}{dx^2} - y = 1$ which vanishes when $x = 0$ and tends to a finite limit as $x \to -\infty$.	3	3	E	C
2	Reduce the following matrix A into either normal form or echelon form. $A = \begin{bmatrix} 1 & -2 & 3 & -1 \\ 2 & -1 & 2 & 2 \\ 3 & 1 & 2 & 3 \\ -2 & 4 & -6 & 2 \end{bmatrix}$ hence find the rank of matrix A. What will happen to the rank of matrix A if all the elements of matrix A are taken as 1?	3	1	An	P
3	Show that the following system of equations: $x + 2y = 2u,$ $2x - y - u = 0,$ $x + 2z - u = 0,$ $4x - y + 3z - u = 0$ do not have a non-trivial solution.	3	1	A	C
4	Solve the following differential equations of first order and first degree: (i) $\frac{dy}{dx} = \frac{x^2 - 4y}{4x - y^2}$ (ii) $(e^y + 1)\cos x\, dx + e^y \sin x\, dy = 0$	3	3	U	F

5	Define complex matrix and give an example of complex matrix of order 3 x 3. Show that the matrix A where, $$A = \begin{bmatrix} 2 & 3-4i \\ 3+4i & 2 \end{bmatrix}$$ is Hermitian. Also verify if iA is Skew-Hermitian matrix?	3	1	R	C

Section – B

Attempt All Questions. 5 x 3 = 15 Marks

No.	Detail of Question	Marks	CO	BL	KL
6	Find the eigen values and eigen vectors of the matrix $$A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$$ Also, without finding A^{-1}, find the eigen values of A^{-1}.	5	2	E	C
7	Solve the following differential equations: (i) $(y - xy^2)\,dx - (x + xy^2)\,dy = 0$ (ii) $\frac{d^4y}{dx^4} - y = e^x$ **OR,** Check the consistency of the following system of simultaneous linear equations and hence solve, if consistent. $$-x + y + 2z = 2,$$ $$3x - y + z = 6,$$ $$-x + 3y + 4z = 4$$ Also, if the constants of the right-hand side (R.H.S.) of each of the above equations are made zero, will the new system have a unique trivial solution or an infinite number of non-trivial solutions? Give reasons.	5	3	An	P
8	Obtain the complete solution of the following differential equations: (i) $(D^2 + 16 - 8D)\,y = e^{4x} - e^{-4x} + 3$ (ii) $y\,dx - x\,dy + \log x\,dx = 0$ **OR,** (i) Find the characteristic equation of the matrix $$A = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$$ Hence find the real latent roots of A. (ii) Show that $A = \frac{1}{\sqrt{3}}\begin{pmatrix} 1 & 1 & 1 \\ 1 & \omega & \omega^2 \\ 1 & \omega^2 & \omega \end{pmatrix}$ is a unitary matrix where ω is a complex cube root of unity. It is known that $\omega^3 = 1$ and $1 + \omega + \omega^2 = 0$.	5	3, 2	C	M

CO – Course Outcome, BL – Abbreviation for Bloom's Taxonomy Level (R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, C-Create), KL – Abbreviation for Knowledge Level (F-Factual, C-Conceptual, P-Procedural, M-Metacognitive).