CODE : 1192

APRIL- MAY 2025 EXAMINATION
I B.TECH. (4YDC) EXAM
MA 10511 : MATHEMATICS-II

Time : 3 Hrs.] [Max. Marks :70

TOTAL NO. OF QUESTIONS IN THIS PAPER : 5

Note : Attempt all questions. All questions carry equal marks. Each question carries five subparts(a),(b),(c),(d) and (e).Parts (a),(b),(c) are compulsory and attempt any one from part(d) and (e) in each question.

S.No	Questions	Marks	CO	BL	PI
Q.1(a)	Define symmetric and skew-symmetric matrix.	(2)	CO1	BL1	1.1.1
(b)	Show that the vectors $x_1 = (1,2,-2)$, $x_2 = (-1,3,0)$, $x_3 = (0,-2,1)$ are linearly independent.	(2)	CO1	BL2	1.1.1
(c)	Determine for what values of λ and μ the following equations have a unique solution: $x+y+z=6, x+2y+3z=10, x+2y+\lambda z=\mu$.	(3)	CO1	BL2	1.1.1
(d)	Reducing the matrix $A=\begin{bmatrix} 2 & -2 & 3 \\ 3 & -1 & 2 \\ 1 & 2 & -1 \end{bmatrix}$ to normal form and hence find its rank.	(7)	CO1	BL3	1.1.1
	OR				
(e)	Find eigen values and eigen vectors of matrix $A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.	(7)	CO1	BL3	1.1.1
Q.2(a)	Find index and signature of canonical form $y_1^2+y_2^2-y_3^2$.	(2)	CO2	BL1	1.1.1
(b)	Define orthogonal transformation with a suitable example.	(2)	CO2	BL2	1.1.1
(c)	Find value class(nature) of the following quadratic form using nature of eigen values concept: $Q = x_1^2 + 4x_2^2 + x_3^2 - 4x_1x_2 + 2x_3x_1 - 4x_2x_3$.	(3)	CO2	BL2	1.1.1
(d)	Using Cayley-Hamilton theorem, find the inverse of the following matrix $A=\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$.	(7)	CO2	BL2	1.1.1
	OR				
(e)	Find the modal matrix P of the matrix $A=\begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$ and also find diagonal matrix by calculating $P^{-1}AP$ of the matrix.	(7)	CO2	BL3	1.1.1
Q.3(a)	Form the differential equation associated with the primitive $y^2 = Ax^2 + Bx + C$ where A,B,C are constants.	(2)	CO3	BL2	2.1.3
(b)	Find complementary function(C.F.) of following differential equation $(D^4 - 3D^2 - 4)y = 0$.	(2)	CO3	BL2	2.1.3

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<tr><td>(c)</td><td>By exactness solve the following differential equation:
$(2xy\cos x^2 - 2xy + 1)dx + (\sin x^2 - x^2 + 3)dy = 0$</td><td>(3)</td><td>CO3</td><td>BL2</td><td>2.1.3</td></tr>
<tr><td>(d)</td><td>Solve the differential equation $(D^2 + 2)y = x^3 + x^2 + e^{-2x} + \cos 3x$.</td><td>(7)</td><td>CO3</td><td>BL2</td><td>2.1.3</td></tr>
<tr><td></td><td>OR</td><td></td><td></td><td></td><td>2.1.3</td></tr>
<tr><td>(e)</td><td>Solve the differential equation $\frac{dy}{dx} - \frac{\tan y}{1+x} = (1+x)e^x \sec y$.</td><td>(7)</td><td>CO3</td><td>BL2</td><td>2.1.3</td></tr>
<tr><td>Q.4(a)</td><td>Write the working rule to solve differential equation by Cauchy's homogeneous linear differential equations.</td><td>(2)</td><td>CO4</td><td>BL2</td><td>2.1.3</td></tr>
<tr><td>(b)</td><td>Solve simultaneous differential equations $\frac{dx}{dt} + wy = 0, \frac{dy}{dt} - wx = 0$.</td><td>(2)</td><td>CO4</td><td>BL2</td><td>2.1.3</td></tr>
<tr><td>(c)</td><td>An inductance of 2 henries and a resistance of 20 ohms are connected in series with an e.m.f. E volts. If the current is zero when $t = 0$, find the current at the end of 0.01 seconds if $E = 100$ volts.</td><td>(3)</td><td>CO4</td><td>BL3</td><td>2.1.3</td></tr>
<tr><td>(d)</td><td>Solve the following differential equation:
$(1+2x)^2 \frac{d^2y}{dx^2} - 6(1+2x)\frac{dy}{dx} + 16y = 8(1+2x)^2$.</td><td>(7)</td><td>CO4</td><td>BL2</td><td>2.1.3</td></tr>
<tr><td></td><td>OR</td><td></td><td></td><td></td><td></td></tr>
<tr><td>(e)</td><td>Apply variation of parameter method to solve differential equation $\frac{d^2y}{dx^2} + y = \tan x$.</td><td>(7)</td><td>CO4</td><td>BL3</td><td>2.1.3</td></tr>
<tr><td>Q.5(a)</td><td>The probability that machine A will be performing an usual function is 1/4 in 5 years time and the probability that machine B will still operating usefully at the end of the same period is 1/3. Find the probability in 5 years time (i) both machines will be performing an usual function, (ii) only machine B will be operating.</td><td>(2)</td><td>CO5</td><td>BL2</td><td>1.1.2</td></tr>
<tr><td>(b)</td><td>Write properties of normal distribution.</td><td>(2)</td><td>CO5</td><td>BL1</td><td>1.1.2</td></tr>
<tr><td>(c)</td><td>Fit a Poisson distribution to the given data and hence calculate the theoretical frequencies:
<table>
<tr><td>x:</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>f:</td><td>122</td><td>60</td><td>15</td><td>2</td><td>1</td></tr>
</table></td><td>(3)</td><td>CO5</td><td>BL2</td><td>1.1.2</td></tr>
<tr><td>(d)</td><td>If mean and variance of a binomial distribution are 4 and 2 respectively, find the probability of (i) exactly 2 successes , (ii) less than 2 successes, (iii) at least 2 successes.</td><td>(7)</td><td>CO5</td><td>BL3</td><td>1.1.2</td></tr>
<tr><td></td><td>OR</td><td></td><td></td><td></td><td></td></tr>
<tr><td>(e)</td><td>A sample of 100 dry battery cells tested to find the length of life produced the results: $\mu = 12$ hours and $\sigma = 3$ hours. Assuming the data to be normally distributed, what percentage of battery cells are expected to have life (i) more than 15 hours, (ii) less than 6 hours , (iii) between 10 and 14 hours? Given that if z is normal variable then $(P(0<z<1)=0.3413, P(0<z<2)=0.4772, P(0<z<0.67)=0.2485)$.</td><td>(7)</td><td>CO5</td><td>BL3</td><td>1.1.2</td></tr>
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