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3E1201

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B.Tech. III Sem. (Main) Examination, April/May - 2022

Artificial Intelligence & Data Science

3AID2-01 Advanced Engineering Mathematics

(AID, CAI, CS, IT)

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates:

Attempt all Ten questions From Part A, All five Questions from Part B and three questions out of five questions from Part C .

Schematic diagram must be shown wherever necessary. Any data missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination (As mentioned in form No. 205).

PART - A(Word limit 25) (10×2=20)

1. Given the function $f(x)=\begin{cases} e^{-x}, & x\geq 0 \\ 0, & x<0 \end{cases}$. Is this function a density function?

2. If E(X) = 2 and E(Y) = 5, then what is the value of E(2X+3Y)?

3. Define normal distribution.

4. Write Chebyshev's inequality.

5. Write two applications of optimization in Engineering.

6. What is the difference between linear and nonlinear programming problems?

7. What is Lagrangian function?

8. Consider the following problem:

   Minimize z = f(X),

   subject to $g_j(X) \leq 0;\ j=1,2,3,\ldots,m.$

   Then write the suitable Kuhn-Tucker conditions.

9. What is difference between a slack and surplus variable?

10. For non-degenerate feasible solution of m×n transportation problem, how many independent individual positive assignments will be required?

PART - B(Word limit 100) (5×4=20)

1. Derive moment generating function for Binomial distribution.

2. Fit a straight line to the following data regarding x as independent variable:

x:	0	1	2	3	4
y:	1.0	1.8	3.3	4.5	6.3

3. A company manufactures two products A and B, which are processed in the same machine. It takes 10 minutes to process one unit of product A and 3 minutes for each unit of product B and the machine operates for a maximum of 35 hours per week. Product A requires 0.8 kg and B requires 0.4 kg of raw material per unit. The supply of raw material is 500 kg per week. Market requires at least 700 units of product B every week. Product A costs Rs. 4 per unit and sold at Rs. 10, where as B costs Rs. 6 per unit and sold at Rs. 8. Formulate the linear programming problem to maximize the profit.

4. A beam of length l is supported at one end. If ω is the uniformly distributed load per unit length and the bending moment M at a distance x from the end is given by

$$M = lx - \frac{1}{2}\omega x^2,$$

then find the maximum bending moment.

5. Write the dual of the following linear programming problem:

Maximize $z = x_1 + 4x_2 + 3x_3$

Subject to $2x_1 + 3x_2 - 5x_3 \le 2$,

$3x_1 - x_2 + 6x_3 \ge 1$

$x_1 + x_2 + x_3 = 4$

and $x_1, x_2 \ge 0, x_3$ is unrestricted in sign.

PART - C (Any three) (3×10=30)

1. Joint Distribution function of two discrete random variable X and Y are given by $f(x,y) = c(2x+y)$. Where x and y assumes all integer values such that $0 \le x \le 2, 0 \le y \le 3$. Find

i) c

ii) $P(X=2, Y=1)$

iii) $P(X \ge 1, Y \le 2)$

iv) Marginal Distributions

v) Check the dependency.

2. Calculate the coefficient of correlation from the following data:

X:	1	2	3	4	5	6	7	8	9
Y:	9	8	10	12	11	13	14	16	15

Also obtain the equations of line of regression and obtain an estimate of Y which should correspond on the average to $X = 6.2$.

3. Write a short note on the classification of optimization problems based on various parameters.

4. Using two phase simplex method, solve:

$$
\begin{aligned}
&\textit{Max.} && z = -x_1 - x_2 \\
&\textit{Subject to} && 3x_1 + 2x_2 \geq 30 \\
& && -2x_1 - 3x_2 \leq -30 \\
& && x_1 + x_2 \leq 5 \\
&\textit{and} && x_1, x_2 \geq 0
\end{aligned}
$$

5. Using Vogel's Approximation method, find basic feasible solution for the following Transportation problem:

	Destination				Availability
	X	Y	Z	W	
A	1	2	1	4	30
B	3	3	2	1	50
C	4	2	5	9	20
Requirement	20	40	30	10	100

Hence, also find the optimum solution.

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B. Tech. III - Sem. (Main / Back) Exam., February - 2023

Automobile Engineering

3AE2 – 01 Advance Engineering Mathematics - I

AN, AG, AE, CE, CR, EC, EI, ME, MH, PT

Time: 3 Hours **Maximum Marks: 70**

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 Find the Laplace transform of -

$$f(t) = \begin{Bmatrix} \cos t & 0 < t < 2\pi \\ 0 & t > 2\pi \end{Bmatrix}$$

Q.2 What is unit step function?

Q.3 Find the Z-transform of sequences -

$\{u_n\} = \{25, 10, 5, 3, 2, 1, 0, 5\}$ $-3 \le n \le 4$

Q.4 Find the inverse Z-transform of $\log\left(\frac{z}{z+1}\right)$ by power series method.

Q.5 State Convolution Theorem for Fourier transform.

Q.6 Find the Fourier transform of $f(x) = \begin{Bmatrix} 1 & \text{for } |x| < 1 \\ 0 & \text{for } |x| > 1 \end{Bmatrix}$.

Q.7 Prove $E = 1 + \frac{1}{2}\delta^2 + \delta\sqrt{1 + \frac{\delta^2}{4}}$.

Q.8 By using Lagrange's formula, find x corresponding to y = 10 of following data -

x	10	15	17	20
y	3	7	11	14

Q.9 Find the first approximation value of x by Newton-Raphson method of $f(x) = xe^x - 2$ upto three decimal places.

Q.10 Write formula of Milne's Predictor Corrector Method.

PART – B

(Analytical/Problem solving questions) **[5×4=20]**

Attempt all five questions

Q.1 Find the inverse Laplace transform of $\frac{2s^2-1}{(s^2+1)(s^2+4)}$.

Q.2 Find Fourier sine and cosine transform of -

$$f(x) = \begin{Bmatrix} x & \text{for} & 0 < x \le 1 \\ 2 - x & \text{for} & 1 < x < 2 \\ 0 & \text{for} & x \ge 2 \end{Bmatrix}$$

Q.3 If $\bar{u}(z) = \frac{2z^2 + 3z + 4}{(z-3)^3}$, $|z| > 3$, then show that $u_1 = 2$, $u_2 = 21$ and $u_3 = 139$.

Q.4 Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using –

(i) Trapezoidal rule

(ii) Simpson 1/3 rule

Q.5 Given $\frac{dy}{dx} = x^2 + y$, $y(0) = 1$. Determine y (0.02) and y (0.04) by using modified Euler's method.

Q.6 By using Stirling formula, find u_{32} from the following data -

$u_{20} = 14.035$, $u_{25} = 13.674$, $u_{30} = 13.257$

$u_{35} = 12.734$ $u_{40} = 12.089$, $u_{45} = 11.309$

Q.7 Solve linear difference equation $u_{n+2} + 6u_{n+1} + 9u_n = 2^n$ given $u_0 = 1 = u_1$.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[3×10=30]**

Attempt any three questions

Q.1 From the following table of values of x and y find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.2 -

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.72	3.32	4.06	4.96	6.05	7.39	9.02

Q.2 If $\frac{dy}{dx} = x + y^2$ use Runge-Kutta method to find an approximate value of y for x = 0.2, given that y = 1 when x = 0. Use Laplace transform to solve.

Q.3 $(D^2 + 9)y = \cos 2t$, $y(0) = 1$, $y(\pi/2) = -1$.

Q.4 Obtain the Fourier transform of $f(x) = \begin{Bmatrix} x^2 & |x| \le a \\ 0 & |x| > a \end{Bmatrix}$. Hence evaluate

$$\int_0^\infty \cos\left(\frac{as}{2}\right)\frac{(a^2s^2 - 2)\sin as + 2as\cos as}{s^3}.ds$$

Q.5 Find Z $\{a^{|n|}\}$ and hence find Z $\left\{\left(\frac{1}{2}\right)^{|n|}\right\}$.
