

3E1656

Roll No. : _____

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B. Tech. (Sem. III) (Main/Back) Examination, December - 2017
Computer Sc. & Engg.
3CS6A Advanced Engg. Mathematics - I

Time : 3 Hours**Maximum Marks : 80**
Min. Passing Marks : 26

Attempt any five questions, selecting one question from each unit.
All Questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

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

1. _____ Nil _____ 2. _____ Nil _____

UNIT - I

- 1 (a) Define optimization techniques and write its various engineering applications
- (b) Solve the problem by constrained variation method.

$$\text{Min} \quad f(X) = \frac{1}{2}(x_1^2 + x_2^2 + x_3^2)$$

$$\begin{aligned} \text{Sub. to} \quad g_1(X) &= x_1 = x_2 \\ g_2(X) &= x_1 + x_2 + x_3 = 1 \end{aligned}$$

OR

1 (a) Optimize $Z = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$.
 Subject to $x_1 + x_2 + x_3 = 15$,
 $2x_1 - x_2 + 2x_3 = 20$,
 $x_1, x_2, x_3 \geq 0$

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(b) Maximum $Z = 2x_1 + 3x_2 - (x_1^2 + x_2^2 + x_3^2)$
 Subject to $x_1 + x_2 \leq 1$,
 $2x_1 + 3x_2 \leq 6$,
 $x_1, x_2 \geq 0$

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UNIT - II

- 2 (a) A firm manufacturing two types of electric items, A and B can make a profit of Rs. 20 per unit of A and Rs. 30 per unit of B. Each unit of A requires 3 motors and 4 transformers and each unit of B requires 2 and 4 respectively. The supply of these per month is 210 and 300 respectively. Type B requires a stabilizer with supply of 65 units per month. Formulate the LPP for maximum profit and solve it graphically.

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- (b) User two-phase method to solve :

Min $Z = x_1 + x_2$,
 Subject to $2x_1 + x_2 \geq 4$,
 $x_1 + 7x_2 \geq 7$
 and $x_1, x_2 \geq 0$

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OR

- 2 (a) Find the dual of the problem
 Min $Z = 2x_2 + 5x_3$
 Subject to $x_1 + x_2 \geq 2$,
 $2x_1 + x_2 + 6x_3 = 6$,
 $x_1 - x_2 + 3x_3 \leq 4$
 and $x_1, x_2, x_3 \geq 0$

- (b) Solve the following transportation problem to minimize the cost

From \ To	D_1	D_2	D_3	Supply
A	2	7	4	5
B	3	3	1	8
C	5	4	7	7
D	1	6	2	14
Demand	7	9	18	34

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UNIT - III

- 3 (a) If p is prime and a is an integer not divisible by p , then prove $a^{p-1} \equiv 1 \pmod{p}$

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- (b) State the Chinese Remainder Theorem. And solve the linear system $x \equiv 1 \pmod{3}$, $x \equiv 2 \pmod{4}$, $x \equiv 3 \pmod{5}$ <https://www.rtuonline.com>

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OR

- 3 (a) Show that the set $U_9 = \{1, 2, 3, 5, 7, 8\}$ with an operation defined as multiplication modulo 9, i.e. $a \cdot b = 9m + c$ for all $a, b \in U_9$ and $c \in U_9$ is a cyclic group.

Find the order of various elements and subgroup generated by them.

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- (b) If $\{G, *\}$ is a finite cyclic group generated by an element $a \in G$ and is of order n , then $a^n = e$ so that $G = \{a, a^2, \dots, a^n (= e)\}$. Also n is the least positive integer for which $a^n = e$.

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UNIT - IV

- 4 (a) Find inverse L-transform of function of $\frac{s}{s^4 + 4a^4}$. 8
- (b) Find the bounded solution $u(x, t), 0 < x < 1, t > 0$ of the boundary value problem $\frac{\partial u}{\partial x} - \frac{\partial u}{\partial t} = 1 - e^{-t}, u(x, 0) = x$. 8

OR

- 4 (a) Find Laplace transform of $\sin \sqrt{t}$ and deduce $L\left[\frac{\cos \sqrt{t}}{\sqrt{t}}\right] = \sqrt{\frac{\pi}{s}} e^{-\frac{1}{4s}}$. 8
- (b) Solve $\frac{d^2 y}{dt^2} - 3\frac{dy}{dt} + 2y = 1 - e^{2t}; y(0) = 1; y'(0) = 0$. 8

UNIT - V

- 5 (a) The population of a country in the decimal census were as under; estimate the population for the year 1925.

Year (X)	1891	1901	1911	1921	1931
Population (in thousands) f(x)	46	66	81	93	101

- (b) Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ by Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rule. Hence obtain the approximate value of π in each case. 8

OR

- 5 (a) Given $2\frac{dy}{dx} = (1+x^2)y^2$ and $y(0) = 1$, evaluate $y(0.4)$ by Milne's Predictor-corrector method. 8
- (b) Solve $y_{n+2} + y_{n+1} + y_n = n^2 + n + 1$. 8