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3E1656

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B. Tech III Sem. (Main/Back) Exam. Jan. 2016

Computer Engineering & Information Technology

3CS6A & 3IT6A Advanced Engineering Mathematics-I

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks: 24

Instructions to Candidates:

*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 material is permitted during examination.

1. Graph Paper 2. NIL

UNIT-I

Q.1 (a) State Kuhn –Tucker conditions. Use them to minimize [8]

$$f(x, y, z) = x^2 + y^2 + z^2 + 20x + 10y$$

s.t. $x \geq 40$

$x + y \geq 80$

$x + y + z \geq 120$

(b) Define optimization techniques and write its various engineering applications. [8]

OR

Q.1 (a) Find the maxima of the function $f(X) = 2x_1 + x_2 + 10$

subject to $g(X) \equiv x_1 + 2x_2^2 = 3$ using Lagrange's multiplier method. [8]

UNIT-IV

Q.4 (a) Use convolution theorem to evaluate [8]

$$L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$$

(b) Solve the differential equation by Laplace transform $(D^2 - 3D + 2)\, x = 1 - e^{2t}$

where $x(0) = 1, \left(\frac{dx}{dt}\right)_{t=0} = 0$ [8]

OR

Q.4 (a) Find Laplace – inverse of $\frac{s^3+6s^2+14s}{(s+2)^4}$ [8]

(b) Solve the pde using Laplace – transform

$\frac{\partial u}{\partial t} = 2\frac{\partial^2 u}{\partial x^2}$, given $u(0, t) = 0 = u(5,t)$ and $u(x, 0) = 10 \sin 4\pi x$. [8]

UNIT-V

Q.5 (a) Use Stirling's central difference formula to find y_{28}, given that -

$y_{20} = 49225$, $y_{25} = 48316$, $y_{30} = 47236$

$y_{35} = 45926$, $y_{40} = 44306$. [8]

(b) Use Runge – Kutta method to solve -

$\frac{dy}{dx} = x + y^2$, given at $x = 0$; $y = 1$ [8]

OR

Q.5 (a) Evaluate $\int_0^6 \frac{dx}{1+x^2}$, using Simpson's $\frac{3}{8}$ rule. Also, find the actual value by integration and compare the results. [8]

(b) Find the root of the equation $xe^x = \cos x$, using Regula – Falsi method, correct to three decimal places. [8]

(b) The lower corner of a leaf in a book is folded over so as just to reach the inner edge of the page. Show that the fraction of the width folded over when the area of the folded part is minimum is $\frac{2}{3}$. [8]

UNIT-II

Q.2 (a) Write the dual of the following LPP and hence solve it - [8]

Max. $z = 3x_1 - 2x_2$

s.t. $x_1 \le 4$

$x_2 \le 6$

$x_1 + x_2 \le 5$

$-x_2 \le -1$

$x_1 + x_2 \ge 0$

(b) Solve the following LPP by graphical method [8]

Max. $z = 8000\,x_1 + 7000\,x_2$

$3x_1 + x_2 \le 66$

$x_1 + x_2 \le 45$

$x_1 \le 20$

$x_2 \le 40$

$x_1 + x_2 \ge 0$

OR

Q.2 (a) Use Big – M method to solve - [8]

Max. $z = 3x_1 + 2x_2 + x_3$

$-3x_1 + 4x_2 + x_3 = 7$

$-3x_1 + 2x_2 + 2x_3 = 8$

$x_1, x_2, x_3 \ge 0$

(b) Solve the following transportation problem using VAM and check the optimality. [8]

	D_1	D_2	D_3	D_4	Supply
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demands	5	8	7	14	34

UNIT-III

Q.3 (a) If p is prime and K is not a multiple of p, then show that k has a multiplicative inverse. [5]

(b) Determine the least non–negative residue x in the congruence $5^{10} \equiv x$ (mod 31). [5]

(c) The necessary and sufficient condition for a non – empty subset H of a group {G, *} to be a subgroup is $a, b \in H \Rightarrow a * b^{-1} \in H$. [6]

OR

Q.3 (a) Prove that if {G, *} is a finite cyclic group generated by an element $a \in G$ and is of order n, then $a^n = e$. Also n is the least positive integer for which $a^n = e$. [8]

(b) If S is the set of ordered pairs (a, b) of real numbers and if the binary operations $\oplus$ and $\odot$ are defined by the equations - [8]

$(a, b) \oplus (c, d) = (a + c, b + d)$

and $(a, b) \odot (c, b) = (ac - bd, bc + ad)$

prove that $(S, \oplus, \odot)$ is a field.