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1465

B. E. - II Year (Sem. III) Examination, December – 2007

Mathematics - III

(Common to Computer Engg. & IT)

Time : 3 Hours] [Total Marks : 80

[Min. Passing Marks : 24

*Attempt overall **5** questions selecting **one** question from each unit. All questions carry **equal** marks.*

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

1. Nil 2. Nil

UNIT - I

1 (a) Give five examples of Engineering applications of optimization. Also, describe how optimization problems are classified. 4+4=8

(b) Use Lagrange method of multipliers to obtain the minimum value of $x^2+y^2+z^2$ subject to the condition $x+y+z=3a$. 8

OR

1 (a) Discuss the maxima or minima of

$$f(x, y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2.$$

8

(b) Use Lagrange method of multipliers to obtain three real numbers whose sum is 9 and sum of whose squares is as small as possible.

8

UNIT - II

2 (a) (i) Find all the basic solutions for the equations

$$x + y + 2z = 4$$

$$2x + 5y + z = 5,$$

Explain if the basic solutions are non-degenerate.

4

(ii) Use graphical method to

Maximize $Z = 2x + 3y$

subject to $x + y \le 4$, $6x + 2y \ge 8$, $x + 5y \ge 4$, $x \le 3$, $y \le 3$ and $x, y \ge 0$

4

(b) Use two phase method to solve the LPP :

Minimize $Z = x_1 + x_2$

subject to $2x_1 + x_2 \ge 4$, $x_1 + 7x_2 \ge 7$, $x_1, x_2 \ge 0$.

8

OR

2 (a) Solve the following LPP by Simplex method :

Maximize $Z = x_1 - x_2 + 3x_3$

Subject to $x_1 + x_2 + x_3 \le 10,\ 2x_1 - x_3 \le 2,$

$2x_1 - 2x_2 + 3x_3 \le 0,\ x_1,\ x_2,\ x_3 \ge 0$

8

(b) Find the optimal solution to the following LPP by solving its dual LPP with the help of Simplex method :

Maximize $Z = 2x_1 + x_2$

Subject to

$x_1 + 5x_2 \le 10,\ x_1 + 3x_2 \le 6,\ 2x_1 + 2x_2 \le 8$

with $x_1,\ x_2 \ge 0$.

2+6=8

UNIT - III

3 (a) Consider the following data for the activities concerning a project :

Name of activity	*Pre-operations*	*Duration (Days)*
A	-	2
B	A	3
C	A	4
D	B, C	6
E	-	2
F	E	8

(i) Draw a network diagram for the above project.

(ii) Find the minimum time for completion of the project.

(iii) Describe the critical path.

(iv) Find float.

2+2+2+2=8

(b) A machine operator has to perform two operations on six jobs. The time required to perform these operations in minutes for each job is given below. Find the sequence in which the jobs should be processed in order to minimize the total time required. Find the total elapsed time also :

Jobs

Timings for	**1**	**2**	**3**	**4**	**5**	**6**
Operation I : M_1	**3**	**12**	**5**	**2**	**9**	**11**
Operation II : M_2	**8**	**10**	**9**	**6**	**3**	**1**

8

OR

3 (a) Prepare a network diagram for the following activities concerning a certain project :

(i) Find the critical path,

(ii) Find EST, EFT, LST, LFT

(iii) Find float

Activity	*Name of activity*	*Preceeding activity*	*Duration (weeks)*
1, 2	A	-	3
1, 3	B	-	5
1, 4	C	-	4
2, 5	D	A	2
3, 5	E	B	3
4, 6	F	C	9
5, 7	G	D, E	8
3, 6	H	B	7
6, 7	I	H, F	9

2+4+2=8

(b) Given the following information of time estimates concerning various activities of a project :

Activities	t_0	t_p	t_m
1	2	6	4
2	6	10	8
3	1	15	5
4	2	9	5
5	6	10	8
6	6	9	7

Find t_e for these activities. Calculate standard deviation σ_i and variance V_i for each activity.

2+3+3=8

UNIT - IV

4 (a) Find

(1) $L\left[e^{-2t}(5\cos 6t - 4\sin 4t)\right]$

(2) $L^{-1}\left[\dfrac{(3s+4)}{(4s^2+12s+9)}\right]$

4, 4

(b) Use Laplace transform to solve the following equation

$$(D^2+3D+2)\,x(t)=1,\ \ x(0)=x'(0)=0$$

at $t=0$, $D \equiv \dfrac{d}{dt}$.

8

OR

4 (a) Find $f(x)$ if its Fourier sine transform is $\frac{1}{s}e^{-as}$.

Hence deduce $\overline{F_s}^{-1}\left(\frac{1}{s}\right)$.

6+2=8

(b) Solve $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$, $x > 0,\ t > 0$

given that $u(0,\ t) = f(t)$ and $u(x,\ 0) = 0$, with the help of Fourier transforms.

8

UNIT - V

5 (a) (i) Use Gauss' elimination method to solve :

$x + y + 2z = 4$, $2x + 2y + z - w = -1$

$y + z + w = 6$, $y - z + 2w = 5$.

(ii) Find the Newton-Raphson method a root of the equation $x^3 + x - 1 = 0$.

4+4=8

(b) (i) Apply Lagrange's interpolation formula to find $f(3)$ from the following data :

x	0	1	4	5
$f(x)$	3	4	24	39

4

(ii) Use Runge-Kutta method of fourth order to find y for $x = 0.6$ given $\frac{dy}{dx} = \sqrt{(x+y)}$, $y(0.4) = 0.41$. Take $h = 0.2$.

4

OR

5 (a) Solve the difference equation

$$y_n - y_{n-1} + 2y_{n-2} = n + 2^n .$$

8

(b) Use Milne's method to calculate $y(0.8)$, where $\frac{dy}{dx} = 1 + y^2$, given that

x	0	0.2	0.4	0.6
y	0	0.2017	0.4225	0.6841

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