3E1465

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B.Tech. IIIrd Semester (Back) Examination, Feb.-2011

Mathematics - III

Common for Comp. Engg & IT

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt overall **Five** questions in all. Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitable be assumed and stated clearly.*

Unit - I

1. a) Show that the volume of the greatest rectangular parallelepiped that can be inscribed in the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$ is $\frac{8}{\sqrt{3}}abc$. **(8)**

   b) Use Lagrange's method of undetermined multipliers to find the minimum value of $x^2+y^2+z^2$ subject to the conditions $x+y+z=1,\ xyz+1=0$. **(8)**

OR

   a) Obtain the stationary points of $x^4+y^4-2x^2+4xy-2y^2$. Determine their nature also. **(8)**

   b) In a plane triangle, find the maximum value of

   $\cos A \cos B \cos C$. **(8)**

Unit - II

2. a) Solve graphically the following linear programming problem :

   Maximize $z=5x_1+3x_2$,

   subject to $3x_1+5x_2\le 15$,

   $5x_1+2x_2\le 10$,

   and $x_1, x_2\ge 0$. **(8)**

b) Solve the following transportation problem :

	D_1	D_2	D_3	D_4	a_i
O_1	1	2	1	4	30
O_2	3	3	2	1	50
O_3	4	2	5	9	20
b_i	20	40	30	10	

(8)

OR

a) Solve the following L.P. problem by simplex method :

Max. $z = 2x_1 + 4x_2$

subject to $2x_1 + 3x_2 \leq 48$

$x_1 + 3x_2 \leq 42$

$x_1 + x_2 \leq 21$

and $x_1, x_2 \geq 0$. **(8)**

b) Use graphical method to solve the L.P. problem given below :

Min. $z = 1.5x_1 + 2.5x_2$

subject to $x_1 + 3x_2 \geq 3$

$x_1 + x_2 \geq 2$

and $x_1, x_2 \geq 0$. **(8)**

Unit - III

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

Activity	Name of Activity	Preceding Activity	Duration (in 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

i) Find the critical path.

ii) Find EST, EFT, LST, LFT.

iii) Find float. **(2,2,2,2=8)**

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

	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

a) Five jobs are to be processed in three machines M_1, M_2 and M_3 in that order. Processing times on the three machines are given below. Obtain the optimal sequence of jobs that minimises the total elapsed time. Find also the idle time on the three machines M_1, M_2 and M_3.

	Jobs				
	1	2	3	4	5
Processing on M_1 time	8	10	6	7	11
Processing on M_2 time	5	6	2	3	4
Processing on M_3 time	4	9	8	6	5

(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	1	9	5
5	6	10	8
6	5	9	7

Find t_e for all the six activities. Also, calculate standard deviation σ_i and variance v_i for each activity. **(8)**

Unit - IV

4. a) Find the Laplace transform of $e^{-at} - 2\ e^{\left(\frac{1}{2}at\right)} \cos\left(\frac{\sqrt{3}}{2}at\right)$. **(8)**

b) Use Laplace transforms to solve $\left(D^2 - 2D + 2\right) x = 0$, $x_0 = x_1 = 1$; $D \equiv \frac{d}{dt}$. **(8)**

OR

a) Find the Fourier transform of

$f(x) = 1, |x| \le a$

$= 0, |x| > a.$

Also, evaluate

$$\int_{-\infty}^{\infty} \frac{\sin(\lambda a)\cos(\lambda x)}{\lambda} d\lambda.$$ **(4+4=8)**

b) Solve the integral equation :

$$\int_0^{\infty} f(x) \cos(\lambda x)\, dx = e^{-\lambda}.$$ **(8)**

Unit - V

5. a) Use Newton-Raphson method to solve

$x^3 + x - 1 = 0.$ **(8)**

b) Given the following data, find $\frac{dy}{dx}$ for

i) $x = 0.5$ and

ii) $x = 1.5$

x:	0.5	0.75	1.00	1.25
y:	0.3521	0.3011	0.2420	0.1827

(4,4=8)

OR

a) Solve $\frac{dy}{dx} = 2x + y$ with initial conditions $y(0) = 1$ by fourth order Runge-Kutta formula for $x = 0.1$ and $x = 0.2$. **(4,4=8)**

b) Solve by any numerical method :

$\frac{dy}{dx} = 1 - 2xy$, given $y = 0$ for $x = 0$ from $x = 0$ to $x = 0.6$, taking the interval $h = 0.2$. **(8)**
