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3E2071

Roll No. : _____ Total Printed Pages : 4

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B. Tech. (Sem. III) (Main) Examination, February - 2010
(Common for Comp. Engg. & IT)
(Mathematics - III)

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

*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.*

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

1. Graph Paper 2. Nil

UNIT – I

1 (a) Find the maxima and minima of the function
$u = x^3 + y^3 - 3x - 12y + 25$. 6

(b) Solve the following problem using Kuhn-Tucker conditions :
Minimize $f(x_1, x_2, x_3) = x_1^2 + x_2^2 + x_3^2$

$$g_1 = 2x_1 + x_2 - 5 \le 0$$
$$g_2 = x_1 + x_3 - 2 \le 0$$
$$g_3 = 1 - x_1 \le 0$$
$$g_4 = 2 - x_2 \le 0$$
$$g_5 = -x_3 \le 0$$

10

OR

1 (a) Find the point on the plane $x + 2y + 3z = 1$ which is nearest to the point (–1, 0, 1) by Lagrange's multipliers method. 8

(b) A rectangular sheet of metal has four equal square portions removed at the corners and the sides are then turned up so as to form an open rectangular box. Show that when the volume contained in the box is maximum, the depth will be $\frac{1}{6}\left[(a+b) - (a^2 - ab + b^2)^{1/2}\right]$ where 'a' and 'b' are original dimensions of the rectangle. 8

UNIT - II

2 (a) A firm manufactures two products A and B on which the profit earned per unit is Rs. 3.00 and Rs. 4.00 respectively. Each product is processed on two different machines M_1 and M_2. Product A requires 1 minute of processing on M_1 and 2 minutes on M_2, while B requires 1 minute on machine M_1 and 1 minute on machine M_2. Machine M_1 is available for not more than 7 hours 30 minutes while M_2 is available for 10 hours on any working day. Find the number of units of A and B to be manufactured to have maximum profit. Formulate the problem and solve graphically. 8

(b) Solve the following LPP by using Simplex method :

Max. $Z = 5x_1 + 3x_2$

S.T. $3x_1 + 5x_2 \leq 15$

$5x_1 + 2x_2 \leq 10$

and $x_1, x_2 \geq 0$ 8

OR

2 (a) Find the dual problem of the following LPP :

Max. $Z = x_1 + 3x_2$

S.T. $3x_1 + 2x_2 \leq 6$

$3x_1 + x_2 = 4$ *and* $x_1, x_2 \geq 0$ 4

(b) Solve the following transportation problem :

	D_1	D_2	D_3	D_4	
O_1	1	2	1	4	30
O_2	3	3	2	1	50
O_3	4	2	5	9	20
	20	40	30	10	100

using MODI method. 12

UNIT - III

3 (a) A project consists of a series of tasks labelled A, B,.....,I, with the following relationships $A < D, E$; $B, D < F$; $C < G$; $B < H$; $F, G < I$. Construct the network diagram, find also the minimum time of completion of the project, when the time of completion of each task is as follows :

Task	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Time (days)	23	8	20	16	24	18	19	4	10

8

(b) A small project is composed of nine activities, whose time estimates are as given below :

Activity (*i*, *j*)	Estimated durations (days)		
	Optimistic	Most Likely	Pessimistic
(1, 2)	3	6	15
(1, 6)	2	5	14
(2, 3)	6	12	30
(2, 4)	2	5	8
(3, 5)	2	11	20
(4, 5)	3	6	15
(6, 7)	3	9	27
(5, 8)	1	4	7
(7, 8)	4	19	28

Draw the project network and calculate the length and variance of the critical path. Find the probability for the project to be completed in 41 days.

8

OR

3 (a) We have 7 jobs each of which has to go through the machine A and B in the order $A \rightarrow B$. Processing times are given below. Determine a sequence of these jobs that will minimize the total elapsed time :

Jobs	1	2	3	4	5	6	7
A	3	12	15	6	10	11	9
B	8	10	10	6	12	1	3

8

(b) Use graphical method to minimize the time required to process the following jobs on the machine shown below (ie for each machine find the job which should be done first). Also calculate the total elapsed time :

Job 1	*Sequence of Machines*	*A*	*B*	*C*	*D*	*E*
	Time	3	4	2	6	2

Job 2	*Sequence of Machines*	*C*	*A*	*D*	*E*	*B*
	Time	5	4	3	2	6

8

UNIT – IV

4 (a) Find the Laplace transform of $\sin\sqrt{t}$. Hence show that

$$L\left\{\frac{\cos\sqrt{t}}{\sqrt{t}}\right\} = \left(\frac{\pi}{s}\right)^{1/2} e^{-(1/4s)}.$$

8

(b) Use Laplace transform to solve the differential equation $y''+9y=\cos 2t,\ y(0)=1,\ y\left(\frac{\pi}{2}\right)=-1$. 8

OR

4 (a) Find $L^{-1}\left\{\frac{1}{s^3(s^2+1)}\right\}$. 6

(b) Solve $\frac{\partial u}{\partial t}=3\frac{\partial^2 u}{\partial x^2}$,

BC : $u(x,\ 0)=30\cos 5x,\ u\left(\frac{\pi}{2},\ t\right)=0,\ \left(\frac{\partial u}{\partial x}\right)_{x=0}=0$. 10

UNIT - V

5 (a) Using Lagrange's interpolation formula, find the value of y when $x=10$ from the following data :

x	5	6	9	11
y	12	13	14	16

8

(b) Use Gauss' backward central interpolation formula to estimate the population in 1936, given that

Year	1901	1911	1921	1931	1941	1951
Population in thousands	12	15	20	27	39	52

8

OR

5 (a) Use Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rule to calculate $\int_0^1 \frac{dx}{1+x^2}$. Hence obtain the approximate value of π in each case. 8

(b) Use modified Euler's method to solve $\frac{dy}{dx}=x+\sqrt{y}$, with initial conditions, $y=1$ at $x=0$, for $x=0.6$ in steps of 0.2. 8