C 5458 (Pages 4) Name.....

Reg. No.....

SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2010

EE 04 705 B—NUMERICAL ANALYSIS AND OPTIMIZATION TECHNIQUES

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

I. (a) Obtain a root of the following equations correct to three decimal places using the bisection method :

$$x^3 - x - 1 = 0.$$

(b) Using Crout's method solve the following equation :

$$\begin{aligned} x + y + z &= 3 \\ 2x - y + 3z &= 16 \\ 3x + y - z &= -3 \end{aligned}$$

(c) Apply Simpson's rule to evaluate $\int_0^2 \frac{dx}{1+x^3}$ to two decimal places, by dividing the range into 4 equal parts.

(d) Solve numerically using Taylor series approach :

$$\frac{dx}{dt} = t^3 + x \text{ for } t = 1{\cdot}1, 1{\cdot}2, 1{\cdot}3, 1{\cdot}4, 1{\cdot}5.$$

The initial conditions are $t = 1$, $x = 1$.

(e) Use simplex method to maximise :

$$Z = 2x_1 - x_2 + x_3$$

subject to the constraints

$$\begin{aligned} 3x_1 + x_2 + x_3 &\leq 60 \\ x_1 - x_2 + 2x_3 &\leq 10 \\ x_1 + x_2 - x_3 &\leq 20 \quad \text{and} \\ x_1, x_2, x_3 &\geq 0. \end{aligned}$$

Turn over

(f) Use dual simplex method to solve the following :

Minimize $z = x_1 + x_2$

subject to the constraints

$$2x_2 + x_2 \geq 4$$

$$x_1 + 7x_2 \geq 7$$

$$x_1, x_2 \geq 0.$$

(g) Solve the following transportation problem :

	Destination				
Source	1	2	3	4	Available
1	21	16	25	13	11
2	17	18	14	23	13
3	32	27	18	41	19
Requirement	6	10	12	15	43

(h) Solve the following assignment problems :—

	1	2	3	4
A	10	12	19	11
B	5	10	7	8
C	12	14	13	11
D	8	15	11	9

(8 × 5 = 40 marks)

Part B

II. (a) Obtain a root of the following equations correct to three decimal places, using bisection method :—

(i) $x^3 - x^2 + x - 7 = 0$.

(ii) $x^3 - 9x + 1 = 0$.

Or

(b) Use the method of iteration to solve the equations :

(i) $x^3 + x^2 - 1 = 0$.

(ii) $x^3 - 2x^2 - 4 = 0$.

III. (a) (i) Use the Trapezoidal rule evaluate $\int_{0.6}^{2} y\,dx$ from the following table :—

x :	0·6	0·8	1·0	1·2	1·4	1·6	1·8	2·0
y :	1·23	1·58	2·03	4·32	6·25	8·36	10·23	12·45

(ii) Use the Trapezoidal rule to evaluate $\int_{1}^{2} \frac{x}{dx}$ by dividing the interval into 5 equal parts.

Or

(b) (i) Find an approximate value of $\log_e 5$ by calculating to 4 decimal places by Simpson's rule the integral $\int_{0}^{5} \frac{dx}{4x+5}$ dividing the range into 10 equal parts.

(ii) Using Simpson's rule, evaluate $\int_{0}^{\pi} \sin^3 x\,dx$ from the following data :—

x :	0	$\pi/4$	$\pi/2$	$3\pi/4$	π
$\sin x$:	0	0.7071	1.000	0.7071	0

IV (a) Use simplex method to solve the linear programming problem :

(i) Maximize $Z = 3x_1 + 2x_2$

subject to the constraints :

1 $x_1 + x_2 \leq 4,\ x_1 - x_2 \leq 2,\ x_1 \geq 0, x_2 \geq 0.$

2 $x_1 + x_2 \leq 6,\ 2x_1 + x_2 \leq 6,\ x_1, x_2 \geq 0.$

(ii) Maximize $Z = 2x_1 + 3x_2$

subject to constraints :

$x_1 + x_2 \leq 4, -x_1 + x_2 \leq 1$ and $x_1 + 2x_2 \leq 5,\ x_1 \geq 0, x_2 \geq 0.$

Or

(b) Use dual simplex method to solve the following :—

(i) Minimize $Z = x_1 + x_2$

subject to the constraints :

$2x_1 + x_2 \geq 4,\ x_1 + 7x_2 \geq 7,\ x_1, x_2 \geq 0.$

(ii) Maximize $Z = -2x_1 - x_2$

subject to the constraints :

$3x_1 + x_2 \geq 3,\ 4x_1 + 3x_2 \geq 6,\ x_1 + 2x_2 \geq 3,\ x_1, x_2 \geq 0.$

Turn over

V. (a) Solve the following transportation problem :—

	To			
From	A	B	C	Available
I	6	8	4	14
II	4	9	8	12
III	1	2	6	5
Demand	6	10	15	

Or

(b) Solve the following assignment problem :—

(i)

	A	B	C	D
I	1	4	6	3
II	9	7	10	9
III	4	5	11	7
IV	8	7	8	5

(ii)

	M_1	M_2	M_3	M_4
J_1	5	8	3	2
J_2	10	7	5	8
J_3	4	10	12	10
J_4	8	6	9	4

(4 × 15 = 60 marks)