F 3042 (Pages : 3) Reg. No .....

Name .....

B.TECH. DEGREE EXAMINATION, JANUARY 2007

Fifth Semester

Branches : Computer Science and Engineering/Information Technology

ENGINEERING MATHEMATICS—IV (RT)

(Regular/Supplementary)

Time : Three Hours Maximum : 100 Marks

Answer **one** *question from each module.*
All questions carry equal marks.

Module I

1. (a) Write notes on queueing theory. (5 marks)

(b) Cars arrive at a petrol pump with exponential inter arrival timehaving mean $\frac{1}{2}$ minute. The attendant take on an average of $\frac{1}{5}$ minute per car to supply petrol. The service time being exponentially distributed. Determine

(i) the average number of cars waiting to be served ;

(ii) the average number of cars in the queue ; and

(iii) the proportion of time for which attendant is idle.

(15 marks)

2. (a) Arrivals at a telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially with mean 3 minutes.

(i) What is the probability that a person arriving at the booth will have to wait ?

(ii) What is the average length of queue that forms from time to time ?

(10 marks)

(b) A barber shop has 6 chairs to accomodate people waiting for hair cut. Assume the customers who arrive when all 6 chairs are full leave without entering the barber shop. Customers arrive at the average rate of 3 per hour and spend an average of 15 minutes in the shop then find (i) the probability a customer can get directly into the barber chair upon arrival ; (ii) expected number of customers waiting for a hair cut.

(10 marks)

Turn over

Module II

3. (a) Find a root of the equation $2x - \log_{10} x = 7$ near 3.5 using Regula-Falsi method. (10 marks)

(b) Using Jacobi's method, solve the system of equations :

$$\begin{aligned} 5x + 2y + z &= 12 \\ x + 4y + 2z &= 15 \\ x + 2y + 5z &= 20 \end{aligned}$$

(10 marks)

4. (a) Compute $\sqrt{41}$ correct to 4 decimal places by Newton-Raphson method. (10 marks)

(b) Using bisection method, find a root of $x^3 - x - 11 = 0$. (10 marks)

Module III

5. (a) Using Trapezoidal rule and Simpson's rule, evaluate $\int_0^{\pi/2} \sin x \, dx$ by using 11 ordinates. (10 marks)

(b) Derive Newton's backward interpolation formula. (10 marks)

6. (a) Using Lagrange's interpolation formula, find $f(4)$ if $f(0) = 1, f(2) = 19, f(3) = 55, f(5) = 241, f(6) = 415$. (10 marks)

(b) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 0.9$ and $x = 1.6$ for the following data :—

x	:	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y	:	7.989	8.403	8.781	9.129	9.451	8.75	10.3

(10 marks)

Module IV

7. (a) Solve graphically the following linear programming problem :—

$$\begin{aligned} \text{Maximize} \quad & Z = 5x_1 + 3x_2 \\ \text{subject to} \quad & 3x_1 + 5x_2 \leq 15 \\ & 5x_1 + 2x_2 \leq 10 \\ & x_1, x_2 \geq 0. \end{aligned}$$

(10 marks)

(b) Using Simplex method, solve the problem :—

$$\begin{aligned} \text{Maximize} \quad & Z = 2x_1 + 5x_2 + 7x_3 \\ \text{subject to} \quad & 3x_1 + 2x_2 + 4x_3 \leq 100 \\ & x_1 + 4x_2 + 2x_3 \leq 100 \\ & x_1 + x_2 + 3x_3 \leq 100 \\ & x_1, x_2, x_3 \geq 0. \end{aligned}$$

(10 marks)

8. (a) Use Big M method to solve the problem :

$$\text{Minimize} \quad Z = 2x_1 + 9x_2 + x_3$$
$$\text{subject to} \quad x_1 + 4x_2 + 2x_3 \geq 5$$
$$3x_1 + x_2 + 2x_3 \geq 4$$
$$x_1, x_2, x_3 \geq 0.$$

(10 marks)

(b) Using duality, solve the problem :

$$\text{Minimize} \quad Z = 4x_1 + 3x_2 + 6x_3$$
$$\text{subject to} \quad x_1 + x_3 \geq 2$$
$$x_2 + x_3 \geq 5$$
$$x_1, x_2, x_3 \geq 0.$$

(10 marks)

Module V

9. Solve the following transportation problem for minimum cost :—

	D_1	D_2	D_3	D_4	D_5	Supply
O_1	7	7	10	5	11	45
O_2	4	3	8	6	13	90
O_3	9	8	6	7	5	95
O_4	12	13	10	6	3	75
O_5	5	4	5	6	12	105
	120	80	50	75	85	

(20 marks)

10. Find the optimal assignment for the assignment problem with the following cost matrix :—

	I	II	III	IV
A	5	3	1	8
B	7	9	2	6
C	6	4	5	7
D	5	7	7	6

(20 marks)