(Pages : 4) **B – 3358**

Reg. No. : .....

Name : .....

Fifth Semester B.Tech. Degree Examination, December 2016
(2013 Scheme)
13.502 : ENGINEERING MATHEMATICS – V (FR)
(Advanced Mathematics and Queueing Models)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Differentiate between slack and surplus variable.
2. What is the purpose of introducing artificial variables in LPP ?
3. State any two properties of primal and dual optimal solutions.
4. Define critical path in Network analysis.
5. What are the basic characteristics of queueing models ?

PART – B

Answer **any one full** question from **each** Module. **Each** question carries **20** marks.

Module – I

6. a) Use graphical method to solve the LPP :

Maximize $z = 5x_1 + 7x_2$

Subject to the constraints $x_1 + x_2 \leq 4$

$3x_1 + 8x_2 \leq 24$

$10x_1 + 7x_2 \leq 35$

$x_1, x_2 \geq 0.$

P.T.O.

b) Find all the basic solutions of the following system of equations identifying in each case the basic and non-basic variables. Also investigate whether the basic solutions are degenerate basic solutions or not. Hence find the basic feasible solution of the system.

OR

7. a) Convert the following LPP to the standard form :

Maximize $z = 3x_1 + 5x_2 + 7x_3$

Subject to $6x_1 - 4x_2 \leq 5$

$3x_1 + 2x_2 + 5x_3 \geq 11$

$4x_1 + 3x_2 \leq 2$

$x_1, x_2, x_3 \geq 0.$

b) Use simplex method to solve :

Minimize $z = x_1 - 3x_2 + 3x_3$

Subject to $3x_1 - x_2 + 2x_3 \leq 7$

$2x_1 + 4x_2 \geq -12$

$-4x_1 + 3x_2 + 8x_3 \leq 10$

$x_1, x_2, x_3 \geq 0.$

Module – II

8. a) Write the dual of the following problem :

Maximize $z = 2x_1 + 3x_2 + 4x_3$

Subject to $2x_1 + 3x_2 + 5x_3 \geq 2$

$3x_1 + x_2 + 7x_3 = 3$

$x_1 + 4x_2 + 6x_3 \leq 5$

$x_1 \geq 0$, $x_2 \leq 0$ and x_3 is unrestricted.

b) Obtain an optimum basic feasible solutions to the following transportation problem :

	To			Availability
From	7	3	4	2
	2	1	3	3
	3	4	6	5
Requirement	4	1	5	

OR

9. a) Solve the following assignment problem :

	A	B	C	D
I	15	13	14	17
II	11	12	15	13
III	18	12	10	11
IV	15	17	14	16

b) i) What is an assignment problem and how do you interpret it as a linear programming problem ?

ii) A salesman is planning to tour cities B, C, D and E starting from his home city A. The inter-city distances are shown in the following table :

City	A	B	C	D	E
A	∞	103	188	136	38
B	103	∞	262	176	52
C	188	262	∞	85	275
D	136	176	85	∞	162
E	38	52	275	162	∞

How should he plan his tour so that :

i) He visits each of the cities only once, and

ii) Travels the minimum distance.

Module – III

10. A small project consists of seven activities for which the relevant data are given below :

Activities	Preceding Activity	Duration (Days)
A	–	4
B	–	7
C	–	6
D	A, B	5
E	A, B	7
F	C, D, E	6
G	C, D, E	5

i) Draw the network and find the project completion time.

ii) Calculate total float for each of the activities and highlight the critical path.

OR

11. A project is composed of seven activities whose time estimates are listed in the table as follows :

Activity (i j)	Estimated Duration (Weeks)		
	Optimistic	Most likely	Pessimistic
(1 2)	1	1	7
(1 3)	1	4	7
(1 4)	2	2	8
(2 5)	1	1	1
(3 5)	2	5	14
(4 6)	2	5	8
(5 6)	3	6	15

i) Draw the project network.

ii) Find the expected duration and variance of each activity. What is the expected project length ?

iii) Calculate the variance and standard deviation of project length.

Module – IV

12. Customers arrive at a one window-drive – in bank according to a Poisson distribution with mean 10 per hour. Service time per customer is exponential with mean 5 minutes. The car space in front of the window including that for the serviced, can accommodate a maximum of three cars. Others can wait outside this space.

i) What is the probability that an arriving customer will have to wait outside the indicated space ?

ii) Find the average waiting time of a customer in the queue.

OR

13. a) Explain the terms :

i) Arrival process

ii) Queue discipline

iii) Traffic intensity with respect to queueing problem.

b) The mean arrival rate of a service centre is 3 per hour. The mean service time is found to be 10 minutes per service. Assuming Poisson arrival and exponential service time, find :

i) Utilisation factor for this service facility

ii) Probability of two units in the system

iii) Expected number of units in the queue

iv) Expected time in minutes that a customer has to spend in the system.
