CBCS SCHEME

Sahyadri College of Engineering & Management CENTRAL LIBRARY Adyar, Mangalore - 7

USN | | | | | | | | | | |

18ME735

Seventh Semester B.E. Degree Examination, Feb./Mar.2022

Operations Research

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of statistical table permitted.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Operation Research models help to solve several problems facing the industry today. Elaborate. **(04 Marks)**

b. Discuss various phases in solving OR problems. **(06 Marks)**

c. The following table Q1(c) summarizes the key facts above two products A and B and the resources Q and R required to produce them. Formulate the linear programming model for this problem and solve it graphically.

Resource	Resource usage per unit produced		Amount of resource available
	Product A	Product B	
Q	1	1	5
R	3	2	12
Profit per unit	6	5	

Table Q1(c) **(10 Marks)**

OR

2 a. Write down the general structure of linear programming problem. What are its three basic elements? **(04 Marks)**

b. Solve the following LPP by graphical method:

Minimize $z = 20x_1 + 10x_2$

Subject to, $x_1 + 2x_2 \le 40$

$3x_1 + x_2 \ge 30$

$4x_1 + 3x_2 \ge 60$

$x_1, x_2 \ge 0$ **(06 Marks)**

c. A confectionery company mixes three types of toffees to form one kg toffee packs. The pack is sold at Rs.170. The three types of toffees cost Rs.200, Rs.100 and Rs.50 per kg respectively. The mixture must contain atleast 0.30 kg of the first type of toffees and the weight of the first two types of toffees must atleast be equal to the weight of the third type. Formulate the problem as LPP. **(10 Marks)**

Module-2

3 a. Solve the following LPP using simplex method,

Maximize $z = x_1 + x_2 + 3x_3$

Subject to $3x_1 + 2x_2 + x_3 \le 3$

$2x_1 + x_2 + 2x_3 \le 2$

$x_1, x_2, x_3 \ge 0$ **(08 Marks)**

b. Use Big M method to solve the following LPP:

Minimize $z = 5x_1 + 3x_2$

Subject to $2x_1 + 4x_2 \le 12$

$2x_1 + 2x_2 = 12$

$5x_1 + 2x_2 \ge 10$

$x_1, x_2 \ge 0$ **(12 Marks)**

VTU-24-02-2022 01:02:51pm - SF - SF - SF - SF
24-02-2022 01:32:08pm SF - SF - SF - SF

Sahyadri College of Engineering & Management
CENTRAL LIBRARY
Adyar, Mangalore-7

OR

4 a. Obtain the dual of the following primal problem,

Minimize $z = 3x_1 - 2x_2 + x_3$

Subject to $2x_1 - 3x_2 + x_3 \le 5$

$4x_1 - 2x_2 \ge 9$

$-8x_1 + 4x_2 + 3x_3 = 8$

$x_1, x_2 \ge 0$, x_3 is unrestricted. **(08 Marks)**

b. Use two phase method to solve

Maximize $z = 5x_1 - 4x_2 + 3x_3$

Subject to $2x_1 + x_2 - 6x_3 = 20$

$6x_1 + 5x_2 + 10x_3 \le 76$

$8x_1 - 3x_2 + 6x_3 \le 50$

$x_1, x_2, x_3 \ge 0$ **(12 Marks)**

Module-3

5 a. With the aid of simple examples, describe the procedure to be adopted to balance,

(i) Transportation problem.

(ii) Assignment problem **(08 Mark**

b. Solve the transportation problem, the numbers in the cells represent unit transportation cost from warehouse i to store j . **(12 Marks)**

Stores

Warehouse	A	B	C	D	E	F	Supply
1	9	12	9	6	9	10	5
2	7	3	7	7	5	5	6
3	6	5	9	11	3	11	2
4	6	8	11	2	2	10	9
Demand	4	4	6	2	4	2	22 / 22

OR

6 a. An expert operations researcher provided the following transportation schedule. Check if this solution is optional. If not, get the optimal solution. [Refer Fig. Q6 (a)] **(08 Marks)**

3	1 (300)	7	4
2 (250)	6	5 (150)	9
8	3 (50)	3 (250)	2 (200)

Fig. Q6 (a)

b. There are five jobs to be assigned, one each to five machines and the associated cost matrix is as follows. Find the optimum assignment schedule. **(08 Marks)**

Machines

Jobs	1	2	3	4	5
A	11	17	8	16	20
B	9	7	12	6	15
C	13	16	15	12	16
D	21	24	17	28	26
E	14	10	12	11	15

Table Q6(b)

c. Explain in brief, travelling salesman problem. **(04 Marks)**

VTU 24-02-2022 01:02:51pm - SF - SF - SF - SF 24-02-2022 01:32:08pm

Sahyadri College of Engineering & Management
CENTRAL LIBRARY
Adyar, Mangalore-7

Module-4

7 a. What is critical path? How does it help project manager? **(04 Marks)**

b. For the network shown (Refer Fig. Q7 (b)), the estimates to, tm and tp are given in this order for each of the activities. Find the probability of completing the project in 25 days. **(08 Marks)**

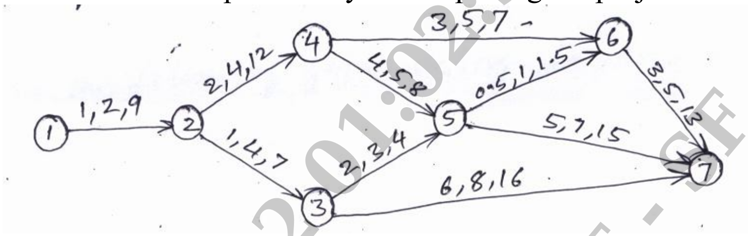

Fig. Q7 (b)

c. A project schedule has the following characteristics,

Activity	1–2	1–3	2–4	3–4	3–5	4–9	5–6	5–7	6–8	7–8	8–10	9–10
Time (days)	4	1	1	1	6	5	4	8	1	2	5	7

i) Construct a network diagram.
ii) Compute the earliest event time and latest event time.
iii) Determine the critical path and total project duration.
iv) Compute total float for each activity. **(08 Marks)**
v)

OR

8 a. Explain Kendall's notations for representing queuing models. **(04 Marks)**

b. Describe the characteristics of queuing models. **(08 Marks)**

c. In a railway yard goods train arrive at a rate of 30 trains per day. Assume that the inter arrival time follows exponential distribution and the service time distribution is also exponential with an average of 36 min. Calculate the following:
(i) The average number of trains in the system.
(ii) The probability that the queue size exceeds 10.
(iii) Expected waiting time in the queue.
(iv) Average number of trains in the queue.
(v) The changes in (i) and (ii) if the input of trains increase to an average 33 per day. **(08 Marks)**

Module-5

9 a. Define the following:
(i) Payoff matrix.
(ii) Saddle point.
(iii) Pure strategy.
(iv) Two-person zero-sum game. **(04 Marks)**

b. Find the value of 'X' and 'Y', so that the following game has a saddle point. (Refer Table Q9 (b)).

Player B

Player A			
	18	Y	36
	X	54	99
	63	27	36

Table Q9 (b) **(06 Marks)**

c. Solve the following game using dominance rule (Table Q9 (c)):

Player B

Player A				
	3	2	4	0
	3	4	2	4
	4	2	4	0
	0	4	0	8

Table Q9 (c) **(10 Marks)**

VTU-24-02-2022 01:02:51pm - SF - SF - SF
24-02-2022 01:32:08pm - SF - SF - SF - SF - SF - SF - SF

OR

10 a. List out the basic assumptions for solving sequencing problems. **(04 Marks)**

b. Find the sequence that minimizes the total elapsed time required to complete the following tasks. (Table Q10 (b)).

Tasks	A	B	C	D	E	F	G
Time on Machine I	3	8	7	4	9	8	7
Time on Machine II	4	3	2	5	1	4	3
Time on Machine III	6	7	5	11	5	6	12

Table Q10 (b) **(08 Marks)**

c. Processing times and due dates for six jobs waiting to be processed at a work center are given in the following table (Table Q10 (c)). Determine the sequence of jobs, the average flow time, average tardiness and number of tardy jobs for each of the following priority rules:
   (i) FCFS
   (ii) SPT
   (iii) EDD.

Job	A	B	C	D	E	F
Processing time (days)	2	8	4	10	5	12
Due date	7	16	4	17	15	18

Table Q10 (c) **(08 Marks)**

* * * * *

VTU-24-02-2022 01:02:51pm SF - SF - SF - SF - SF
24-02-2022 01:32:08pm SF - SF - SF - SF - SF - SF