Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2163201 **Date:06/05/2016**

Subject Name: Operation Research

Time: 10:30 AM to 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain the phases of OR study. **07**

(b) Discuss different types of OR models. Also discuss effect of data availability on modeling. **07**

Q.2 **(a)** Construct the dual of the following primal problem and solve dual using simplex method. **07**

Maximize $Z = 5x_1 + 2x_2 + 3x_3$

Subject to $x_1 + 5x_2 + 2x_3 = 30$

$x_1 - 5x_2 - 6x_3 \leq 40$ and $x_1, x_2, x_3 \geq 0$

(b) A cloth trader has rolls of clothes for selling. Each roll of cloth is of 100 m in length and 48 m in width. This roll can be used in width 6, 8, 12 and 20 cm. So, the trader has to cut the cloth roll such that loss is minimum in each width. It has minimum demand and possible cutting alternatives as follows. Formulate LP such that the trimming loss is minimum. **07**

	Width of rolls (cm)				
Alternatives	**6**	**8**	**12**	**20**	**Waste (cm)**
1	4	3	-	-	-
2	-	3	2	-	-
3	1	1	1	1	1
4	-	-	2	1	2
5	-	4	1	-	2
Demand	1000	1600	2600	1500	

OR

(b) Use graphical method to solve the following LPP: **07**

Maximize $Z = 2x_1 + 3x_2$

Subject to $2x_1 + x_2 \leq 30$

$x_1 \geq 3;$

$x_2 \leq 12$ and $x_1, x_2 \geq 0.$

Q.3 **(a)** Find out optimal solution for following transportation problem using VAM and MODI method. **07**

	1	2	3	4	5	Supply
A	40	30	10	20	60	80
B	50	20	30	40	50	60
C	30	50	60	30	20	40
D	20	40	40	50	30	20
Demand	60	60	30	40	10	200

(b) Using PERT find critical path for given activities. Also calculate variance and standard deviation for each activity. **07**

Activity	t_o	t_m	t_p	Activity	t_o	t_m	t_p
1-2	6	9	12	3-5	1	1.5	5
1-3	3	4	11	2-6	5	6	7
2-4	2	5	14	4-6	7	8	15
3-4	4	6	8	5-6	1	2	3

OR

Q.3 **(a)** The captain of cricket team has to allot five middle batting positions to six batsmen available for selection. The average runs scored by each batsman at these positions are as follows: **07**

Batting Position → I II III IV V

Batsman ↓

	I	II	III	IV	V
A	40	40	35	25	50
B	42	30	16	25	27
C	50	48	40	60	50
D	20	19	20	18	25
E	58	60	59	55	53
F	45	52	38	50	49

Using assignment model, determine the assignment of batsmen to positions which would give maximum runs in favor of team. Which batsman will not qualify for selection based on the solution obtained?

(b) Determine the Critical path for given activities: **07**

Activity	Duration	Activity	Duration	Activity	Duration
1-2	10	2-6	3	5-7	7
1-3	6	3-8	12	6-7	15
1-4	7	4-6	9	7-9	4
2-5	3	4-8	8	8-9	6

Q.4 **(a)** Explain different types of queuing system using of six character code. **07**

(b) Company has purchased machine A costing Rs. 4500 and it has estimated operating cost of Rs. 100 for the first year increasing by Rs. 1000 per year in the second and subsequent years. Now, after six months due to technological advancement machine B was introduced costing Rs. 5000. Its operating cost is Rs. 200 for the first year, increasing by Rs. 400 in second year and subsequent years. Now, company is thinking to buy the machine B. Suggest him optimal time. Consider resale value as zero for both machines. **07**

OR

Q.4 **(a)** Explain the elements of queuing system. **07**

(b) A machine cost Rs 500. Operation and maintenance cost are zero for the first year and increases by Rs. 100 every year. If money is worth 5% every year, determine the best age at which the machine should be replaced. The resale value of the machine is negligibly small. What is the weighted average cost of owning and operating the machine? **07**

Q.5 **(a)** A toll booth owner is presently using a manual system having service rate of 10 vehicles per minutes. On an average 8 vehicles are coming in minute. Calculate: **07**

1. Utilization factor of booth operator
2. Idle time for booth operator in a day having working hour of 8 hours
3. Number of persons waiting in the system
4. Number of persons waiting in the queue
5. Average waiting time in the queue
6. Total time spent in the system

(b) Discuss the different methods for random number generation. **07**

OR

Q.5 **(a)** Customers arrive at a one window drive according to the poisons distribution with the **07**

mean of 10 minutes and service time per customer is exponential with mean of 6 minutes. The space in front of the window can accommodate only three vehicles including the serviced one. Other vehicles have to wait outside the space. Calculate:

1. Probability that an arriving customer can drive directly to the space in front of the window
2. Probability that an arriving customer will have to wait outside the directed space.
3. How long an arriving customer is expected to wait before getting the service?

(b) Discuss techniques for resource smoothing and allocation for project management. **07**

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