Con. 253-15 RQ-2407 June 2015

(3 Hours) [Total Marks :100

N.B. (1) Answer any **five** questions.

(2) **Figures** to the **right** indicate **full** marks.

Section A - Production

1. Maximize $z = 5x_1 + 7x_2$ 20

   Subject to $-2x_1 + 3x_2 \leq 6$

   $6x_1 + x_2 \leq 30$

   $x_1, x_2 \geq 0$ and integer.

2. Maximize $Z = 3x_1 + 4x_2$ 20

   Subject to $5x_1 + 4x_2 \leq 200$

   $3x_1 + 5x_2 \leq 150$

   $5x_1 + 4x_2 \geq 100$

   $8x_1 + 4x_2 \geq 80$

   $x_1, x_2 \geq 0$

   Solve by graphically.

3. A project is composed of the following 7 activities. 20

Activity :	1-2	1-3	1-4	2-5	3-5	4-6	5-6
t_o :	12	3	12	1	2	4	5
t_m :	15	4	22	1	5	5	6
t_p :	17	7	28	1	14	8	10

   Draw network. Identify all the parts through it. Identity critical path through it. Find the 20 expected preject length.

4. Western travel agents have a trouring van that requires a special grade of fuel. During the 20 past few months the van's use has varried so much that the amount of fuel necessary for keeping the van operating has varried consideably. A study of the past 200 days reveals that demand for the car has fluctuated between 0 to 5 trips/week.

Trips/week :	0	1	2	3	4	5
Frequency :	16	24	30	60	40	30

   Using the following random numbers, simulate the demand for a ten week period.

   26, 84, 21, 38, 36, 73, 16, 81, 59, 83

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5. Man power requirement for each activity was as follows :   20

Activity :	1-2	2-3	2-4	2-5	3-7	3-4	4-7	5-6	6-7
No. of men required :	2	3	4	4	4	3	1	2	2

Schedule the activities with a view to smoothening out daily man power requirements.

6. Solve the following linear goal programming problem :   20

$\text{Min } Z = (o_3 + o_4, o_1, u_2, u_3 + 8/5\ u4)$

Subject to

$g_1 : x_1 + x_2 + u_1 - o_1 = 20$

$g_2 : x_1 + x_2 + u_2 - o_2 = 50$

$g_3 : x_1 + u_3 - o_3 = 15$

$g_4 : x_2 + u_4 - o_4 = 8$

$\qquad x_i, u_i, o_i \geq 0.$

When the goals are written in order of priority.

7. $\text{Max } Z = 4x_1 + 5x_2$ subject to   20

$x_1 + x_2 \geq 1$

$-2x_1 + x_2 \leq 1$

$4x_1 - x_2 \geq 1$

$x_1, x_2 \geq 0.$

8. A company uses exponential smoothening with trend to forecast monthly sales of its products,   20
which show a trend pattern. At the end of the week, 5 the company wants to forecast sales
for week 6. The trend through week 4 has been 20 additional cases sold per week. Average
sales have been 85 cases per week. The demand for week 5 was 90 cases. The company uses
$\alpha = .20$ and $\beta = .10$. Make a forecast including trend for week. 6.

(3 Hours) [Total Marks :100

N.B. (1) Answer any **five** questions.
(2) **Figures** to the **right** indicate **full** marks.

Section B - Finance

1. An item is sold for Rs. 25 per unit and it costs Rs. 10. Unsold items can be sold for Rs. 4   **20**
   each. It is assumed that there is no shortage penalty cost besides the lost revenue. The demand
   is known to be any value between 600 and 1000 items. Determine the optimum of number
   of units of the item to be stocked.

2. A man on his 50th birthday decides to make a gift of Rs. 10,000 on his 60th birthday. He   **20**
   decides to save this amount by making equal annual payments upto and including his 60th
   birthday to a fund which gives 5% compound interest, the first payment being made at once.
   Calculate the amount of each annual payment.

3. A manufacturing firm produces a single product whose selling price is Rs. 16 per unit and   **20**
   the variable costs per unit are Rs. 12. If the annual fixed costs of the firm are estimated as
   Rs. 1,20,000. Find the break even point is units in rupees and as a percentage of capacity if
   the firm has an estimated capacity of 50,000 units of the product. What is the margin of
   safety ?

4. A company has determined the following probability for net cash flows generated by a project.   **20**

Year 1		Year 2		Year 3	
Cashflow	Prob	Cashflow	Prob	Cashflow	Prob
2000/-	0.10	2000/-	0.20	2000/-	0.30
4000/-	0.20	4000/-	0.30	4000/-	0.40
6000/-	0.30	6000/-	0.40	6000/-	0.20
8000/-	0.40	8000/-	0.10	8000/-	0.10

Calculate the expected monetary values. Also calculate the present value of the expected
cost flow using 10% discount rate.

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5. Calculate the sum of money received by a person retiring at the age of 58 years if he wants **20** to commute his annual pension of Rs. 6,000/- for a present payment when compound interest is reckoned at 8% and the expectation of his life is assessed at 10 years only.

6. The annual demand of a product is 10,000 units. Each unit costs Rs. 100 if orders are placed **20** in quantities below 200 units but for orders of 200 or above the price is Rs. 95. The annual inventory holding cost is 10% of the value of his line and the ordering cost is Rs. 5 per order. Find economic lot size.

7. A pharmaceutical company has 8 medical representatives for allocation in 3 cities A, B, and **20** C. Past experience showed that brand loyalty brings some sales from these cities even if nobody is posted at these places. However sales increase with increased sales effort upto a certain point. Over emphasis of such efforts was found to have negative effect on sales. These ar quantified below :

City	Sales with no. of representatives posted in the city								units Rs. 1000
	0	1	2	3	4	5	6	7	8
A	75	81	95	115	130	145	165	150	130
B	80	85	105	122	130	150	140	125	110
C	100	120	135	160	170	160	140	115	90

Determine the optimum strategy of allocation of available 8 medical representatives without any constraint regarding the number to be posted in a particular city.

8. (a) A person deposits Rs. 1,200 in a bank for 4 years. How much will he get assuming an **20** interest rate of 11 %.

   (b) If the person plans investing Rs. 100 per year in a savings plan that earns 5% interest p.a. compounded annualy. What is the sum of annuity payments at this end of 12 years?

(3 Hours) [**Total Marks :100**

N.B.   (1) Answer any **five** questions.

(2) **Figures** to the **right** indicate **full** marks.

Section C - Marketing

1.   Minimize $y_1^2 + y_2^2 + y_3^2$ **20**

Subject to $y_1 + y_2 + y_3 = 10$

When   (a) y_1, y_2, y_3 are non negative

(b) y_1, y_2, y_3 are non negative integers.

2.   There are seven jobs each of which has to go through the machines A and B in the order AB.   **20**
Processing times in hours are given as :

Job :	1	2	3	4	5	6	7
Mach A :	3	12	15	6	10	11	9
Mach B :	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimise the total elapsed time T. Als find T
and idle time for machines A and B.

3.   If for a period of 2 hours in a day (8Am to 10 Am) trains arrive at the yard every 20 minutes   **20**
but the service time is 36 minutes. Calculate for this period.

(a) the probability that the yard is empty.

(b) the average number of trains at the yard line capacity of the yard is limited to 4
trains only.

4.   (a) A person depostits Rs. 1,200 in a bank for 4 years. How much will he get assuming an   **20**
interest rate of 11% ?

(b) If the person plans investing Rs. 100 per year in a savings plan that earns 5% interest
p.a. comounded annually. what is the sum of annuity payments at the end of 12 years ?

[TURN OVER

5. A particular item has a demand of 9,000 units 1 year. The cost of one procurrement is Rs. **20**
100 and the holding cost per unit is Rs. 2.40 per year. The replacement is instantaneous and
non shortages are allowed. Determine :
   (a) economic lot size
   (b) number of orders per year
   (c) time between orders
   (d) the total cost per year if the cost year if the cost of one unit is Rs. 1.

6. An initial forecast of 28 is given. If = α = 0.1 smooth expantially the following series. **20**
   $\qquad$ 30, 30, 23, 28, 25, 24, 29, 25.

7. What do you understand by decision tree analysis ? What is the node in a decision tree ? **20**
   What is backward pass ?

8. The reliability of a particular skin cost for TB is an follows. If the subject has TB, the test **20**
   comes back +ve 98% of the time. If this subject does not have TB the list comes back -ve
   99% of the time. From a large population in which 2 in every 10000 people have TB a
   person is selected at random and given the list which comes back +ve. What is the probability
   that the person actually has TB ?

(3 Hours) [Total Marks : 100

N. B. : (1) Answer any **five** questions.
(2) **Figures** to the **right** indicate **full** marks.

Section A Production

1. A farmer wants to customize his fertilizer for his current crop. He can buy plant 20
   food mix A and Plant food mix B. Each cubic yard of food A contains 20 pounds
   of phosphoric acid, 30 pounds of Nitrogen and 5 pounds of potash. Each cubic
   yard of food B contains 10 pounds of phosphoric acid, 30 pounds of nitrogen
   and 10 pounds of potash. He requires a minimum of 460 pounds of phosphoric
   acid, 960 pounds of nitrogen and 220 pounds of phosphoric acid, 960 poind of
   nitrogen, and 220 pounds of potash. If food A costs $ 30 per cubic yard and
   food B costs $ 35 per cubic yard, how many cubic yards of each food should
   the farmer blend it meet the chemical requirements at a minimal cost? What is
   this cost?

2. Solve the following LPP by graphical method. 20
   Minimise $Z = 20x_1 + 10x_2$
   Subject to $x_1 + 2x_2 \leq 40$
   $3x_1 + x_2 \geq 30$
   $4x_1 + 3x_2 \geq 60$
   $x_1, x_2 \geq 0.$

3. Write short notes on: 20
   (a) Branch and bound algorithm
   (b) Gomory's cutting plane algorithm.
   (c) EL envelope
   (d) Project monitoring and control.

4. Write the dual of the following prob primal 20
   Mini $Z = 2x_1 - 3x_2$
   Subject to $1x_1 + 2x_2 \leq 12$
   $4x_1 - 2x_2 \geq 3$
   $6x_1 - 1x_2 = 10$
   $x_1, x_2 \geq 0.$

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5. Use revised simplex method to solve the following problem.   20

    Max $z = 5x_1 + 8x_2 + 7x_2 + 4x_4 + 6x_5$

    Subject to $x_i \geq 0$ and

                  $2x_1 + 3x_2 + 3x_3 + 2x_4 + 2x_5 \leq 20$

                  $3x_1 + 5x_2 + 4x_3 + 2x_4 + 4x_5 \leq 30.$

6. Draw a network corresponding to the following information. Obtain the early and   20
late start and completion times. Determine the critical activities.

Activity:	1-2	1-3	2-6	3-4	3-5	4-6	5-6	5-7	6-7
Duration:	4	6	8	7	4	6	5	19	10

7. A home decorate manufactures two types of lamps Alpha, and Delta. Both these   20
lamps require the services of a cutter and a finisher. Alpha requires 3 hours of
cutter's time and 2 hours of finisher's time. Delta requires 2 hours of cutter's
time and 1 hour of finisher's time. The cutter has 180 hours and finisher 110
hours time each month. If one Alpha gives a profit of Rs. 10 and Delta a profit
of Rs. 7, formulate this LPP and solve this sum through simplex md.

8. Min $c = x_1 + x_2$ 20

    Subject to $x_1 + x_2 \geq 12$

                  $5x_1 + 8x_2 \geq 74$

                  $x_1 + 6x_2 \geq 24$

                  $x_1, x_2 \geq 0.$

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(3 Hours) [**Total Marks : 100**

N. B. : (1) Answer any **five** questions.
(2) **Figures** to the **right** indicate **full** marks.

Section B Finance

1. Solve the following problem graphically: 20
   Max $Z = -x_1 + 4x_2$
   Subject to $-3x_1 + x_2 \leq 6$
   $x_1 + 2x_2 \leq 4$
   $x_2 \leq -3$
   no lower bound constraint for x_1.

2. In a cattle feed mix problem cost per loss and protein content of its four ingredients 20
   were as follows:

Ingredient	1	2	3	4
Protein content %	50	10	15	35
Cost per ton (m)	45	25	28	32

   A minimum protein content of 18% was desired in the feed. Further a maximum
   of 20% of second and third ingredients together was allowed. If the feed was
   prepared in batches of one ton. Determine an optimum blend.

3. Max $Z = 2x_1 + 5x_2$ 20
   Subject to $x_1 + 4x_2 \leq 24$
   $3x_1 + x_2 \leq 21$
   $x_1 + x_2 \leq 9$
   $x_1, x_2 \geq 0.$
   use simplex method to solve the problem.

4. Write short notes on: 20
   (a) Duality in linear programming
   (b) Max-f low Min cut theorem
   (c) Liability curve
   (d) EL envelope

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5. (a) Solve the problem: 20

Max $Z = x_1 + 5x_2 + 3x_3$

Subject to $x_1 + 2x_2 + x_3 = 3$

$2x_1 - x_2 = 4$

$x_1, x_2, x_3 \geq 0.$

(b) If the objective function is changed to   20

Max $Z = 2x_1 + 5x_2 + 2x_3,$

find the new optimal solution.

6. Draw a network for the activities given in the table below: 20

Activity:	1-2	1-3	1-4	2-3	2-6	3-5	3-6	4-5	5-6
Duration: (days)	3	4	14	10	5	4	6	1	1

Find ES, LS, and finish time of activities.

Find TF, FF for each activities.

Find critical path activities and project duration.

7. Given a primal   20

Min $Z = 2x_1 + 3x_2 - 1x_3$

Subject to $5x_1 + 1x_2 + 1x_3 \geq 20$

$2x_1 + 1x2 + 3x3 = 24$

$1x_1 + 2x_2 - 1x_3 \leq 18$

Write the dual of the above primal.

8. Min $Z = 4y_1 + y_2$ 20

Subject to $3y_1 + y_2 = 3 + 3\lambda$

$4y_1 + 3y_2 \geq 6 + 2\lambda$

$y_1 + 2y_2 \leq 3 + 4\lambda$

$y_1, y_2, \lambda \geq 0.$

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(3 Hours) [**Total Marks : 100**

N. B. : (1) Answer any **five** questions.
(2) **Figures** to the **right** indicate **full** marks.

Section C Marketing

1. A town has six wards and they contains 170, 510, 640, 75, 250 and 960 houses   20
respectively. Make a random selection of 8 houses using the table of random
numbers. Explain the procedure adopted by you.

2. Activities their duration and crew sizes required to implement them are given   20
below:

Activity:	1-2	1-3	1-5	2-3	2-6	3-4	4-7	5-6	6-7
Duration:	10	6	5	0	8	10	10	7	5
Crew size:	1	2	3	0	1	2	3	1	2

3. Solve the following by graphical method.   20
Max $Z = 3x_1 + 4x_2$
Subject to $x_1 + x_2 \leq 450$
$2x_1 + x_2 \leq 600$
$x_1, x_2 \geq 0.$

4. A manufacturer of tennis rackets makes a profit of 15/- on each oversized racket   20
and 8/- on each standard racket. To meet dealer demand, daily production of
standard rackets should be between 30 and 80 and production of oversized rackets
should be between 10 and 30. To maintain high quality, the total number of rackets
produced should not exceed 80 per day. How many of each type of racket should
be manufactural daily to maximise the profit?

5. Explain the following with suitable examples: 20
(a) Cutting plane algorithm
(b) Gomory's constraint.

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6. Max $\quad$ $Z = 3x_1 + x_2 + 3x_3$ $\hspace{6cm}$ **20**
   Subject to $\quad$ $-x_1 + 2x_2 + x_3 \leq 4$
   $$2x_2 - \frac{3}{2} x_3 \leq 1$$
   $$x_1 - 3x_2 + 2x_3 \leq 3$$
   $$x_1, x_2, x_3 \geq 0 \text{ and integer}$$

7. Solve the following 3×3 matrix game whose pay off matrix is $\hspace{1.5cm}$ **20**

$$\begin{pmatrix} 3 & -1 & -3 \\ 2 & 3 & -1 \\ -4 & -3 & 3 \end{pmatrix}.$$

8. Explain the following: $\hspace{8cm}$ **20**
   (a) Resource smoothing
   (b) Resource analysis and scheduling
   (c) Integer Programming
   (d) branch and bound algorithm.

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Instructions:
- All questions carry equal marks.
- Attempt **any five** questions.

1. (a) Discuss the basic internal structure of a personal computer.

   (b) Identify the components of CPU and explain the role of each component.

2. (a) Explain how RAM, ROM and Cache memory guarantee smooth accessing of data and instructions in a computer?

   (b) What are storage devices in a computer. Compare various storage devices?s

3. (a) Discuss the need of operating systems. Write in brief about any two operating systems.

   (b) Discuss the development of programming languages.

4. Discuss Networking topologies, it's advantages, disadvantages and opportunities.

5. Define DBMS and RDBMS. Distinguish between DBMS and RDBMS.

6. Compare MIS, DSS and ERP systems.

7. Explain the role of computer in Operations Research.

8. Write short notes on:
   (a) Data Analysis.
   (b) Business Intelligence.
   (c) File Processing concepts.
   (d) Query Languages.

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Instructions:
- **Question 1 is compulsory** and attempt **any four** from the rest.
- Real life examples will receive more weightage.
- Answer must be brief and to the point.
- All questions carry **equal marks**.

1. BIPM (Brazil Institute of Product Maintenance) developed TPM (Total Productive Maintenance) as a model for Operation Excellence. It is based on following eight pillars (i) Autonomous Maintenance, (ii) Focussed Improvement, (iii) Quality Maintenance, (iv) Product maintenance, (v) Education and Training , (vi) Proactive (Early) Management, (vii) Safety, Health and Environment and (viii) Office and Administration. Write the contribution of OR techniques while addressing each of the above eight pillars.

Or

Write contribution of OR techniques to achieve breakthrough improvements in Primary Health Centres.

2. (a) Explain concept of Decision Support Systems and the role of OR in their development.

   (b) Highlight synergies between decision support systems and Information Systems towards overall improvement of bottom line of an organization.

3. (a) What are the impediments towards integration of OR department in a large organisation with Manufacturing and Service functions? Give your opinion. As a head of OR department how will you tackle such issues.

   (b) Highlight basic principles of Strategic Management and contribution of OR department in their fulfilment.

4. (a) Explain in brief any ten OR techniques and provide at least one application area for each of the techniques in Industry, Business, Marketing and Administration.

   (b) Explain the difference between Policy planning, Strategic planning and Operational planning by means of real life examples.

5. (a) Explain the interdisciplinary team approach in the organisational set up of OR department.

   (b) Describe various elements of MIS (Management Information System) and their linkages to project management.

6. Define Strategic, Tactical and Operational decisions and categorise them by providing a list of decision making areas with their functions, where Operation Research or other Quantitative Methods can be applied during setting up and during running the industry.

7. Write short notes on **any four** of the following:

   (a) Role of OR in the midst of Computer Revolution

   (b) Application of OR in road transport system.

   (c) Elements of MIS.

   (d) Relationship of OR and Lean Six Sigma.

   (e) Satisficing, Optimising and Adaptising.

   (f) Basic Principles of Strategic Management.