Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech(PE)/SEM-2/PEM-210/2013

2013

APPLIED OPERATIONS RESEARCH

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Graph sheet(s) will be supplied by the Institution.

Answer any *five* questions. 5 × 14 = 70

1. a) Briefly describe how operations research works as a quantitative approach for optimization of resource management.

   b) A company makes 2 kinds of bags *X* and *Y*. Bag *X* is a high-quality bag and bag *Y* is of lower quality. The respective profits are Rs. 4 and Rs. 3 respectively per bag. The production of each type *X* requires **twice** as much time as a bag of type *Y* and if all bags were of type *Y*, the company could make 1000 bags per day. The supply of raw materials is sufficient for only 800 bags per day (both *X* and *Y* combined). Bag *X* requires a fancy sticker and only 400 of these are available per day. There are only 700 stickers available a day for bag *Y*.

   What should be the daily production of each type of bag ? Formulate this problem as an LP model and solve it using the Simplex method. 4 + 10

2. a) A travelling salesman has to visit 5 (five) cities. He wishes to start from a particular city, visit each city once and then return to his starting point. The travelling cost (in Rs. '000) of each city from a particular city is given below :

		To City				
		A	***B***	***C***	***D***	***E***
From City	***A***	∞	2	5	7	1
	B	6	∞	3	8	2
	C	8	7	∞	4	7
	D	12	4	6	∞	5
	E	1	3	2	8	∞

What should be the sequence of visit of the salesman so that the cost is minimum ? Explain your answer.

b) "Assignment problem is a special case of transportation problem." Justify the statement with an example.

(5 + 2) + 7

3. Solve any *two* of the following LP problems graphically :

a) Maximize $Z = 3x_1 + 4x_2$

subject to the constraints :

i) $x_1 - x_2 = -1$;

ii) $-x_1 + x_2 \leq 0$;

$x_1, x_2 \geq 0$.

b) Maximize $Z = 6x_1 - 4x_2$

subject to the constraints :

i) $2x_1 + 4x_2 \leq 4$

ii) $4x_1 + 8x_2 \geq 16$

$x_1, x_2 \geq 0$.

c) Maximize $Z = x_1 + x_2/2$

subject to the constraints :

i) $3x_1 + 2x_2 \leq 12$

ii) $5x_1 = 10$

iii) $x_1 + x_2 \geq 8$

iv) $-x_1 + x_2 \geq 4$

$x_1, x_2 \geq 0$. 7 + 7

4. An airline company has drawn up a new flight schedule that involves five flights. To assist in allocating five pilots to the flights, it has asked them to state their preference scores by giving each flight a number out of 10. The higher the number, the greater is the preference. A few of these flights are unsuitable to some pilots owing to domestic reasons. They have marked with '×' .

	Flight Number				
	1	**2**	**3**	**4**	**5**
A	8	2	×	5	4
B	10	9	2	8	4
C	5	4	9	6	×
D	3	6	2	8	7
E	5	6	10	4	3

Pilot

What should be the allocation of the pilots to flights in order to meet as many preferences as possible ? 14

5. a) Compare and contrast PERT and CPM. Under what circumstances would you recommend the scheduling by PERT ? Justify your answer.

b) Explain the reasons for incorporating dummy activities in a network diagram. In what way do these differ from the normal activities ?

c) State the circumstances where CPM is a better technique than PERT in project management. 5 + 4 + 5

6. a) The activities and sequencing that are necessary for a maintenance job of a refinery are listed below :

Activities	***Description***	***Predecessor Activity***
A	Dismantle pipe connection	—
B	Dismantle heater, closure and floating front	*A*
C	Remove tube bundle	*B*
D	Clean bolts	*B*
E	Clean heater and floating head front	*B*
F	Clean tube bundle	*C*
G	Clean shell	*C*
H	Replace tube bundle	*F, G*
I	Prepare shell pressure test	*D, E, H*
J	Prepare tube pressure and reassemble	*I*

Draw a network diagram of activities for the project.

b) What are the major limitations of PERT model ? Explain. 10 + 4

7. The activities of a production schedule is listed below :

Activity	**Optimistic** (t_o)	***Completion time*** ***(Most expected*** t_m)	***Pessimistic time*** (t_p)
1 - 2	4	8	12
2 - 3	1	4	7
2 - 4	8	12	16
3 - 5	3	5	7
4 - 5	0	0	0
4 - 6	3	6	9
5 - 7	3	6	9
5 - 8	4	6	8
7 - 9	4	8	12
8 - 9	2	5	8
9 - 10	4	10	16
6 - 10	4	6	8

Represent the above activities in the form of a network chart and determine the following :

a) Critical path

b) Earliest and Latest Expected Time

c) Probability of completing the project within scheduled completion of 48 days. 4 + 6 + 4

8. Write short notes on any *four* of the following : $4 \times 3\frac{1}{2}$

a) GERT

b) LOB

c) Opportunity Cost

d) Float

e) Artificial variable

f) Integer Linear Programming.