

**COLLEGE OF ENGINEERING, PUNE**  
(An Autonomous Institute of Government of Maharashtra)

**End Semester Examination**

**(PE-401) Operations Research**  
**Programme: B .Tech (Production Sandwich)**

Semester I  
Duration: 3 hrs.

Year: 2012-13  
Max. Marks:50  
Date: 29/11/2012

**Instructions:**

1. Solve any five questions.
2. Figures to right indicate full marks
3. Assume suitable data if required

- Q 1 a** A Manufacturer of leather belts makes three types of belts A, B and C which are processed on three machines M1 , M2, and M3. Belt A requires 2 hours on Machine M1 and 3 Hours on M3. Belt B requires 3 hours on Machine M1, 2 hours on M2 and 2 Hours on M3. Belt C requires 5 hours o M2 and 4 Hours on M3. There are 8 hours per day available on M1, 10 hours on M2, and 15 hours on M3. The profit gained from belt A is Rs. 3 per unit, belt B is Rs. 5 per unit and belt C is Rs. 4 per unit. What should be the daily production so as to maximize the profit. **8**
- b** State and explain the distinguishing characteristics of dynamic programming. **2**
- Q 2 a** A company has a team of four salesmen and there are four districts where the company wants to start its business. After taking into account the capabilities of the salesmen and the nature of districts, the company estimates that the profit per day in rupees for each salesman in each district is as follows. **5**

		District			
		1	2	3	4
Salesman	A	16	10	14	11
	B	14	11	15	15
	C	15	15	13	12
	D	13	12	14	15

Find the assignment of salesmen so as to maximize the profit.

- b** Goods trucks arrive at a stockyard with a mean of 8 trucks per hour. A crew of 4 operators can unload the truck in 6 minutes. Trucks waiting in the queue are to be unloaded are paid a waiting charge at the rate of Rs. 60 per hour. Operatives are paid at the rate of Rs. 20 per hour. It is possible to augment the crew strength to 2 or 3 when the unloading time will be 4 minutes or 3 minutes respectively per truck. Find the optimal crew size. **5**

Q 3 a Solve the following game using analytical method.

5

		Player B				
		I	II	III	IV	V
Player A	1	4	2	0	2	1
	2	4	3	1	3	2
	3	4	3	7	-5	2
	4	4	3	4	-1	2
	5	4	3	3	-2	

b Solve the following game using graphical method and find the value of the game.

5

		Player B				
		1	2	3	4	5
Player A	1	-5	5	0	-1	8
	2	8	-4	-1	6	-5

Q 4 a Four jobs are to be processed on each of the five machines A,B, C, D, and E in the same order. Find the total minimum time elapsed if no passing is permitted. Also determine the idle time for each job and each machine.

5

M/C Job	A	B	C	D	E
1	7	5	2	3	9
2	6	6	4	5	10
3	5	4	5	6	8
4	8	3	3	2	6

b A computer contains 10,000 resistors. When any resistor fails, it is replaced. The cost of replacing individual resistor is Re. 1 only. If all resistors are replaced at the same time, cost per resistor would reduce to 35 paise. The percent surviving at the end of month t is given below. What is the optimum replacement plan?

5

Month	0	1	2	3	4	5	6
% surviving	100	97	90	70	30	15	0

Q 5 A Project is to be scheduled based on different activities. The precedence of these activities and the durations are given below. Draw the network and find the total duration, critical path for the project. Find the probability that the project can be completed in 60 days and 65 days. The precedence and activity durations are as given below.

10

A < D; B < E,F; C,F < H; E < G,K; D,G < I,J; H < L; I < M; J,K < N; L < O.

Activity	Optimistic time	Most likely time	Pessimistic time
A	6	9	12
B	4	7	8
C	7	10	13
D	8	10	12
E	12	15	18
F	6	8	10
G	9	11	12
H	13	18	25
I	14	17	20
J	17	20	25
K	7	10	13
L	10	14	16
M	3	5	9
N	1	4	7
O	13	18	25

**Q 6** The following table gives data on normal time and crash time and also the costs. **10**  
 Draw the network, identify critical path. What is the normal project duration and associated cost? Crash the relevant activities and find the optimum cost duration and the optimum duration. Indirect cost per day is Rs. 100 per week.

ACTIVITY	Normal Duration	Crash Duration	Normal Cost	Crash Cost
1-2	5	3	600	800
1-3	6	3	500	550
2-4	6	3	700	1030
2-5	8	6	800	900
3-5	7	4	600	750
3-6	8	6	900	1200
4-7	7	3	700	1500
4-9	9	6	300	780
5-7	5	2	600	810
6-8	9	5	700	780
7-11	4	2	600	660
8-10	6	4	900	980
9-12	8	6	600	780
10-11	7	3	600	840
11-12	8	5	800	950