minimize the total time required to turn out all the books :

Book	1	2	3	4	5	6
Printing Time	30	120	50	20	60	110
Binding Time	80	100	90	60	30	10

(12.5)

6. (a) Define a queue. What do you mean by 'Poisson' arrivals and 'Exponential' Services ?

In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that arrival time and service time distribution follows an exponential distribution with an average of 30 minutes, calculate the following :

(i) The mean queue size.

(ii) The probability that the queue size exceeds 10.

(iii) If the input of the train increases to an average of 33 per day, what will be the change in part (i) and (ii) ?

(12.5)

OR

(b) Why is there a need of replacement of equipments which fail suddenly ? A manufacturing firm has come to know from his past records that a machine costing Rs. 56,000/- is not working satisfactorily inspite of its regular maintenance. With a view to replacing this machine the following facts were obtained :

Year	1	2	3	4	5	6	7	8
Annual Running Cost (Rs)	7000	9100	11900	15400	20300	26600	33600	42000
Resale Value (Rs)	28000	14000	8400	4200	3500	3000	3000	3000

When should the machine be replaced ?

MBA.

(SEM. II) THEORY EXAMINATION 2013-14

OPERATIONS RESEARCH

Time : 3 Hours   *Total Marks : 100*

Note :– Attempt **all** Sections.

SECTION–A

1. Attempt any **four** from following :   (5×4=20)

(a) Discuss characteristics of M/M/I Queue Model.

(b) How PERT and CPM techniques are useful in managerial decision-making ?

(c) What is the role of Operations Research in decision-making ?

(d) Show that assignment model is a special case of Transportation Problem ?

(e) What are some of the limitations of use of Operations Research Models in business decision making ?

(f) Write short note on Johnson Algorithm for n jobs and 3 machines.

SECTION–B

2. Attempt any **two** of the following :   (2×15=30)

(a) Solve the following L.P.P.

Max $Z = 100x + 60y + 40z$

Subject to :

$x + y + z \leq 100$

$10x + 4y + 5z \leq 600$

$2x + 2y + 6z \leq 300$

$x, y, z \geq 0.$

(b) A small project consists of the following jobs whose precedence relationship is given below :

Job	1-2	1-3	2-3	2-5	3-4	3-6	4-5	4-6	5-6	6-7
Duration (days)	15	15	3	5	8	12	1	14	3	14

(i) Draw an arrow diagram representing the project.

(ii) Find the critical path and total duration.

(iii) Calculate the floats.

(c) Use the graphical method to solve the following L.P.P problem :

Minimize $Z = 20x + 10y$

Subject to :

$x + 2y \geq 40$

$3x + y \geq 30$

$4x + 3y \geq 60$

$x, y \geq 0$

SECTION–C   **(4×12.5=50)**

3. (a) What are the techniques used to solve decision-making problems under uncertainty ?

OR

(b) A physician purchases a particular vaccine on Monday each week. The vaccine must be used within the following week, otherwise it become worthless. The vaccine costs Rs. 30 per dose and the physician charges Rs. 50 per d In the past 50 weeks, the physician has administered the vaccine in the following quantities :

Doses per week	20	30	50	60
Number of weeks	5	15	20	10

Determine how many doses does the physician buy every week.

4. (a) Discuss areas of application for Transportation Problems? Find an optimal solution to the following transportation problem :

To → From ↓	X	Y	Z	Supply
A	2	7	4	50
B	3	3	7	70
C	5	4	1	80
D	1	6	2	140
Demand	70	90	180	

OR

(b) "Linear Programming is one of the most frequently and successfully used operations research technique to managerial and business decisions". Elucidate.

5. (a) What do you mean by Pure and Mixed Strategy game ? For the following two-person-zero-sum game, find the optimal strategies for the two players and the value of the game :

Player B

		B1	B2	B3
	A1	5	9	3
Player A	A2	6	−12	−11
	A3	8	16	10

If the saddle point exists, determine it using the principle of dominance.   **(12.5)**

OR

(b) A book binder has one printing press, one binding machine and manuscripts of a number of different books. The times required in minutes to perform the printing and binding operations for each book are known. We wish to determine the order in which books should be processed in order to