

BACHELOR OF MECHANICAL ENGINEERING
4th YEAR 2ND SEM. EXAMINATION, 2019

Subject: OPERATIONS RESEARCH

Time: Three hours

Full Marks:100

Answer any Five Questions

1. a) Define Operations Research. Give the main characteristics of Operations Research. (05)
- b) Describe four models used in Operations Research. (05)
- c) The advertising manager of Skylark Ltd has a budget of Rs.200,000 for the annual sales campaign for a particular year. The current advertisement proposal is to promote the Baggies through two leading fashion magazines, *Fashion Today*, and *Look*. The unit cost of an ad in *Fashion Today* is Rs. 2,000 and that of *Look* is Rs.3,500. Past experience shows that during the sales campaign the company will need at least 25 ads to appear in *Look*. *Fashion Today* is a monthly magazine and not more than one insertion is desired in one issue. The expected effective readership for unit ad in *Fashion Today* is 40 thousand and for *Look* it is 55 thousand. Formulate a suitable linear programming which will maximise effective readership for the company's advertisements. (10)
2. a) Briefly explain the different decision rules usually adopted in context of decision-making under condition of uncertainty. (05)
- b) Considering the linear programming model, solve it using Simplex Method. (15)
- Maximize $Z=6X_1+8X_2$
- Subject to $5X_1+10X_2 \leq 60$
- $4X_1+4X_2 \leq 40$
- X_1 and $X_2 \geq 0$
3. a) What are useful aspects of Duality in L.P.P? (04)
- b) In LPP; define the terms: i. Basic Solution ii. Basic Feasible Solution
iii. Degenerate Solution (06)
- c) A company has four salesmen who are to be assigned to four different sales territories. The monthly increases, estimated for each salesman in different territories (in lakh rupees), are shown in the following table: (10)

Salesmen	Sales territories				
	I	II	III	IV	V
A	75	80	85	70	90
B	91	71	82	75	85
C	78	90	85	80	80
D	65	75	88	85	90

Suggest optimal assignment for the salesman. Which sales territory will remain unassigned? What will be the maximum sales increase every month?

If for certain reasons salesman D cannot be assigned to territory III, will the optimal assignment be schedule be different? If so, show the new assignment schedule/schedules.

[Turn over

4. a) Formulate Transportation Problem (TP). Is this an LPP? (05)
 b) Explain Maxi-Min and Min-Max principle used in Game Theory. (05)
 c) In an engineering workshop, motors breakdown at an average rate of 5 per day, the number of breakdowns being Poisson distributed. The present unqualified machine can repair motors at an average of six per day and is paid a daily wage of Rs 100 .A qualified mechanic offers his services at a daily wage of Rs. 200 and is capable of repairing, on an average, eight motors per day. Whenever a motor is idle, there is downtime cost incurrence at the rate of Rs 100 per day .Would it be worthwhile to employ the qualified mechanic in lieu of the present mechanic? Justify on cost/benefit analysis. (10)

5. a) Explain the basic Queuing process. (03)
 b) Describe Kendall's Notation for representing Queuing model (03)
 c) A project consists of the following activities: (14)

Activity	Immediate predecessors	Time(Weeks)
A	-	6
B	-	9
C	A	9
D	B,C	3
E	B,C	12
F	D	6
G	E,F	3

- (i) Draw a project diagram
 (ii) Complete the ES, EF, LS, and LF of each activity.
 (iii) What is the project completion time? Which of the activities must be completed in time so that the project may be completed in time?
 (iv) If, for activity E, the immediate predecessors are not B and C, but D, how would, if at all, it affect the project duration?
6. a) A manufacturer of toys makes two types of toys ,A and B. processing of these toys is done on two machines X and Y. Toy A requires two hours on machine X and six hours on machine Y. Toy B requires four hours on machine X and five hours on machine Y. There are 18 hours of time per day available on machine X and 30 hours on machine Y. The profit obtained on both the toys in same, that is Rs25 per toy. What should be the daily production of each of the two toys? (A non-integer solution for this problem will not be accepted.) (14)
 b) In Project scheduling, explain: Crashing, Dummy activities and Float. (06)

7. a) Write the dual problems for the following linear programmes: (05)

$$\begin{aligned} &\text{Maximise } 6x_1+4x_2+6x_3+x_4 \\ &\text{Subject to} \\ &4x_1+5x_2+4x_3+8x_4=21 \\ &3x_1+7x_2+8x_3+2x_4 \leq 40 \\ &x_1, x_2, x_3, x_4 \geq 0 \end{aligned}$$

- b) For a Game with the following pay off matrix, determine the optimal strategies and value of the Game: (10)

A	<table style="border-collapse: collapse; margin: 0 auto;"> <tr> <td style="padding: 0 10px;">B</td> <td></td> </tr> <tr> <td style="padding: 0 10px;">6</td> <td style="padding: 0 10px;">-3</td> </tr> <tr> <td style="padding: 0 10px;">-3</td> <td style="padding: 0 10px;">0</td> </tr> </table>	B		6	-3	-3	0
B							
6	-3						
-3	0						

- c) Write an explanatory note on Sensitivity Analysis? (05)