**SUBJECT CODE :  11MT/PE/OR34**

**M. Sc. DEGREE EXAMINATION, NOVEMBER 2015**
**BRANCH I  - MATHEMATICS**
**THIRD SEMESTER**

COURSE     :  ELECTIVE
PAPER       :  OPERATIONS RESEARCH
TIME         :  3 HOURS                                    MAX. MARKS :   100

**SECTION – A**                            ( 5 X 2 = 10 )
**ANSWER ALL THE QUESTIONS**

1.  Define operations research.
2.  State the limitations of the graphical method of solving a linear programming problem.
3.  What do you mean by balanced and unbalanced transportation problem? Explain how to convert unbalanced into a balanced one?
4.  Define total elapsed time and idle time in sequencing problem.
5.  What is the significance of the total float with regard to the resources available for a project?

**SECTION – B**                            ( 5 X 6 = 30 )
**ANSWER ANY FIVE QUESTIONS**

6.  What are the different phases of operations research?

7.  Alpha Heavy Engineering Company produces earthmovers and harvesters. Each product passes through two assembly departments A and B, which respectively, have 300 hours and 320 hours of available time for the next month's production. Each earthmovers requires 20 hours in department A and 40 in department B and each harvester requires 30 hours in department A 20 hours in department B. The two products are tested in a third department. Each earthmovers is given 60 hours of testing and each harvester 20, and as per the agreement with the labour union, the total labour hours devoted to testing cannot fall below 270. The management has the operating policy of manufacturing at least one harvester for every two earthmovers produced. A major customer has placed an order for a minimum of 5 earthmovers and harvesters (in any combination, whatever) for next month, and so at least that many must be produced. Each earthmovers gives a profit of Rs.10,000 and each harvester Rs.8,000. FORMULATE the above as a linear programming problem.

8.  Find the initial basic feasible solution for the following transportation problem:

| | | Distribution Centers | | | | Availability |
|---|---|---|---|---|---|---|
| | | D1 | D2 | D3 | D4 | |
| ORIGIN | S1 | 11 | 13 | 17 | 14 | 250 |
| | S2 | 16 | 18 | 14 | 10 | 300 |
| | S3 | 21 | 24 | 13 | 10 | 400 |
| Requirements | | 200 | 225 | 275 | 250 | |

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9. Consider the problem of assigning five jobs to five persons. The assignment costs are given as follows, determine the optimum assignment schedule.

JOBS

|  |  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| | A | 8 | 4 | 2 | 6 | 1 |
| | B | 0 | 9 | 5 | 5 | 4 |
| PERSON | C | 3 | 8 | 9 | 2 | 6 |
| | D | 4 | 3 | 1 | 0 | 3 |
| | E | 9 | 5 | 8 | 9 | 5 |

10. Seven jobs go first over machine 1 and then over machine 2. Processing times in hours are given as:

| Job | : | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|
| Machine 1 | : | 6 | 24 | 30 | 12 | 20 | 22 | 18 |
| Machine 2 | : | 16 | 20 | 20 | 12 | 24 | 2 | 6 |

Find the optimal sequence in which jobs should be processed.

11. Construct the network for the project whose activities and their precedence relationship are as follows:

$A < C, D, I;$   $B < G, F;$   $D < G, F;$   $F < H, K;$   $G, H < J;$   $I, J, K < E$

12. Construct the network for the project whose activities are given below and calculate the earliest start, earliest finish, latest start and latest finish of each activity.

| Activity | : | 0-1 | 1-2 | 1-3 | 2-4 | 2-5 | 3-4 | 3-6 | 4-7 | 5-7 | 6-7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Duration (weeks) | : | 3 | 8 | 12 | 6 | 3 | 3 | 8 | 5 | 3 | 8 |

**SECTION – C** ( 3 X 20 = 60 )
**ANSWER ANY THREE QUESTIONS**

13. What are the different types of models and mention the characteristics of a good model?

14. A Company manufactures two types of cloth, using three different colours of wool, one yard length of type A cloth require 4 OZ of red wool, 5 OZ of green wool and 3 OZ of yellow wool. One yard length of type B cloth requires 5 OZ of red wool, 2 OZ of green wool and 8 OZ of yellow wool. The wool available for manufacturer is 1000 OZ of red wool, 100 OZ of green wool and 1200 OZ of yellow wool. The manufacturer can make a profit of Rs.5 on one yard of type A cloth and Rs.3 on one yard of type B cloth. Find the best combination of the quantities of type A and type B cloth which gives him maximum profit by solving the LPP graphically.

15. An automobile workshop wishes to put four mechanics to four different jobs. The mechanics have somewhat different kinds of skills and they exhibit different levels of efficiency from one job to another. The manager of the workshop has estimated the number of manhours that would be required for each job-man combination as follows:

| Job \ Mechanic | A | B | C | D |
|---|---|---|---|---|
| 1 | 5 | 3 | 2 | 8 |
| 2 | 7 | 9 | 2 | 6 |
| 3 | 6 | 4 | 5 | 7 |
| 4 | 5 | 7 | 7 | 8 |

Find the optimum assignment that will result in minimum manhours needed.

16. Find the sequence that minimizes the total elapsed time required to complete the following tasks on two machines, also compute the idle time.

| Job : | I | II | III | IV | V | VI | VII | VIII | IX |
|---|---|---|---|---|---|---|---|---|---|
| Machine A : | 4 | 10 | 8 | 18 | 12 | 16 | 14 | 10 | 8 |
| Machine B : | 12 | 16 | 14 | 8 | 6 | 18 | 6 | 16 | 22 |

17. A project consists of the following activities and time estimates:

| Activity | Least Time (days) | Greatest Time (days) | Most Likely Time (days) |
|---|---|---|---|
| 1-2 | 3 | 15 | 6 |
| 1-3 | 2 | 14 | 5 |
| 1-4 | 6 | 30 | 12 |
| 2-5 | 2 | 8 | 5 |
| 2-6 | 5 | 17 | 11 |
| 3-6 | 3 | 15 | 6 |
| 4-7 | 3 | 27 | 9 |
| 5-7 | 1 | 7 | 4 |
| 6-7 | 2 | 8 | 5 |

(a) Draw the network
(b) What is the probability that the project will be completed in 27 days?
(c) What due date has about 90% chance of being met?

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