**Name:**

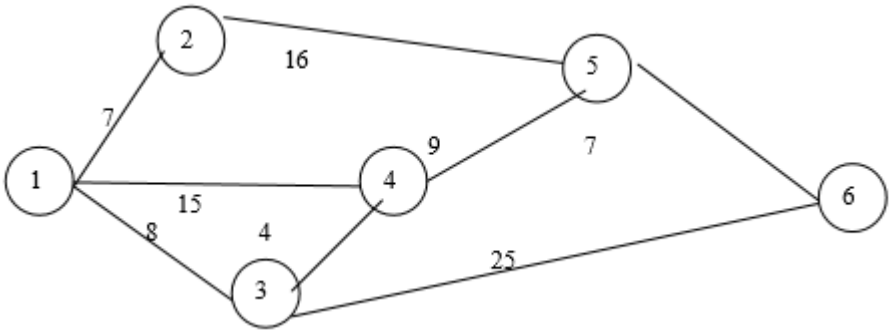
**Enrolment No:**

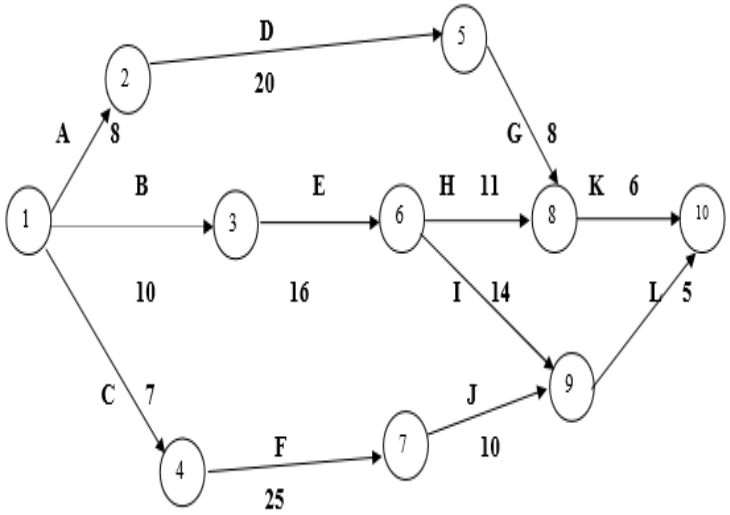
# UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

## END Semester Examination, May 2019

**Programme Name:** B.Tech(ADE) **Semester :** VIII
**Course Name :** Operation Research (Elective) **Time :** 03 hrs
**Course Code :** ADEG 461 **Max. Marks :** 100
**Nos. of page(s) :** 5

## SECTION A

| S. No. | | Marks | CO |
|---|---|---|---|
| Q 1 | Determine the shortest path of the following network activities and duration(Hours):<br>  | 5 | CO4 |
| Q 2 | Describe different techniques of O.R. | 5 | CO1 |
| Q 3 | Solve the following game strategy by using the principle of dominance and find value of the game. Determine to whom the game favors with the trails.<br>Player B<br>Player A<br>I II III IV V VI<br>1 4 2 0 2 1 1<br>2 4 3 1 3 2 2<br>3 4 3 7 –5 1 2<br>4 4 3 4 1 2 2<br>5 4 3 3 –2 2 2 | 5 | CO5 |
| Q 4 | Find out the completion time (Hours) and the critical activities for the following | 5 | CO4 |




**SECTION B**

| | | | |
|---|---|---|---|
| Q 5 | Solve the following linear programming problem using **two phase** method.<br>Minimize 6X + 3Y<br><br>Subject to : X + Y ≥ 1<br>2X − Y ≥ 1<br>3Y≤ 2<br>X,Y > 0. | **10** | **CO2** |
| Q6 | The estimates of time in days of the activities of a project are as follows:<br><br>Determine the critical activities, variance, standard deviation and the project completion time using PERT. | **10** | **CO4** |
| Q 7 | Explain the various steps in the O.R. development process.<br><br>**OR** | **10** | **CO1** |

| Activity | Predecessor Activity | Optimistic time estimate ($t_o$ days) | Most likely time estimate ($t_m$ days) | Pessimistic time estimate ($t_p$ days) |
|---|---|---|---|---|
| A | - | 2 | 5 | 8 |
| B | A | 2 | 3 | 4 |
| C | A | 6 | 8 | 10 |
| D | A | 2 | 4 | 6 |
| E | B | 2 | 6 | 10 |
| F | C | 6 | 7 | 8 |
| G | D, E, F | 6 | 8 | 10 |

| | | | |
|---|---|---|---|
| | Discuss the applications and the limitations of O.R. | | |
| Q 8 | TOBO Toy Company assembles three types of toys: trains, trucks and cars, using three operations. Available assembly times for the three operations are 430,460 and 420 minutes per day, respectively, and the revenues per toy train, truck and car are Rs. 3, 2 and 5, respectively. The assembly times per train for the three operations are 1, 3 and 1 minutes, respectively. The corresponding times per truck and per car are (2,0,4) and (1,2,0) minutes (a zero time indicates that the operation is not used). Formulate the LPP and find the optimum solution. | **10** | **CO2** |
| | **SECTION C** | | |
| Q9 | | **20** | **CO5** |

| Job | Machine | | | | | |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| 1 | 7 | 5 | 2 | 3 | 9 | 0 |
| 2 | 6 | 6 | 0 | 5 | 10 | 12 |
| 3 | 5 | 4 | 5 | 6 | 8 | 10 |
| 4 | 7 | 3 | 8 | 11 | 0 | 9 |
| 5 | 0 | 8 | 6 | 3 | 12 | 6 |
| 6 | 10 | 0 | 9 | 10 | 7 | 4 |
| 7 | 8 | 3 | 3 | 0 | 6 | 8 |

Find an optimal sequence for the following sequencing problem of seven jobs and six machines when passing is not allowed, of which processing time (in hours) is given below:

Also find (i) the total elapsed time (ii) Idle time for all the machines (iii) Idle time for the jobs if any.

| | | | |
|---|---|---|---|
| Q 10 | The Hard rock Concrete Company has plants in three locations and is currently working on three major construction projects, each located at a different site. The | **20** | **CO3** |

shipping cost per truckload of concrete, daily plant capacities, and daily project requirements are provided in the accompanying table.

a) Formulate an initial feasible solution to Hardrock's transportation problem using Vogal approx. Method. (6)

b) Then solve using the MODI method.(12)

c) Was the initial solution optimal?(2)

**OR**

**(a)** Determine an initial basic feasible solution to the following transportation problem using the North-West corner rule and least cost method given its distance in KM in table with the supply and requirements in TONS of a product.

| | **Warehouses** | | | |
|---|---|---|---|---|
| **Company** | A | B | C | **Supply** |
| W | 10 | 8 | 9 | 15 |
| X | 5 | 2 | 3 | 20 |
| Y | 6 | 7 | 4 | 30 |
| Z | 7 | 6 | 9 | 35 |
| **Requirement** | 25 | 26 | 49 | 100 |

(b)A marketing manager wants to assign salesman to four cities. He has four salesmen of varying experience. The possible profit (in hundreds) for each salesman in each city is given in the following table. Find out an assignment which maximizes the profit.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Cities** | | | | | |
| | | | **1** | **2** | **3** | **4** | | |
| | | **1** | 25 | 27 | 28 | 38 | | |
| | **Salesmen** | **2** | 28 | 34 | 29 | 40 | | |
| | | **3** | 35 | 24 | 32 | 33 | | |
| | | **4** | 24 | 32 | 25 | 28 | | |