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**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_\_

**End Semester Examination – April/May– 2017**

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| **Code :** | **16MA3004** | **Duration :** | **3hrs** |
| **Sub. Name :** | **APPLIED OPERATIONS RESEARCH** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| --- | --- | --- | --- | --- |
| Q. No. | Sub Div. | Questions | Course outcome | Marks |
| 1. | a. | What are the three basic elements of an Optimization Model? | CO1 | 4 |
| b. | What are the limitations of Operations Research techniques? | CO1 | 5 |
|  | c. | A company manufactures two products A and B. Both the products pass through two machines M1 and M2. The time required to process each unit of products A and B on each machine and the available machine capacity are given below:   |  |  |  | | --- | --- | --- | |  | Machine | | |  | M1 | M2 | |  | Processing time per unit (in hours) | | | A | 6 | 2 | | B | 4 | 4 | | Available capacity (Hours) | 3600 | 2000 |   The availability of materials is sufficient to produce 500 nos. of product ‘A’ and 400 nos. of product ‘B’. Each unit of product ‘A’ gives a profit of Rs. 25 and each unit of product ‘B’ gives a profit of Rs. 20. Construct a Linear Programming Model to determine the quantity of each product to be manufactured to maximize the profit. | CO2 | 12 |
| (OR) | | | | |
| 2. | a. | Explain the following terms using graphical representation of a Linear Programming Model:   1. Feasible Region 2. Infeasible constraints | CO2 | 10 |
|  | b. | Solve the following Linear Programming Problem using Graphical Method.  Maximize Z = 8 X1 + 6 X2  Subject to  2 X1 + X2 ≤ 1000  X1 + X2  ≤ 800  X1 ≤ 400  X2 ≤ 700  &  X1, X2 ≥ 0 | CO3 | 10 |
|  |  |  |  |  |
| 3. | a. | Define the following terms in connection with Transportation Model:   1. Basic feasible solution. 2. Optimal solution. 3. Degenerate solution | CO2 | 9 |
|  | b. | Obtain the initial basic feasible solution by North-West Corner rule for the following Transportation problem. The figures inside the table indicate the unit cost of transportation in rupees.     |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  |  | Destinations | | | | Availability | | Origins |  | D1 | D2 | D3 | D4 |  | | O1 | 11 | 9 | 7 | 10 | 120 | | O2 | 5 | 11 | 9 | 6 | 115 | | O3 | 4 | 7 | 8 | 6 | 210 | | O4 | 3 | 12 | 4 | 5 | 105 | | Requirement | | 95 | 115 | 140 | 200 | 550 | | CO2 | 11 |
| (OR) | | | | |
| 4. | a. | Explain the following three methods of solving Transportation problem:   1. North West Corner Rule. 2. Least Cost Method. 3. Vogel’s Approximation Method. | CO1 | 9 |
|  | b. | Obtain the initial basic feasible solution by Vogel’s Approximation method for the following Transportation problem. The figures inside the table indicate the unit cost of transportation in rupees.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  | Warehouses | | | Availability | | P | Q | R |  | | Plants | A | 13 | 11 | 8 | 30 | | B | 14 | 16 | 13 | 40 | | C | 12 | 10 | 12 | 30 | | Requirement | | 45 | 35 | 20 | 100 | | CO2 | 11 |
|  | | | | |
| 5. | a. | Define an Assignment Model. | CO1 | 5 |
|  | b. | How will you solve an Assignment problem with Maximization objective? | CO2 | 5 |
|  | c. | A Machine Tool company decides to make four sub-assemblies through four contractors. Each contractor is to receive only one sub-assembly. The cost of each sub-assembly is determined by the bids submitted by each contractor  (in thousands of rupees)and is shown in the table below:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  | Contractors | | | | |  |  | I | II | III | IV | | Sub-assemblies | A | 15 | 13 | 14 | 17 | | B | 11 | 12 | 15 | 13 | | C | 13 | 12 | 10 | 11 | | D | 15 | 17 | 14 | 16 |   Solve the problem using Hungarian Method and arrive at the optimal assignment. | CO3 | 10 |
| (OR) | | | | |
|  |  |  |  |  |
| 6. | a. | Explain the methodology of solving the sequencing problem of processing ‘n’ jobs through three machines. | CO2 | 8 |
|  | b. | There are seven jobs, each of which has to go through the machines A and B in the order A → B. The processing time (in hours) are given below.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Job | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | Machine -A | 3 | 12 | 15 | 6 | 10 | 11 | 9 | | Machine - B | 8 | 10 | 10 | 6 | 12 | 1 | 3 |   Determine the sequence of the jobs that will minimize the total elapsed time. Find the total elapsed time and the idle time for machines ‘A’ and ‘B’. | CO3 | 12 |
| 7. | a. | What are the reasons for the replacement of machines/equipments? What is the logic behind determining the replacement time? | CO1 | 6 |
|  | b. | The cost of a machine is Rs. 61,000. And its scrap value is Rs. 1000. The maintenance costs assessed from experience are found to be as shown in the table below:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | Maintenance Cost (Rs.) | 1000 | 2500 | 4000 | 6000 | 9000 | 12500 | 16000 | 20000 |   When should the machine be replaced? | CO3 | 14 |
| (OR) | | | | |
| 8. | a. | Define the following terms associated with Queuing Theory:  1. Balking  2. Reneging  3. Jockeying  4. Collusion  5.Service Mechanism | CO1 | 10 |
|  | b. | In a railway yard, goods trains arrive at a rate of 30 trains/day. The arrival rate follows Poisson distribution. The trains are serviced at an average rate of 40 trains/day. The service time follows exponential distribution.   1. What is the average number of trains in the queue? 2. What is the average number of trains in the system? | CO2 | 10 |
| **Compulsory:** | | | | |
|  |  |  |  |  |
| 9. | a. | Distinguish between CPM and PERT. | CO1 | 5 |
|  | b. | Draw the network diagram for the given data and arrive at the Critical Path.   |  |  |  | | --- | --- | --- | | Activity | Immediate Predecessor | Duration (in months) | | A | - | 2 | | B | - | 6 | | C | - | 4 | | D | B | 3 | | E | A | 6 | | F | A | 8 | | G | B | 3 | | H | C , D | 7 | | I | C, D | 2 | | J | E | 5 | | K | F, G, H | 4 | | L | F, G, H | 3 | | M | I | 13 | | N | J, K | 7 | | CO3 | 15 |