15MN751

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020
Mine Systems Engineering

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Define Systems Engineering. Explain in detail the scope of Mine Systems Engineering.
                                                                                    (04 Marks)
   b. Explain the characteristics and phases of Mine Systems Engineering.   **(04 Marks)**
   c. Solve the following by Graphical method :
      Max $Z = 3000x_1 + 2000x_2$
      Subject to $x_1 + 2x_2 \leq 6$
      $\qquad 2x_1 + x_2 \leq 8$
      $\qquad x_2 \leq 2$
      $\qquad x_2 - x_1 \leq 1$
      $\qquad x_1 , x_2 \geq 0.$ **(08 Marks)**

OR

2 a. What are the limitations of Systems Engineering?   **(02 Marks)**
   b. Define Linear program. Formulate mathematical formulation of L.P problems in terms of coal sector.   **(04 Marks)**
   c. Solve following by Simplex method
      Min $Z = x_2 - 3x_3 + 2x_5$
      Subject to $3x_2 - x_3 + 2x_5 \leq 7.$
      $\qquad - 2x_2 + 4x_3 \leq 12$
      $\qquad - 4x_2 + 3x_3 + 8x_5 \leq 10$
      $\qquad x_2 , x_3 , x_5 \geq 0.$ **(10 Marks)**

Module-2

3 a. Differentiate between Primal linear solution and Dual linear solution.   **(02 Marks)**
   b. Explain how simulation techniques helps information system in controlling and managing the mining activities.   **(04 Marks)**
   c. Solve the dual of the following Linear Programming Pattern :
      Minimize $Z = 2x_1 + 9x_2 + x_3$
      Subject to $x_1 + 4x_2 + 2x_3 \geq 5$
      $\qquad 3x_1 + x_2 + 2x_3 \geq 4$
      $\qquad x_1 , x_2 , x_3 \geq 0.$ **(10 Marks)**

OR

4 a. Define Optimal Solution. Differentiate between the basic feasible solution and optimal solution.   **(04 Marks)**
   b. Define Inventory Model. Enumerate different Inventory models.   **(04 Marks)**
   c. Solve the following LPP by Dual – Simplex method
      Min $Z = 6x_1 + x_2$
      Subject to $2x_1 + x_2 \geq 3$
      $\qquad x_1 - x_2 \geq 0$
      $\qquad x_1 , x_2 \geq 0.$ **(08 Marks)**

Module-3

5 a. What are the applications of transportation model interms of mineral sector? **(06 Marks)**

   b. Formulate transportation model for the mineral sector. **(08 Marks)**

   c. Coal India Limited operates three subsidiary coal mines A, B, C which provides 70, 30, 50 tons of coal respectively. Orders for 65, 42, 43 tonns per week has been received from thermal power plant P, Q, R respectively. Transportation cost in Rs / ton from each mine to each power plant are given below. Find the weekly optimum transportation schedule which minimize total expenditure. **(06 Marks)**

	P	Q	R
A	5	7	8
B	4	4	6
C	6	7	7

OR

6 a. The layout of mineral processing plant is being modified. Four new mineral processing equipments M_1, M_2, M_3 and M_4 are to be installed in mineral processing plant. There are 5 vacant places A, B, C, D and E available. Because of space constraints equipment M_L cannot be placed at C while M_3 cannot be placed at A. The cost of locating machines to vacant places is shown below. Find the optimum assignment schedule which space is left vacant after the assignment. **(08 Marks)**

	A	B	C	D	E
M_1	9	11	15	10	11
M_2	12	9	-	10	9
M_3	-	11	14	11	7
M_4	14	8	12	7	8

   b. A salesman has to visit fine mines A, B, C, D and E. The distance (in hundred miles) between five mines are as follows. If salesman starts from city A and has to come back to city A which route should be select to find total distance travelled in minimum. **(08 Marks)**

	A	B	C	D	E
A	-	7	6	8	4
B	7	-	8	5	6
C	6	8	-	9	7
D	8	5	9	-	8
E	4	6	7	8	-

Module-4

7 The three times estimates of a certain project are given below : **(16 Marks)**

Activity	Time Optimist	Time Normal	Time Pessimistic
0-1	2	3	4
1-3	15	16	17
1-2	3	6	9
1-4	6	10	14
2-3	4	8	12
3-4	3	5	7
4-5	2	3	4

   1) Draw network diagram, find control path.

   2) If the scheduled time for the end event is equal to earlier expected time of last event, find the probability of completion of project work.

   3) If the scheduled time is 28 days, find probability of completion of project work.

OR

8 a. Define PERT and CPM. **(02 Marks)**
   b. Differentiate between PERT and CPM. **(04 Marks)**
   c. Explain in detail how PERT and CPM helps mining sector for project scheduling. **(10 Marks)**

Module-5

9 An coal mine organization has one banskman on duty in the local mine of anytime. The banskman handles information regarding workmen information and shift timings. Assume that number of workmen receiving during any shift is Poisson distributed with an arrival rate of eight per hour and bankman can serve a workman in 6 minutes on an average, with an exponentially distributed service time.
   i)   What is the probability that the system is busy?
   ii)   What is the average time a workmen spends in system?
   iii) What is the average length of the queue?
   iv)   What is the average number of workmen in system? **(16 Marks)**

OR

10 Following pay off matrix for players A and B , use dominance property to obtain optimum strategies for both players and determine the value of game. **(16 Marks)**

Player B

		B_1	B_2	B_3	B_4	B_5
Player A	A_1	2	4	3	3	4
	A_2	5	6	3	7	8
	A_3	6	7	9	8	7
	A_4	4	2	8	4	3

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