

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: BTECH  
BRANCH: PROD.**

**SEMESTER : III  
SESSION : MO/19**

**SUBJECT: PE203-OPERATIONS RESEARCH**

**TIME: 3 HOURS**

**FULL MARKS: 50**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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Q.1(a) Explain various types of O.R models and indicate their application to production Inventory and distribution system. [2]

Q.1(b) A firm can produce three types of cloth, say: A, B, and C. Three kinds of wool are for it, say: red, green and blue wool. One unit length of type A cloth needs 2 meters of red wool and 3 meters of blue wool; one unit of type B cloth needs 3 meters of red wool, 2 meters of green wool and 2 meters of blue wool; and one unit of C type cloth needs 5 meters of green wool and 4 meters of blue wool. The firm has only a stock of 8 meters of red wool, 10 meters of green wool and 15 meters of blue wool. It is assumed that the income obtained from one unit length of type A cloth is Rs. 3.00, of type B cloth is Rs. 5.00, and of type C cloth is Rs. 4.00. Formulate and solve this problem in order to maximize total profit. [8]

Q.2(a) Define (i) A Feasible Solution (ii) An unbounded Solution. [2]

Q.2(b) A firm manufactures two types of product X and Y and sells them of profit of Rs. 2 on type X and Rs. 3 on type Y. Each product is processed on two machine G and H. Type X requires one minute of processing time on G and two minutes on H. Type Y requires one minute on G and one minute on H. The machine G is available for not more than 6 hours 40 minutes while machine H is available for 10 hours during any working day. Solve the problem. [8]

Q.3(a) Solve by simplex method: [5]

Maximize  $Z = 3X_1 + 2X_2$

Subject to:

$$X_1 + X_2 \leq 4$$

$$X_1 - X_2 \leq 2$$

$$X_1, X_2 \geq 0$$

Q.3(b) A company has three plants A, B and C and three warehouses X, Y and Z. Number of units available at the plants is 60, 70 and 80 respectively. Demands at X, Y, and Z are 50, 80 and 80 respectively. Unit costs of transportation are as follows in table 1 : [5]

**TABLE 1**

**TO**

	X	Y	Z	Available
A	8	7	3	60
B	3	8	9	70
C	11	3	5	80
Requirement	50	80	80	

What would be your transportation plan? for initial feasible solution use VAM and find the minimum distribution cost

Q.4(a) Five operators have to be assigned to 5 machines. The Assignment cost are given in table 2. Operator A cannot be operate Machine III and operator C cannot be operate Machine IV. Find the optimal assignment. [5]

TABLE 2

Machines→ Operator ↓	I	II	III	IV	V
A	5	5	----	2	6
B	7	4	2	3	4
C	9	3	5	-----	3
D	7	2	6	7	2
E	6	5	7	9	1

Q.4(b) Find the sequence that minimizes the total elapsed time required to complete the following tasks. [5]  
Each job is processed in the order A-B-C as shown in table 3.

TABLE:3

Job → Machine ↓	1	2	3	4	5	6
A	8	3	7	2	5	1
B	3	4	5	2	1	6
C	8	7	6	9	10	9

Q.5(a) A branch of office has only one typist. Since the typing work varies in length, the mean service rate 8 letters/hour. The letters arrive at a rate of 5 per hour during the entire 8 hours workday. If the typewriter is valued at Rs. 1.50 per hour, determine: [5]

- (i) The equipment utilization.
- (ii) The percent time that an arriving letter has to wait.
- (iii) The average time spends in the system.

Q.5(b) Reduce the following game by dominance and find the game value: [5]

TABLE 4

PLAYER A→ PLAYER B ↓	I	II	III	IV	V
I	1	3	2	7	4
II	3	4	1	5	6
III	6	5	7	6	5
IV	2	0	6	3	1