# A LECTURE NOTE
# ON
# TH.1 INDUSTRIAL ENGINEERING & MANAGEMENT
# SEMESTER -6



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**Sr. Lecture Mechanical Engineering**

**Mechanical Engineering**

# GOVT. POLYTECHNIC, MALKANGIRI

Q.2

a. Principles of material handling —
1. Planning principle
2. System principle
3. Space utilization principle
4. Unit load principle
5. Gravity principle
6. Material flow principle
7. Simplification principle
8. Safety principle
9. Mechanisation principle
10. Standardisation principle
11. Flexibility principle
12. Equipment selection principle
13. Dead weight principle
14. Motion principle
15. Idle time principle
16. Maintenance principle
17. Obsolesence principle
18. Capacity principle
19. Control principle
20. Performance principle

b. Features of governing plant layout : —

- Types of production (Engineering Industry, process industry)
- Production system - job shop, batch production, mass production
- scale of production
- Availability of the total area
- Arrangement of material handling system
- Types of building - single storey or multiple storey
- Future expansion plan
- Types of production facilities

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C. Maximize $z = 12x + 24y$

Subjected to $x + 4y \leq 20$

$3x + y \leq 15$

$x + y \leq 6$    $x, y \geq 0$

$x + 4y = 20 \quad\quad (1)$

$3x + y = 15 \quad\quad (2)$

$x + y = 6 \quad\quad (3)$

**for eqⁿ ⟨1⟩**

$x + 4y = 20$

If $x = 0$, $y = 20/4 = 5 \quad (0, 5)$

If $y = 0$, $x = 20 \quad (20, 0)$

**For eqⁿ ⟨2⟩**

$3x + y = 15$

If $x = 0$, $y = 15 \quad (0, 15)$

If $y = 0$, $x = 15/3 = 5 \quad (5, 0)$

**For eqⁿ ⟨3⟩**

$x + y = 6$

If $x = 0$, $y = 6 \quad (0, 6)$   If $y = 0$, $x = 6, \quad (6, 0)$

The coordinates of the corner points are $0(0,0)$, $A(0,5)$, $b(1.33,0)$, $c(4.5)$ and $d(5,0)$

Coordinates of pt. b

Equating eqⁿ 1 & eqⁿ 3

$x + 4y = 20$

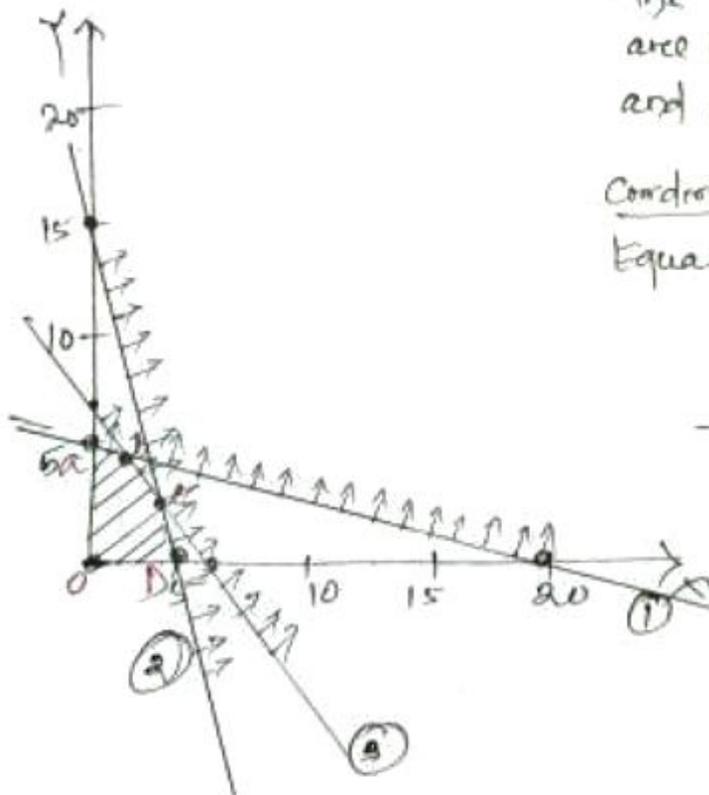$\underline{-x - y = -6}$

$\quad 3y = 14$

$\quad y = 4.67$

$\quad x = 1.33$

Pt. b $(1.33, 4.67)$

Co-ordinate of point C

Equating eqn 3 & eqn 2

$$x + 4y = 20 \qquad 3x + y = 15$$
$$x + y = 06$$
$$\underline{\qquad\qquad}$$
$$2x = 9$$
$$x = 4.5, \quad y = 1.5$$

Coordinates are $(4.5, 1.5)$

The value of objective function

| Points | coordinates | objective function value |
|--------|-------------|--------------------------|
| A | $(0, 5)$ | $z = (12 \times 0 + 24 \times 5) = 120$ |
| B | $(1.33, 4.67)$ | $z = (12 \times 1.33 + 24 \times 4.67) = 128.04$ |
| C | $(4.5, 1.5)$ | $z = (12 \times 4.5 + 24 \times 1.5) = 90$ |
| D | $(5, 0)$ | $z = (12 \times 5 + 24 \times 0) = 60$ |

The optimum value of objective function is = 128.04
The optimal solution is $x = 1.33, \quad y = 4.67$

| D) A | P | $T_0$ | $T_0 \times 4$ | $T_p$ | $T_e$ | $\sigma$ |
|------|---|-------|----------------|-------|-------|----------|
| A | — | 6 | $7 \times 4 = 28$ | 8 | 7 | .11 |
| B | — | 3 | $5 \times 4 = 20$ | 7 | 5 | .44 |
| C | — | 4 | $7 \times 4 = 28$ | 10 | 7 | 1 |
| D | A | 2 | $3 \times 4 = 12$ | 4 | 4 | .11 |
| E | B | 3 | $4 \times 4 = 16$ | 11 | 5 | 1.77 |
| F | C | 4 | $8 \times 4 = 32$ | 12 | 8 | 1.77 |
| G | C | 3 | $3 \times 4 = 12$ | 9 | 4 | 1 |
| H | E,F | 6 | $6 \times 4 = 24$ | 12 | 7 | 1 |
| I | D | 5 | $8 \times 4 = 32$ | 11 | 8 | 1 |
| J | H,G | 3 | $3 \times 4 = 12$ | 9 | 4 | 1 |
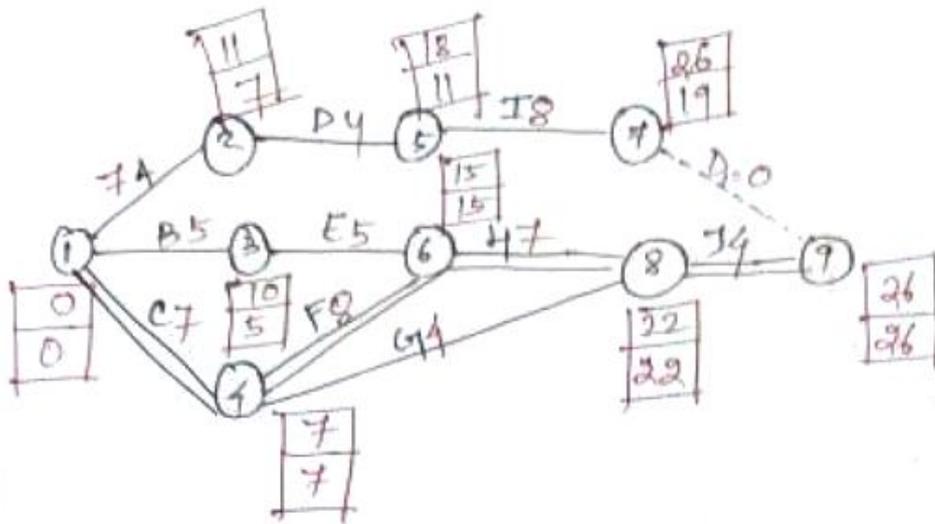
Critical path :- 1 — 4 — 6 — 8 — 9

$$\boxed{C - F - H - J}$$

duratio — 7 + 8 + 7 + 4 = $\boxed{26}$

## Q.1

**a) Plant layout :-** It reffrs to the physical arrangement of production facilities. It is the configuration of departments, work centres and equipment in the conversion process.

It is a plan of an optimum arrangement of facilities including personnel, operating equipment, storage space, material handling equipment and all other supporting services along with the design of best structure to contain all these facilities.

**b) Operational Research :-** It refers to quantative approach to decision making based on scientific method of problem solving. (or)

OR is the application of method of science of complex problem in the direction and management of large system of men, machine, material and money in industry, business, government and defence.

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➔ Break down maintenance: In this type of maintenance the plant or equipment is operated until it fails and then it is brought back into running condition by repair. The maintenance staff locate any mechanical, electrical or any other fault to correct it immediately.

➔ Inventory :- It refers to the materials in stock. It is also called idle resource of an enterprise. It represents those items which are either stocked for sale or they are in the process of manufacturing or they are in the form of materials which are yet to be utilised.

➔ CPM: It is the technique where it identify tasks that are necessary for project completion and determine scheduling flexibilities.