

INDUSTRIAL LAYOUT AND DESIGN

ENIE 354

Lecture : 3
Tutorial : 0
Practical : 3

Year : III
Part : II

Course Objectives:

The objective of this course is to equip students with the knowledge and skills to design and improve efficient, safe and cost-effective plant layouts, enabling them to plan, evaluate and improve industrial facilities for enhanced productivity, flexibility, sustainability and overall organizational performance.

- 1 Introduction (2 hours)**
 - 1.1 Plant layout needs and feature
 - 1.2 Developments of plant layout practices
 - 1.3 Objectives and principles of plant layout

- 2 Plant Location (6 hours)**
 - 2.1 Factors affecting plant location
 - 2.2 Stages of facility planning
 - 2.3 General and particular site selection
 - 2.4 Location economics and analysis
 - 2.5 Theories of industrial locations
 - 2.6 Evaluation of plant location

- 3 Plant Layout: Types and Selection (5 hours)**
 - 3.1 Principles of layout selection
 - 3.2 Product (Line) layout: Characteristics and applications
 - 3.3 Process (Functional) layout: Characteristics and applications
 - 3.4 Fixed position layout: Management of large-scale projects
 - 3.5 Cellular layout: Group Technology (GT) and manufacturing cells
 - 3.6 Hybrid and flexible layouts

- 4 Layout Planning (8 hours)**
 - 4.1 Basics and objectives of layout planning
 - 4.2 Systematic layout planning (SLP) procedure
 - 4.3 Activity relationship selection
 - 4.4 Plant service activities and auxiliary space requirements
 - 4.5 Constructing activity relationship charts and diagrams

- 4.6 Space relationship diagrams and integration
- 4.7 Computer-aided layout design

5 Evaluation of Layout (4 hours)

- 5.1 Measurement of effectiveness and efficiency
- 5.2 Systematic evaluation
- 5.3 Optimizing evaluation
- 5.4 Qualitative and quantitative evaluation

6 Plant Layout Problems (2 hours)

- 6.1 Causes of layout problems
- 6.2 Categories of the problems
- 6.3 Trends in plant layout/ rectifying issues

7 Factory Building (6 hours)

- 7.1 Single-storey and multi-storey buildings
- 7.2 Factors considered in factory building design
- 7.3 Features of industrial building
- 7.4 Layout design for greenfield projects
- 7.5 Layout adaptation for brownfield projects

8 Materials Handling (7 hours)

- 8.1 Elements of material handling
- 8.2 Objectives of materials handling
- 8.3 Material handling activities and functions
- 8.4 Principles of material handling
- 8.5 Analysis of material handling problems
- 8.6 Unit load concepts
- 8.7 Systematic handling analysis

9 Material Handling Equipment (5 hours)

- 9.1 Selection criteria
- 9.2 Equipment classification
- 9.3 Automated systems: AGV, AS/RS, Robotics
- 9.4 Conveyors, cranes, hoists and industrial trucks
- 9.5 Integration of plant layout and material handling

Practical (45 hours)

- 1. Linear and angular measurement of an existing industrial space using tapes and total stations.
- 2. CAD for 2D plant floor plan drawing
- 3. Practice with from-to charts, flow process charts for assembly line

4. Activity relationship chart (ARC) for a department level layout
5. Calculation of total space requirements including gangways, storage and service areas
6. Design of plant layout for a small manufacturing unit with relationship charts, diagram and drawings
7. Assessment of local industrial layout and efficiency metrics and redesign proposal

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

| Chapters | Hours | Marks distribution* |
|--------------|-----------|---------------------|
| 1 and 2 | 8 | 10 |
| 3 | 5 | 8 |
| 4 | 8 | 12 |
| 5 and 6 | 6 | 8 |
| 7 | 6 | 8 |
| 8 | 7 | 8 |
| 9 | 5 | 6 |
| Total | 45 | 60 |

* There may be minor deviation in marks distribution.

References

1. Agrawal, G. K. (2017). Plant layout and material handling. Jain Brothers.
2. Apple, J. M. (1977). Plant layout and material handling (Latest Edition). John Wiley & Sons.
3. Moore, J. M. (1962). Plant layout and design (Latest Edition). Macmillan.
4. Muther, R. (1995). Practical plant layout (Latest Edition). McGraw-Hill Education.
5. Sharma, S. C. (2000). Plant layout and materials handling. Khanna Publishers.
6. Stephens, M. P. (2019). Manufacturing facilities design and material handling. Purdue University Press.
7. Tompkins, J. A., White, J. A., Bozer, Y. A., Tanchoco, J. M. A. (2010). Facilities planning. John Wiley & Sons.