



# GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering

Subject Code: 3724601

Semester – II

Subject Name: FACILITY PLANNING AND DESIGN

Type of course: Elective

Prerequisite: Nil

### Rationale:

The aim of this course is to make students understand the importance of facility layout design and its impact on productivity. Students can get acquainted with different types of computerized layout improvement approaches. The course is also aimed at imparting knowledge of plant layout and material handling aspects to students.

### Teaching and Examination Scheme:

| Teaching Scheme |   |    | Credits<br>C | Examination Marks |         |                 |    | Total<br>Marks |
|-----------------|---|----|--------------|-------------------|---------|-----------------|----|----------------|
| L               | T | P  |              | Theory Marks      |         | Practical Marks |    |                |
|                 |   |    | ESE (E)      | PA (M)            | ESE (V) | PA (I)          |    |                |
| 03              | 0 | 02 | 04           | 70                | 30      | 30              | 20 | 150            |

### Content:

| Sr. No. | Content  | Total<br>Hrs |
|---------|--|--------------|
| 1       | Introduction:<br>Facilities design function- Scope, Objectives, need for layout study, types of layout problem, Types of flow pattern, Types of plant layout, Nature, Significance and Scope of Facilities Layout Planning, Facility design procedure. | 04           |
| 2       | Plant location:<br>Plant location analysis-factors, costs, Facility location: Single facility location problem, Multiple facility location problem, Gravity facility location problem, Euclidean distance location problem.                            | 06           |
| 3       | Activity relationship analysis:<br>Activity relationship diagram, worksheet, dimensionless block diagram, Flow analysis, Computer generated REL chart.   | 02           |
| 4       | Layout design:<br>Design cycle - SLP procedure manpower, machinery requirements – Computer algorithms - ALDEP, CORELAP, CRAFT.   | 06           |
| 5       | Quantitative methods:<br>Group technology-Production Flow analysis (PFA), ROC (Rank Order clustering), Quantitative analysis in cellular manufacturing.  | 06           |
| 6       | Manual Assembly Lines:<br>Assembly workstations, Analysis of Single model assembly lines, line balancing problems, Line balancing algorithm: i) Largest candidate rule ii) Kilbridge and wester method iii)  | 06           |



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|    |   |    |
|----|---|----|
|    | Ranked positional weight method iv) COMSOAL, Mixed model assembly lines, Line of balance.   |    |
| 7  | Auxiliary Services Requirement Space:<br>Receiving and shipping, Storage, Warehousing, Maintenance and Tool room, Utilities.  | 03 |
| 8  | Employee Services-Space requirements:<br>Parking lot, Employee entrances, Locker rooms, Toilets and Restrooms, Lunch room, Recreation, Drinking fountains, Aisles, Medical facilities.        | 04 |
| 9  | Materials handling:<br>Cost justification, Goals of material Handling, Principles of material handling, MH problem solving procedure, Unit load concept, and material handling system design. | 04 |
| 10 | Material Handling Equipment:<br>Receiving and shipping, Stores, Fabrication, Assembly, Shop floor, Warehousing, Packaging, Computer integrated material handling system.                      | 04 |

### Suggested Specification table with Marks (Theory):

| Distribution of Theory Marks |         |         |         |         |         |
|------------------------------|---------|---------|---------|---------|---------|
| R Level                      | U Level | A Level | N Level | E Level | C Level |
| 10                           | 20      | 25      | 20      | 15      | 10      |

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Reference Books:

1. Plant layout & Material Handling, G. K. Agrawal, Jain Publishers, New Delhi.
2. Automation, Production Systems and Computer Integrated Manufacturing, 2nd edition, Mikell P. Groover, Prentice Hall of India, New Delhi, 2003.
3. Plant Layout & Material Handling, 3rd edition, J.M Apple, John Wiley & Sons, 1972, New York.
4. Production and Operations Management, 3rd edition, R. Panneerselvam, PHI Learning Private Ltd., New Delhi, 2012.
5. Facilities planning, J. A. Tompkins and J. A. White, John Wiley, 1984.
6. Facilities Layout and Location: An analytical approach, Richard Francis L. and John A. White, Prentice Hall Inc., 1984.
7. Plant Layout and Design, Moore, J. M. Macmillan Company, New York, 1970.
8. Manufacturing Facilities Design, 2nd edition, Fred F. Meyers, Matthew P. Stephens, Prentice Hall, New Jersey.
9. Practical Plant layout, Richard Muther, McGraw Hill Book Company, New York
10. Facilities Planning and Materials Handling, Vijay Sheth, Marcle Decker, New York.



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## Course Outcomes:

| Sr. No. | CO statement   | Marks % weightage |
|---------|--|-------------------|
| CO-1    | To understand the concept of Facility planning and layout design.  | 10                |
| CO-2    | To know the concept of Facility location problem in different areas also concept of Activity Relationship Diagram. | 25                |
| CO-3    | To understand how to generate computerized layout solutions for plant layout design problem.                       | 20                |
| CO-4    | To understand different line balancing algorithms and their use.   | 15                |
| CO-5    | Study of Quantitative Analysis in Cellular Manufacturing   | 20                |
| CO-6    | Understand the requirements of different types of auxiliary and Employee Services                                  | 10                |

## Term Work:

The term work shall be based on the topics mentioned above.

## List of Experiments:

- 1) Exercise on plant location and its problems.
- 2) Exercise on computerized layout design.
- 3) Exercise on line balancing algorithm.
- 4) Exercise on material handling equipment's.
- 5) Exercise on quantitative analysis in cellular manufacturing.
- 6) Exercise on service facilities.

## Major Equipment:

Plant Layout software (not mandatory)

## List of Open Source Software/learning website:

- 1) Students can have hands on practices on plant layout optimization techniques and also evaluate the cases computerized layout improvements from research papers.
- 2) Students can evaluate the line balancing alternative methods for different industries (available on net/research papers).