# INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMOUS)
Dundigal, Hyderabad - 500 043

## MECHANICAL ENGINEERING

## COURSE DESCRIPTION FORM

| | | | | |
|---|---|---|---|---|
| **Course Title** | **PLANT LAYOUT AND MATERIAL HANDLING** | | | |
| **Course Code** | **A80365** | | | |
| **Regulation** | **R13 - JNTUH** | | | |
| **Course Structure** | **Lectures** | **Tutorials** | **Practicals** | **Credits** |
| | **4** | **0** | **-** | **4** |
| **Course Coordinator** | **Mr. G. S. Vivek, Assistant Professor, Mechanical Engineering.** | | | |
| **Team of Instructors** | **Mr. G. S. Vivek, Assistant Professor,**<br>**Mr. A. Venu Prasad, Assistant Professor.** | | | |

### I. COURSE OVERVIEW:

Introduction to Plant Layout and Material Handling Objectives and Functions of Plant Layout and Material Handling Introduction to Layout and its Importance Types of layouts Selection and specifications of layouts Implementation and follow up of layouts Introduction to CORELAP,ALDEP and CRAFT CRAFT,CORELAP and ALDEP concepts Introduction to Group Layout And Fixed Position Layout Quadratic assignment model. Branch and bound method Introduction to Material Handling Relationship of material handling to plant layout Methods to minimize cost of material handling Ergonomics of Material Handling equipment

### II. PREREQUISITE(S):

| Level | Credits | Periods / Week | Prerequisites |
|---|---|---|---|
| UG | 4 | 4 | Industrial Engineering, Manufacturing Technology |

### III. MARKS DISTRIBUTION:

| Sessional Marks (25) | University End Exam Marks | Total Marks |
|---|---|---|
| **Continuous Assessment Tests (Midterm examinations)**:<br>There shall be 2 midterm examinations. Each midterm examination consists of one objective paper, one subjective paper and four assignments. The objective paper is for 10 marks and subjective paper is for 10 marks, with duration of 1 hour 20 minutes (20 minutes for objective and 60 minutes for subjective paper). Objective paper is set for 20 bits of – multiple choice questions, fill-in the blanks, 10 marks. Subjective paper contains of 4 full questions (one from each unit) of which, the student has to answer 2 questions, each question carrying 5 marks.<br>First midterm examination shall be conducted for 2.5 units of syllabus and second midterm examination shall be conducted for another 2.5 units. 5 marks are allocated for Assignment. The total marks secured by the student in each midterm examination are evaluated for 25 marks. | 75 | 100 |

### IV. EVALUATION SCHEME:

| S. No. | Component | Duration | Marks |
|---|---|---|---|
| 1 | I Mid Examination | 80 min | 20 |
| 2 | I Assignment | | 5 |
| | | **TOTAL** | **25** |
| 3 | II Mid Examination | 80 min | 20 |
| 4 | II Assignment | | 5 |
| | | **TOTAL** | **25** |
| 5 | EXTERNAL Examination | 3 hours | 75 |
| | | **GRAND TOTAL** | **100** |

## V. COURSE OBJECTIVES:

**The objectives of the course are to enable the student;**

I. Plan, analyze and design to improve manufacturing and services facilities.
II. Explore equipment requirements for a specific process.
III. Summarize the benefit of an efficient material handling system.
IV. Understand what effect process layout has on the material handling system.
V. Apply the techniques to evaluate and design material handling and storage systems.
VI. Visualize plant layout and material handling in industries.
VII. Explore integrate concepts and techniques learned through this course in order to design and efficient plant layout in a team environment.

## VI. COURSE OUTCOMES:

**On successful completion of the course, the student will be able to**

1. **Explain** the importance of proper material handling and storage techniques.
2. **Explain** List hazards associated with hoisting and conveying.
3. **Understand** proper material handling engineering techniques regarding hoisting and conveying equipment
4. **Understand** toxic hazards of materials being handled, such as chemicals, dusts and poisons
5. **Demonstrate** the formal training requirements for material handling personnel, especially equipment operators.
6. **Explain** the preventative maintenance requirements for material handling equipment.
7. **Explain** the components of a material handling equipment inspection program
8. **Demonstrate** understanding of the Department of Transportation Labeling and pla-carding regulations
9. **Explain** the methods to protect workers from the hazards involved in manual lifting
10. **Understand** the requirements for a vehicle safety program, including driver training and preventative maintenance.

## VII. HOW COURSE OUTCOMES ARE ASSESSED:

| Program Outcomes | | Level | Proficiency assessed by |
|---|---|---|---|
| PO1 | **Engineering knowledge**: Capability to apply the knowledge of Mathematics, Science and Engineering in the field of Mechanical Engineering. | S | External exams |
| PO2 | **Problem analysis**: An ability to analyze complex engineering problems to arrive at relevant conclusions using knowledge of Mathematics, Science and Engineering. | H | External exams |
| PO3 | **Design/development of solutions**: Competence to design a system, com ponent or process to meet societal needs within realistic constraints. | H | External exams |
| PO4 | **Conduct investigations of complex problems**: To design and conduct research oriented experiments as well as to analyze and implement data using research methodologies. | H | Assignments |
| PO5 | **Modern tool usage**: An ability to formulate, solve complex engineering problems using modern engineering and Information Technology tools. | H | Mid-term, |
| PO6 | **The engineer and society**: To utilize the Engineering practices, Techniq ues, skills to meet needs of the health, safety, legal, cultural and societal issues. | S | Assignments |

| | | | |
|---|---|---|---|
| PO7 | **Environment and sustainability**: To understand impact of Engineering solutions in the societal context and demonstrate the knowledge for sustainable development. | S | Guest Lecture. |
| PO8 | **Ethics**: An understanding and Implementation of professional and Ethical responsibilities. | S | Mini Project |
| PO9 | **Individual and teamwork**: To function as an effective individual and as a member or leader in Multi-disciplinary environment and adopt in diverse teams. | H | Mini Project |
| PO10 | **Communication**: An ability to assimilate, comprehends, communicate, give and receive instructions to present effectively with engineering community and society. | S | Assignments, |
| PO11 | **Project management and finance**: An ability to provide leadership in managing complex engineering projects at Multidisciplinary environme nt and to become a professional engineer. | H | Mid-term, |
| PO12 | **Life-long learning**: Recognition of the need and an ability to engage in life-long learning to keep abreast with technological changes. | H | Tutorials. |

## VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

| | Program Specific Outcomes | Level | Proficiency assessed by |
|---|---|---|---|
| PSO1 | **Professional Skills:** To produce engineering professional capable of synt hesizing and analyzing mechanical systems including allied engineering streams. | H | Guest Lectures. |
| PSO2 | **Design/Analysis:** An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability. | H | Mini Project |
| PSO3 | **Successful Career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to become Technocrat. | H | Guest Lectures. |

## IX. SYLLABUS:

**UNIT-I**

Introduction: Classification of Layout, Advantages and Limitations of different layouts, Layout design procedures. Overview of the plant layout. Process layout & Product layout: Selection, specification. Implementation and follow up. Comparison of product and process layout

**UNIT-II**

Heuristics for Plant layout - ALDEP. CORELAP, CRAFT, Group Layout, Fixed position layout- Quadratic assignment model. Branch and bound method.

**UNIT-III**

Introduction, Material Handling systems. Material handling principles. Classification of Material Handling Equipment. Relationship of material handling to plant layout.

**UNIT-IV**

Basic Material Handling systems: Selection, Material Handling method- path, Equipment, function oriented systems.

**UNIT - V**

Methods to minimize cost of material handling- Maintenance of Material Handling Equipment's, Safety in handling Ergonomics of Material Handling equipment. Design, Miscellaneous equipment's

**TEXT BOOKS:**

1. Operations Management/ PB Mahapatra/PHI
2. Aspects of Material handling/Dr. KC Arora & Shinde. /Lakshmi Publications
3. Facility Layout & Location an analytical approach/ RL Francis/ LF Me Linnis Jr, White/ PHI
4. Production and Operations Management/ R Panneerselvam/ PHI
5. Introduction to Material handling/ Ray. Siddhartha/ New Age

## X. COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

| Lecture No. | Course Learning Outcomes | Topics and / Sub-Topics Covered | Reference |
|---|---|---|---|
| 1 | Distinguish about plant layout and material handling | Overview of Plant Layout and material handling | T4:6.1 |
| 2 | Classify layouts | Classification of Layout | T4: 6.2 |
| 3 | List detail of layout | Classification of Layout | T4: 6.2 |
| 4 | List out types of layouts. | Types of Layout | T4: 6.2 |
| 5 | Discuss about Advantages and Limitations of | Advantages and Limitations of | T4: 6.2.2 |
| 6 | List out Types of Plant Layout | Different Types of Plant Layout | T4:6.2 |
| 7 | Evaluate the design procedure of plant layout. | Design Procedure of Plant Layout | T4: 6.3 |
| 8 | List out Factors Affecting Plant Layout | Factors Affecting Plant Layout | T4: 6.2 |
| 9 | Write an overview of the Plant Layout | Overview of the Plant Layout | T4: 6.4 |
| 10 | Write about introduction to process layout | Introduction to process layout | T4: 6.4.2 |
| 11 | Define the Selection of process layout | Selection of process layout | T4: 6.4.3 |
| 12 | Explain the Specification of process plant layout | Specification of process plant layout | T4: 6.4.7 |
| 13 | Discuss Implementation and follow-up process layout | Implementation and follow- up process layout | T4: 6.2 |
| 14 | Write about Introduction to product layout | Introduction to product layout | T4: 6.2 |
| 15 | Define the Selection of product layout | Selection of product layout | T4: 6.2.2 |
| 16 | Explain the Specification of product plant layout | Specification of product plant layout | T4: 6.2 |
| 17 | Evaluate Implementation and follow-up product layout | Implementation and follow- up process layout | T4: 6.2 |
| 18 | Distinguish between Product and process layout | Comparison of Product and process layout | T4: 6.2 |
| 19 | Explain the Heuristics for Plant Layout | Heuristics for Plant Layout | T4: 6.3 |
| 20 | Define the Computerized facilities design | Computerized facilities design | T4: 6.3 |
| 21 | Define the Computer Aided Layout Planning (CALP) | Computer Aided Layout planning (CALP) | T4: 6.3 |
| 22 | Write about Automated Layout Design Programme (ALDEP) | Automated Layout Design Programme (ALDEP) | T4:6.3 |
| 23 | Evaluate Computerized Relative Allocation of Facilities Technique (CRAFT) | Computerized Relative Allocation Facilities Technique (CRAFT) | T4: 6.3.2 |
| 24 | Evaluate Computerized Relationship Layout Planning (CORELAP) | Computerized Relationship | T4: 6.3.6 |
| 25 | Define Group Layout | Introduction to Group Layout | T4: 6.2 |
| 26 | Explain the effect of layout on production control | The effect of layout on production control | T4: 6.3 |
| 27 | Write about Work Place design | Work Place design | T4: 6.5.1 |
| 28 | Define Fixed position layout | Fixed position layout | T4: 6.2 |

| | | | |
|---|---|---|---|
| 29 | Explain the Quadratic assignment model | Quadratic assignment model | T4: 6.5 |
| 30 | Define the Branch and Bound method | Branch and Bound method | T4: 6.4.2 |
| 31 | Explain Flow line or Flow Systems | Flow line or Flow Systems | T4: 6.5.2 |
| 32 | List out the factors determining the space required for a facility | Determining the space required for a facility | T2: 4 |
| 33 | Define the Material Handling System | Introduction to Material Handling System | T2: 4.1 |
| 34 | Explain the Importance and Benefits of Material Handling | Importance and Benefits of Material Handling | T2: 4.1.1 |
| 35 | Evaluate Principle of Material Handling | Principle of Material Handling | T2: 4.2.1 |
| 36 | Write about Classification of Material Handling Equipment | Classification of Material Handling Equipment | T2: 4.2.3 |
| 37 | Classify Material Handling Equipment | Classification of Material Handling Equipment | T2: 4.2.3 |
| 38 | Distinguish Relationship of Material Handling to plant layout | Relationship of Material Handling plant layout | T2: 4.3.1 |
| 39 | Write about Selection of Material Handling Equipment | Selection of Material Handling Equipment | T2: 4.2.4 |
| 40 | Define the Basic Material Handling Systems | Introduction to Basic Material Handling Systems | T2: 4.1 |
| 41 | List out the different types of Material Handling Methods | Different types of Material Handling Methods | T2: 4.3.2 |
| 42 | Classify Equipment by function | Classification of Equipment by function | T2: 4.5 |
| 43 | Explain the Functions of Material Handling | Functions of Material Handling | T2: 4.2.2 |
| 44 | List out the Methods to minimize cost of Material Handling | Methods to minimize cost of Material Handling | T2: 4.4 |
| 45 | Evaluate Maintenance of Material Handling Equipment | Maintenance of Material Handling Equipment | T2: 4.4.3 |
| 46 | Classify the Safety Precaution in Material Handling | Safety Precaution in Material Handling | T2: 4.6 |
| 47 | Write about Ergonomics of Material Handling Equipment | Ergonomics of Material Handling Equipment | T2: 4.6.3 |
| 48 | Explain the Design of Material Handling Equipment | Design of Material Handling Equipment | T2: 4.5.2 |
| 49 | List out the Miscellaneous Material Handling Equipment | Miscellaneous Material Handling Equipment | T2: 4.7 |
| 50 | Discuss about Material Handling Equipment | Revision of Material Handling Equipment | T2: 4.7 |

## XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

| Course Objectives | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| I | S | | | | H | | | | | S | | | S | H | H |
| II | | | H | | | | S | | H | | | H | H | | H |
| III | S | | S | | | | | | | | H | | | H | S |
| IV | S | | | | | | H | | | S | | | S | | |
| V | | | | S | H | | | | H | | | | S | S | H |
| VI | | S | | | | H | | | | | S | | | | |
| VII | | H | | H | | | | S | | | | | | H | |

**S =Supportive** **H=Highly Related**

## XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| I. | S | | | | | | | | S | | | | S | H | S |
| II. | | H | | H | | | H | | | | | H | | S | H |
| III. | | | | | S | | | | | | H | | | | S |
| IV. | S | H | | | | S | | H | S | S | | | S | H | |
| V. | | | H | S | | | S | | | | | | | S | |
| VI. | S | | | | S | | | | | S | H | H | H | H | S |
| VII. | S | S | | | | | S | | | | | | | | |
| VIII. | | | S | | | | | S | | | | | | S | |
| IX. | H | | | H | | H | | | S | | | S | | | H |
| X. | | S | | | H | | | | | | H | | | S | |

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**Prepared By:**
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**HOD, MECHANICAL ENGINEERING**