# E.G.S. PILLAY ENGINEERING COLLEGE
# (Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai
Accredited by NAAC with 'A' Grade | Accredited by NBA
NAGAPATTINAM – 611 002

## B.E. Mechanical Engineering

**Fourth Year – Eighth Semester**

| Course Code | Course Name | L | T | P | C | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | CA | ES | Total |
| **Theory Course** | | | | | | | | |
| | Elective VII | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | Elective VIII | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | Elective IX | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **Laboratory Course** | | | | | | | | |
| 1704ME851 | Project Viva Voce | - | - | 18 | 9 | 50 | 50 | 100 |

**L – Lecture | T – Tutorial | P – Practical | CA – Continuous Assessment | ES – End Semester**

| 1703ME014 | DESIGN OF JIGS, FIXTURES AND PRESS TOOLS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

1. To provide knowledge on design principles for desiging the jigs and fixtures.
2. To impart knowledge on locating and clamping principles for designing jigs and fixtures.
3. To introduce the different types of jigs for producing the part.
4. To study the different types of fixtures for producing the part.
5. To introduce about press working terminologies and press accessories.

**UNIT I TOOL DESIGN** **7 Hours**

Objectives, Challenges and Requirements, Production and Inspection Devices. Jigs and Fixtures - Differences, Design principles, Advantages, Essential Features, Materials used. Introduction to Limits, Fits and Tolerances, International Tolerance Grades, Geometric Dimensioning and Tolerancing.

**UNIT II LOCATION AND CLAMPING** **8 Hours**

Location - Principles, Basic rules, Degrees of Freedom, 3-2-1 Principle, Locating Methods, Types of Locators, Standard Parts. Clamping - Principles, Types of Mechanical Actuation Clamps, Pneumatic, Hydraulic, Magnetic, Vacuum, Electrostatic clamping, Epoxy Resin Clamping. Factors considered for Design of Jigs and Fixtures.

**UNIT III JIGS** **10 Hours**

Jigs - Elements, Construction, Types and Materials for Jig Elements. Drill bushes - Types, Special Bushes, Bush Clearance. Automatic drill jig, Rack and pinion operated, Indexing, Air operated Jig components - Design of Jigs for given components.

**UNIT IV FIXTURES** **10 Hours**

General Design Principles of Fixture. Types of Boring, Lathe, Milling and Broaching fixtures - Setting Block. Grinding, Planing and Shaping fixtures. Inspection - Gauging, Measuring and Supplement fixtures. Welding, Assembly and Modular fixtures. Design of fixtures for given component.

**UNIT V PRESS TOOLS** **10 Hours**

Mechanical Presses - Working terminology, Elements, Types and Press Accessories. Types of Dies, Punches and Strippers. Pressure pad, Knockouts, Stops and Pilots. Bending, Forming, Drawing and Deep Drawing - Dies and its Types. Spring-back phenomenon and Draw Ratio. Progressive, Combination and Compound Dies. Design and Development of Dies - Blank Development, Strip Layout, Computation of capacities and tonnage requirements.

**TOTAL: 45 HOURS**

**FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :**

Analysis of Clamping forces - Tolerance and Error Analysis - Design considerations in forging, extrusion, casting and plastic dies.

**REFERENCES:**

1. Edward G. Hoffman, Jig and Fixture Design, Cengage Learning, New Delhi, 2004.
2. C. Elanchezhian, Design of Jigs, Fixtures and Press Tools, Eswar Press, Chennai, 2010.
3. P. H. Joshi, Jigs & Fixtures, Tata McGraw Hill Education Private Limited, New Delhi 2012.
4. Hiram E Grant, Jigs and Fixtures, Tata McGraw Hill Education Private Limited, New Delhi, 2011.
5. C. Donaldson, G. H. Lecain and V. C. Goold, Tool Design, Tata McGraw Hill Education Private Limited, New Delhi, 2011.
6. http://nptel.ac.in/courses/112105126/35

**1703ME015 COMPUTER INTEGRATED MANUFACTURING L T P C**
**3 0 0 3**

**COURSE OBJECTIVES:**

- To introduce the basic concepts of Computer Integrated Manufacturing (CIM).
- To provide knowledge on Group Technology and Computer Aided Process Planning.
- To impart knowledge on Shop Floor Control and Flexible Manufacturing Systems.
- To learn the various CIM implementation and data communication techniques.
- To provide knowledge on the concept of Manufacturing automation protocol, Technical office protocol and database terminology.

**UNIT I INTRODUCTION 8 Hours**

The changing manufacturing and management scene, External communication, Islands of automation and software, dedicated and open systems, manufacturing automation protocol, introduction to CAD/CAM integration

**UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10 Hours**

Classification and coding - DCLASS, MICLASS and OPITZ coding systems. Facility design using Benefits of G.T - cellular manufacturing. Process planning, role of process planning in - CAD/CAM integration-approaches to computer aided process planning- variant approach and generative approaches.

**UNIT III SHOP FLOOR CONTROL AND FMS 9 Hours**

Shop floor control phases -factory data collection system -automatic identification methods- Bar code technology - automated data collection system. FMS- components of FMS- types -FMS workstation- material handling and storage systems- FMS layout-computer control systems-application and benefits

**UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION 9 Hours**

System modeling tools- ICAM definition (IDEF) models, activity cycle diagram, CIM open system architecture (CIMOSA) - manufacturing enterprise wheel- CIM architecture- Product data management, implementation-software. Communication fundamentals- local area networks (LAN) - topology -LAN implementations - network management and installations.

**UNIT V OPEN SYSTEM AND DATABASE FOR CIM 9 Hours**

Open systems-open system inter-connection - manufacturing automations protocol and technical office protocol-(MAP/TOP).Development of databases -database terminology- architecture of database systems- data modeling and data associations-relational data bases - database operators - advantages of data base and relational database.

**Total: 45 HOURS**

**FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :**

Paperless factory, introduction virtual reality and applications, virtual prototyping and manufacturing Instrumentation and Measurement, virtual enterprises.

**REFERENCES :**

1. Mikell P. Groover, Automation of production systems and computer integrated manufacturing, Pearson Education, United States of America, 2008.
2. Lee Kunwoo, Principles of CAD, CAM, CAE systems, Addison Wesley, United States of America, 1999
3. Kant Vajpayee. S, Principles of Computer Integrated Manufacturing, Prentice Hall, New Delhi, 2003
4. Radhakrishnan P, Subramanyan. S and Raju. V, CAD, CAM, CIM, Second Edition New Age International Pvt. Ltd, New Delhi, 2000.
5. Lee Kunwoo, Principles of CAD, CAM, CAE systems, Addison Wesley, United States of America, 1999
6. http://nptel.ac.in/courses/112102101/

**1703ME011 INDUSTRIAL ROBOTICS**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To explain the fundamentals and working of robots.
- To describe the importance of drives and end effectors of robots.
- To explain the types of sensors and concept of machine vision system.
- To analyze kinematics of robots and its programming.
- To identify and explain the applications of robots in industries.

**UNIT I FUNDAMENTAL OF ROBOTICS 06 Hours**

Robot -Definition -scope of industrial robot - Robotics and Automation - Law of robotics -Robot Anatomy - Co-ordinate Systems, Work Envelope, classification - Specifications - Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load - Need for Robots.

**UNIT II ROBOT DRIVE SYSTEM AND END EFFECTORS 09 Hours**

Pneumatic Drives, Hydraulic Drive, Mechanical Drives and Electrical Drives. End Effectors – Grippers-Pneumatic gripper, Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers, and Mechanical Grippers - Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers.

**UNIT III SENSORS AND MACHINE VISION SYSTEMS 12 Hours**

Sensors - types - tactile sensors, proximity and range sensors, contact and non contact sensors, velocity sensors, touch and slip sensors, force and torque sensors. Robotic vision systems, imaging components, image representation, picture coding, object recognition and categorization, visual inspection.

**UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 12 Hours**

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) - Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages - VAL Programming - Motion Commands, Sensor Commands, End effecter commands, and Simple programs.

**UNIT V IMPLEMENTATION AND APPLICATION 06 Hours**

Implementation of Robots in Industries - Various Steps- Application of robots in machining - Welding - Assembly - Material handling - Loading and unloading - hostile and remote environments. Inspection and future application-safety, training, maintenance and quality.

**Total: 45 HOURS**

**FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :**

Recent trends and developments in the field of robotics (Evolutionary robots, swarm robots, nano robots, micro robots, medical robots, space robots, wearable robots, intelligent robots, autonomous robots, medical robots, space robots, wearable robots, etc.)

**REFERENCES**

1. M. P. Groover, Industrial Robotics Technology, Programming and Applications, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2001.
2. D. Richard, Klafter, A. Thomas, Chmielewski and Michael Negin, Robotics Engineering, An Integrated Approach, Prentice Hall of India, New Delhi, 2001.
3. K. S. Fu, R. C. Gonzalez and C. S. G. Lee, Robotics Control, Sensing, Vision and Intelligence, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2003
4. Yoram Koren, Robotics for Engineers, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2004.
5. Subir Kumar Saha, Introduction to Robotics, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2008.
6. http://nptel.ac.in/courses/112101099/

| 1704ME851 | PROJECT VIVA VOCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 18 | 9 |

**Course Objectives**

- To develop skills to formulate a technical project.
- To give guidance on the various tasks of the project and standard procedures.
- To teach use of new tools, algorithms and techniques required to carry out the projects.
- To give guidance on the various procedures for validation of the product and analyse the cost effectiveness.
- To provide guidelines to prepare technical report of the project.

**GUIDELINE FOR REVIEW AND EVALUATION**

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department

**Course Outcomes (COs)**

After completion of the course students will be able to

1. Formulate a real world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Perform test and validate through conformance of the developed prototype and analysis the cost effectiveness.
5. Explain the acquired knowledge through preparation of report and oral presentations.