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| Program: Diploma in Mechanical Engineering | |
| Course Code: 6021B | Course Title: Computer Integrated Manufacturing |
| Semester: 6 | Credits: 4 |
| Course Category: Program Elective | |
| Periods/Week: 4 (L:4 T:0 P:0) | Periods/Semester: 60 |

Course Objectives:

- To introduce computer integration in all aspects of production system.
- To identify the features of CAM and industrial robotics.
- To provide an eye opening to the present scenario of a manufacturing plant so that the student can better understand their future job roles.
- To familiarize with the automation related to material handling, storage, inspection and manufacturing system

Course Pre-requisites:

| Topic | Course code | Course name | Semester |
|---|--------------------|--------------------------|-----------------|
| Basic knowledge on machining, machine tools and manufacturing | | Machine tools | 3 |
| | | Manufacturing technology | 2 |

Course Outcomes

On completion of the course, the students will be able to:

| CO_n | Description | Duration (Hours) | Cognitive Level |
|-----------------------|---|-------------------------|------------------------|
| CO1 | Outline the automation opportunities and strategies. | 18 | Understanding |
| CO2 | Familiarize the computer integration in design phase of product development. | 11 | Understanding |
| CO3 | Identify the features of CAM and industrial robotics. | 18 | Understanding |
| CO4 | Describe the automation related to material handling, storage, inspection and manufacturing system. | 11 | Understanding |
| | Series test | 2 | |

CO-PO Mapping

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 2 | - | - | - | - | - | - |
| CO2 | 2 | - | - | - | - | - | - |
| CO3 | 2 | - | - | - | - | - | - |
| CO4 | 2 | - | - | - | - | - | - |

3-Strongly mapped 2-Moderately mapped 1-Weakly mapped

Course Outline

| Module Outcome | Description | Duration (Hours) | Cognitive Level |
|---|---|------------------|-----------------|
| CO1 | Outline the automation opportunities and strategies. | | |
| M1.01 | Identify the opportunities for computerization in manufacturing system. | 2 | Understanding |
| M1.02 | Discuss about automation, its elements and types | 10 | Understanding |
| M1.03 | Discuss the principles and strategies for automation | 6 | Understanding |
| <p>Contents: Concept of Computer Integrated Manufacturing (CIM); Opportunities for Automation and Computerization in a Production System– Facilities and Manufacturing Support Systems; Basic elements of automation, Advanced automation functions, Levels of automation; Sensors – Desirable features, common types of sensors used in automation; Actuators - common types of actuators used in automation; Types of Automation – Programmable Automation, Flexible Automation and Fixed Automation; Reasons for Automation; USA principle, Ten Strategies for Automation and Process Improvement; Automation Migration Strategy – Manual Production, Automated Production, Automated Integrated Production.</p> | | | |
| CO2 | Recognize the computer integration in design phase of product development. | | |
| M2.01 | Describe the product development. | 4 | Understanding |
| M2.02 | Describe the computer-aided designing, Analysis and prototyping. | 7 | Understanding |
| | Series Test - I | 1 | |

Contents:

Product Development – Product Development Cycle and Product Development Spiral. Sequential and Concurrent Engineering (Introduction Level Only), Comparison.

Computer Aided Design (CAD): Definition, Advantages, CAD hardware (Name and function) and software (Name Only); Geometric Modelling – Wireframe, Surface and Solid Modelling.

Engineering Analysis - Types; Design Review and Evaluation.

Rapid Prototyping – Liquid Based, Solid Based and Powder Based.

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| CO3 | Identify the features of CAM and industrial robotics. | | |
| M3.01 | Describe CAM, CAPP and GT | 3 | Remembering |
| M3.02 | Explain the Variant and Generative techniques in CAPP | 4 | Understanding |
| M3.03 | Describe MPS, MRP, CRP and inventory Control with aid of computer. | 3 | Remembering |
| M3.04 | Discuss about CNC and industrial robotics. | 8 | Understanding |

Contents:

Computer Aided Manufacturing (CAM)- Definition;

Computer Aided Process Planning (CAPP)- Definition; Group Technology (Introduction Level treatment of cellular manufacturing, part family and its methods), Variant and Generative CAPP.

Master Production Schedule (MPS), Material Requirements Planning (MRP), Capacity Requirement Planning (CRP), and Inventory Control with the aid of Computer (Introduction Level only).

CNC and DNC- Features and Advantages;
Machining Centers – Turning center, Milling Centre.

Industrial Robots- Definition, Anatomy, Types of End effectors, Degrees of Freedom [DOF]; Classification of Robots- Articulated, Polar Configuration, SCARA, Cartesian Co-ordinate, Delta; Applications of Robot.

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| CO4 | Discuss the automation related to material handling, storage, inspection and manufacturing systems. | | |
| M4.01 | Describe various automated material handling and storage systems | 4 | Understanding |
| M4.02 | Describe various automated inspection technologies. | 4 | Understanding |
| M4.03 | Describe the manufacturing systems and factors for selection. | 3 | Understanding |

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| | Series Test - II | 1 | |
| <p>Contents: Material handling – Fixed Routing and Variable Routing; List of Material Handling Equipment for Each Routing.</p> <p>Storage – Automated Storage/Retrieval System (AS/RS) and Carousel Storage System (Introduction Level Only).</p> <p>Inspection Technologies – Comparison of Contact and Non-Contact Inspection Techniques, CMM and Machine Vision (Introduction with Simple Diagram).</p> <p>Manufacturing Systems – Factors for Selection, Types – Single Station Cell, Multistation Fixed Routing, Multistation Variable Routing (Introduction Level Only].</p> | | | |

Text / Reference

| T/R | Book Title/Author |
|-----|--|
| T1 | Mikell P. Groover, Automation, Production Systems and Computer-Integrated Manufacturing. 4 th edn. Pearson. |
| T2 | P.Radhakrishnan S.Subramanyan and V. Raju, CAD/CAM/CIM. 4 th edn. New Age International Publishers. |
| R1 | S.R. Deb and S. Deb, Robotics Technology and Flexible Automation, Tata McGraw |

Online resources

| S.No | Website Link |
|------|---|
| 1 | https://nptel.ac.in/courses/112/104/112104289/ |
| 2 | https://www.sciencedirect.com/search?q=computer%20integrated%20manufacturing |
| 3 | https://en.wikipedia.org/wiki/Computer-integrated_manufacturing |