Department of Mechanical Engineering

Scheme and Syllabus (2016 Scheme)
2nd Semester Computer Integrated Manufacturing
INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

MISSION

To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem solving ability with an analytical and innovative mindset.

QUALITY POLICY

● Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
● Fostering cultural, ethical, moral and social values in the human resources of the institution.
● Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

DEPARTMENT VISION

To emerge as a center of excellence in technical education and research by moulding students with techno managerial skills coupled with ethics and to cater to the needs of the industry and society in general.

MISSION

To impart value based education and to promote research and training in frontier areas to face the challenges in the changing global scenario; to provide impetus to industry institute relation, to imbibe social, ethical, managerial and entrepreneurial values in students.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. The graduates will acquire core competence in basic science and mechanical engineering fundamentals necessary to formulate, analyze and solve engineering problems and to pursue advanced study or research.

2. The graduates will engage in the activities that demonstrate desire for ongoing personal and professional growth and self-confidence to adapt to rapid and major changes.

3. The graduates will maintain high professionalism and ethical standards, effective oral and written communication skills, work as part of teams on multi-disciplinary projects under diverse professional environments and relate engineering issues to the society, global economy and to emerging technologies.
PROGRAM OUTCOMES (POs)

1. Scholarship of Knowledge:
   Graduates shall acquire in-depth knowledge in machine design and update the same, integrating existing and updated knowledge in global perspective.

2. Critical Thinking:
   Graduates shall possess ability for independent judgement based on critical analysis and also for synthesis of information for extensive research in the area of specialization.

3. Problem Solving:
   Graduates shall conceptualize through lateral thinking and obtain feasible and optimal solutions for engineering problems considering societal and environmental requirements.

4. Research Skill:
   Graduates shall review relevant literature, apply appropriate research methodologies, working individually or as a team contributing to the advancement of domain knowledge.

5. Usage of modern tools:
   Graduates shall be able to adopt modern techniques, analytical tools and softwares for complex engineering solutions.

6. Collaborative and Multidisciplinary work:
   Graduates shall be able to engage in collaborative multidisciplinary scientific research for decision making through rational analysis.

7. Project Management and Finance:
   Graduates shall be able to apply engineering and management principles for efficient project management considering economical and financial factors.

8. Communication:
   Graduates shall possess communication skills to comprehend, document and present effectively to the engineering community and society at large.

9. Life-long Learning:
   Graduates shall engage in lifelong learning with motivation and commitment for professional advancement.

10. Ethical Practices and Social Responsibility:
    Graduates shall imbibe the professional ethics and integrity for sustainable development of society.

11. Independent and Reflective Learning:
    Graduate shall be able to introspect and apply corrections.
### Scheme of Teaching for M. Tech. Computer Integrated Manufacturing CIM (2016-17)

**Curriculum frame work: Department of Mechanical Engineering**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Subject Area</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Professional Core ( Theory &amp; Practical)</td>
<td>PC 36</td>
</tr>
<tr>
<td>2</td>
<td>Professional Elective</td>
<td>PE 16</td>
</tr>
<tr>
<td>3</td>
<td>Lab</td>
<td>PC 4</td>
</tr>
<tr>
<td>4</td>
<td>Seminar</td>
<td>PC 2</td>
</tr>
<tr>
<td>5</td>
<td>Internship</td>
<td>SS 10</td>
</tr>
<tr>
<td>6</td>
<td>Project</td>
<td>PR 22</td>
</tr>
<tr>
<td>7</td>
<td>Term assignment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

**Distribution of credits**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>94</td>
</tr>
</tbody>
</table>

*Lecture (L): One Hour /week – 1 credit*

*Practical (P): Two hours /week – 1 credit*
SEE: SEE (Theory exam) will be conducted for 100 marks of 3 hours duration. It is reduced to 50 marks for the calculation of SGPA and CGPA.

Term Assignment: The performance is continuously evaluated by the faculty member and Grade is given.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Credits</th>
<th>Total Hours/week</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CIM21</td>
<td>PC</td>
<td>Advanced Foundry Technology</td>
<td>4-0-0</td>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td>2.</td>
<td>CIM22</td>
<td>PC</td>
<td>Industrial Robotics</td>
<td>4-0-0</td>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td>3.</td>
<td>CIM23</td>
<td>PC</td>
<td>Non Traditional Machining</td>
<td>4-0-0</td>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td>4.</td>
<td>CIM24</td>
<td>PC</td>
<td>Flexible Manufacturing Systems</td>
<td>4-0-0</td>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td>5.</td>
<td>CIM25X</td>
<td>PE</td>
<td>Elective-B</td>
<td>4-0-0</td>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td>6.</td>
<td>CIM26</td>
<td>PC</td>
<td>Rapid Prototyping and Casting Analysis Lab</td>
<td>0-0-2</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>7.</td>
<td>CIM27</td>
<td>PC</td>
<td>Seminar-2</td>
<td>1-0-1</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>8.</td>
<td>PTA28</td>
<td>PC</td>
<td>Mini Project-2</td>
<td>0-0-2</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td>25-30</td>
<td>300</td>
<td>300</td>
</tr>
</tbody>
</table>

**Elective – B**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIM251</td>
<td>Advanced Tool EngineeringDesign</td>
</tr>
<tr>
<td>CIM252</td>
<td>Non Destructive Testing</td>
</tr>
<tr>
<td>CIM253</td>
<td>Artificial Intelligence and Expert Systems</td>
</tr>
<tr>
<td>CIM254</td>
<td>Advanced Control Engineering</td>
</tr>
</tbody>
</table>
ADVANCED FOUNDRY TECHNOLOGY

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Credits</th>
<th>CIE Marks</th>
<th>SEE Marks</th>
<th>SEE Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIM21</td>
<td>4</td>
<td>50 marks</td>
<td>50 marks</td>
<td>3 Hours for 100 marks</td>
</tr>
</tbody>
</table>

Course learning objectives
1. Foundry metallurgy and concept of solidification of metals. Interpretation and use of cooling curves.
2. Design principles of Casting, Gating and Riser system.
3. Advanced melting techniques and quality control of castings.
4. Cast iron foundry, particular attention to grey cast iron, ductile iron and malleable iron.
5. Aluminum alloy foundry practice discussing principal alloys such as Al-Si, Al-Cu and Al-Zn-Mg.

Pre-requisites: Basic Knowledge of Foundry technology and material science

Unit – I 10 Hours

Unit – II 10 Hours
Casting Design: Initial considerations in design, Functional design, Simplification of foundry practices, Metallurgical design, Economic considerations.
Riser Design: Types of risers and their application, Optimum riser design, Feed metal volume, Riser location, Progressive and directional Solidification, Feeding Distance, NRL method, Feeding aids used in riser design, Factors in riser size, computerized method of riser design.
Gating Design: Components of Gating system, Effects of gates on aspiration, turbulence and dross trap, Pressurized versus unpressurized systems, Vertical versus horizontal gating systems.

Unit - III 10 Hours
Furnace Technology: Cupola and its recent developments, charge calculation, Electron Beam Melting, Plasma Melting and Heating, Electro slag, Re melting.
Self-Learning Topics: Casting Defects & Quality Control Casting defects: Shaping faults arising in pouring, Inclusions and sand defects, Gas defects, Shrinkage defects, Contraction defects, Dimensional errors, Compositional errors and segregation. Different inspection and testing methods to evaluate the casting. Coating of Castings, Quality control activities in a foundry.
Unit - IV  
10 Hours
Ductile iron foundry practice: Melting practice, Desulfurization methods, Composition control, magnesium treatment, inoculation, casting and solidification, Engineering Properties, Austempered Ductile iron(ADI) Applications.
Malleable iron foundry practice: Melting practice, Structure of White-heart and black-heart malleable cast iron, Pearlitic malleable iron, Properties and applications.
Cast Iron Metallurgy
Classification of cast iron, Composition and graphitization, Carbon equivalent, Graphite morphology, effect of various elements. Special casting processes Investment casting, Die casting, centrifugal casting, full mould casting, vacuum shield casting etc.

Unit - V  
10 Hours
Soft Material foundry Practice: Aluminum casting-Composition, properties and application of common aluminum alloy casting, Melting and casting of aluminum alloys, Gating and risering of Al-alloy casting, Copper alloy foundry practice- General characteristics of common cast copper alloys, Melting and casting of copper alloys, Gating and risering of copper alloy castings.

Books
2. P.R. Beelely, Foundry Technology, Butterworth, 2001
3. Titov Stepnov, Foundries practice
7. P.C. Mukherjee, Fundamentals of Metal casting Technology
8. P.D.Webster, Fundamentals of Foundry Technology

Course Outcome (COs)
At the end of the course, the student will be able to

1. Design casting, gating and risering systems
   The students will get a clear thought on importance of solidification of advanced alloys, interpretation of cooling curves, imaging of solidification process and microstructure evaluation
2. The student will recognize the different types of melting and molding techniques for a particular alloy
   They will be able to appraise control casting quality, knowledge in inspection, testing methods and statistical quality control activities
3. Ability to use the methods, skills and engineering tools to produce castings of grey cast iron, ductile iron and malleable iron
4. Develop foundry practice for advanced soft materials
5. Ability to implement computer and robot technology in the foundry process to

Bloom’s Level
[L6]
[L3]
[L2]
[L5]
[L3]
[L6]
[L5]
meet desired needs and to function on multi disciplinary team

Broad education to understand the impact of mechanization in melting, pouring and material handling

Program Outcome of this course (POs)

1. Graduates shall acquire in-depth knowledge in machine design and update the same, integrating existing and updated knowledge in global perspective.
2. Graduates shall possess ability for independent judgment based on critical analysis and also for synthesis of information for extensive research in the area of specialization.
3. Graduates shall conceptualize through lateral thinking and obtain feasible and optimal solutions for engineering problems considering societal and environmental requirements

PO No. [L2]

Course delivery methods
1. Black Board Teaching
2. Power Point Presentation
3. Working Models
4. Videos

Assessment methods
1. Internal Assessment
2. Assignment
3. Seminar
4. Mini-project

Scheme of Continuous Internal Evaluation (CIE):

<table>
<thead>
<tr>
<th>Components</th>
<th>Average of best two IA tests out of three</th>
<th>Average of assignments (Two) / activity</th>
<th>Seminar/Mini Project</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Marks: 50</td>
<td>30</td>
<td>10</td>
<td>10</td>
<td>50</td>
</tr>
</tbody>
</table>

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 20
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.
### INDUSTRIAL ROBOTICS

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CIM22</th>
<th>Credits</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course type</td>
<td>PC</td>
<td>CIE Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Hours/week: L-T-P</td>
<td>4-0-0</td>
<td>SEE Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Total Hours:</td>
<td>50</td>
<td>SEE Duration</td>
<td>3 Hours for 100 marks</td>
</tr>
</tbody>
</table>

**Course learning objectives**

1. To introduce the basic concepts, parts of robots and types of robots.
2. To study different robot transformations and sensors.
3. To study the kinematics and dynamics of different standard configuration of manipulators.
4. To make the student familiar with the various drive systems for robot, sensors and their applications in robots.
5. To understand various control systems and their applications in robot

**Pre-requisites:** Basic knowledge of mathematics - matrices, control systems.

#### Unit – I 10 Hours

**Introduction:** Automation and Robotics, Historical Development, Definitions, Basic Structure of Robots, Robot Anatomy, Complete Classification of Robots, Fundamentals about Robot Technology, Factors related to use Robot Performance, Basic Robot Configurations and their Relative Merits and Demerits, Types of Drive Systems and their Relative Merits, the Wrist & Gripper Subassemblies.

**ROBOT TRANSFORMATIONS:** 2D and 3D Transformation-Scaling, Rotation, Translation-Homogeneous coordinates, multiple transformation-Simple problems.

**Self learning topics:** Automation and Robotics, Historical Development, Definitions, Basic Structure of Robots, Robot Anatomy, Complete Classification of Robots, Fundamentals about Robot Technology, Factors related to use Robot Performance, Basic Robot Configurations and their Relative Merits and Demerits

#### Unit – II 10 Hours


#### Unit – III 10 Hours


#### Unit – IV 10 Hours

**Robotic Motion Trajectory Design:** Introduction, Trajectory Interpolators, Basic Structure of Trajectory Interpolators, Cubic Joint Trajectories. General Design Consideration on Trajectories: 4-3-4 & 3-5-3 trajectories.
**Robot Teaching:** Introduction, Various Teaching Methods, Task Programming, Survey of Robot Level Programming Languages, WAIT, SIGNAL & DELAY Commands, various Textual Robot Languages such as VAL II, RAIL, AML and their Features, Typical Programming Examples such as Palletizing, Loading etc.

**Unit – V**

**10 Hours**


**Self learning topics:** Objectives, Automation in Manufacturing, Robot Application in Industry, Task Programming, Goals of AI Research, AI Techniques.

**Books**


**Course Outcome (COs)**

At the end of the course, the student will be able to

1. Familiarize with the history, concept development and key components of robotics technologies
   - Bloom’s Level [L2]
2. Understand basic mathematic manipulations of spatial coordinate representation and transformation
   - Bloom’s Level [L2, L4]
3. Understand and able to solve basic robot forward and inverse kinematics problems
   - Bloom’s Level [L2, L3]
4. Understand and able to solve basic robotic dynamics, path planning and control problems
   - Bloom’s Level [L2, L3]
5. Understand and demonstrate principles of various Sensors and their applications in robots
   - Bloom’s Level [L2]
Program Outcome of this course (POs)

1. Graduates shall possess ability for independent judgement based on critical analysis and also for synthesis of information for extensive research in the area of specialization.
   Graduates shall conceptualise through lateral thinking and obtain feasible and optimal solutions for engineering problems considering societal and environmental requirements.
2. Graduates shall review relevant literature, apply appropriate research methodologies, working individually or as a team contributing to the advancement of domain knowledge.
3. Graduates shall be able to adopt modern techniques, analytical tools and softwares for complex engineering solutions.

PO No. [PO2]

PO No. [PO3]

PO No. [PO4]

PO No. [PO5]

Course delivery methods

1. Black Board Teaching
2. Power Point Presentation
3. Working Models
4. Videos

Assessment methods

1. Internal Assessment
2. Assignment
3. Seminar
4. Mini-project

Scheme of Continuous Internal Evaluation (CIE):

<table>
<thead>
<tr>
<th>Components</th>
<th>Average of best two IA tests out of three</th>
<th>Average of assignments (Two) / activity</th>
<th>Seminar/Mini Project</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Marks: 50</td>
<td>30</td>
<td>10</td>
<td>10</td>
<td>50</td>
</tr>
</tbody>
</table>

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 20
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.
# NON TRADITIONAL MACHINING

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CIM23</th>
<th>Credits</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course type</td>
<td>PC</td>
<td>CIE Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Hours/week: L-T-P</td>
<td>4-0-0</td>
<td>SEE Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Total Hours:</td>
<td>50</td>
<td>SEE Duration</td>
<td>3 Hours for 100 marks</td>
</tr>
</tbody>
</table>

## Course learning objectives
1. To introduce the concept of non-traditional machining (NTM) processes and the need/scope of those processes.
2. To present an overview of classification and comparison between conventional and non-conventional machining process
3. To lay a firm foundation with regard to the principles, equipments and applications of NTM processes with emphasis on the latest developments.
4. To analyze some of the NTM processes with regard to the material removal rate (mrr) and to solve related engineering problems.

### Pre-requisites:
Basic knowledge of Conventional manufacturing and its concepts.

## Unit - I 10 Hours

**Introduction:** History, Classification, comparison between conventional and Non- conventional machining, process selection.

**Ultrasonic Machining (USM):** Introduction, equipment, tool materials & tool size, abrasive slurry, Acoustic Head, Tool Feed Mechanisms, Mechanics of USM, Expression for MRR:- Effect of process parameters: Effect of amplitude and frequency and vibration, Effect of abrasive grain diameter, effect of applied static load, effect of slurry concentration, tool & work material, USM process characteristics: Material removal rate, tool wear, Accuracy, surface finish, Numerical Problems

### Self learning topics:
Applications, advantages & Disadvantages of USM, Latest Developments

## Unit - II 10 Hours


### Self Learning Topics:
Advantages and limitations of water Jet machining, Abrasive water Jet machining, Latest Developments in AJM, WJM

## Unit - III 10 Hours

**Electrochemical Machining (ECM):** Introduction, study of ECM machine, elements of ECM process: Cathode tool, Anode work piece, source of DC power, Electrolyte, chemistry of the process, ECM Process characteristics – Material removal rate, Kinematics and Dynamics of ECM, Accuracy, surface finish, Selective Dissolution, Effect of Heat and Hydrogen Gas Bubbles, ECM Tooling: ECM tooling technique & example, Tool & insulation materials, Tool size Electrolyte flow arrangement, Handling of slug, Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding,

**Chemical Machining (CHM):** Introduction, elements of process, chemical blanking process: Preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, applications of chemical blanking, chemical milling (contour machining): process steps – masking, Etching, process characteristics of CHM: material removal rate, accuracy, surface finish, advantages & application of CHM. Latest Developments.

**Self Learning Topics:** Electrochemical Honing, Electrochemical De-burring, Hydrogen embrittlement

---

**Unit - IV**

**Electrical Discharge Machining (EDM):** Introduction, mechanism of metal removal, EDM Circuits and Operating Principles, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design, choice of machining operation, electrode material selection, under sizing and length of electrode, machining time. Flushing; pressure flushing, suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy, surface finish, Machining Accuracy, Heat Affected Zone. Machine tool selection, Application, EDM accessories / applications, electrical discharge grinding. Numerical Problems.

**Self Learning Topics:** traveling wire EDM, Latest Developments

---

**Unit - V**

**Plasma Arc Machining (PAM):** Introduction, equipment, non-thermal generation of plasma, selection of gas, Mechanism of metal removal, PAM parameters, process characteristics, PAM Torch, Accuracy and Surface Finish, Metallurgical Effects, Safety precautions, Latest Developments.


**Self Learning Topics:** applications, advantages and limitation of PAM, EBM and LBM.

---

**Books**

3. 1. HMT, Production Technology, Tata McGraw Hill, 2001
5. 3. NPTEL Notes nptel.ac.in/downloads/

---

**Course Outcome (COs)**

At the end of the course, the student will be able to

1. Explain the concept and evolution of Non -Traditional Machining (NTM) processes. [L2]
2. Explain equipment, mechanism of material removal and effect of different process parameters in the mechanical NTM processes (AJM, USM, WJM) and thermal NTM processes (EDM, PAM, LBM, EBM) [L3, L4]
3. Explain equipment, mechanism of material removal and effect of different [L6]
process parameters in the chemical and electrochemical NTM processes (CHM, ECM) [L3, L4]

4. Solve numerical problems and explain latest developments related to NTM processes.

Program Outcome of this course (POs)

1. Graduates shall acquire in-depth knowledge in machine design and update the same, integrating existing and updated knowledge in global perspective.
2. Graduates shall conceptualise through lateral thinking and obtain feasible and optimal solutions for engineering problems considering societal and environmental requirements.
3. Graduates shall be able to adopt modern techniques, analytical tools and softwares for complex engineering solutions

Program Outcome of this course (POs)

PO No. | Program Outcome of this course (POs)
--- | ---
[PO1] | Graduates shall acquire in-depth knowledge in machine design and update the same, integrating existing and updated knowledge in global perspective.
[PO3] | Graduates shall conceptualise through lateral thinking and obtain feasible and optimal solutions for engineering problems considering societal and environmental requirements.
[PO5] | Graduates shall be able to adopt modern techniques, analytical tools and softwares for complex engineering solutions

Course delivery methods

1. Black Board Teaching
2. Power Point Presentation
3. Working Models
4. Videos

Assessment methods

1. Internal Assessment
2. Assignment
3. Seminar
4. Mini-project

Scheme of Continuous Internal Evaluation (CIE):

<table>
<thead>
<tr>
<th>Components</th>
<th>Average of best two IA tests out of three</th>
<th>Average of assignments (Two) / activity</th>
<th>Seminar/Mini Project</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Marks: 50</td>
<td>30</td>
<td>10</td>
<td>10</td>
<td>50</td>
</tr>
</tbody>
</table>

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 20
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.
FLEXIBLE MANUFACTURING SYSTEMS

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CIM24</th>
<th>Credits</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course type</td>
<td>PC</td>
<td>CIE Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Hours/week: L-T-P</td>
<td>4-0-0</td>
<td>SEE Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Total Hours:</td>
<td>50</td>
<td>SEE Duration</td>
<td>3 Hours for 100 marks</td>
</tr>
</tbody>
</table>

**Course learning objectives**

1. To impart the concept & need for flexibility in manufacturing industries.
2. To impart the knowledge required to develop and implement an FMS.
3. To study the different types of automated material transport systems its design and analysis for different applications both AS/RS and Carousel storage system.
4. To understand the concepts of group technology and cellular manufacturing.
5. To learn the perception of aggregate production planning, master production schedule, MRP and Inventory control.

**Pre-requisites:** Basics of manufacturing processes and computer integrated manufacturing.

**Unit – I:** 10 Hours

**Definition of an FMS:** Types, configurations & concepts – Types of flexibility & performance measures. Function of FMS host computer, FMS host and area controller function distribution. Development and implementation of an FMS: Planning phase, Integration, System configuration, FMS layouts, Simulation, FMS Project development steps.

**Self Learning Topics:** Project management, Equipment development, Host system development, planning, and Hardware & Software development.

**Unit – II:** 10 Hours

Automated Material Handling & Storages systems: Functions, Types, Analysis of material handling equipments, Design of Conveyor & AGV systems. Benefits of Automated material handling systems. Problems. Storage system performance, AS/RS, Carousel storage system, WIP storage system

**Unit – III:** 10 Hours


**Unit – IV:** 10 Hours

Production Planning & Control system: Aggregate production planning and master production schedule, material requirement planning.

Just-In-Time: Definition JIT, Concept, Objectives

**Self learning topics:** Capacity planning, shop floor control, Inventory control, Extension of MRP.

**Unit – V:** 10 Hours

**Scheduling:** Introduction, Scheduling of operations on a single machine, 2 machine flow shop scheduling, 2 machine job shop scheduling, 3 machine flow shop scheduling, scheduling ‘n’ operations on ‘n’ machines, Scheduling rules, loading problems, Tool management of FMS, material Handling system schedule. Problems.
Books

Course Outcome (COs)
At the end of the course, the student will be able to

<table>
<thead>
<tr>
<th>Bloom’s Level</th>
<th>COs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.  Students will learn and understand the concepts, techniques and applications of flexible Manufacturing System [L2]</td>
</tr>
<tr>
<td></td>
<td>2.  The students will be able to describe an FMS system in present manufacturing scenario [L2]</td>
</tr>
<tr>
<td></td>
<td>3.  The student will understand the different types of FMS layouts, material transport and retrieval systems [L2]</td>
</tr>
<tr>
<td></td>
<td>4.  To solve the sequencing problems for different cases and tool management [L2]</td>
</tr>
</tbody>
</table>

Program Outcome of this course (POs)

<table>
<thead>
<tr>
<th>PO No.</th>
<th>POs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.  Graduates shall acquire in-depth knowledge in machine design and update the same, integrating existing and updated knowledge in global perspective. [PO1]</td>
</tr>
<tr>
<td></td>
<td>2.  Graduates shall be able to adopt modern techniques, analytical tools and softwares for complex engineering solutions [PO5]</td>
</tr>
<tr>
<td></td>
<td>3.  Graduates shall possess communication skills to comprehend, document and present effectively to the engineering community and society at large. [PO8]</td>
</tr>
</tbody>
</table>

Course delivery methods       Assessment methods
1. Black Board Teaching       1. Internal Assessment
2. Power Point Presentation   2. Assignment
4. Videos                     4. Mini-project

Scheme of Continuous Internal Evaluation (CIE):

<table>
<thead>
<tr>
<th>Components</th>
<th>Average of best two IA tests out of three</th>
<th>Average of assignments (Two) / activity</th>
<th>Seminar/Mini Project</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Marks: 50</td>
<td>30</td>
<td>10</td>
<td>10</td>
<td>50</td>
</tr>
</tbody>
</table>

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):
1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 20
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.
ADVANCED TOOL DESIGN

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CIM251</th>
<th>Credits</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course type</td>
<td>PE</td>
<td>CIE Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Hours/week: L-T-P</td>
<td>4-0-0</td>
<td>SEE Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Total Hours:</td>
<td>50</td>
<td>SEE Duration</td>
<td>3 Hours for 100 marks</td>
</tr>
</tbody>
</table>

Course learning objectives
1. To impart the basic concepts and fundamentals of Tool engineering, its techniques and applications
2. To comprehend the relationship between Tools and Machine tool
3. To enhance awareness in the recent aspects of Tool engineering.

Pre-requisites: Basic Knowledge of machine tools and cutting tools and also machining process.

Unit - I 10 Hours
Introduction to tool design of Single point Cutting Tools
Introduction to tool design: Tooling, requirements of a tool designer, general tool design procedure. Design of Single point Cutting Tools. Design of single point lathe tool. Design of shank dimension using strength and rigidity considerations for rectangular, square and round cross section and selection of tool geometry.

Self Learning Topics: Solid type tool, brazed tip tool, long indexable insert, throwaway index able insert types and chip breakers.

Unit - II 10 Hours
Design of Multi Point Cutting Tool
Design of milling cutter. Design of elements like number of teeth and height circular pitch, body thickness, chamfer width, fillet radius and selection of tool geometry.

Self Learning Topics: Drill bit design of elements like back taper, web thickness, land width, margin, flute length and cross section and selection of tool geometry.

Unit - III 10 Hours
Design of Jigs and Fixtures
Functions and differences between jigs and fixtures, advantages in mass production, design principles, economics of jigs and fixtures. Principles of location -3-2-1 and 4-1-1 types of locations, different types of locating elements. Clamping – Principles of clamping, types of clamping including power clamping devices. Drill jigs- Types, Drill bushes, simple exercises of designing jigs for given components. Fixture Design turning fixtures, milling fixtures, grinding and broaching fixtures, indexing fixtures. Design of fixtures for simple components.

Unit - IV 10 Hours
Design of Sheet Metal
Working of a power press and classification of presses. Components of a simple die, press tool operation, die accessories, shearing action in punch & die, clearance, shear on punch and die. Centre of pressure and problems, scrap strip layout. Simple, progressive, compound, combination and
inverted dies. Design problems on blanking and piercing dies for simple components.

**Injection Molding**

Injection moulding machine and its elements, general configuration of a mould. 2 plate and 3 plate mould. Introduction, to gate, runner, parting surface, ejection system. Core and cooling system. Introduction to compression, transfer, blow moulding, extrusion, forming and calendaring.

**Unit - V**

10 Hours

**Die Casting Dies**

Terminology: Core, cavity, sprue, slug, fixed and movable cores, finger cams, draft, and ejector pins ejector plates, gate, goose nozzle, over-flow, platten, plunger, runner, vent, water-line etc. Types of Dies: Single cavity, multicavity dies, combination dies, unit dies, advantages and disadvantages of types of dies. Die casting dies, unit dies. Advantages and disadvantages of types of dies. Die casting alloys, defects in die casting, finishing trimming and inspection of die casting components, safety, and modern trends in die casting dies.

**Books**


**Course Outcome (COs)**

At the end of the course, the student will be able to

1. Students will learn the concepts, techniques and applications of Tool Design engineering
2. Students will learn the working concepts of Fixturing and various tools of engineering

**Program Outcome of this course (POs)**

1. Graduates shall acquire in-depth knowledge in machine design and update the same, integrating existing and updated knowledge in global perspective.
2. Graduates shall possess ability for independent judgment based on critical analysis and also for synthesis of information for extensive research in the area of specialization.
3. Graduates shall conceptualise through lateral thinking and obtain feasible and optimal solutions for engineering problems considering societal and environmental requirements.

**Course delivery methods**

1. Black Board Teaching
2. Power Point Presentation
3. Working Models
4. Videos

**Assessment methods**

1. Internal Assessment
2. Assignment
3. Seminar
4. Mini-project
**Scheme of Continuous Internal Evaluation (CIE):**

<table>
<thead>
<tr>
<th>Components</th>
<th>Average of best two IA tests out of three</th>
<th>Average of assignments (Two) / activity</th>
<th>Seminar/Mini Project</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Marks: 50</td>
<td>30</td>
<td>10</td>
<td>10</td>
<td>50</td>
</tr>
</tbody>
</table>

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

**Scheme of Semester End Examination (SEE):**
1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.
Course Code | CIM252 | Credits | 4
--- | --- | --- | ---
Course type | PE | CIE Marks | 50 marks
Hours/week: L-T-P | 4-0-0 | SEE Marks | 50 marks
Total Hours: | 50 | SEE Duration | 3 Hours for 100 marks

Course learning objectives

1. The concept & need for inspection equipment and techniques.
2. The different methods of non destructive evaluation

Pre-requisites: Basic knowledge of Inspection techniques

Unit – I


Self learning topics: Liquid Penetrant Inspection

Unit – II

Magnetic Particle Inspection - Methods of generating magnetic field, types of magnetic particles and suspension liquids steps in inspection.

Eddy Current Inspection- principles, operation variables, procedure, inspection coils, and detectable discounts by the method

Self Learning Topics: application and limitations of magnetic particle inspection.

Unit – III

Microwave Inspection: Microwave holography, applications and limitations

Ultrasonic Inspection- Basic equipment characteristics of ultrasonic waves, variables inspection, inspection methods pulse echo A,B,C scans transmission, resonance techniques, search units, contact types and immersion types inspection standards-standards reference books.

Self Learning Topics: transducer elements couplets

Unit – IV

Acoustic Emission Inspection- relationship to other test methods, range and applicability, acoustic emission waves and propagation, acoustic emission sensors and preamplifiers, instrumentation principles, acoustic emission in material studies.

Radiographic Inspection- principles, radiation source X-rays and gamma rays, X-ray-tube, radiographic films, neutron radiography, Thermal inspection principles, equipment inspection methods applications.

Unit – V

Neutron Radiography- Principles of neutron radiography, attenuation of neutron beams, applications

Optical Holography- Basics of Holography, recording and reconstruction - Acoustical Holography: systems and techniques applications.

Self Learning Topics: neutron detection methods, Indian standards for NDT.
Books


Course Outcome (COs)

At the end of the course, the student will be able to

1. Students will understand the concepts, techniques and applications of non destructive testing
2. The students will describe the importance of non destructive testing in present inspection world
3. The student will learn and explain the different types of different non destructive methods

Bloom’s Level

Program Outcome of this course (POs)

1. Graduates shall acquire in-depth knowledge in machine design and update the same, integrating existing and updated knowledge in global perspective.
2. Graduates shall possess ability for independent judgment based on critical analysis and also for synthesis of information for extensive research in the area of specialization.
3. Graduates shall be able to adopt modern techniques, analytical tools and softwares for complex engineering solutions.

PO No.

Course delivery methods

1. Black Board Teaching
2. Power Point Presentation
3. Working Models
4. Videos

Assessment methods

1. Internal Assessment
2. Assignment
3. Seminar
4. Mini-project

Scheme of Continuous Internal Evaluation (CIE):

<table>
<thead>
<tr>
<th>Components</th>
<th>Average of best two IA tests out of three</th>
<th>Average of assignments (Two) / activity</th>
<th>Seminar/Mini Project</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Marks: 50</td>
<td>30</td>
<td>10</td>
<td>10</td>
<td>50</td>
</tr>
</tbody>
</table>

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 20
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.
ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CIM253</th>
<th>Credits</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course type</td>
<td>PE</td>
<td>CIE Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Hours/week: L-T-P</td>
<td>4-0-0</td>
<td>SEE Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Total Hours:</td>
<td>50</td>
<td>SEE Duration</td>
<td>3 Hours for 100 marks</td>
</tr>
</tbody>
</table>

**Course learning objectives**

1. The course is aimed at providing a complete overview of Artificial Intelligence and Expert Systems.
2. The course is aimed in order to make the student aware of the significance of AI & expert System’s application in advanced manufacturing applications.

**Prerequisites:** Basic knowledge of control systems.

**Unit - I**

**10 Hours**

**Human and Machine Intelligence:** Concepts of fifth generation computing, programming AI environment, developing artificial intelligence system, definition of Expert systems, Natural Language processing, neural networks.

**Tools for Machine Thinking:** Forward chaining, backward chaining, use of probability and fuzzy logic.

**Self Learning Topics:** Functions of different parts of Mechatronic system

**Unit - II**

**10 Hours**

**Expert System Development:** Choice of Domain, collection of knowledge base, selection of inference mechanism, case studies of expert system development in design and manufacturing.

**Advanced Programming Techniques:** Fundamentals of object-oriented programming, creating structure and object, object operations, involving procedures, programming applications, object-oriented expert system.

**Unit - III**

**10 Hours**

**Languages in AI:** Using PROLOG to design expert systems, converting Rules to PROLOG, Conceptual example, introduction to LISP, Function evaluation, Lists, Predicates, Rule creation.

**Unit - IV**

**10 Hours**

**Advanced knowledge representation for smart systems:** Semantic nets-structure and objects, ruled systems for semantic nets, certainly factors, Automated learning

**Expert System Tools:** General structure of an expert system shell, examples of creation of an expert system using an expert system tool.

**Unit - V**

**10 Hours**

**Industrial Application of AI and Expert systems:** Robotic vision systems, Image processing techniques, application to object recognition and inspection, automatic speech recognition.

**Self learning topics:** Robotic vision systems, Image processing techniques, application to object recognition and inspection, automatic speech recognition.
Books

Course Outcome (COs)
At the end of the course, the student will be able to

1. Familiarize and understand human and Machine Intelligence. [L2]
2. Understand tools for machine thinking and associated advanced programming techniques. [L2, L3]
3. Demonstrate the application of AI & expert systems in industry [L3]
4. Explain fabrication, design and packaging of MEMS and Microsystems. [L1, L2]

Program Outcome of this course (POs)
1. Graduates shall possess ability for independent judgment based on critical analysis and also for synthesis of information for extensive research in the area of specialization. [PO2]
2. Graduates shall conceptualise through lateral thinking and obtain feasible and optimal solutions for engineering problems considering societal and environmental requirements. [PO3]
3. Graduates shall review relevant literature, apply appropriate research methodologies, working individually or as a team contributing to the advancement of domain knowledge. [PO4]
4. Graduates shall be able to adopt modern techniques, analytical tools and softwares for complex engineering solutions. [PO5]

Course delivery methods
1. Black Board Teaching
2. Power Point Presentation
3. Working Models
4. Videos

Assessment methods
1. Internal Assessment
2. Assignment
3. Seminar
4. Mini-project

Scheme of Continuous Internal Evaluation (CIE):

<table>
<thead>
<tr>
<th>Components</th>
<th>Average of best two IA tests out of three</th>
<th>Average of assignments (Two) / activity</th>
<th>Seminar/Mini Project</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Marks: 50</td>
<td>30</td>
<td>10</td>
<td>10</td>
<td>50</td>
</tr>
</tbody>
</table>

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.
Scheme of Semester End Examination (SEE):
1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the
calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 20
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full
questions. SEE question paper will have two compulsory questions (any 2 units) and choice will
be given in the remaining three units.
ADVANCED CONTROL ENGINEERING

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CIM254</th>
<th>Credits</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course type</td>
<td>PE</td>
<td>CIE Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Hours/week: L-T-P</td>
<td>4-0-0</td>
<td>SEE Marks</td>
<td>50 marks</td>
</tr>
<tr>
<td>Total Hours:</td>
<td>50</td>
<td>SEE Duration</td>
<td>3 Hours for 100 marks</td>
</tr>
</tbody>
</table>

Course learning objectives
1. To study various control techniques used in industrial automatic controls.
2. To study various frequency response methods.
3. To study various response and system compensation methods.
4. To get exposure of digital control systems

Pre-requisites: Should have knowledge of Basic Electronics and Control Engineering

Unit – I
10 Hours
Introduction to Automatic Controls: Steady-State Operation, Laplace Transforms.

Self Learning Topics: Representation of Control Components, Representation of Control Systems, Characteristic functions.

Unit – II
10 Hours
Frequency Response Methods: - Introduction, Evaluating the Gain K, Equivalent Unity-Feedback Systems, Polar Plots, M And α Circles, Correlation between Transient and Frequency Response, Determining the Gain K to Yield a Desired Mp, Relative Stability

Self Learning Topics: Frequency Response, Logarithmic Representation

Unit – III
10 Hours

Self Learning Topics: Nyquist Stability Criterion

Unit – IV
10 Hours

Unit – V
10 Hours
Books


Course Outcome (COs)

At the end of the course, the student will be able to

<table>
<thead>
<tr>
<th>Bloom’s Level</th>
<th>COs</th>
</tr>
</thead>
<tbody>
<tr>
<td>[L2, L3]</td>
<td>1. Understand various control techniques used in modern engineering control system</td>
</tr>
<tr>
<td>[L2, L3]</td>
<td>2. Understand various system compensation and response methods</td>
</tr>
<tr>
<td>[L1]</td>
<td>3. Explain digital control systems</td>
</tr>
</tbody>
</table>

Program Outcome of this course (POs)

<table>
<thead>
<tr>
<th>PO No.</th>
<th>POs</th>
</tr>
</thead>
<tbody>
<tr>
<td>[PO1]</td>
<td>1. Graduates shall acquire in-depth knowledge in machine design and update the same, integrating existing and updated knowledge in global perspective.</td>
</tr>
<tr>
<td>[PO3]</td>
<td>2. Graduates shall conceptualise through lateral thinking and obtain feasible and optimal solutions for engineering problems considering societal and environmental requirements.</td>
</tr>
<tr>
<td>[PO4]</td>
<td>3. Graduates shall possess ability for independent judgement based on critical analysis and also for synthesis of information for extensive research in the area of specialization.</td>
</tr>
<tr>
<td>[PO6]</td>
<td>4. Graduates shall be able to engage in collaborative multidisciplinary scientific research for decision making through rational analysis</td>
</tr>
<tr>
<td>[PO11]</td>
<td>5 Graduate shall be able to introspect and apply corrections.</td>
</tr>
</tbody>
</table>

Course delivery methods

<table>
<thead>
<tr>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Black Board Teaching</td>
</tr>
<tr>
<td>2. Power Point Presentation</td>
</tr>
<tr>
<td>3. Working Models</td>
</tr>
<tr>
<td>4. Videos</td>
</tr>
</tbody>
</table>

Assessment methods

<table>
<thead>
<tr>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Internal Assessment</td>
</tr>
<tr>
<td>2. Assignment</td>
</tr>
<tr>
<td>3. Seminar</td>
</tr>
<tr>
<td>4. Mini-project</td>
</tr>
</tbody>
</table>

Scheme of Continuous Internal Evaluation (CIE):

<table>
<thead>
<tr>
<th>Components</th>
<th>Average of best two IA tests out of three</th>
<th>Average of assignments (Two) / activity</th>
<th>Seminar/Mini Project</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Marks: 50</td>
<td>30</td>
<td>10</td>
<td>10</td>
<td>50</td>
</tr>
</tbody>
</table>

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.
Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.

2. Minimum marks required in SEE to pass: 20

3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.
RAPID PROTOTYPING AND CASTING ANALYSIS LAB

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CIM26</th>
<th>Credits</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course type</td>
<td>PC</td>
<td>CIE Marks</td>
<td>25 marks</td>
</tr>
<tr>
<td>Hours/week: L-T-P</td>
<td>0-0-3</td>
<td>SEE Marks</td>
<td>25 marks</td>
</tr>
<tr>
<td>Total Hours:</td>
<td>30</td>
<td>SEE Duration</td>
<td>3 Hours for 50 marks</td>
</tr>
</tbody>
</table>

**Course learning objectives**

1. To enable the students to use CAD software for solid modeling
2. To enable the students to use RP process and parameters for prototyping
3. To enable the students to use Solidcast for casting analysis

**List of experiments**

1. Solid modeling using modelers like CATIA/SE of casting component 1
2. Solid modeling using modelers like CATIA/SE of casting component 2
3. Solid modeling using modelers like CATIA/SE of casting component 3
4. Rapid Prototyping system- introduction to FDM process and parameters
5. Making the RP parts for simple components
6. Introduction to Casting analysis, gating and riser design
7. Introduction to Solidcast- Casting parameters and process
8. Casting analysis of component using Solidcast, riser design parameters to predict shrinkage.
9. Designing of riser, gates in modeling software.
10. Casting analysis of component incorporating riser and gates using Solidcast and Flowcast to reduce shrinkage

**Books**


**Course Outcome (COs)**

At the end of the course, the student will be able to

1. Ability to understand the tools to model mechanical components. [L2]
2. Ability to understand the process to manufacture prototypes using FDM process [L2]
3. Ability to analyze castings for shrinkage and other defects. [L4]

**Program Outcome of this course (POs)**

1. Graduates shall acquire in-depth knowledge in machine design and update the same, integrating existing and updated knowledge in global perspective. [PO1]
2. Graduates shall be able to adopt modern techniques, analytical tools and [PO5]
softwares for complex engineering solutions.

**Assessment methods**
1. Lab Internal Assessment
2. VIVA

**Scheme of Continuous Internal Evaluation (CIE):**

<table>
<thead>
<tr>
<th>Components</th>
<th>Conduct of the lab</th>
<th>Journal submission</th>
<th>Lab test</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Marks: 25</td>
<td>10</td>
<td>10</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

- Submission and certification of lab journal is compulsory to qualify for SEE.
- **Minimum marks required to qualify for SEE : 13**

**Scheme of Semester End Examination (SEE):**

1. It will be conducted for 50 marks of 3 hours duration. **It will be reduced to 25 marks for the calculation of SGPA and CGPA.**
2. **Minimum marks required in SEE to pass:**
   - Initial write up 2*10 = 20 marks
   - Conduct of experiments 2*10 = 20 marks
   - Viva- voce 10 marks
   - Total 50 marks
Bloom’s Taxonomy of Learning Objectives

Bloom’s Taxonomy in its various forms represents the process of learning. It was developed in 1956 by Benjamin Bloom and modified during the 1990’s by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom’s) to make it relevant to the 21st century. The revised taxonomy given below emphasizes what a learner “Can Do”.

### Lower order thinking skills (LOTS)

<table>
<thead>
<tr>
<th>Level</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Remembering</td>
<td>Retrieve relevant knowledge from memory.</td>
</tr>
<tr>
<td>L2</td>
<td>Understanding</td>
<td>Construct meaning from instructional material, including oral, written, and graphic communication.</td>
</tr>
<tr>
<td>L3</td>
<td>Applying</td>
<td>Carry out or use a procedure in a given situation – using learned knowledge.</td>
</tr>
</tbody>
</table>

### Higher order thinking skills (HOTS)

<table>
<thead>
<tr>
<th>Level</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L4</td>
<td>Analyzing</td>
<td>Break down knowledge into its components and determine the relationships of the components to one another and then how they relate to an overall structure or task.</td>
</tr>
<tr>
<td>L5</td>
<td>Evaluating</td>
<td>Make judgments based on criteria and standards, using previously learned knowledge.</td>
</tr>
<tr>
<td>L6</td>
<td>Creating</td>
<td>Combining or reorganizing elements to form a coherent or functional whole or into a new pattern, structure or idea.</td>
</tr>
</tbody>
</table>