Academic Regulations -GR17
Programme Structure
&
Detailed Syllabus

Master of Technology
(M. Tech)
Design For Manufacturing
(Two Year Regular Programme)
(Applicable for Batches admitted from 2017)

Department of Mechanical Engineering

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING & TECHNOLOGY
Bachupally, Kukatpally, Hyderabad, Telangana, India
500 090
Academic Regulations-GR17

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
For all Post Graduate Programmes (M.Tech)
GR17 REGULATIONS

Gokaraju Rangaraju Institute of Engineering & Technology 2017 Regulations (GR 15 Regulations) are given hereunder. These regulations govern all the Post Graduate programmes offered by various departments of Engineering with effect from the students admitted to the programmes in 2017-18 academic year.

1. **Programme Offered:** The Post Graduate programme offered by the department is M.Tech, a two-year regular programme in that discipline.

2. **Medium of Instruction:** The medium of instruction (including examinations and reports) is English.

3. **Admissions:** Admission into the M.Tech Programme in any discipline shall be made subject to the eligibility and qualifications prescribed by the University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in PGCET conducted by the APSCHE for M. Tech Programmes or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government from time to time.

4. **Programme Pattern:**
   a) A student is introduced to “Choice Based Credit System (CBCS)” for which he/she has to register for the courses as per the procedure.
   b) Each Academic year of study is divided into two semesters.
   c) Minimum number of instruction days in each semester is 90.
   d) The total credits for the Programme is 88.
   e) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).
   f) A student has a choice of registering for credits from the courses offered in the programme.
   g) All the registered credits will be considered for the calculation of final CGPA.

5. **Award of M.Tech Degree:** A student will be declared eligible for the award of the M. Tech Degree if he/she fulfills the following academic requirements:
   a) A student shall be declared eligible for the award of M.Tech degree, if he/she pursues the course of study and completes it successfully in not less than two academic years and not more than four academic years.
   b) A Student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the date of admission, shall forfeit his/her seat in M.Tech course.
   c) The Degree of M.Tech shall be conferred by Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, on the students who are admitted to the programme and fulfill all the requirements for the award of the degree.

6. **Attendance Requirements**
   a) A student shall be eligible to appear for the end semester examinations if he/she puts in a minimum of 75% of attendance in aggregate in all the courses concerned in the semester.
   b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below
75%) in a semester may be granted. A committee headed by Dean (Academic Affairs) shall be the deciding authority for granting the condonation.

c) **A student has to acquire a minimum of 5.0 SGPA in each semester for the award of M. Tech degree.**

d) Students who have been granted condonation shall pay a fee as decided by the Academic Council.

e) A candidate shall get minimum required attendance at least in three theory subjects in the semester to get promoted to the next semester. In order to qualify for the award of M.Tech. Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

f) Students whose shortage of attendance is not condoned in any semester are detained and are not eligible to take their end examinations of that semester. They may seek re-registration for that semester when offered next with the academic regulations of the batch into which he/she gets re-registered.

7. **Paper Setting, Evaluation of Answer Scripts, Marks and Assessment**

a) Paper setting and Evaluation of the Answer Scripts shall be done as per the procedures laid down by the Academic Council of the College from time to time.

b) The following is the division of marks between internal and external evaluations.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Internal Evaluation</th>
<th>External Evaluation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Practical</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Comprehensive Viva</td>
<td>----</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Seminar</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Project work</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
</tbody>
</table>

c) The marks for internal evaluation per semester per theory course are divided as follows:

i. **For Mid written examinations:** 20 Marks

ii. **For Assignment:** 5 Marks

iii. **For Attendance:** 5 Marks

iv. **Total:** 30 Marks

d) **Mid-Term Written Examination:** There shall be two mid-term written examinations during a semester. The first mid-term written examination shall be conducted from the first 50 per cent of the syllabus and the second mid-term written examination shall be conducted from the remaining 50 per cent of the syllabus. The mid-term written examinations shall be evaluated for **20 marks** and average of the marks scored in the two mid-term written examinations shall be taken as the marks scored by each student in the mid-term written examination for that semester.

e) **Assignment:** Assignments are to be given to the students and marks not exceeding 5 (5%) per semester per paper are to be awarded by the teacher concerned.

f) **Attendance:** A maximum of 5 marks (5%) per semester per course are to be awarded on the basis of attendance one puts in. Course-wise attendance is taken for this purpose.
g) **For Internal Evaluation in Practical/Lab Subjects:** The marks for internal evaluation are 30. Internal Evaluation is done by the teacher concerned with the help of the other staff member nominated by Head of the Department. Marks Distribution is as follows:

1. **Writing the program/Procedure:** 10 Marks
2. **Executing the program/Procedure:** 10 Marks
3. **Viva:** 05 Marks
4. **Attendance:** 05 Marks
5. **Total:** 30 Marks

h) The Semester end examination shall be conducted by an external examiner and a staff member of the Department nominated by Head of the Department. Marks distribution is as follows:

1. **Writing the program/Procedure:** 20 Marks
2. **Executing the program/Procedure:** 20 Marks
3. **Viva:** 15 Marks
4. **Lab Record:** 15 Marks
5. **Total:** 70 Marks

d) **Evaluation of Main Project Work:** A Project Review Committee (PRC) is to be constituted with Principal/Director with Head of the Department as the Chairman and two other senior faculty members of the department.

i. **Registration for Project work:** A candidate is permitted to register for the project work after satisfying the attendance requirements of all the courses (theory and practical courses) up to III Semester.

ii. After satisfying the registration requirements, a candidate is permitted to register for the project work after satisfying, the title, objectives and plan of action of his project work to the Project Review Committee for its approval. Only after obtaining the approval of Project Review Committee of the Department, the student can initiate the project work. Any changes thereafter in the project are to be approved by PRC. The student has to work under the guidance of both internal guide (one faculty member of the department) and external guide (from Industry not below the rank of an officer). Internal guide is allotted by the Head of the Department or Coordinator of the Project Work whereas external guide is allotted by the industrial organization in which the project is undertaken.

iii. The candidate shall submit status of the report in two stages at least with a gap of 20 days between them.

iv. The work on the project shall be initiated in the beginning of the fourth semester and the duration is one semester. A candidate is permitted to submit project report only after successful completion of theory and practical courses with the approval of PRC and not earlier than 40 days from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of the thesis to the Head/Coordinator (through internal research guide) and shall make an oral presentation before the PRC.

v. Two hardcopies and one soft copy of the project work (dissertation) certified by the research supervisors shall be submitted to the College/Institute.

vi. The thesis shall be adjudicated by one external examiner selected by the Institute out of 5-member panel, submitted by the department.

vii. **The marks allotted for project work review are 100, out of which 30 are for internal and 70 for external.** Internal evaluation marks are awarded by the PRC on
the basis of the student’s performance in the three pre-submission reviews and the external evaluation is done by the external examiner.

viii. **The marks allotted for project work and dissertation are 100, out of which 30 are for internal and 70 for external.** Internal evaluation marks are awarded by the PRC on the basis of the student’s performance in the three pre-submission reviews and the external evaluation is done by the external examiner. In both internal and external evaluations the student shall score at least 40% marks and an aggregate of 50% marks for to pass in the project work. If the report of the examiner is favorable, Viva-voce examination shall be conducted by a Board consisting of the Supervisor, Head and the External Examiner who adjudicated the project work. The Board shall jointly evaluate the student’s performance in the project work.

ix. In case the student doesn’t pass through the project work, he has to reappear for the viva-voce examination, as per the recommendations of the Board. If he fails succeed at the second Viva-voce examination also, he will not be eligible for the award of the degree, unless he is asked to revise and resubmit the Project by the Board. Head of the Department and Project coordinator shall coordinate and make arrangements for the conduct of viva-voce examination. When one does get the required minimum marks both in internal and external evaluations the candidate has to revise and resubmit the dissertation in the time frame prescribed by the PRC. If the report of the examiner is unfavorable again, the project shall be summarily rejected.

x. If the report of the viva-voce is not satisfactory, the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination, he will not be eligible for the award of the degree, unless the candidate is asked to revise and resubmit.

8. **Recounting of Marks in the End Examination Answer Books:** A student can request for recounting of his/her answer book on payment of a prescribed fee.

9. **Re-evaluation of the End Examination Answer Books:** A student can request for re-evaluation of his/her answer book on payment of a prescribed fee.

10. **Supplementary Examinations:** A student who has failed in an end semester examination can appear for a supplementary examination, as per the schedule announced by the College/Institute.

11. **Malpractices in Examinations:** Disciplinary action shall be taken in case of malpractices during Mid/End-examinations as per the rules framed by the Academic Council.

12. **Academic Requirements:**
   a) A student shall be deemed to have secured the minimum academic requirement in a subject if he/she secures a minimum of 40% of marks in the Semester-end Examination and a minimum aggregate of 50% of the total marks in the Semester-end examination and Internal Evaluation taken together.
   b) In order to qualify for the award of M.Tech Degree, the student shall complete the academic requirements of passing in all the Courses as per the course structure including Seminars and Project if any.
   c) In case a Student does not secure the minimum academic requirement in any course, he/she has to reappear for the Semester-end Examination in the course, or re-register for the same course when next offered or re-register for any other specified course, as may be required. However, one more additional chance may be provided for each student, for improving the internal marks provided the internal marks secured by a student are less than 50% and he/she failed finally in the course concerned. In the event of taking another chance for re-
registration, the internal marks obtained in the previous attempt are nullified. In case of re-registration, the student has to pay the re-registration fee for each course, as specified by the College.

d) Grade Points: A 10-point grading system with corresponding letter grades and percentage of marks, as given below, is followed

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Grade Points</th>
<th>Percentage of marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>O (Outstanding)</td>
<td>10</td>
<td>Marks ≥ 80 and Marks ≤ 100</td>
</tr>
<tr>
<td>A+ (Excellent)</td>
<td>9</td>
<td>Marks ≥ 70 and Marks &lt; 80</td>
</tr>
<tr>
<td>A (Very Good)</td>
<td>8</td>
<td>Marks ≥ 60 and Marks &lt; 70</td>
</tr>
<tr>
<td>B+ (Good)</td>
<td>7</td>
<td>Marks ≥ 55 and Marks &lt; 60</td>
</tr>
<tr>
<td>B (Above Average)</td>
<td>6</td>
<td>Marks ≥ 50 and Marks &lt; 55</td>
</tr>
<tr>
<td>F (Fail)</td>
<td>0</td>
<td>Marks &lt; 50</td>
</tr>
<tr>
<td>Ab (Absent)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Earning of Credit:
A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range O-P. Letter grade ‘F’ in any Course implies failure of the student in that course and no credits earned.

Computation of SGPA and CGPA:
The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i) $S_k$, the SGPA of $k^{th}$ semester (1 to 4) is the ratio of sum of the product of the number of credits and grade points to the total credits of all courses registered by a student, i.e.,

$$SGPA (S_k) = \frac{\sum_{i=1}^{n} (C_i \times G_i)}{\sum_{i=1}^{n} C_i}$$

Where $C_i$ is the number of credits of the $i^{th}$ course and $G_i$ is the grade point scored by the student in the $i^{th}$ course and $n$ is the number of courses registered in that semester.

ii) The CGPA is calculated in the same manner taking into account all the courses $m$, registered by a student over all the semesters of a programme, i.e., upto and inclusive of $S_k$, where $k \geq 2$.

$$CGPA = \frac{\sum_{i=1}^{m} (C_i \times G_i)}{\sum_{i=1}^{m} C_i}$$

iii) The SGPA and CGPA shall be rounded off to 2 decimal points.

13. Award of Class: After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of M. Tech Degree by JNTUH, he/she shall be placed in one of the following four classes:

<table>
<thead>
<tr>
<th>Class Awarded</th>
<th>CGPA Secured</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.1 First Class With Distinction</td>
<td>CGPA ≥ 7.75</td>
</tr>
<tr>
<td>13.2 First Class</td>
<td>CGPA ≥ 6.75 and CGPA &lt; 7.75</td>
</tr>
<tr>
<td>13.3 Second Class</td>
<td>CGPA ≥ 6.00 and CGPA &lt; 6.75</td>
</tr>
</tbody>
</table>

14. Withholding of Results: If the student has not paid dues to the Institute/University, or if any case of indiscipline is pending against him, the result of the student (for that Semester) may be withheld and he will not be allowed to go into the next Semester. The award or issue of the Degree may also be withheld in such cases.

15. Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/Universities: Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/Universities shall be considered only on case-to-case basis by the Academic Council of the Institute.

16. Transitory Regulations: Students who have discontinued or have been detained for want of attendance, or who have failed after having undergone the Degree Programme, may be considered
eligible for readmission to the same or equivalent subjects as and when they are offered.

17. **General Rules**
   
a) The academic regulations should be read as a whole for the purpose of any interpretation.
b) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.
c) In case of any error in the above rules and regulations, the decision of the Academic Council is final.
d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.
### COURSE STRUCTURE FOR GR17

**M. TECH. (Mechanical Engineering: Design for Manufacturing)**

#### I YEAR - I SEMESTER

<table>
<thead>
<tr>
<th>Code</th>
<th>Group</th>
<th>Subject</th>
<th>L</th>
<th>P</th>
<th>C</th>
<th>Int</th>
<th>Ext</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR17D5107</td>
<td>PC</td>
<td>Advanced Mechanics of Solids</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5108</td>
<td>PC</td>
<td>Materials Technology</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5109</td>
<td>PC</td>
<td>Precision Engineering</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>OE</td>
<td></td>
<td>Open Elective – I</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5111</td>
<td>Elective I PE</td>
<td>Special Manufacturing Processes</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5112</td>
<td>PE</td>
<td>Finite Element Applications in Manufacturing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GR17D5113</td>
<td>PE</td>
<td>Quality Engineering in Manufacturing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GR17D5114</td>
<td>Elective II PE</td>
<td>Advanced CAD</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5115</td>
<td>PE</td>
<td>Mechatronics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GR17D5116</td>
<td>PE</td>
<td>Theory of Elasticity &amp; Plasticity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GR17D5117</td>
<td>Lab</td>
<td>Manufacturing Simulation &amp; Precision Engg Lab</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5173</td>
<td>SPW</td>
<td>Seminar-I</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>28</td>
<td>4</td>
<td>28</td>
<td>240</td>
<td>560</td>
<td>800</td>
</tr>
</tbody>
</table>

#### I YEAR - II SEMESTER

<table>
<thead>
<tr>
<th>Code</th>
<th>Group</th>
<th>Subject</th>
<th>L</th>
<th>P</th>
<th>C</th>
<th>Int</th>
<th>Ext</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR17D5118</td>
<td>PC</td>
<td>Design of Hydraulics and Pneumatics Systems</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5119</td>
<td>PC</td>
<td>Total Quality Management</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5120</td>
<td>PC</td>
<td>Computer Aided Manufacturing</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>OE – II</td>
<td></td>
<td>Open Elective – II</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5122</td>
<td>Elective I PE</td>
<td>Industrial Robotics</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5123</td>
<td>PE</td>
<td>Tool Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GR17D5124</td>
<td>PE</td>
<td>Production and Operations Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GR17D5125</td>
<td>Elective II PE</td>
<td>Performance modeling and Analysis of Manufacturing Systems</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5126</td>
<td>PE</td>
<td>Computational Fluid Dynamics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GR17D5127</td>
<td>PE</td>
<td>Automation in Manufacturing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GR17D5128</td>
<td>Lab</td>
<td>CAD/CAM Lab</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5174</td>
<td>SPW</td>
<td>Seminar-II</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>28</td>
<td>4</td>
<td>28</td>
<td>240</td>
<td>560</td>
<td>800</td>
</tr>
</tbody>
</table>
### II YEAR - I SEMESTER

<table>
<thead>
<tr>
<th>Code</th>
<th>Group</th>
<th>Subject</th>
<th>L</th>
<th>P</th>
<th>C</th>
<th>Int</th>
<th>Ext</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR17D5175</td>
<td>SPW</td>
<td>Comprehensive Viva-voce</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>0</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>GR17D5176</td>
<td>SPW</td>
<td>Project work Review</td>
<td>-</td>
<td>-</td>
<td>12</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>16</td>
<td>30</td>
<td>170</td>
<td>200</td>
</tr>
</tbody>
</table>

### II YEAR - II SEMESTER

<table>
<thead>
<tr>
<th>Code</th>
<th>Group</th>
<th>Subject</th>
<th>L</th>
<th>P</th>
<th>C</th>
<th>Int</th>
<th>Ext</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR17D5177</td>
<td>SPW</td>
<td>Project work and Dissertation</td>
<td>-</td>
<td>-</td>
<td>16</td>
<td>30</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

A student has a choice to select one Open Elective – I in I Semester and one Open Elective – II in II Semester.

**Open Elective Pools**

**Open Elective I**

- E- Commerce (CSE)
- Enterprise Resource Planning (IT)
- Modern Control Theory (EEE)
- Computer - Oriented Numerical Methods in Engineering (CE)
- Advanced Computer Architecture (ECE)
- Operations Research (ME)

**Open Elective -II**

- Human Computer Interaction (CSE)
- Big Data and Analytics (IT)
- Neural and Fuzzy Systems (EEE)
- Project Management (CE)
- Hardware Software Co-Design(ECE)
- Non - Conventional Energy Resources (ME)
Course Objectives
The Objective of this course is to provide the student to

1. Introduce the concepts of continuum mechanics, theory of elasticity and solid mechanics.
2. Solve advanced solid mechanics problems using classical methods.
3. Employ commercial software to advanced solid mechanics problems.
4. Analyze the structural responses to various loading conditions.
5. Implant the two dimensional elasticity problems and plate problems.

Course Outcomes
At the end of the course, the student will be able to:

1. Analyze solid mechanics problems using classical methods and energy methods.
2. Estimate stresses and deflections of beams under unsymmetrical loading.
3. Identify the shear center of thin wall beams.
4. Obtain stresses and deflections of beams on elastic foundations.
5. Apply various failure criteria for general stress states at points.
6. Develop a basic understanding and ability to use ANSYS for the modeling and solution of beam, frame, and shell structures.
7. Compare theoretical solutions with those obtained using analysis software.

UNIT I:
Shear center: Bending axis and shear center, shear center for axis-symmetric and unsymmetrical sections
Unsymmetrical bending: Bending stresses in beams subjected to nonsymmetrical bending, deflection of straight beams due to nonsymmetrical bending.

UNIT II:
Curved beam theory: Winkler Bach formula for circumferential stress, limitations, correction factors, radial stress in curved beams, closed ring subjected to concentrated and uniform loads- stresses in chain links.

UNIT III:
Torsion: Linear elastic solution; prandtal elastic membrane (Soap-Film) analogy; narrow rectangular cross section; hollow thin wall torsion members ,multiply connected cross section.

UNIT IV:
Theory of plates: Introduction; stress resultants in a flat plate; kinematics: strain-displacement relations for plates; equilibrium equations for small displacement theory of flat plates; stress-strain-temperature relation for isotropic plates: strain energy of a plate; boundary conditions for plate;
Two Dimensional Elasticity Problems: in polar co-ordinates, general equations in polar coordinates, stress distribution symmetrical about an axis, pure bending of curved bars, displacements for symmetrical stress distributions, rotating discs.
UNIT V:

Beams on Elastic Foundation: General theory, infinite beam subjected to concentrated load, boundary conditions, infinite beam subjected to a distributed load segment, semi-infinite beam with concentrated load near its end, short beams

Contact stresses: Introduction, problem of determining contact stresses, assumptions on which a solution for contact stresses is based, expressions for principal stresses, method of computing contact stresses, deflection of bodies in point contact, stresses for two bodies in contact over narrow rectangular area (Line contact), loads normal to area, stresses for two bodies in line contact, normal and tangent to contact area.

Text books:


References:

1. Advanced strength of materials by Den Hortog J.P.
2. Theory of plates, Timoshenko.
3. Strength of materials & Theory of structures (Vol I & II) by B.C Punmia

Teaching Methodology:

- Lecture is delivered on black board, preparing OHP sheets and by preparing Power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial visits for practical exposure to understand and explore things.
M.Tech (Design for Manufacturing)  I Year-I Semester

Subject Code: GR17D5108

MATERIALS TECHNOLOGY

Course Objectives
The Objective of this course is to provide the student to

1. Introduce elastic and plastic behaviour of metals and polymers.
2. Impart the knowledge on strengthening mechanisms of metals and polymers.
3. Analyze the fracture behaviour analysis of ductile and brittle materials.
4. Gain the skill of identifying the relationship between materials selection and processing for various applications - Case studies.
5. Develop the knowledge on composites, superalloys, adhesives, coatings and application of these in aero, auto, Marine, Machinery and Nuclear.

Course Outcomes
At the end of the course, the student will be able to:

1. Apply core concepts in materials technology to solve engineering problems.
2. Analyze materials for design and construction and the importance of lifelong learning.
3. Study the fiber and dispersion strengthening mechanisms in materials.
4. Perform the fracture analysis of metals.
5. Examine the theories of fracture for brittle and ductile materials.
6. Select the best material for particular engineering applications.
7. Describe the scope of modern metal composites.

UNIT I:
Elastic And Plastic Behavior: Elasticity in metals and polymers, mechanism of plastic deformation, role of dislocations, yield stress, shear strength of perfect and real crystals, strengthening mechanism, work hardening, solid solution, grain boundary strengthening.

UNIT II:
Poly phase, mixture, precipitation, particle, fiber and dispersion strengthening, effect of temperature, strain and strain rate on plastic behavior, super plasticity, deformation of non-crystalline material.

UNIT III:

UNIT IV:
Material Selection: Motivation for selection, cost basis and service requirements, selection for mechanical properties, strength, toughness, fatigue and creep. Selection for Surface durability, Corrosion and Wear resistance, Relationship between Materials Selection and Processing, Case studies in Materials Selection with relevance to Aero, auto, Marine, Machinery and Nuclear applications.
UNIT V:


**Text Books:**
1) Mechanical Metallurgy George E Dieter
2) Selection and use of engineering materials Charles JA, Butter worth, Heir maker

**Teaching Methodology:**

- Lecture is delivered on black board, preparing OHP sheets and by preparing Power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial visits for practical exposure to understand and explore things.
Course Objectives
The Objective of this course is to provide the student to

1. Introduction to concepts of accuracy, geometric dimensioning, tolerancing, Datum’s creation, process capability.
2. Representation and application of geometric dimensioning, surface finish and tolerance.
3. Draw process drawings for different operations and tolerance work sheets.
4. Summarize machining considerations during manufacturing.
5. Processing of nanotechnology, working of surface-mechanical, optical and CMM measuring systems.

Course Outcomes
At the end of the course, the student will be able to:

1. Define datum planes for any oddly configured bodies and demonstrate the accuracy of Numerical Control system.
2. Reproduce process drawings, tolerance worksheets and tolerance zone conversions.
3. Demonstrate mechanical measuring system processing to find dimensional features and surface finish.
4. Interpret the overall performance with tolerance analysis.
5. Inculete the nanotechnology processing technique to manufacture intelligent precision products with extremely high precision and high construction.
6. Make use of measuring systems to check the dimensional quality and surface finish of the product.
7. Examine the process by calculating process capability of the experiment

UNIT I:

UNIT II:
Geometric Dimensioning And Tolerancing: Representation of Geometric dimensioning and tolerances, MMC, LMC and RFS, Tolerance Zone conversions, Effect of positional tolerances and its representation, Computation of transnational and rotational accuracy, geometric analysis and application.

UNIT III:
Datums: Six degree of freedom, Datum point, Datum line and Datum Plane, Three mutually perpendicular planes, 3-2-1 principle of location, 4-1-1 and V’ block location.

Cylindrical and Diamond pin location, Grouped datum system with Spigot and Recess pair, equalizing datum. Datum oddly configured.

Analysis of Surface Finish: Importance of Surface finish, Representation and analysis of Surface finish, Relationship between attainable tolerance grades and different machining process, Cumulative affect of tolerances and sure fit law, normal law and truncated normal law.

UNIT IV:
Tolerance Analysis: Process capability, Mean, Median, Mode Variance Skewness, Kurtosis, 6sigma, Cp, Cpk, Cost aspects, Application of 6sigma limits to inaccuracies and performance analysis.

Tolerance Charting Techniques: Operation sequence for typical shaft type components, preparation of process drawings for different operations, tolerance work sheets and centrally analysis, Examples, Design features to facilitate machining, Datum featured, functional and manufacturing. Components design-Machining considerations, redesign for manufacturing, Examples.
UNIT V:
Measuring System Processing: In processing or In-Situ measurement of position of processing point-post process and on machine measurement of dimensional features and surface- mechanical and optical measuring systems. Working systems of CMM. Laser alignment and testing.

Text Books
1) Precision Engineering in manufacturing / Murthy.R.L / New Age International (P) limited, 1996
2) Geometric Dimensioning and Tolerancing / James D.meadows / Marcel Deckker inc.1995
3) Mechatronics by HMT

Teaching Methodology:
• Lecture is delivered on black board, preparing OHP sheets and by preparing Power point presentations.
• Seminars are conducted on new technologies related to subject.
• Assignments are given.
• Group discussions are conducted on familiar topics related to subject.
• Industrial visits for practical exposure to understand and explore things.
OPEN ELECTIVE- I  
OPERATIONS RESEARCH

Course Objectives
The Objective of this course is to provide the student to

1. Analyse quantitative methods and techniques for effective Decisions–making.
2. Constructing models that are used in solving business decision problems.
3. Introduce the students to the use of basic methodology for the solution of linear programs and integer programs.
4. Introduce the students to the methods to solve large-scale transportation and assignment problems.
5. Illustrate how sequencing is carried out in assigning jobs to machines
6. Understand the concept of Inventory and apply the different models in optimizing the same.
7. Apply PERT/CPM: [Project scheduling and allocation of resources] to schedule and control construction of dams, bridges, roads etc. in an optimal way.

Course Outcomes
At the end of the course, the student will be able to:

1. Apply the various linear programming techniques for optimal allocation of limited resources such as machine, materialand money
2. Solve transportation problems to minimize cost and understand the principles of assignment of jobs and recruitment policies.
4. Solve problems of inventory and develop proper inventory policies.
5. Apply PERT/CPM: [Project scheduling and allocation of resources] to schedule and control construction of dams, bridges, roads etc in a optimal way.
7. Develop optimum replacement policy

UNIT-I
Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modelling, phases of OR study.
Linear Programming:
Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis.

UNIT-II
Transportation Problems: Types of transportation problems, mathemataical models, transportation algorithms,
Assignment: Allocation and assignment problems and models, processing of job through machines.

UNIT-III
Network Techniques: Shortest path model, minimum spanning Tree Problem, Max- Flow problem and Min-cost problem.
Project Management: Phases of project management, guidelines for network construction, CPM and PERT.

UNIT-IV
Theory of Games: Rectangular games, Minimax theorem, graphical solution of 2 x n or m x 2 games, game with mixed strategies, reduction to linear programming model.
Quality Systems: Elements of Queuing model, generalized poisson queuing model.
UNIT-V

Inventory Control: Models of inventory, operation of inventory system, quantity discount. Replacement: Replacement models: Equipments that deteriorate with time, equipments that fail with time.

Text / Reference Books:

Teaching Methodology:

- Lecture is delivered on black board, preparing OHP sheets and preparing Power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial visits for practical exposure to understand and explore things.
Course Objectives
The Objective of this course is to provide the student to

1. Provide the concepts of surface treatments and coatings based on the application of manufacturing processes for materials
2. Impart knowledge of selection and design of ceramics and composite materials
3. Inculcate the selection of best methods to manufacture steel and aluminum
4. Expose e-manufacturing and nano-technology processes
5. Identify the appropriate heat treatment and welding technique for the material to be joined.

Course Outcomes
At the end of the course, the student will be able to:

1. Provide Knowledge of protective coatings, based on the description of the basic systems of industrially produced Metals.
2. Select the most appropriate manufacturing process for fabricating ceramic and composite components
3. Indicate which processes are likely to be used for production steel and aluminum
4. Implement e-manufacturing technique to any manufacturing products.
5. Explain the state-of-the-art characterization methods for nano-materials
6. Explain various hardening of materials through heat applications
7. Create parts using information provided in blueprints to the given specifications

UNIT I:
Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, Ceramic and Organic methods of coating, Economics of coating, Electroforming, Chemical vapor deposition, Thermal spraying, Ion implantation, Diffusion coating, and Cladding.

UNIT II:

UNIT III:
Metal processing and manufacturing

UNIT IV:
UNIT V:


**TEXT BOOKS:**
1. Manufacturing and Technology/ Kalpakjian/Pearson Education, INC/Forth Edition

**Reference Books:**
1. Advanced Machining Processes/V.K.Jain/Allied Publications
2. Introduction to Manufacturing Processes / John A schey/ Mc Graw Hill

**Teaching Methodology:**

- Lecture is delivered on black board, preparing OHP sheets and by preparing Power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial visits for practical exposure to understand and explore things.
Course Objectives
The Objective of this course is to provide the student to

1. Gain a fundamental understanding of the finite element method for solving boundary value problems.
2. Analyze important concepts of variational form, minimum potential energy principles, and method of weighted residuals.
3. derive one dimensional problems such as truss, beam, and frame members, two-dimensional problems such as plain stress and plain strain elasticity problems, torsion problem.
4. Introduce the finite element analysis of static and dynamic problems and heat transfer problems and manufacturing processes.
5. Aanalysing skills in applying basic laws in mechanics and integration by parts to develop element equations and steps used in solving the problem by finite element method.

Course Outcomes
At the end of the course, the student will be able to:

1. obtain an understanding of the fundamental theory of the FEA method
2. apply the concepts of minimum potential energy principles to solve structural mechanics problems.
3. Compute Eigen values and eigenvectors of simple dynamic systems
4. obtain weak form from strong form and total potential, and recognize similarities between such solutions, and those obtained by variational principles and principal of virtual work.
5. develop the ability to generate the governing FE equations for systems governed by partial differential equations
6. obtain finite element solution and compare with exact solution of simple one dimensional problems.
7. apply the finite element procedure for stress analysis and design of load carrying structures and heat transfer problems and manufacturing processes.

UNIT I

UNIT II
One Dimensional Analysis: Steps in FEM – Discretization. Interpolation, derivation of elements characteristic matrix, shape function, assembly and imposition of boundary conditions-solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

UNIT III
Shape Functions And Higher Order Formulations: Shape functions for one and two dimensional elements- Three noded triangular and four noded quadrilateral element Global and natural co-ordinates—Non linear analysis – Isoparametric elements – Jacobian matrices and transformations – Basics of two dimensional, plane stress, plane strain and axisymmetric analysis.

UNIT IV
Computer Implementation: Pre Processing, mesh generation, elements connecting, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages – Development of code for one dimensional analysis and validation.
UNIT V

Text Books:

Reference Books:

Teaching Methodology:
- Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial visits for practical exposure to understand and explore things.
QUALITY ENGINEERING IN MANUFACTURING

Course Objectives
The Objective of this course is to provide the student to
1. The concept and techniques of quality engineering manufacturing.
2. Demonstrate knowledge of international tolerance in engineering.
3. Explain the relationship between customer’s desire and satisfaction on quality.
5. Illustrate when, and be able, to carry out a one way and two way analysis of variance.

Course Outcomes
At the end of the course, the student will be able to:
1. Apprehend the fundamentals of quality engineering in manufacturing.
2. Comprehend the engineering aspects of improving quality in manufactured products.
3. Develop quality as passion and habit.
4. Illustrate the concept of quality by using quality tools to avoid quality loss.
5. Enumerate the techniques to find out the variation in the data and obtain optimal results.
6. Apply orthogonal arrays in designing, conducting and analyzing the experiments.
7. Apply the international standards(ISO) in quality checks.

UNIT I:
Quality Value and Engineering: An overall quality system, quality engineering in production design, quality engineering in design of production processes. Loss Function and Quality Level: Derivation and use of quantatile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances (N-type, S-type and L-type).

UNIT II:
Tolerance Design and Tolerancing: Functional limits, tolerance design for N-type, L-type and S-type characteristics, tolerance allocation for multiple components. Parameter and Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

UNIT III:
Analysis of Variance (ANOVA): NO-way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT IV:
Orthogonal Arrays: Typical test strategies, better test strategies, efficient test strategies, steps in designing, conducting and analyzing an experiment. Interpolation of Experimental Results: Interpretation methods, percent contribution, estimating the mean.

UNIT V:
Quality: ISD-9000 Quality System, BDRE, 6-sigma, Bench making, Quality circles, Brain Storming, Fishbone diagram, problem analysis.
TEXT BOOKS:


REFERENCE BOOKS:


Teaching Methodology:

- Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial visits for practical exposure to understand and explore things.
Course Objectives
The Objective of this course is to provide the student to

1. Impart knowledge of Computer Aided Design tools in design of machine components.
2. Create Wire-frame, Surface and Solid models for Engineering Components using the CAD system.
3. Gain the knowledge of special surfaces and solid model representation techniques to create models of complex products.
4. Inculcate collaborative engineering principles in industry or organization.

Course Outcomes
At the end of the course, the student will be able to:

1. Illustrate the basic principles of Computer Aided Design tools used in Engineering.
2. Develop synthetic curves like cubic curve, Bezier curve, B-spline and NURBS to create wire frame models of engineering products.
3. Apply analytical surfaces like plane surface, surface of revolution, tabulated cylinder to create standard surfaces of engineering products.
4. Employ synthetic surfaces like cubic surfaces, Bezier surfaces and B-spline surfaces to create complex surfaces of engineering products.
5. Examine special surfaces like coons patch, blending surface, ruled surface and sculptured surface to modify the surfaces developed.
6. Create the solid model of the object using Boundary representation, Constructive solid geometry, Sweep representation methods. And able to recognize the CAD/CAM exchange formats.
7. Analyze a CAD model using Finite Element Method (FEM).

UNIT I:
Cad Tools: Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, brief treatment of input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, software documentation, efficient use of CAD software.

UNIT II:
Geometric modeling: mathematical description of Analytical curves such as Line, Circle, Ellipse, Parabola etc., Problems
Wire frame models, wire frame entities parametric representation of synthetic curves, hermite cubic splines, Bezier curves B-splines, rational curves, NURBS, Problems

UNIT III:
Surface Modeling: Mathematical representation of surfaces, Surface model, Surface entities, Definition of a Patch, surface representation, Parametric representation of surfaces, plane surface, Tabulated Cylinder.
Parametric Representation Of Synthetic Surfaces - Hermite Bicubic surface, Bezier surface, B- Spline surface, COON surface, Surface of Revolution, Ruled Surface, Blending surface, Sculptured surface, Surface manipulation — Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).
UNIT IV:  
**Geometric modelling-3D** : Solid modeling, Solid Representation, Boundary Representation (B- rep), Constructive Solid Geometry (CSG). Difference between Feature-based and Parametric based modeling, Description of features such as Extrude, Sweep, Loft, Hole, Extrude-cut etc.,

CAD/CAM Exchange: Evaluation of data—exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF.

UNIT V:  
**Design Applications**: Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis, Preprocessing and Post processing in FEA, Types of Structural, Thermal analysis and Mechanical Assembly.  

TEXT BOOKS:  

REFERENCE BOOKS:  
2. CAD/CAM / P.N.Rao / TMH.  
3. CAD/CAM/CIM Radhakrishnan.

**Teaching Methodology:**

- Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial visits for practical exposure to understand and explore things.
Course Objectives
The Objective of this course is to provide the student to

1. Impart the knowledge of Mechatronics systems such as controls, drives, real time interfacing and data acquisition systems.
2. Inculcate the concepts of electromechanical, hydraulic, and pneumatic systems.
3. Impart the knowledge of PLC systems for controlling CNC machines.
4. Inculcate the knowledge of microcontroller programming and microprocessors in design of embedded systems.
5. Inculcate the knowledge of sensors, switches and control loops of CNC machines.

Course Outcomes
At the end of the course, the student will be able to:

1. Design a mechatronic system such as pick and place robot, car park barriers, car engine management and bar code reader.
2. Develop an intelligent and automated systems.
3. Apply design principles of electromechanical, hydraulic and pneumatic systems to develop actuators and motion controllers.
4. Design a PLC system for controlling the CNC machines.
5. Apply the microcontroller programming, microprocessors in design of embedded systems.
6. Design electromechanical systems for acquiring the CAD/CAM database.
7. Design sensors and control loops for CNC machines.

UNIT I

Mechanical Systems, Electromechanical modules, actuators, motion controls and accuracies. Characteristics of electromechanical, Hydraulic, Pneumatic systems and comparison. Control parameters and system objectives, popular control system configuration-S curves. Motor load, Torque Inertia/acceleration torque analysis. Types of motors and speed control systems

UNIT II
Motion Controls: Motion control algorithms. Significance of feed forward control loops, shortfall, fundamental concepts of adaptive and fuzzy controls. Fuzzy logics compensatory control of transformation and deformation non linear Z-inertia.

UNIT III
RLC, PLC : Architecture of intelligent Machines, Relay logic controllers. Programmable logic controllers. Architecture of PLC. Interfacing, Types of PLC’s and selection. Advantages and applications
UNIT IV


UNIT V


Encoders & Linear scales Position controls. Coordinated Measuring Machines. CNC software and applications, Flexible manufacturing systems.

TEXT BOOKS

2. MECHATRONICS - HMT - McGraw-Hill Education

Reference Books:

1. Introduction to Mechatronics and measurement systems Tata Mc Graw Hill
2. Control sensors and actuators “prentice Hall”Teaching Methodology:

Teaching Methodology:

- Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial vists for practical exposure to understand and explore things.
Course Objectives
The Objective of this course is to provide the student to

1. To introduce to students the concepts of stresses, strains and stress-strain relationships, as well as the basic theory of elasticity, plasticity and failure criteria.
2. To develop students with an understanding of how stresses and strains within engineering components are related to both loads and displacements imposed at their boundaries and to inertial loads.
3. To prepare students for the use of different methods to analyze the stresses and strains within engineering components.
4. To allow students become familiar with problem formulations and solutions in elasticity and plasticity; and prepare students for future study in advanced engineering mechanics.
5. To develop analytical skills of solving problems using plain stress and plain strain.

Course Outcomes
At the end of the course, the student will be able to:

1. Apply the differential equations of equilibrium and reciprocal theorem to structural problems.
2. Analyze the structure using plasticity.
3. Summarize the theories of plasticity and apply them in real time problems.
4. Interpret the stress and strain distribution in bars and apply them in engineering problems.
5. Interpret the stress and strain distribution in beams.
6. Outline the deformation and creep of materials in plastic stage.
7. Analyze and predict the characteristics of the materials in plastic stage using different methods practically.

UNIT I
Elasticity: Two dimensional stress analysis, Plane stress, Plane strain, Equations of compatibility, Stress function, Boundary conditions.

Problem in rectangular coordinates: Solution by polynomials, Saint Venents Principles, Determination of displacement, Simple beam problems.

Problems in polar coordinates, General equations in polar coordinates- Stress distribution symmetrical about axis, Strain components in polar coordinates, Simple and Symmetric problems.

UNIT II
Analysis of Stress and strain in three dimensions: Principle stresses, Homogeneous deformations, Strain spherical and deviatoric stress, Hydrostatic strain.

General theorems: Differential equations of equilibrium and compatibility, Displacement, Uniqueness of solution, Reciprocal theorem.

UNIT III
Bending of Prismatic bars, Stress function, bending of cantilever beam, beam of rectangular cross section and beams of circular cross sections
UNIT IV
Plasticity: Plastic deformation of metals, Structure of metals, Deformation, Creep stress relaxation deformation, Strain rate condition of constant maximum shear stress, Condition of constant strain energy approximate equation of plasticity.

UNIT V
Methods of solving practical problems, the characteristic method, Engineering method, Compression of metal under press, Theoretical and experimental data drawing.

Text Books:
1. Theory of Elasticity by Timoshenko, S.P. and Goodier, J.N

Reference Books:
2. Theory of Plasticity by Hoffman and Sacks.

Teaching Methodology:
- Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial visits for practical exposure to understand and explore things.
MANUFACTURING SIMULATION & PRECISION ENGINEERING-- LAB

Course Objectives
The Objective of this course is to provide the student to

1. Impart the knowledge of material handling software like FLEXIM
2. Implement the knowledge of FLEXIM software in developing material handling models.
3. Implement the knowledge of PLC and Microcontroller programming in controlling machining operations.
4. Impart the knowledge of robot programming in material handling.
5. Implement the optimization techniques in shop floors layout in increase in productivity.

Course Outcomes
At the end of the course, the student will be able to:

1. Demonstrate the functions of FLEXIM software. And able to apply FLEXIM software to create material handling models.
2. Apply FLEXIM software in shop floor layouts to reduce the cost of material handling.
3. Create new machine layouts by studying the existing layouts using FLEXIM softwares to increase the productivity.
4. Explain Programmable Logic Controller (PLC) and Microcontroller programming skills for project related applications.
5. Apply various programs on robots like Mentor ROBO for efficient material handling.
6. Demonstrate the programs of Linear Synchronized Motor Controller (LSM) for efficient material handling.
7. Apply all material handling systems to design and develop an efficient Flexible Manufacturing System (FMS).

List of Experiments

Task 1: Material handling simulation of shop floor layout and determination of process time
   – Model 1 using Flexsim software
Task 2: Material handling simulation of shop floor layout and determination of process time
   – Model 2 using Flexsim software
Task 3: Material handling simulation of shop floor layout and determination of process time
   – Model 3 using Flexsim software
Task 4: Demonstration of mentor ROBO for material handling.
Task 5: X-Y Table motion control with varying velocity and acceleration on LSM controller
Task 6: Demonstration of Double acting pneumatic drive and rotation of synchronized motors with and without PLC on LSM controller.
Task 7: Estimation of cutting force in orthogonal turning using lathe tool dynamometer.
Task 8: Estimation of cutting force in oblique turning using lathe tool dynamometer.
Task 9: Study on operation of tool and cutter grinder.
Task 10: To study the various features of surface roughness measuring instrument and tool makers microscope and measure the parameters on the specimen.
Task 11: Demonstration of the various features on data logger
Task 12: Demonstration of the various features on unconventional machine EDM.
Teaching Methodology:

- Lecture is delivered on projector showing the software and its features.
- Seminars are conducted on new technologies related to subject.
- Exercises are created to practice of various models.
- Quiz’s are conducted to test the competency level of student with software
- Industrial vists for practical exposure to understand and explore things.
Course Objectives

The Objective of this course is to provide the student to

1. Introduce the students, the basic concepts of hydraulic and pneumatic systems.
2. Expose the students with various hydraulic and pneumatic actuators.
3. Provide knowledge on fluid power systems and its applications to real time.
4. Know the problem, which occur in fluid power systems and take necessary troubleshooting/maintenance activities.
5. Get practiced in designing hydraulic and pneumatic systems.

Course Outcomes

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

1. Gain knowledge on hydraulic and pneumatic systems concepts.
2. Compare the various actuators and choose according to required application.
3. Determine the components and accessories required in constructing a hydraulic power pack.
4. Design hydraulic and pneumatic circuits.
5. Solve the problem that occurs in fluid power systems and take relevant troubleshooting/maintenance activities.
6. Gain the skills on hydraulic and pneumatic power pack with its components and accessories.
7. Analyze the problems that will occur during operating fluid power systems and take decision and troubleshooting/maintenance activities

UNIT I

UNIT II:
Hydraulic Pumps: Classification of Pumps, Gear Pump, Vane Pump, piston Pump, bent axis in line piston pumps. Internal and external Gear pumps. Selection and specification of Pumps.


UNIT III:

UNIT IV:

Pneumatic Circuits: FRL-Unit, Pneumatic line in the Industry, Applications of Pneumatic Equipment. Hydro Pneumatic Circuits.
UNIT V:

Automation: Hydraulic and Pneumatic equipment in Automation, Low Cost Automation, Relay Circuits, PLC Circuits, Micro Controllers,


Text Books

1. S.R Majumdar, Oil Hydraulics systems.Tata MC.graw Hill

Reference Books:


Teaching Methodology:

• Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.

• Seminars are conducted on new technologies related to subject.

• Assignments are given.

• Group discussions are conducted on familiar topics related to subject.

• Industrial vists for practical exposure to understand and explore things
Course Objectives
The Objective of this course is to provide the student to

1. Introduce the students, the basic concepts of hydraulic and pneumatic systems.
2. Expose the students with various hydraulic and pneumatic actuators.
3. Provide knowledge on fluid power systems and its applications to real time.
4. Know the problem, which occur in fluid power systems and take necessary troubleshooting/maintenance activities.
5. Get practiced in designing hydraulic and pneumatic systems.

Course Outcomes
At the end of the course, the student will be able to:

1. Gain knowledge on hydraulic and pneumatic systems concepts.
2. Compare the various actuators and choose according to required application.
3. Determine the components and accessories required in constructing a hydraulic power pack.
4. Design hydraulic and pneumatic circuits.
5. Solve the problem that occurs in fluid power systems and take relevant troubleshooting/maintenance activities.
6. Gain the skills on hydraulic and pneumatic power pack with its components and accessories.
7. Analyze the problems that will occur during operating fluid power systems and take decision and troubleshooting/maintenance activities

UNIT I
Introduction: The concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems, Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs, Process control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT II
Customer Focus and satisfaction: Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer-Supplier relationships. Benchmarking, Evolution of benchmarking, meaning of benchmarking, benefits of benchmarking, the benchmarking process, pitfalls of benchmarking.

UNIT III
Organizing for TQM: the systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circle. Productivity, Quality and Reengineering: The leverage of Productivity and Quality, Management systems Vs. Technology, Measuring Productivity, Improving Productivity Re-engineering.

UNIT IV
UNIT V

ISO9000: Universal standards of Quality: ISO around the world. The ISO9000 ANSI/ASQCQ- Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

REFERENCE BOOKS

2. “Beyond TQM” by Robert L. Flood.
3. Statistical Quality Control” by Grant.

Teaching Methodology:

• Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.

• Seminars are conducted on new technologies related to subject.

• Assignments are given.

• Group discussions are conducted on familiar topics related to subject.

• Industrial visits for practical exposure to understand and explore things.
Course Objectives
The Objective of this course is to provide the student to

1. Develop CNC programs of lathe and Milling machines.
2. Outline the Interchangeable tooling, coolant fed, and automatic head changer tooling for CNC machines.
3. Express the need, functions, communications and major variables in the DAPP-Based post processor.
4. Gain the knowledge on components, selection, programming and applications of microcontrollers and programmable logical controls (PLC’s) in CNC machines.
5. Apply the knowledge of computer aided process planning (CAPP), Computer Aided Quality Control tools and Expert systems in Manufacturing of Engineering products.

Course Outcomes
At the end of the course, the student will be able to:

1. Demonstrate machining fundamentals including speed and feed calculations, tooling systems, work-holding systems and Postprocessor’s for Computer Numerical Control milling and turning equipment.
2. Develop Computer Numerical controlled (CNC) programs and Automatically Programmed Tools (APT) programs for CNC milling and turning equipment.
3. Explain applications of microcontrollers and programmable logic controllers(PLC’s) in CNC machines.
5. Explain expert systems and its structure used in various industries and adapt principles of Artificial Neural Networks (ANN), Artificial Intelligence to improve productivity.
6. Outline contact and non-contact inspection instruments for measuring dimensional accuracy of the part.
7. Illustrate the principle of working, applications, limitations of coordinate measuring machine.

UNIT I
Computer Aided programming: General information. APT Programming, Examples Apt programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors Introduction to CAD/ CAM software, Automatic Tool Path generation.

UNIT II

UNIT III
Post Processors for CNC: Introduction to Post Processors: The necessity of a Post Processor, the general structure of a Post Processor, the functions of a Post Processor, DAPP, based, Post Processor Communication channels and major variables in the DAPP-based Post Processor, the creation of a DAPP-Based Post Processor.
UNIT IV


UNIT V


**Text Books:**


**Teaching Methodology:**

- Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial visits for practical exposure to understand and explore things.
Course Objectives
The Objective of this course is to provide the student to

1. Introduce the need of the non-conventional energy sources.
2. Impart the role of non-conventional energy for the environment.
3. Identify the energy resources utilization systems.
4. Recognise the source and potential of wind energy and understand the classifications of wind mills.
5. Summarize the principles of bio-conversion, ocean energy and geothermal energy.

Course Outcomes:
At the end of the course the learners will be able to
1. Choose the appropriate renewable energy as an alternate for conventional power in any application.
2. Analyze the environmental and cost economics of using renewable energy sources compared to fossil fuels.
3. Apply the principles of various energy systems in day to day life.
4. Analyze the industrial needs and convert theoretical model to practical circuits with wide range of specifications.
5. Evaluate the importance of the renewable resources of energy as the fossil fuels are depleting in the world very fast express about clean and green energy for next generation.
6. Analyse large scale demand of heat energy for meeting day to day domestic, institutional and industrial requirements can be met by utilizing solar thermal systems, biogas, PV cells, wind energy, Geothermal, MHD etc.
7. Design the various techniques and models fabricated in utilizing the above said sources of energy.

UNIT-I
Introduction
Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits.

Solar Cells:
Theory of solar cells. solar cell materials, solar cell array, solar cell power plant, limitations.

UNIT-II
Solar Thermal Energy:
Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

UNIT-III
Geothermal Energy:
Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations.

Magneto-hydrodynamics (MHD):
Principle of working of MHD Power plant, performance and limitations.
Fuel Cells:
Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT-IV
Thermo-electrical and thermionic Conversions:
Principle of working, performance and limitations.

Wind Energy:
Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.

UNIT-V
Bio-mass:
Availability of bio-mass and its conversion theory.

Ocean Thermal Energy Conversion (OTEC):
Availability, theory and working principle, performance and limitations.

Wave and Tidal Wave:

Text/References Books:

Teaching Methodology:

- Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial vists for practical exposure to understand and explore things.
Course Objectives
The Objective of this course is to provide the student to

1. Familiar with the automation and applications of robotics.
2. Proficient with the fundamental concepts of kinematics of robots.
3. Emphasize the concepts about robot End-effectors and their design.
5. Incorporate knowledge about various Sensors and their applications in robots.

Course Outcomes
At the end of the course, the student will be able to:

1. Familiarized with the Robot Anatomy and Robot configurations
2. Well-versed with the automation and Robot applications.
3. Skilled with the principles of kinematic of robot.
4. Nurtured with the Programming methods & various Languages of robots.
5. Equipped with the principles of various Sensors and their applications in robots.
6. Acquainted with the concepts of Robot cell design and control
7. Develop sound knowledge about robot end effectors and their design concepts.

UNIT I:
Introduction: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement. Control System and Components: basic concept and modal controllers control system analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, power transmission system.

UNIT II:
Motion Analysis And Control: Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller.

UNIT III:
End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design Sensors: Desirable features, tactile, proximity and range sensors, uses sensors in robotics.
Machine Vision: Functions, Sensing and Digitizing imaging, Devices, Lighting techniques, Analog to digital single conversion, Image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application.

UNIT IV:
Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINGNAL AND DELAY commands, Branching capabilities and Limitations.

Robot Languages: Textual robot languages, Generation, Robot language structures, Elements in
function.

UNIT V:
Robot Cell Design and Control: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work design, Work and control, Inter locks, Error detection, Work cell controller.

Robot Application: Material transfer, Machine loading/unloading, Processing operation, Assembly and Inspection, Feature Application.

Text Books
1. Industrial robotics, Mikell P.Groover /McGraw Hill.
Reference Books:

Teaching Methodology:

• Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.

• Seminars are conducted on new technologies related to subject.

• Assignments are given.

• Group discussions are conducted on familiar topics related to subject.

• Industrial vists for practical exposure to understand and explore things.
Elective III
TOOL DESIGN

Course Objectives
The Objective of this course is to provide the student to

1. Inculcate the selection of best cutting tool material for machining
2. Impart knowledge of selection and design of single and multi-point cutting tool.
3. Inculcate the principle of jigs and fixtures for holding the workpiece
4. Inculcate the selection of locating and clamping for a given component
5. Impart knowledge in Design of die and punch for blanking, piercing and bending operations

Course Outcomes
At the end of the course, the student will be able to:

1. Learn the importance of selecting the proper cutting tool material and cutting tool angles required to machine a work piece.
2. Identify cutting tools and explain the purpose of each type of rake and clearance angle
3. Identify the applications of various types of cutting tool materials.
4. Study and practically perform the calibration of checking fixtures.
5. Design and check fixture on CAD software.
6. Learn briefly the theoretical concepts of jigs and fixtures.
7. Select the right tool material for making dies depending upon the tonnage required for the particular operation.

UNIT I:
Tool Materials
Classification of work & Tool materials. Low carbon, high carbon and alloy steels. Carbides, coated carbides, ceramics, CBN, Diamonds. Abrasive materials

Theory of Metal Cutting

UNIT II:
Design of Cutting Tools
Single point cutting tools, determination of shank size, Boring tools, Micro bore tools, Multi point tools, Drill nomenclature, end mills, reamers, brazed tools, insert tools, Types of milling cutters, cutting parameters, milling cutters selection, Grinding wheels.

UNIT III:
Design of Jig and Fixtures
Basic principles of work holding, location and clamping. Morse & ISO tapers, jig definition and types drill jig bush design., Line boring principles. Vices, milling, boring, lathe, grinding fixtures. CNC tooling, concepts of auto Tool changers.

UNIT IV
Design of Sheet Metal Blanking and Piercing Dies
Fundamentals of die cutting operation, power press types, general press information, materials handling equipment. Cutting action in punch and die operations. Die clearance, types of die construction. Die design fundamentals-banking and piercing die construction, pilots, stripper and pressure pads presswork material, strip layout, short run
tooling for piercing.

UNIT V:

DESIGN OF METAL BENDING, FORMING AND DRAWINGS DIES
Bending dies, drawing dies, forming dies, drawing operations, variables that effect metal flow during drawing. Determination of blank size, drawing force, single and double action draw dies. Application of Softwares
Die design by 2D & 3D softwares, Cad & Cam softwares. CNC machines.

Text books:

2. George F Dieter “Mechanical Metallurgy” Tata McGraw Hill

Reference books:

1. Taylor Altan, Sool Ik-Oh and Harold L. Gegel O. “American Society for metals”.1983

Teaching Methodology:

- Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial visits for practical exposure to understand and explore things.
PRODUCTION AND OPERATIONS MANAGEMENT

Course Objectives
The Objective of this course is to provide the student to

1. Introduction to the technical design and manufacturing operations and supply management to the sustainability of enterprises.
2. Import the basic principles of Project management and other business functions, such as human resources, purchasing, marketing, finance, etc.
3. Distinguish the Just in Time principles and PERT techniques to reduce the lead time in production.
4. Analyse the new demands of the globally competitive business environment that supply chain managers face today.
5. Creation of the innovative technological tools to improve quality of production.

Course Outcomes
At the end of the course, the student will be able to:

1. Demonstrate the operations and supply management to the sustainability of an Enterprise.
2. Interpret the basic principles of Project management.
3. Identify various Production and Plant layouts.
4. Examine the quality control of the production.
5. Apply the Just in time (JIT) basic principles and applications.
6. Recommend the production schedule for productivity.
7. Adapt PERT Technique to reduce the lead time in production.

UNIT I
Operation Management, Definition, Objectives, Types of Production systems, historical development of operations management, Current issues in operation management.
Product design, Requirements of good product design, product development, approaches, concepts in product development, standardization, simplification, Speed to market, Introduction to concurrent engineering.

UNIT II
Value engineering, objective, types of values, function & cost, product life cycle, steps in value engineering, methodology in value engineering, FAST Diagram, Matrix Method.
Location, Facility location and layout, Factors considerations in Plant location, Comparative Study of rural and urban sites, Methods of selection plant layout, objective of good layout, Principles, Types of layout, line balancing.

UNIT III
Aggregate Planning, definition, Different strategies, Various models of Aggregate Planning, Transportation and graphical models.
Advance inventory control systems push systems, Material Requirement, Terminology, types of demands, inputs to MRP, techniques of MRP, Lot sizing methods, benefits and drawbacks of MRP, Manufacturing Resources Planning (MRP II), Pull systems, Vs Push system, Just in time (JIT) philosophy kanban system, Calculation of number of kanbans Requirements for implementation JIT, JIT Production Process, benefits of JIT.
UNIT IV

Scheduling, Policies, Types of scheduling, Forward and Backward Scheduling, Grant Charts, Flow shop Scheduling, n jobs and 2 machines, n jobs and 3 machines, job shop Scheduling, 2 jobs and n machines, Line of Balance.

UNIT V

Project Management, Programming Evaluation Review Techniques (PERT), three times estimation, critical path, Probability of completion of project, critical path method, crashing of simple nature.

Text Books
1. “Operation Management” by E.s.Buffs

Reference Books:
1. “Operation Management” by E.s.Buffs
5. “Operations Management” by chase
6. “Production and Operation Management” by panner Selvam
7. “Production and Operation Analysis” by Nahima

Teaching Methodology:

- Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial vists for practical exposure to understand and explore things.
PERFORMANCE MODELLING AND ANALYSIS OF MANUFACTURING SYSTEMS

Course Objectives
The Objective of this course is to provide the student to
1. Introduce concept of controls in manufacturing systems.
2. Impart knowledge in queuing model and networks to control manufacturing processes.
3. Analyse Kanban system in industries.
4. Demonstrate a basic understanding of network models employed in manufacturing industry.
5. Application of different network analyses like petrinets etc.

Course Outcomes
At the end of the course, the student will be able to:
1. Gain the skill of the modelling and analysis of manufacturing systems
2. Demonstrate the Kanban system is modeled in industry.
3. Analyze basics of network models employed in manufacturing industry.
4. Apply the queuing model for analysis of a flexible machine center.
5. Examine the different types queuing network for manufacturing systems
6. Compute the equations in manufacturing process to different transfer lines
7. Employ the different net work analyses.

UNIT I
Manufacturing Systems & Control: Automated manufacturing systems, modeling role of performance, simulation models-analytical models. Product cycle manufacturing automation, economics of scale and scope, input/output model, plant configurations, performance measures
- manufacturing lead time - work in process -machine utilization - throughput -capacity, flexibility, performability, quality control systems, control system architecture, factory communications, local area networks interconnection manufacturing automation protocol, database management system.

UNIT II:
Manufacturing processes:
Examples of stochastic processes, poisson process discrete time markov chain models, definition and notation, sojourn times in states, examples of dtmcs in manufacturing, chapman kolmogorov equation, steady-state analysis. continuous time Markov chain models, definitions and notation, sojourn times in states, examples of CTMCS in manufacturing, equations for CTMCS evolution, Markov model of a transfer line, birth and death processes in manufacturing, steady state analysis of BD processes, typical BD processes in manufacturing.

UNIT III:
Queuing Model:
Notation for queues, examples of queues in manufacturing systems, Performance measures, Little's result, steady state analysis of M/M/m queue, queues with general distributions and queues with breakdowns, analysis of a flexible machine center.
Unit IV:
Queuing Networks:
Examples of QN models in manufacturing, Little's law in queuing networks, Tandem queue, an open queuing network with feed back, an open central server model for FMS, Closed transfer line, Closed server model, Garden Newell networks.

UNIT V:

Petri nets:

Text Books

References:

Teaching Methodology:

- Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial visits for practical exposure to understand and explore things.
ELECTIVE - IV

COMPUTATIONAL FLUID DYNAMICS

Course Objectives
The Objective of this course is to provide the student to

1. Describe the physical significance of each term in the governing equations for CFD
2. Identify the use of a commercial CFD package to solve practical CFD problems
3. Quantify and analyse the numerical error in CFD discretization schemes
4. Develop finite difference and finite volume forms of the CFD equations for heat transfer and fluid flow problems
5. Formulate explicit and implicit algorithms for solving the Navier-Stokes equations

Course Outcomes
At the end of the course, the student will be able to:

1. Implement FDM techniques to steady state and unsteady state problems in heat transfer.
2. Examine various numerical techniques (FEM, FVM, FDM) available for solving CFD problems.
3. Classify the partial differential equations to understand the behavior of the equations.
4. Gain knowledge about the various discretization schemes.
5. Calculate the flow field with SIMPLE and SIMPLER schemes.
6. Exposure to various turbulent flow modeling techniques in FVM.
7. Discuss the pressure velocity and density coupling in compressible flows.

UNIT I
Introduction: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, derivation of finite difference equations.


UNIT II

UNIT III
Formulations of incompressible viscous flows: Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

Treatment of Compressible flows: Potential equation, Euler equations Navier, stokes system of equations flow field-dependent variation methods, boundary conditions, example problems.

UNIT IV
Finite Volume method: Finite volume method via finite difference method, formulations for two and three dimensional problems.
UNIT V

**Standard variational methods**: Linear fluid flow problems, steady problems, Transient problems.

**Text Book:**

**References:**

**Teaching Methodology:**

- Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.
- Seminars are conducted on new technologies related to subject.
- Assignments are given.
- Group discussions are conducted on familiar topics related to subject.
- Industrial visits for practical exposure to understand and explore things.
AUTOMATION IN MANUFACTURING

Course Objectives
The Objective of this course is to provide the student to

1. Introduce the fundamental concepts of automation in manufacturing.
2. Impart the knowledge on design and fabrication of automated flow lines.
3. Gain the skill of analysis and implementation on transfer lines
4. Prioritize the line balancing methods in automated assembly systems.
5. Inculcate knowledge on analysis of automated material handling systems in automation.

Course Outcomes
At the end of the course, the student will be able to:

1. Identify the manufacturing tools, solutions to industrial applications.
2. Visualize the automation systems and take up multi disciplinary tasks.
3. Analyze the impact of automation in engineering solutions for society in global and economic context.
4. Design and construct automated flow lines for simple products.
5. Select the various material handling systems used in advanced automation systems.
6. Classify the various manufacturing cells
7. Examine the modern engineering tools, software and equipments to and solve the problems related to specific manufacturing applications.

UNIT I

Fundamentals of Manufacturing Automation: Basic Principles of automation, types of automated systems, degrees of automation, automation reasons, Production operations and automation strategies, Plant Layout, Production concepts and mathematical models, design the parts for automation, Automatic loading systems.

UNIT II

High Volume production Systems: Automated flow lines. Methods of work flow, transport transfer mechanism buffer storage, Control functions, Automation for machining operations Design and fabrication considerations.

UNIT III

Analysis of Automated Flow Lines: Analysis of transfer lines without storage, partial automation automated flow lines with storage buffers implementing of automatic flow lines, Line balancing problems, Considerations in assembly line design.

UNIT IV

UNIT V

Automated Material Handling: Types of equipment and functions, design and analysis of material handling system, conveyor system. Automated guided vehicle system, components operation, types, design of automated guided vehicles and applications. Automated storage and Retrieval systems, types, basic components and applications. Transfer lines, Design for Automated Assembly, Partial Automation, Communication Systems in Manufacturing.

Text Books:


Reference Books:


Teaching Methodology:

- Lecture is delivered on black board, preparing OHP sheets and by preparing power point presentations.

- Seminars are conducted on new technologies related to subject.

- Assignments are given.

- Group discussions are conducted on familiar topics related to subject.

- Industrial vists for practical exposure to understand and explore things.
CAD/CAM LAB

Course Objectives
The Objective of this course is to provide the student to

1. Impart the knowledge of CAD software like Solid works or CATIA.
2. Apply CAD software in creating 2D and 3D models and assembly of machine components.
3. Develop CNC manual part programming and machining of components on Lathe and Milling machines.
4. Inculcate the knowledge of CAM software in automatic generation of CNC programs.
5. Gain the knowledge of Robot programming and its simulation.

Course Outcomes
At the end of the course, the student will be able to:

1. Apply CAD softwares like Solid Works or CATIA to create 2D model, 3D model of the objects, assembly of the parts and analyze the model.
2. Demonstrate the constructional features of CNC Lathe and Milling machines.
3. Examine the CAM software like FANUC or SINUMERIC, or HINUMERIC to generate CNC manual part programs for various Lathe and Milling machine operations.
5. Develop automatic tool path generation and its CNC code using CAM software like MASTER CAM, ESPRIT CAM etc.
6. Illustrate the Robot programming and its simulation.
7. Develop route sheets, Simulation of manufacturing systems using CAM softwares.

List of Experiments

CAD
Task 1: Part modelling and drawing - Model 1
Task 2: Part modelling and drawing - Model 2
Task 3: Part modelling and drawing - Model 3
Task 4: Assembly and drawing of foot step bearing.
Task 5: Assembly and drawing of Plummber block.
Task 6: Analysis of simple truss element
Task 7: Analysis of Axis symmetric shaft.

CAM
Task 8: Simulation and execution of CNC Programme on XL Turn using G01 code
Task 9: Simulation and execution of CNC Programme on XL Turn using G90 cycle.
Task 10: Simulation and execution of CNC Programme on XL Turn using G70 and G71 cycle
Task 11: Simulation and execution of CNC Programme on XL Mill for a square profile
Task 12: Simulation and execution of CNC Programme on XL Mill for any given profile.
Teaching Methodology:

- Lecture is delivered on projector showing the software and its features.
- Seminars are conducted on new technologies related to subject.
- Exercises are created to practice to solve various industrial problems
- Quiz’s are conducted to test the competency level of student with software
- Industrial visits for practical exposure to understand and explore things.