Condition for Admission
Candidates for admission to the first year of the four year B.E. Degree programmes shall be required to have passed the final examination of the plus 2 Higher Secondary Course with Mathematics, Physics and Chemistry as subjects of study and candidates who have passed the Higher Secondary Examination through vocational stream under Engineering, conducted by the Board of Secondary Education, Government of Tamilnadu or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.

Candidates who have passed the Diploma course in Engineering of the State Board of Technical Education, Tamil Nadu (listed in Annexure-1) will be eligible for admission to the second year of the four year degree programme in B.E. under the lateral entry scheme provided they satisfy other conditions.

Branches of Study in B.E.
- BRANCH I - Civil Engineering
- BRANCH II - Civil and Structural Engineering
- BRANCH III - Mechanical Engineering
- BRANCH IV - Mechanical Engineering (Manufacturing)
- BRANCH V - Electrical and Electronics Engineering
- BRANCH VI - Electronics and Instrumentation Engineering
- BRANCH VII - Chemical Engineering
- BRANCH VIII - Computer Science and Engineering
- BRANCH IX - Information Technology
- BRANCH X - Electronics and Communication Engineering

Courses of Study
The courses of study and the respective syllabi are given separately.

Scheme of Examinations
The scheme of Examinations is given separately.

Choice Based Credit System (CBCS)
The curriculum includes six components namely Humanities / Social Sciences /Management, Basic Sciences, Engineering Sciences, Professional Core, Professional Electives and Open Electives in addition to Seminar & Industrial Training and Project. Each semester curriculum shall normally have a blend of
theory and practical courses. The total credits for the entire degree Programme is 176 (135 for lateral entry students).

**Eligibility for the Degree**

A candidate shall be eligible for the degree of Bachelor of Engineering if the candidate has satisfactorily undergone the prescribed courses of study for a period of four academic years and has passed the prescribed examinations in all the four academic years. For the award of the degree, a student has to

1. Earn a minimum of 176 credits (135 for lateral entry students).
2. Serve in any one of the Co-curricular activities such as
   - National Cadet Corps (NCC)
   - National Service Scheme (NSS)
   - National Sports Organization (NSO) and
   - Youth Red Cross (YRC)

for at least one year. The students enrolled in any one of the co-curricular activities (NCC / NSS / NSO / YRC) will undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid. While the training activities will normally be during weekends, the camp will normally be during vacation period.

(or)

Enroll as a student member of a recognized professional society such as
- Student Chapters of Institution of Engineers (India)
- Student Chapters of other Professional bodies like ICI, ISA, IIChE

**Assignment of Credits for Courses**

Each course is normally assigned one credit per hour of lecture/tutorial per week and one credit for two hours or part thereof for laboratory or practical or drawing per week.

**Duration of the Programme**

A student is normally expected to complete the B.E. programme in four years but in any case not more than eight years from the time of admission.

**Registration for Courses**

A newly admitted student will automatically be registered for all the courses prescribed for the first, second and third semesters without any option.

Every other student shall enroll for the courses intended to be credited in the succeeding semester in the current semester itself by completing the registration form indicating the list of courses. This registration will be done a week before the last working day of the current semester.

A student is required to earn 176 (135 for lateral entry students) credits in order to be eligible for obtaining the degree. However the student is entitled to enjoy an option to earn either more or less than the total number of credits prescribed in the curriculum of a particular semester on the following guidelines:

The **slow learners** may be allowed to withdraw certain courses with the approval by Head of the Department and those courses may be completed by them in the fifth year of study and still they are eligible to be awarded with I Class. A student can withdraw a maximum of 2 courses per semester from IV semester to VII semester and take up those courses in the fifth year of study. However, courses
withdrawn during odd semesters (V and VII) must be registered in the odd semester of fifth year and courses withdrawn during even semesters (IV and VI) must be registered in the even semester of fifth year.

The **advance learners** may be allowed to take up the open elective subjects of eighth semester in sixth and seventh semesters one in each to enable them to pursue industrial training/project work in the entire eighth semester period provided they should register those courses in the fifth semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

**Seminar / Industrial Training**

The student has to present a seminar on the chosen topic. However, the student can select a topic duly approved by the Seminar Coordinator and the Head of the Department concerned. The student who has presented the seminar has to submit a report and appear for viva-voce examination at the end of the semester.

**Project Work**

The student typically registers for project at the end of seventh semester and completes it at the end of the eighth semester along with the courses prescribed for study in the eighth semester. However a student who has registered and successfully completed the courses of eighth semester by acquiring additional credits in the earlier semesters can attempt to spend his/her period of study in an industry and complete his/her project work, submit the project report and appear for viva-voce examination at the end of eighth semester.

**Industrial Training (Value added courses)**

One credit courses shall be offered by a Department with the prior approval from the Dean, Faculty of Engineering and Technology. For one credit course, a relevant potential topic may be selected by a committee consisting of Head of the department concerned and the Board of Studies member from the Department and a senior faculty member from the department concerned. An expert from industry familiar with the topic chosen may be accordingly invited to handle classes for the students. The details of the syllabus, time table and the name of the industrial expert may be sent by the above committee to the Dean for approval. The credits earned through the one credit courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. Students can take a maximum of two one credit courses (one each in VI and VII semesters). They shall be allowed to take one credit courses offered in other Departments with the permission of Head of the Department offering the course. A separate mark sheet shall be issued for one credit courses.

**Electives**

The elective courses fall under two categories: Professional Electives and Open Electives. The Professional Elective courses are offered in the concerned branch of specialization and a student can choose the Professional Elective courses with the approval of the Head of the Department concerned. Apart from the various Professional elective courses, a student can choose the open electives from any specialization offered in any Department in the Faculty of Engineering & Technology during the entire period of study, with the approval of the Head of the Department and the Head of the Department offering the course.
Further, the student can also credit not more than two courses offered through the SWAYAM Portal of UGC with the approval of the Head of the Department concerned. These courses will be considered as equivalent of open electives.

Assessment

The break-up of continuous assessment and examination marks for theory courses is as follows:

- First assessment (Mid-Semester Test-I) : 10 marks
- Second assessment (Mid-Semester Test-II) : 10 marks
- Third Assessment : 5 marks
- End Semester Examination : 75 marks

The break-up of continuous assessment and examination marks for Practical courses is as follows:

- First assessment (Test-I) : 15 marks
- Second assessment (Test-II) : 15 marks
- Maintenance of record book : 10 marks
- End Semester Examination : 60 marks

The continuous assessment marks for the seminar / industrial training will be 40 and to be assessed by a seminar committee consisting of the Seminar Coordinator and a minimum of two members nominated by the Head of the Department. The continuous assessment marks will be awarded at the end of seminar session. 60 marks are allotted for the seminar / industrial training and viva voce examination conducted based on the seminar / industrial training report at the end of the semester.

The continuous assessment marks for the project work will be 40 and to be assessed by a review committee consisting of the project guide and a minimum of two members nominated by the Head of the Department. One of the committee members will be nominated as the Chairman by the Head of the Department. The Head of the Department may be a member or the Chairman. At least two reviews should be conducted during the semester by the review committee. The student shall make presentation on the progress made before the committee. 60 marks are allotted for the project work and viva voce examination at the end of the semester.

Substitute Assessment

A student, who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the final examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Dean / Head of the Department within a week from the date of the missed assessment.

Student Counsellors (Mentors)

To help the students in planning their course of study and for general advice on the academic programme, the Dean / Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student
counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Dean / Head of the Department.

**Class Committee**

For all the branches of study during the first two semesters, a common class committee will be constituted by the Dean of the faculty. From among the various teachers teaching the same common course to different classes during each semester of the first year, the Dean shall appoint one of them as course coordinator. The composition of the class committee during first and second semesters will be as follows:

- Course coordinators of all courses.
- All Heads of the Sections, among whom one may be nominated as Chairman by the Dean.
- The Dean may opt to be a member or the Chairman.

For each of the higher semesters, separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from third to eighth semester will be as follows:

- Teachers of the individual courses.
- A seminar coordinator (for seventh semester only) shall be appointed by the Head of the Department
- A project coordinator (for eighth semester only) shall be appointed by the Head of the Department from among the project supervisors.
- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory/40 marks for seminar/industrial training, practical and project work will be finalized for every student and tabulated and submitted to the Head of the Department (to the Dean in the case of I & II Semester) for approval and transmission to the Controller of Examinations.

**Attendance requirements**

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.
**Temporary break of study**

A student is permitted to go on break of study for a maximum period of one year either as two breaks of one semester each or a single break of one year.

The student applies for break of study, the student shall apply to the Dean in advance, in any case, not later than the last date of the first assessment period. The application duly filled by the student shall be submitted through the Head of the Department. In the case of short term employment/ training/ internship, the application for break of study shall be approved and forwarded by the Head of the department concerned to the Dean.

However, the student must complete the entire programme within the maximum period of eight years.

**Procedure for withdrawing from the Examinations**

A student can withdraw from all the examinations of the semester only once during the entire programme on valid grounds accepted by the University. Such withdrawal from the examinations of a semester will be permitted only if the candidate applies for withdrawal at least 24 hours before the commencement of the last examination. The letter grade ‘W’ appears in the mark sheet for such candidates.

**Passing and declaration of examination results**

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the Controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA), and prepare the mark sheets.

<table>
<thead>
<tr>
<th>Marks Range</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 to 100 marks</td>
<td>Grade 'S'</td>
</tr>
<tr>
<td>80 to 89 marks</td>
<td>Grade 'A'</td>
</tr>
<tr>
<td>70 to 79 marks</td>
<td>Grade 'B'</td>
</tr>
<tr>
<td>60 to 69 marks</td>
<td>Grade 'C'</td>
</tr>
<tr>
<td>55 to 59 marks</td>
<td>Grade 'D'</td>
</tr>
<tr>
<td>50 to 54 marks</td>
<td>Grade 'E'</td>
</tr>
<tr>
<td>Less than 50 marks</td>
<td>Grade 'RA'</td>
</tr>
<tr>
<td>Withdrawn from the examination</td>
<td>Grade 'W'</td>
</tr>
</tbody>
</table>

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course, is declared to have successfully completed that course. Such a course cannot be repeated by the student.

A student who is detained for lack of attendance must re-register for and repeat the courses in the respective semester.

A student who obtains letter grade RA / W in the mark sheet must reappear for the examination of the courses.
The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-totaling of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

Awarding degree

After successful completion of the programme, the degree will be awarded with the following classification based on CGPA.

- For **First Class with Distinction**, the student must earn a minimum of 176 credits within four years (135 credits within three years for lateral entry students) from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above for all the subjects from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

- For **First Class**, the student must earn a minimum of 176 credits within five years (135 credits within four years for lateral entry students) from the time of admission and obtain a CGPA of 6.75 or above for all the subjects from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

- For **Second Class**, the student must earn a minimum of 176 credits within eight years (135 credits within seven years for lateral entry students) from the time of admission.

Ranking of Candidates

The candidates who are eligible to get the B.E. degree in the First Class with Distinction will be ranked together on the basis of CGPA for all the subjects of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The Candidates passing with First Class will be ranked next after those with distinction on the basis of CGPA for all the subjects of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The ranking of candidates will be done separately for each branch of study.
Transitory Regulations

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

Wherever there had been change of syllabi, examinations based on the existing syllabi will be conducted for three consecutive times after implementation of the new syllabi in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent courses, as per the new syllabi, on the recommendations of the Head of the Department concerned.

Diploma Programmes Eligible for the B.E (Lateral Entry) Programmes offered in FEAT (from 2017-2018)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Branches of Study</th>
<th>Eligible Diploma Programme (FT / PT / SW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Civil Engineering</td>
<td>i. Civil Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. Civil Engineering (Architecture)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii. Environmental Engineering and Pollution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control (Full Time)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iv. Architectural Assistantship</td>
</tr>
<tr>
<td></td>
<td></td>
<td>v. Civil Engineering (Rural Tech.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vi. Civil and Rural Engineering</td>
</tr>
<tr>
<td>2.</td>
<td>Civil and Structural Engineering.</td>
<td>i. Mechanical Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. Mechanical and Rural Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii. Mechanical Design and Drafting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iv. Production Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>v. Production Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vi. Automobile Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vii. Automobile Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>viii. Metallurgy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ix. Mechatronics Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x. Machine Tool Maintenance and Repairs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xi. Tool and Die making</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xii. Tool Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xiii. Tool Design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xiv. Foundry Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xv. Refrigeration and Air Conditioning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xvi. Agricultural Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xvii. Agricultural Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xviii. Marine Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xix. Mechanical Engineering(Production)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xx. Mechanical Engineering(Tool &amp;Die)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xxi. Mechanical Engineering (Foundry)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xxii. Mechanical Engineering(R &amp; A.C.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xxiii. Electronics(Robotics)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xxiv. Mining Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xxv. Agricultural Engineering and Farm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xxvi. Equipment Technology</td>
</tr>
<tr>
<td>3.</td>
<td>Mechanical Engineering</td>
<td>i. Mechanical Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. Mechanical and Rural Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii. Mechanical Design and Drafting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iv. Production Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>v. Production Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vi. Automobile Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vii. Automobile Technology</td>
</tr>
<tr>
<td>4.</td>
<td>Mechanical Engineering (Manufacturing Engineering)</td>
<td>i. Electrical and Electronics Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. Electrical and Communication Engg.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii. Electronics and Instrumentation Engg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iv. Electronics Engineering(Instrumentation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>v. Instrument Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vi. Instrumentation and Control Engineering</td>
</tr>
</tbody>
</table>
### Branches of Study and Eligible Diploma Programme (FT / PT / SW)

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Branches of Study</th>
<th>Eligible Diploma Programme (FT / PT / SW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td><strong>Electronics and Instrumentation</strong></td>
<td>vii. Electrical Engineering (Instruments and Control)</td>
</tr>
<tr>
<td></td>
<td><strong>Engineering</strong></td>
<td>viii. Electrical Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ix. Instrumentation Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x. Electronics (Robotics)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xi. Mechatronics Engineering</td>
</tr>
<tr>
<td>7.</td>
<td><strong>Chemical Engineering</strong></td>
<td>i. Petrochemical Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. Chemical Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii. Environmental Engineering and Pollution Control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iv. Leather Technology (Footwear)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>v. Leather Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vi. Plastic Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vii. Polymer Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>viii. Sugar Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ix. Textile Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x. Chemical Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xi. Ceramic Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xii. Petro Chemical Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xiii. Pulp &amp; Paper Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xiv. Petroleum Engineering</td>
</tr>
<tr>
<td>8.</td>
<td><strong>Computer Science and Engineering</strong></td>
<td>i. Electronics and Communication Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. Computer Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii. Computer Science and Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iv. Information Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>v. Computer Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vi. Computer Networking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vii. Electronics (Robotics)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>viii. Mechatronics Engineering</td>
</tr>
<tr>
<td>9.</td>
<td><strong>Information Technology</strong></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td><strong>Electronics and Communication</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Engineering</strong></td>
<td></td>
</tr>
</tbody>
</table>

**FT- Full Time; PT-Part Time; SW- Sandwich.**

### COURSES AND CREDITS - SUMMARY

<table>
<thead>
<tr>
<th>Semester</th>
<th>No. of Courses</th>
<th>HS</th>
<th>BS</th>
<th>ES</th>
<th>PC</th>
<th>PE</th>
<th>OE</th>
<th>S&amp;IT</th>
<th>Proj.</th>
<th>Total Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>4+2</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>II</td>
<td>4+4</td>
<td>8</td>
<td>4</td>
<td>13</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>III</td>
<td>6+2</td>
<td>8</td>
<td></td>
<td></td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>IV</td>
<td>6+2</td>
<td>8</td>
<td></td>
<td>4</td>
<td>3</td>
<td></td>
<td>16</td>
<td></td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>V</td>
<td>6+3</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
<td>8</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>VI</td>
<td>6+3</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>10</td>
<td>11</td>
<td>3</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>VII</td>
<td>5+3</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>8</td>
<td>3</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>VIII</td>
<td>2+1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td><strong>Total Courses</strong></td>
<td><strong>39+20</strong></td>
<td><strong>59</strong></td>
<td><strong>4</strong></td>
<td><strong>10</strong></td>
<td><strong>8</strong></td>
<td><strong>21</strong></td>
<td><strong>10</strong></td>
<td><strong>4</strong></td>
<td><strong>1</strong></td>
<td><strong>14</strong></td>
</tr>
</tbody>
</table>

* - No of Credits ; ** - No of Courses.

### DETAILS OF COURSE CODE

<table>
<thead>
<tr>
<th>Code (First)</th>
<th>Details</th>
<th>Code (3rd and)</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sl. No.</td>
<td>Category</td>
<td>Course Code</td>
<td>Course</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>-------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>1.</td>
<td>HS-I</td>
<td>00HS101</td>
<td>Technical English</td>
</tr>
<tr>
<td>2.</td>
<td>BS-I</td>
<td>00BS102</td>
<td>Engineering Mathematics I</td>
</tr>
<tr>
<td>3.</td>
<td>BS-II</td>
<td>00BS103</td>
<td>Applied Physics I</td>
</tr>
<tr>
<td>4.</td>
<td>BS-III</td>
<td>00BS104</td>
<td>Applied Chemistry I</td>
</tr>
<tr>
<td>5.</td>
<td>ES-I Lab</td>
<td>00SP105</td>
<td>Computer Programming Laboratory</td>
</tr>
<tr>
<td>6.</td>
<td>ES-II Lab</td>
<td>00SP106</td>
<td>Engineering Workshop</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

* **Basic Civil Engg. Course** for Mech., Manuf., EEE, EIE, ECE, CSE & IT.


**Basic Mechanical Engg. Course** for Civil, Civil and Structural, EEE, EIE, ECE, CSE, IT & Chem. Engg.

L - Lecture; T-Tutorial; P-Practical;
Exam - End Semester Examination; CA-Continuous Assessment.

5th digit represents the semester and 6th and 7th digits represent the serial number of courses.

COURSES OF STUDY AND SCHEME OF EXAMINATIONS

FIRST SEMESTER
### SECOND SEMESTER

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category</th>
<th>Course Code</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Exam</th>
<th>CA</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BS-IV</td>
<td>00BS201</td>
<td>Engineering Mathematics-II</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>BS-V</td>
<td>00BS202</td>
<td>Applied Physics-II</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>BS-VI</td>
<td>00BS203</td>
<td>Applied Chemistry II</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>ES-I</td>
<td>00ES204</td>
<td>Basic Engineering*</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>HS-II</td>
<td>00HP205</td>
<td>Communication Skills and Language Laboratory</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>BS-I Lab</td>
<td>00BP206</td>
<td>Applied Physics Laboratory</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>BS-II Lab</td>
<td>00BP207</td>
<td>Applied Chemistry Laboratory</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>ES-III Lab</td>
<td>00SP208</td>
<td>Engineering Graphics</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
<td>4</td>
<td>12</td>
<td>540</td>
</tr>
</tbody>
</table>

### THIRD SEMESTER

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category</th>
<th>Course Code</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Exam</th>
<th>CA</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HS-III</td>
<td>00HS301</td>
<td>Environmental Studies</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>BS-VII</td>
<td>00BS302</td>
<td>Engineering Mathematics III</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>ES-II</td>
<td>00ES303</td>
<td>Engineering Mechanics</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>ES-III</td>
<td>06ES304</td>
<td>Fluid Mechanics and Hydraulic Machinery</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>PC-I</td>
<td>06PC305</td>
<td>Circuit Theory</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>PC-II</td>
<td>06PC306</td>
<td>Fundamentals of Semiconductor Devices</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>ES-IV Lab</td>
<td>06SP307</td>
<td>Hydraulics Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>PC-I Lab</td>
<td>06CP308</td>
<td>Circuit and Devices Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
<td>1</td>
<td>6</td>
<td>570</td>
</tr>
</tbody>
</table>

### FOURTH SEMESTER

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category</th>
<th>Course Code</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Exam</th>
<th>CA</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BS-VIII</td>
<td>06BS401</td>
<td>Probability, Random processes and Numerical Methods</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>ES-IV</td>
<td>06ES402</td>
<td>Thermodynamics</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PC-III</td>
<td>06PC403</td>
<td>Electronic Circuits</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>PC-IV</td>
<td>06PC404</td>
<td>Digital Electronics</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>PC-V</td>
<td>06PC405</td>
<td>Analog and Digital Integrated Circuits</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>PC-VI</td>
<td>06PC406</td>
<td>Transducers and Measurement System</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>PC-II Lab</td>
<td>06CP407</td>
<td>Linear and Digital ICs Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>PC-III Lab</td>
<td>06CP408</td>
<td>Sensors and Signal Conditioning Circuits Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
<td>1</td>
<td>6</td>
<td>570</td>
</tr>
</tbody>
</table>
## FIFTH SEMESTER

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category</th>
<th>Course Code</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Exam</th>
<th>CA</th>
<th>Total</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PC-VII</td>
<td>06PC501</td>
<td>Control Systems</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>PC-VIII</td>
<td>06PC502</td>
<td>Industrial Instrumentation</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PC-IX</td>
<td>06PC503</td>
<td>Electronic Instrumentation and Measurement Techniques</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>PC-X</td>
<td>06PC504</td>
<td>Micro Processors and Micro Controllers</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>PE-I</td>
<td>06PE505</td>
<td>Professional Elective -I</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>PE-II</td>
<td>06PE506</td>
<td>Professional Elective -II</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>PC-IV Lab</td>
<td>06CP507</td>
<td>Control System Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>PC-V Lab</td>
<td>06CP508</td>
<td>Microprocessor lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>PE-I Lab</td>
<td>06EP509</td>
<td>Professional Elective-I Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>24</td>
<td>1</td>
<td>9</td>
<td>630</td>
<td>270</td>
<td>900</td>
<td>25</td>
</tr>
</tbody>
</table>

## SIXTH SEMESTER

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category</th>
<th>Course Code</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Exam</th>
<th>CA</th>
<th>Total</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PC-XI</td>
<td>06PC601</td>
<td>Digital Signal Processing</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PC-XII</td>
<td>06PC602</td>
<td>Process Control</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PE-III</td>
<td>06PE603</td>
<td>Professional Elective -III</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>PE-IV</td>
<td>06PE604</td>
<td>Professional Elective -IV</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>PE-V</td>
<td>06PE605</td>
<td>Professional Elective -V</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>OE-I</td>
<td>XXOE606*</td>
<td>Open Elective-I</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>PC-VI Lab</td>
<td>06CP607</td>
<td>Instrumentation and Process Control Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>PC-VII Lab</td>
<td>06CP608</td>
<td>Embedded Systems Laboratory</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>PE-II Lab</td>
<td>06EP609</td>
<td>Professional Elective-II Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>24</td>
<td>9</td>
<td>6</td>
<td>630</td>
<td>270</td>
<td>900</td>
<td>24</td>
</tr>
</tbody>
</table>

* First two digits indicate the code of the Department/Branch offering the elective course.

## SEVENTH SEMESTER

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category</th>
<th>Course Code</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>S</th>
<th>Exam</th>
<th>CA</th>
<th>Total</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HS-IV</td>
<td>00HS701</td>
<td>Engineering Ethics</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PC-XIII</td>
<td>06PC702</td>
<td>Computer Control of Processes</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PE-VI</td>
<td>06PE703</td>
<td>Professional Elective -VI</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>PE-VII</td>
<td>06PE704</td>
<td>Professional Elective -VII</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>OE-II</td>
<td>XXOE705</td>
<td>Open Elective-II</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>PC-VIII Lab</td>
<td>06CP706</td>
<td>Computer Process Control Lab</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>PE-III Lab</td>
<td>06EP707</td>
<td>Professional Elective-III Lab</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>S &amp; IT</td>
<td>06ST708</td>
<td>Seminar/Industrial Training</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>20</td>
<td>6</td>
<td>1</td>
<td>555</td>
<td>245</td>
<td>800</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
EIGHTH SEMESTER

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category</th>
<th>Course Code</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Exam</th>
<th>CA</th>
<th>Total</th>
<th>credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>OE-III</td>
<td>XXOE801</td>
<td>Open Elective-III</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>OE-IV</td>
<td>XXOE802</td>
<td>Open Elective-IV</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Project</td>
<td>06PV803</td>
<td>Project Work and Viva-voce</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>15</td>
<td>60</td>
<td>40</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>8</td>
<td>15</td>
<td>210</td>
<td>90</td>
<td>300</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

SYLLABUS
FIRST SEMESTER

<table>
<thead>
<tr>
<th>00HS101</th>
<th>TECHNICAL ENGLISH</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- English technical communication focuses on developing the proficiency of Engineering students in communicative skills, ensuring them to face the demand of their profession with high command in English.
- At the end of the course, the learners will be able to use English for all purposes of technical communication and come out in “flying colours”.

Unit–I : Listening Strategies

This unit makes the students to get exposed to the listening exercises and get registered in their minds the nuances of listening and its importance.

1. Listening process.
2. Types of listening.
3. Barriers to listening.
5. Team listening and note making.

Unit–II : Critical Reading and Creative Writing Skills

This unit introduces communication model like courtesy, body language, role play and good presentation in an effective manner, where the students are given an opportunity to observe, analyze, interpret, imagine and implement their ideas too.

Poem : Road not taken – Robert Frost
Ulysses – Alfred Lord Tennyson.

Prose : Of Studies – Francis Bacon
Science – Destroyer or creator – J. Bronowski

Play : Pygmalion – Bernardshaw.

Unit–III : Speaking Skill

Students shall be motivated to speak in English on familiar or unfamiliar topics. It is a platform to train the students to achieve competency in oral expression.

1. Interview Techniques
2. Group discussion
3. Making presentation and Discussing on the presentation.
4. Sample interviews
5. Dialogue writing

Unit–IV : Professional Writing

Students shall be trained to create their own proficiency in writing like - calling for quotation, asking clarification, placing orders and so on.

1. Poster making
2. Letter writing (formal and E-mail)
3. Analytical writing
4. Format of memos.
5. Report Writing

Unit–V : Theoretical writing

The nuances of English grammar may be taught to the students so as to present flawless English both in their oral and written communication

2. Single word substitution
3. Concord
4. Tag Questions
5. Active voice and passive voice

TEXT BOOK


REFERENCE BOOKS


COURSE OUTCOMES

1) Understand the role of speaking in English and its contribution to their success.
2) Help the students increase the lingual power and word power, and frame suitable structures to use appropriately in different contexts.
3) Initiate the students to adopt different strategies for personal and professional writing.
4) Train the students use diversified rhetorical functions of technical English.

<table>
<thead>
<tr>
<th>00BS102</th>
<th>ENGINEERING MATHEMATICS - I</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

To acquaint the student with the concepts in

- Matrices,
- Differential calculus,
- Multiple integrals,
Vector calculus, which are most important in connection with practical engineering problems.

Unit–I : Matrices

Unit–II : Differential Calculus
Curvature in Cartesian and parametric co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes.

Unit–III : Differential Calculus: Functions of Several Variables
Jacobians – Taylor’s and Maclaurin’s series expansions of functions of two variables – Maxima and Minima of functions of two variables – Constrained Maxima and Minima by Lagrange Method.

Unit–IV : Multiple Integrals

Unit–V : Laplace Transform
Definition, Transform of elementary functions, Properties, Derivatives and integrals of transforms, Transforms of derivatives, Convolution theorem, Transforms of periodic functions, Inverse Laplace transform, Application to solution of linear ordinary differential equations of second order with constant coefficients.

(In all units, proof of theorems are not included)

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
1) This course equips students to have knowledge and understanding in matrices, differential calculus, multiple integrals and Laplace transforms.
2) Students will be able to solve problems related to above fields in engineering applications.

<table>
<thead>
<tr>
<th>00BS103</th>
<th>APPLIED PHYSICS – I</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES:
At the end of the course the students would be exposed to fundamental knowledge in various engineering subjects and applications

- Determine the different modulus of elasticity and viscosity of the less and highly viscous liquids.
- Design of acoustically good buildings.
- Interferometric techniques in metrology, communication and civil engineering.
- Application of quantum physics to optical and electrical phenomena.
- Application of ultrasonics and acoustics.
- Structure identification of engineering materials.
- Applications of Radio isotopes and power reactor systems.

**Unit–I : Properties of Matter**


**Unit–II : Sound**

Introduction to Acoustics - factors affecting acoustics of buildings and their remedies– absorption coefficient– Sabine’s formula for reverberation time.

Introduction to Ultrasonics – production – magnetostriction and piezo electric methods – Detection of Ultrasonic waves (Acoustics grating) – Applications.

**Unit–III : Optics**


**Unit–IV : Crystal Physics**

Lattice - unit cell - Bravais lattice - Atomic radius, co-ordination number, Packing factor and their calculations of SC,BCC,FCC and HCP crystal structures - Miller indices - Crystal imperfections (Point defect, Line defect, surface defect and volume defect).

**Unit–V : Nuclear Physics**


**TEXT BOOKS**

**REFERENCE BOOKS**

**COURSE OUTCOMES**
1) The Engineering students can gain the basic knowledge in the field of optics, sound, nuclear physics and crystalline materials etc.
2) It will be useful to apply in engineering applications.

<table>
<thead>
<tr>
<th>00BS104</th>
<th>APPLIED CHEMISTRY – I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**
To make the student conversant with the
- Water treatment techniques and disinfection methods.
- Working principle of electrochemical cells.
- Sources, refining and various types of fuels.
- Mechanism, classification, applications of lubricants and introduction adhesives.
- Surface chemistry, principle and applications of chromatography.

**Unit–I : Water Treatment**
Water – Hardness of water – softening of water by ion-exchange process and zeolite process – boiler feed water – specifications – boiler troubles (Sludge and scale formation, priming and foaming, caustic embrittlement and boiler corrosion) – removal of dissolved CO$_2$, O$_2$ and acids – internal treatment of boiler feed water (colloidal, carbonate, phosphate, calgon and EDTA conditioning) – disinfection of water – break point chlorination – desalination of brackish water by reverse osmosis method - Determination of total hardness by EDTA method.

**Unit–II : Electrochemistry**
Electrochemical cell – EMF – determination of EMF of electrochemical cell – single electrode potential – standard electrode potential – Nernst equation –
reference electrodes – standard hydrogen electrode, calomel electrode, glass electrode – electrochemical series – concentration cell.

**Unit-III : Fuels And Combustion**


**Unit-IV : Engineering Materials – I**


**Unit-V : Analytical Technique and Surface Chemistry**


**TEXT BOOKS**


**REFERENCE BOOKS**


**COURSE OUTCOMES**

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

1) Understand and develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.

2) Understand and apply the concepts of electrochemistry including electroplating.

3) Understand the properties, sources of fuel and the concept of combustion
4) Gain the knowledge about types of lubricants, uses & their mechanisms and to understand the binding process of adhesives, and its application in building and construction.

5) Separate and purify various organic and inorganic compounds using different chromatographic techniques.

6) Understand the concept of surface chemistry and its applications.

<table>
<thead>
<tr>
<th>00SP105</th>
<th>COMPUTER PROGRAMMING LABORATORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

- To enable the students to have a good understanding about the concepts of “C” programming.
- To provide the hands on experience in basic concepts of AUTOCAD to students.

**C Programs based on the following concepts:**

- Basic structure of C Programs – Constants – Variables – Data Types – Keywords – Identifiers – Operators – Expressions – IF, IF-ELSE, Nested IF-ELSE, Switch, WHILE, DO, FOR and GOTO statements - Arrays: one dimensional and two dimensional – Strings - Functions.

**AUTOCAD**

- Special Features – Dimensioning – Angular, Diameter and Radius – Hatching – Patterns – Slides – Attributes – Configuring – Plotting– Exercises in AUTOCAD (2D Drawings only)

**TEXT BOOKS**


**REFERENCE BOOKS**


**COURSE OUTCOMES**

3) Understand the concepts of C programming.
4) Apply the syntax of conditional and looping statements for writing C programs.
5) Use the features of AUTOCAD for 2D drawing.

<table>
<thead>
<tr>
<th>00SP106</th>
<th>ENGINEERING WORKSHOP</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

- To provide the students simple hands-on-experience in the basic aspects of production engineering in fitting, carpentry and sheet metal.
Workshop Practice in the Shops

**Carpentry:** Use of hand tools – exercises in planning and making joints namely, half lap joint, dovetail joint, mortising and tenoning.

**Fitting:** Use of bench tools, vice, hammers, chisels, files, hacksaw, centre punch, twist drill, taps and dies – Simple exercises in making T joint and dovetail joints.

**Sheet Metal Work:** Use of hand tools – Simple exercises in making objects like cone, funnel, tray, cylinder.

**Smithy:** Demonstration of hand forging and drop forging.

**COURSE OUTCOMES**

This course

1) Use basic tools of fitting, carpentry and sheet metal fabrication.
2) Experience in the fabrication of simple carpentry joints.
3) Develop skill to make simple fitting joints.
4) Train to make simple shapes of sheet material.
5) Distinguish hand forging and drop forging operation.

**SECOND SEMESTER**

<table>
<thead>
<tr>
<th>00BS201</th>
<th>ENGINEERING MATHEMATICS II</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

- To acquaint the student with the concepts in ordinary differential equations and vector calculus.
- To acquaint the student with the techniques in the theory of analytic functions and complex integration.
- Above topics are most important in connection with practical engineering problems.

**Unit–I : Ordinary Differential Equations**

Second order linear differential equations with constant coefficients, Second order linear differential equations with variable coefficients (Euler and Legendre’s linear equations), Simultaneous first order linear equations with constant coefficients, method of variation of parameters.

**Unit–II : Vector Differentiation**

Gradient, divergence and curl, directional derivative, unit normal vector, irrotational and solenoidal vector fields, expansion formulae for operators involving $\nabla$.

**Unit–III : Vector Integration**

Line, surface and volume integrals, Green’s theorem in a plane, Gauss divergence theorem, Stoke’s theorem – Verification of the above theorems and evaluation of integrals using them.

**Unit–IV : Analytic Functions**

Functions of a complex variable, Analytic function, the necessary conditions (Cauchy-Riemann equations), sufficient conditions, Properties of analytic functions, harmonic functions, construction of Analytic function by Milne-Thomson method, Conformal mapping: $w = z^2$, $1/z$, $e^z$, $\sin z$, $\cos z$. 
Unit–V : Complex Integration

Statement and application of Cauchy theorem, Cauchy integral formulas, Taylor and Laurent expansion, Singularities – Classification; Residues – Statement and application of Cauchy residue theorem, Contour integration round the unit circle.

(In all units, proof of theorems are not included)
TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
1) This course equips students to have knowledge and understanding in ordinary differential equations, vector calculus and complex variables.
2) Students will be able to solve problems related to above fields in engineering applications.

<table>
<thead>
<tr>
<th>00BS202</th>
<th>APPLIED PHYSICS – II</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
At the end of the course the students would be exposed to fundamental knowledge in various materials and applications
- Application of lasers and fiber optics in engineering and technology.
- Astrophysics is the study of physics of the universe. In various objects, such as stars, planets and galaxies.
- To measure positions, brightness, spectra structure of gas clouds, planets, starts, galaxies, globular clusters, quasars etc.
- Physics of modern engineering materials.
- Electromagnetic phenomena and wave propagation
- Applications of nano materials, nano electronics and optoelectronic devices.
- Design of energy sources and applications of solar energy.

Unit–I : Laser and Fiber Optics
Fiber optics - Principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - Types of optical fibers (Material, Mode and refractive index) - Applications - Fiber Optic communication system.

Unit–II : Dielectrics and Superconductors
Superconductivity – Properties – Meissner effect – Type I and Type II superconductors – BCS theory- High temperature Superconductors – Applications.

**Unit–III : Nano Materials**


**Unit–IV : Quantum Mechanics**


The wave Equation, Schrödinger’s Time dependent wave equation, Schrödinger’s time independent wave equation - The Wave function and its physical significance - The particle in a box – energy quantization – Eigen values and Eigen functions.

**Unit–V : Energy Physics**


**TEXT BOOKS**


**REFERENCE BOOKS**


COURSE OUTCOMES
1) The student will have the theoretical knowledge in this field of laser, dielectrics, Nano technique, energy physics etc.
2) It will be very useful to the students to apply in different field of engineering.

<table>
<thead>
<tr>
<th>00BS203</th>
<th>APPLIED CHEMISTRY II</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
To make the students to understand the
- Types of polymers and polymerization processes.
- Phase rule with different kinds of systems.
- Different types of corrosion and their mechanism.
- Working principle and applications of primary and secondary batteries.
- Engineering materials such as refractories and abrasives.

Unit–I : Polymers

Unit–II : Phase Rule

Unit–III : Corrosion and Prevention

**Unit-IV : Energy Storage Devices**


**Unit-V : Engineering Materials II**

Refractories – classification (acidic, basic and neutral refractories) – properties (refractoriness, refactororiness under load, dimensional stability, porosity, thermal spalling) – fire clay bricks, alumina bricks and zirconia bricks. Abrasives – Moh’s scale of hardness – natural abrasive (diamond, corundum, emery, garnets and quartz) – synthetic abrasives – silicon carbide, boron carbide and their uses.

**TEXT BOOKS**


**REFERENCE BOOKS**


**COURSE OUTCOMES**

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

1) Understand the synthesis and applications of various types of polymers and moulding processes.

2) Understand the concept of phase rule and its applications, which is applicable in alloy preparation.

3) Understand the concept of corrosion and to apply the knowledge in the protection of different metals from corrosion.

4) Gain the knowledge about various energy storage devices, especially solar energy.

5) Have the knowledge of converting solar energy into most needy electrical energy efficiently and economically to reduce the environmental pollution.

6) Gain knowledge on classification, synthesis and applications of abrasives and refractories.
COURSE OBJECTIVES

- To inculcate a knowledge on essentials of Civil Engineering.
- To expose the students on the role, significance and contributions of Civil Engineering in satisfying societal needs.
- To illustrate the concepts of various construction techniques.

Module I

Introduction to Civil Engineering - various disciplines of Civil Engineering, relevance of Civil Engineering in the overall infrastructural development of the country. Introduction to various building materials – Stone, Bricks, Steel, Cement, Concrete, Timber – its characteristics, types and uses. Various types of buildings as per nbc; Selection of suitable site for buildings, Components of a residential building – its functions, Orientation of a building, simple definitions - plinth area / built up area, floor area / carpet area – floor space index.

Module II

Surveying - Principles and objectives of surveying; Types, Classifications of surveying, measurement of areas and distances – chain – compass: Introduction to Leveling, Total station, Remote sensing - fundamental principles and applications.


Module III


TEXT BOOKS


REFERENCE BOOKS

COURSE OUTCOMES
1) Understand the basic knowledge on civil engineering materials.
2) Develops the skill to satisfy the social needs.
3) Describe the suitable method of construction technique.

<table>
<thead>
<tr>
<th>00ES204</th>
<th>BASIC ENGINEERING (ELECTRICAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- To impart the basic principles of generation of electrical energy.
- To explain the operation of electrical machines and various measuring instruments.
- To understand the basic concepts of circuit analysis.
- To provide an overview of the principles, operation and application of semiconductor devices like diodes, BJT, FET and a basic knowledge of fundamentals of Communication Systems.

Module I
Sources of Electrical energy–Generation of electrical energy – working principles of DC generators and alternators– Advantages of electrical energy over other forms of Energy.
Working principles of MC and MI voltmeters and Ammeters, Dynamo meter type wattmeter, Induction type energy meter and Multimeter–types of wiring–requirements for house wiring–typical layout for a small house– earthing.

Module II
DC Circuits: Definition of current, voltage, power and energy– DC voltage and current sources– resistance, types of resistors, series and parallel connections of resistors, current and voltage division–loop method of analysis of simple circuits.
AC Circuits: Sinusoidal signals – average, r.m.s values –inductance, capacitance and their V–I relationships. Analysis of simple single phase series circuits– power and power factor–phasor diagrams– Introductions to three phase AC circuits.

Module III
Basic Electronics: Principle and characteristics, uses of PN junction Diode, Zenerdiode, BJT, FET, UJT, Thyristors,-Operating principle of Half wave, Full wave and Bridge rectifiers.
TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
After the completion of the course, the student should be able to
1) Provide comprehensive idea about simple circuit analysis, working principles of machines and common measuring instruments
2) Analyze the behavior of any dc and ac circuits
3) Characterize semiconductor devices that include diodes, BJT and digital functions.
4) Understand fundamental principles of communication systems

<table>
<thead>
<tr>
<th>00ES204</th>
<th>BASIC ENGINEERING (MECHANICAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- To familiarize the students the functioning of different types of Boilers, the mountings and accessories.
- To provide basic knowledge about the use of various machine tools and the basic principles of welding, brazing and soldering.
- To illustrate the concepts of various metal forming operations and metal joining techniques.

Module I
Boilers: Classification – Description and working of Simple vertical boiler, Cochran boiler, Babcock and Wilcox boiler - Description and working of boiler mountings: water level indicator, Pressure gauge, Dead weight and Spring loaded Safety value, Fusible plug, Feed check value, Steam stop value and Blow-off cock - Description and working of boiler accessories: Economiser and Super heater.

Module II

Module III
Machine Tools: Description of parts and operations performed – Lathe, Shaper and Drilling machine.
Metal Forming: Hot working versus cold working; Hand forging – Principle and operations; Rolling – Principle, rolling mill configurations; Extrusion – Direct versus indirect extrusion.


TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
1) Understand the construction and working principles of boiler operations
2) Distinguish between steam turbines and gas turbines.
3) Select suitable manufacturing methods to produce a new component.

<table>
<thead>
<tr>
<th>COURSE OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Language Lab focuses on the production and practices of sounds of language</td>
</tr>
<tr>
<td>The Language Lab familiarizes the students with the use of English in everyday situations and contexts.</td>
</tr>
</tbody>
</table>

Theoretical Session (Internal Assessment only)

- English sound pattern
- Sounds of English
- Pronunciation
- Stress and Intonation
- Situational Dialogues/ Role play
- Oral presentations- Prepared or Extempore
- ‘Just a Minute’ sessions (JAM)
- Describing Objects /situations/ people
- Debate
- Giving Directions
Practical Session

- To make the students recognize the sounds of English through Audio Visual Aids
- To enable the students speak fluently without fear
- To develop their communicative skill with individual practice through the prescribed package
- The Globarena Package consists of the following exercises
  1. Reading comprehension
  2. Listening comprehension
  3. Vocabulary exercises
  4. Phonetics
  5. Role Play in dialogues
  6. Auto Speak

REFERENCE BOOKS
1) Globarena Package for communicative English
2) Cambridge Advanced Learner’s English Dictionary
3) Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
7) A text book of English Phonetics for Indian Students by T. Balasubramanian (Macmillan)
8) English Skills for Technical Students, WBSCTE with British Council, OL.

DISTRIBUTION AND WEIGHTAGE OF MARKS

English Language Laboratory Practical Paper:
1) The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2) For the Language lab sessions, there shall be a continuous evaluation during the year for 40 sessional marks and 60 year-end Examination marks. The year-end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

COURSE OUTCOMES
1) Help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such as GRE, TOEFL, GMAT, etc.
2) Train the students to use language effectively to face interviews, group discussions, and public speaking.
3) Initiate the students into greater use of the computer in resume preparation, reportwriting, format-making, etc.
COURSE OBJECTIVES

The ability to offer students a variety of research opportunities

- To determine the radius of curvature of the plano convex lens and the wavelength of the sodium light by measuring the diameter of Newton’s rings. We can use a spectrometer to measure this angle of deviation.
- To measure the modulus of elastic material by torsional pendulum and bending of a beam.
- To determine the resistivity of a given steel and brass wire.
- To find the velocity of ultrasonic waves in a liquid.
- Less viscosity of the liquid by poiseuille’s method.

List of Experiments (Any Ten)

1) Non-Uniform Bending - Determination of Young’s modulus of the given scale or beam.
2) Newton’s rings- Determination of Radius of curvature of the given Plano convex lens.
3) Viscosity – Determination of co-efficient of Viscosity of a highly viscous liquid by Stoke’s method.
4) Spectrometer – Dispersive power of a given prism.
5) Torsional Pendulum – Determination of Moment of Inertia of the metallic disc and
6) Rigidity Modulus of the material of a wire.
7) Field along the axis of a coil- Determination of horizontal earth magnetic flux density.
8) Air wedge – Determination of thickness of a given thin wire and paper.
9) Viscosity - Determination of co-efficient of Viscosity of a less viscous liquid by Capillary flow method.
10) Uniform bending- Determination of Young’s modulus of the given scale or beam.
11) Spectrometer – Determination of wavelength of the prominent spectral lines using Grating.
13) Band gap determination of a Semiconductor.

COURSE OUTCOMES

1) To determine resistivity of a given steel and brass wire.
2) To find the velocity of ultrasonic waves in a liquid.
3) To measure the thickness of a thin materials.
4) To determine the band gap of a given semiconductor.
5) Diffraction patterns can be formed by light passing through a series of fine lines.
6) Applications of optoelectronic devices.
COURSE OBJECTIVES

- To appreciate the practical significance of acidimetry, alkalimetry and permanganometry
- To analyse quantitatively the amount of a substance present in a given sample.
- To assess the composition of an alloy
- To test the water quality standards.

LIST OF EXPERIMENTS

1) Estimation of Potassium hydroxide
2) Estimation of Acetic acid in vinegar
3) Estimation of Temporary hardness of water sample
4) Estimation of Total hardness of water sample
5) Estimate separate amount of sodium carbonate and sodium hydroxide in a mixture.
6) Estimation of Ferrous sulphate
7) Estimation of Mohr's salt
8) Estimation of ferrous iron
9) Estimation of Oxalic acid
10) Determination of available free chlorine in a water sample.
11) Estimation of copper in brass by iodometry
12) Estimation of iron by dichrometry
13) Estimation of nickel in an alloy

COURSE OUTCOMES

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

1) Gain knowledge in the quantitative chemical analysis of water quality related parameters, acid-base, red-ox and iodometry titrations.

COURSE OBJECTIVES

- To develop the ability to produce simple engineering drawing and sketches based on current practice.
- To develop the means for communication of ideas, thoughts and design of objects, related to engineering applications, to others through drawing.
- To develop the skills to read manufacturing and construction drawings used in industry.
- To develop a working knowledge of the layout of plant and equipment.
- To develop skills in abstracting information from calculation sheets and schematic diagrams to produce working drawings for manufacturers, installers and fabricators.
- To expose the international standards of technical drawing
Unit–I
Introduction to Engineering Drawing, Use of drafting instruments– Lettering and dimensioning.

Construction of conic sections - Ellipse, Parabola & Hyperbola (Eccentricity Method, Rectangle method, Intersecting arcs method) - Special curves- Simple cycloids and involutes– Tangent and normal at points on the curves only.

Unit–II
Orthographic projections - Projections of Points- Projections of Straight lines (given the projections, to determine the true length and true inclinations).

UNIT–III
Projections of Solids like prism, pyramid, cylinder, cone, tetrahedron and octahedron in simple positions.

Auxiliary Projections of prism, pyramid, cylinder, cone when the axis is inclined to one plane only.

Unit–IV
Sections of prism, pyramid, cylinder, cone in simple position – true shape of sections. Intersection of surfaces - cylinder to cylinder and cylinder to cone with axis intersecting at right angles. Development of lateral surfaces of prism, pyramid, cylinder, cone and cut solids.

Unit–V
Isometric Projections of simple solids and combinations. Perspective Projections of simple solids. Conversion of Pictorial view of simple objects into Orthographic views.

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
Upon completion of this course, the students will be able to:
1) Construct, read, and understand the Title and Revision Block.
2) Usage of common drafting tools to construct engineering drawings enhances
3) Apply dimensions on engineering drawing.
4) Ability of converting sketches to engineered drawings will increase.
5) Developing cognitive and psychomotor skills, visualize images and their dimensions.
6) Develop good communication skills and team work.
DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

VISION
To nurture higher echelons of technology through participative education, innovative and collaborative research with a view to bring out employable graduates of International standard.

MISSION
- To establish state of the art facilities related to diverse dimensions in the field of Instrumentation Engineering.
- To foster higher quality of education with equivocal focus in theory and practical areas of Electronics, Control and Instrumentation Engineering.
- To ensure that the dissemination of knowledge reaches the stakeholders and forge the opening of a fresh flair of human resources.
- To create opportunities for advancements in different facets of this discipline and offer avenues to reach the citadels of one’s career.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)
1. To nurture in a spirit of self-confidence, tolerance and adaptability among the graduates pursuing this programme.
2. To inculcate echelons of technical skill and academic excellence for enabling the graduates to choose their field of expertise.
3. To foster curricular and extra-curricular attributes with a perspective to ensure the graduates accomplish their professional career.
4. To promote awareness among graduates for lifelong learning and inculcate professional ethics

PROGRAMME OUTCOMES (PO)
After the successful completion of the B.E. (Electronics and Instrumentation Engineering) degree programme, the students will be able to:

PO 1: INTEGRATION OF KNOWLEDGE
Apply the knowledge of mathematics, science and engineering fundamentals in analog and digital electronic systems, instrumentation and control engineering.

PO 2: PROBLEM ANALYSIS
Formulate, solve and analyze complex problems in electrical circuits, electronic systems, instrumentation and control engineering.

PO 3: DESIGN AND DEVELOPMENT OF SOLUTIONS
Apply the acquired knowledge for designing systems/processes to address the specific needs and to pull off solution, with appropriate consideration for health, safety, and environmental issues.

PO 4: USE OF MODERN TOOLS AND TECHNIQUES
Select and apply appropriate modern engineering tools including prediction and modelling software packages, Distributed Control System, Programmable Controllers and advanced processors.
PO 5: COLLABORATIVE AND MULTIDISCIPLINARY APPROACH
Gain exposure to attain knowledge and understand interdisciplinary and multidisciplinary engineering sciences.

PO 6: ETHICAL PRACTICES AND SOCIAL RESPONSIBILITIES
Acquire professional and intellectual integrity, professional code of conduct, ethics on professional practices, understanding responsibilities and norms for sustainable development of society.

PO 7: COMMUNICATION SKILLS
Interact with the engineering community and with society at large, regarding intricate engineering activities on technical perspectives and emerge as an efficient motivator.

PO 8: PROJECT MANAGEMENT
Understand the engineering and management concepts and demonstrate the knowledge as an entrepreneur or member/leader in teams and multidisciplinary tasks in their profession.

PO 9: LIFE LONG LEARNING
Appreciate the need for self preparation and life-long learning independently in the broadest context of technological challenges.

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEO2</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEO3</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PEO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

LIST OF PROFESSIONAL ELECTIVES
1) Electrical Measurements
2) Electrical Technology
3) Signals and Systems
4) Virtual Instrumentation and Smart Sensors
5) Digital System Design
6) Instrumentation System Design
7) Real Time Operating Systems
8) Computer Networks and DCS
9) Analytical Instrumentation
10) Power Electronics, Drives and Control
11) Advanced Topics in PID Control
12) Soft Computing Techniques
13) VLSI System Design
14) Biomedical Instrumentation
15) Power Plant Instrumentation
16) Fibre Optics and Laser Instrumentation
17) Unit Operations and Control
18) Non-linear Control Systems
19) Optimal Control
20) Model Predictive Control
21) Fault Detection and Diagnosis
22) Microcontroller Based System Design
23) Embedded Systems

LIST OF PROFESSIONAL ELECTIVE LABS

1) Electrical Measurements Laboratory
2) Instrumentation System Design Laboratory
3) Virtual Instrumentation Laboratory
4) Industrial Instrumentation Laboratory
5) Industrial Automation Laboratory
6) Programming Laboratory
7) Digital System Design Laboratory
8) MEMS Laboratory
9) Bio Medical Instrumentation Laboratory

LIST OF OPEN ELECTIVES

10) Robotics and Automation
11) Nano Materials and Nano Electronics
12) Micro Electro Mechanical Systems
13) Operating Systems and Networking
14) Internet of Things
15) Cloud Computing
16) Biology for Engineers
17) Disaster Management
18) Entrepreneurship
19) Human rights
20) National Service Scheme

THIRD SEMESTER

<table>
<thead>
<tr>
<th>01HS301</th>
<th>ENVIRONMENTAL STUDIES</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- To realize the importance of environment for engineering students.
- To understand the basis of ecosystems
- To make aware the student about global environmental problems and natural disasters.
- To give the ideas about advance technologies of Engineering that will useful to protect environment.
Unit I

Introduction - Multidisciplinary nature of environmental studies - Definition, scope and importance - Need for public awareness.

Natural resources - Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.- Role of an individual in conservation of natural resources.- Equitable use of resources for sustainable lifestyles.

Unit II

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological - pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III


Unit IV

Definition - Cause, effects and control measures of Air pollution - Water pollution - Soil pollution - Marine pollution- Noise pollution - Thermal pollution - Nuclear hazards- Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster management : floods, earthquake, cyclone and landslides. Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, and watershed management - Resettlement and rehabilitation of people; its problems and concerns. - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Wasteland reclamation - Consumerism and waste products - Environment Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention

**Unit–V**


**Field work**

Visit to a local area to document environmental assets - river/forest/grassland hill/mountain - Visit to a local polluted site - Urban/Rural/Industrial/Agricultural - Study of common plants, insects, birds - Study of simple ecosystems - pond, river, hill slopes, etc. *(Field work Equal to 5 lecture hours)*

**TEXT BOOKS**

2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email: mapin@icenet.net

**REFERENCE BOOKS**

2) Clark R.S., Marine Pollution, Clanderson Press Oxford
4) De A.K., Environmental Chemistry, Wiley Eastern Ltd.
5) Down to Earth, Centre for Science and Environment
7) Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
11) Mhaskar A.K., Matter Hazardous, Techno-Science Publication


**COURSE OUTCOMES**

At the end students can able to

1) Understand the importance of environment.
2) Analyze the importance of environment in engineering.
3) Apply their own ideas and demonstrate advanced technologies that will be useful to protect environment.
4) Employ awareness among the society about environmental problems and natural disasters.
5) Practice according to the present and future environmental issues.

<table>
<thead>
<tr>
<th>00BS302</th>
<th>ENGINEERING MATHEMATICS III</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

- To learn, partial differential equations, Fourier series, Boundary value problems.
- To learn the transforms such as Sine, Cosine, Fourier transform and Z-transforms.
- To gain knowledge of the method to find the Solution of difference equations.

**Unit–I : Partial Differential Equations**


**Unit–II : Fourier Series**

Dirichlet’s conditions - General Fourier series - Odd and Even functions - Half range sine series - Half range cosine series - Complex form of Fourier series – Parseval’s identity.

**Unit–III : Boundary value problems**

Solutions of one dimensional wave equation – One dimensional heat equation (without derivation) – Fourier series solutions in Cartesian co-ordinates.

**Unit–IV : Fourier Transform**


**Unit–V : Z – Transform and difference equations**

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
At the end of the course the students will be able to acquire knowledge on
1) Partial differential equations.
2) Fourier series.
3) Fourier transform.
4) Z-transforms and the methods of solving them.
5) Solving boundary value problems.

<table>
<thead>
<tr>
<th>CoS</th>
<th>Po1</th>
<th>Po2</th>
<th>Po3</th>
<th>Po4</th>
<th>Po5</th>
<th>Po6</th>
<th>Po7</th>
<th>Po8</th>
<th>Po9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

00ES303 ENGINEERING MECHANICS
<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- To introduce the fundamentals of forces and their effects with their governing laws.
- To understand the definitions of particle, body forces and their equilibrium conditions.
- To understand and predict the forces and its related motions.

Unit–I : Statics of Particles
Equilibrium of Particle-Vector representation of Space Force-Equilibrium of Particle in Space-Equivalent System of Forces-Principle of Transmissibility.

Unit–II : Equilibrium of Rigid Bodies
Free Body Diagram-Types of Supports- Types of loads- Types of beams-Action and Reaction of Forces-Moments and Couples-Moment of a Force-Vectorial Representation of Moments and Couples. Varignon’s Theorem- Stable Equilibrium-

**Unit–III : Geometrical Properties of Surfaces and Solids**

Centroid and Centre of Gravity-Determination of Centroid of Sections of Different Geometry- Centre of Gravity of a Body-Area Moment of Inertia-Parallel Axis Theorem-Perpendicular Axis Theorem-Determination of Moment of Inertias of Rectangular, Triangular, Circular and Semi-circular- Moment of Inertias of structural Steel Sections of Standard and Composite Sections.

Polar Moment of Inertia-RADIUS of Gyration-Principal Moment of Inertia-Mass Moment of Inertia- Determination of Mass Moment of Inertia of a Thin Rectangular Plate, Thin Circular Disc, Solid Cylinder, Prism, Sphere and Cone from first principles.

**Unit–IV : Dynamics of Particles**


**Unit–V : Friction and Elements of Rigid Body Dynamics**


Rolling Resistance-Translation and Rotation of Rigid Bodies-Velocity and Acceleration-General Plane Motion of Simple Rigid Bodies such as Cylinder, Disc/Wheel and Sphere.

**TEXT BOOKS**


**REFERENCE BOOKS**

COURSE OUTCOMES
At the end of the course the students will be able to
1) Explain the forces and its related laws of mechanics in static and dynamic conditions.
2) Analyse the forces and its motions on particles, rigid bodies and structures.
3) Solve the moment of inertia of any sections and masses for the structural members.

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

06ES304 FLUID MECHANICS AND HYDRAULIC MACHINERY

COURSE OBJECTIVES
- To understand the physical properties of fluids, fluid pressure and its measurement.
- To derive the equation of conservation of mass and its application.
- To solve problems of fluid kinematics and dynamics specifically flow through pipes and open channel flow.
- To use important concepts of continuity equation, Bernoulli’s equation and apply the same to problems.
- To study the performance of Turbines, Radial flow, Reaction turbines and governing of turbines.
- To study the characteristics of Centrifugal pumps and reciprocating pumps.

Unit–I : Properties of Fluids, Fluid Pressure and its Measurement
Mass density, specific weight, specific volume, specific gravity, viscosity - Newton's law of viscosity - compressibility - surface tension and capillarity - real and ideal fluids.
Pressure - atmospheric and vacuum pressures - measurement of pressure by manometers and pressure gauges - total pressure and center of pressure – Buoyancy - metacentre - simple problems.

Unit–II : Dynamics of Fluid Flow
Kinematics of flow - types of fluid flow - continuity equation - Euler's equation of motion - Bernoulli's equation - practical applications - venturimeter, orificemeter and pitot tube. Simple treatment of orifices, mouthpieces, notches and weirs.
Flow through pipes - loss of energy due to friction - minor energy losses - hydraulic gradient and total energy line - flow through pipes in series - Flow through parallel pipes - power transmission through pipes - flow through nozzles.

Unit–III : Flow in Open Channels
Classification of flow in channels - Chezy's and Manning's formulae - most economical Rectangular, Trapezoidal and Circular sections of channel.
Non-uniform flow through open channels - specific energy and specific energy curve - critical depth - critical velocity - critical, supercritical and subcritical flows - alternate depths.

**Unit–IV : Impact of Jet and Turbines**

Impact of jets - force exerted by a fluid on stationary and moving flat plates held in various positions - force exerted on curved plates - concept of velocity triangles.


**Unit–V : Pumps**

Centrifugal pumps - main parts - work done - definitions of heads and efficiencies - multistage pumps - specific speed - priming - cavitation.

Reciprocating pumps - main parts - working principle – slip - indicator diagrams - effects of acceleration and friction on indicator diagrams - maximum speed of a reciprocating pump - study of air vessels.

**TEXT BOOKS**


**REFERENCE BOOKS**


**COURSE OUTCOMES**

At the end of the course the students will be able to

1) Apply the basic knowledge of fluid mechanics in finding fluid properties, performance parameters of hydraulic turbines and pumps.

2) Use fluid dynamics for study of flow through pipes and flow in open channels.

3) Present hydraulic design for the construction of efficient hydraulic turbines and pumps.

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cos</strong></td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To analyze electrical circuits using KCL and KVL.
- To learn network theorems and apply them for circuit analysis.
- To study resonance and coupled circuits.
- To study transient analysis of RC, RL, RLC circuits.

Unit–I : Basics of Circuit Analysis


Unit–II : Network Theorems and Transformations


Unit–III : Time Domain Analysis


unit–IV : Analysis of AC Circuits


Unit–V : Coupled Circuits

Coupled circuits: Analysis of magnetically coupled circuits - single and double tuned coupled circuits. Three phase circuits: Three phase sources - Analysis of three phase 3-wire and 4-wire circuits with balanced and unbalanced loads - power relations.

TEXT BOOKS


REFERENCE BOOKS


COURSE OUTCOMES
At the end of the course the students will be able to
1) Understand the basics of electrical circuits and circuit reduction techniques. (Unit-I : and II)
2) Analyze DC and AC circuits. (Unit-II : and IV)
3) Design resonant and tuned circuits. (Unit-III : and V)
4) Find the transient response of RC, RL and RLC circuits. (Unit-IV : )
5) Acquire engineering analytic techniques and skills. (Unit II,III and V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✅</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- To study the qualitative and quantitative exposition of fundamental concepts of silicon and germanium semiconductor devices.
- To understand the principle, operation and characteristics of diode, bipolar junction transistor and metal oxide field effect transistor.
- To analyze MOS capacitor, MOSFET and SPICE models.

Unit–I : Qualitative and Quantitative Theory of Semiconductors

Calculation of free electron density and hole density – Determination of Fermi level in N-type and P-type semiconductor – Moderately doped sample – Five equations of semiconductor theory – Current calculations.

Unit–II : Qualitative and Quantitative Theory of PN Junction Diodes
Unit–III : Qualitative and Quantitative Theory of PN Junction Transistors


Unit–IV : Metal Oxide Semiconductor Field Effect Transistor (MOSFET)

MOSFET structure – Principle of operation of N-channel and P-channel MOSFET – Ideal MOS structure under thermal equilibrium – Ideal MOS structure biased in accumulation mode – Ideal MOS structure biased in depletion mode – Threshold voltage of ideal MOS structure operation in the strong inversion region – C-V characteristics of MOS capacitor – Effect of work function difference – Effect of charges in the oxide – Threshold voltage including non-idealities – Charges in the thermal oxide of silicon and their effect on MOS characteristics.

Unit–V : Analysis of MOSFET

Qualitative analysis of MOSFET operation - static characteristics – Analytical models for the MOSFET characteristics – SPICE models – Substrate bias effect – Sub-threshold conduction in MOSFET – A.C. properties, transconductance - cut-off frequency of MOSFET.

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
At the end of the course the students will be able to
1) Learn the principle of operation of semiconductors. (Unit I)
2) Develop the equations to determine various electronic parameters of semiconductor devices like diode, bipolar junction transistor and metal oxide field effect transistor.
3) (Unit II, III & IV)
   Solve problems on semiconductor devices. (Unit V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mapping with Programme Outcomes
COURSE OBJECTIVES

- To understand the properties of fluids and fluid statics, methods for determination of co-efficient of discharged are to be explained and computed practically.
- To study of the characteristic features of pumps and turbines using experiments in envisaged.
- To understand the significance and role of such utilities in their further course of study.

LIST OF EXPERIMENTS

1) Determination of Co-efficient of discharge of Mouth Piece
2) Determination of Co-efficient of discharge of Venturimeter
3) Determination of Co-efficient of Head loss due to Sudden Change in Section
4) Determination of Co-efficient of Head loss due to Friction in Pipe
5) Determination of Co-efficient of discharge of Rectangular Notch
6) Determination of Co-efficient of Impact of Jet on Vanes
7) Study of Performance characteristics of Elmo Pump (Centrifugal Pump)
8) Study of Performance characteristics of Sump Pump (Centrifugal Pump)
9) Study of Performance characteristics of Submersible Pump (Centrifugal Pump)
10) Study of Performance characteristics of Gould’s Pump (Reciprocating Pump)
11) Study of Performance characteristics of Pelton Turbine (Constant Speed method)
12) Study of Performance characteristics of Francis Turbine (Constant Speed method)
13) Determination of Metacentric Height of a floating vessel (Demo Only)
14) Study on Flow through Open Channel (Demo Only)

COURSE OUTCOMES

After completion of this course, a student will be able to:

1) Determine the properties of fluids, pressure and their measurements
2) Measure flow in pipes and determine frictional losses
3) Compute forces on immersed plane and curved plates applying continuity equation and energy equation in solving problems on flow through conduits
4) Develop Characteristics of pumps and turbines.

COURSE OBJECTIVES

- To study & verify the circuit theorems practically
- To obtain the characteristics graphically of each mentioned circuit devices
- To understand the significance of the circuit devices with their applications
- To analyse the need of each device
LIST OF EXPERIMENTS

1) (a) Analysis of DC resistive circuits and verification of Kirchhoff’s Laws.
    (b) Verification of Maximum power transfer theorem.
2) (a) Verification of Thevenin’s theorem.
    (b) Verification of Norton’s Theorem.
3) (a) Verification of Superposition Theorem.
    (b) Verification of Tellegen’s Theorem.
4) Ampere-Volt (I-V) characteristics of P-N junction semiconductor diode and Zener Diode.
5) Input and output characteristics of BJT and determination of its h-Parameters.
6) Transfer and drain characteristics of JFET and determination of its parameters.
7) Steady State sinusoidal response of RLC series circuit.
8) I-V characteristics of Silicon Controlled Rectifier.
9) Frequency response of RC coupled amplifier.
10) Study of ORCAD software (Application to circuit analysis).

COURSE OUTCOMES

Makes the students understand
1) The significance of the theorem and the practical verification of theorems.
2) The usage of the theorem in the analysis of the circuits.
3) The way of trouble shooting the circuit connection and to test the devices.
4) The circuit connections and testing points of the circuit by simulation and implementation.
5) And observe the characteristics of the devices and to find various practical parameters like input impedance, trans-conductance, pinch-off voltage etc. Related to their applications.

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cos</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
<tr>
<td>CO5</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To expose the students to probability, random processes, and statistical methods designed
- To contribute them to the process of making scientific judgments in the face of uncertainty and variation.
- To develop the skills of the students in numerical mathematics - using method of finite difference interpolation, finding numerical solution of algebraic and transcendental equations, and finding numerical solution of ordinary and partial differential equations.

Unit-I : Probability and Random Variables

Definition – Types of random variables - probability distribution function - probability density function – expectation and moments – moment generating functions – joint probability distribution - marginal probability distribution function – joint probability density function – marginal probability density function – conditional probability density function.

Unit-II : Random Processes


Unit-III : Test of Significance

Hypothesis, testing – Large sampling tests – small sampling test based on t, F and chi-square distributions – interval estimates of mean, standard deviation and proportion.

Unit-IV : Interpolation

Gregory Newton forward and backward interpolation formula; Stirling’s central difference formula; Lagrange’s interpolation formula for unequal interval.

Numerical differentiation: Using Newton’s forward and backward interpolation formula.

Numerical integration: Trapezoidal rule, Simpson’s one-third and three-eight rule.

Unit-V:


TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOME
At the end of the course, the students would
1) Acquire skills in handling situations involving random variables, random processes and to solve problems for engineers in using numerical methods.

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
<th>CO1</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO1</td>
<td>✓</td>
</tr>
<tr>
<td>PO2</td>
<td>✓</td>
</tr>
<tr>
<td>PO3</td>
<td></td>
</tr>
<tr>
<td>PO4</td>
<td></td>
</tr>
<tr>
<td>PO5</td>
<td>✓</td>
</tr>
<tr>
<td>PO6</td>
<td></td>
</tr>
<tr>
<td>PO7</td>
<td></td>
</tr>
<tr>
<td>PO8</td>
<td></td>
</tr>
<tr>
<td>PO9</td>
<td></td>
</tr>
</tbody>
</table>

06ES402 THERMODYNAMICS
L  T  P
4  0  0

COURSE OBJECTIVES
To make the student understand the basic concepts and applications of the following.
- Basics and fundamental laws of Thermodynamics.
- Properties of steam.
- Internal combustion engines.
- Heat transfer, refrigeration and air conditioning.
- Metrology and mechanical measurements.

Unit–I : Thermodynamics
Basic concepts of thermodynamics - System properties, state and equilibrium - Process and cycle - Work - Heat and other forms of energy - Zeroth law and application - First law - Statements - Applications to closed and open systems - General energy equation and application - Second law - Statements - Reversibility, Carnot cycle and theorems - Clausius inequality - Concept of entropy - Availability and irreversibility.

Unit–II : Properties of Steam
Unit–III : Internal Combustion Engines


Unit–IV : Heat Transfer, Refrigeration and Air Conditioning

Basic concepts of heat transfer - Basic laws of conduction, convection and radiation - One dimensional heat conduction through a plane wall and cylinder - Use of fins in heat transfer - Heat exchangers - Parallel counter and cross flow - Simple problems.

Refrigeration - Units of refrigeration - Refrigerants and their properties - Types of refrigeration system - Air, vapour compression and vapour absorption systems - Air conditioning - Summer and winter air conditioning.

Unit–V : Metrology and Mechanical Measurements


Measurement of temperature Bimetallic thermometers - Linear quartz thermometer and pyrometers. Measurement of strain: Electrical resistance strain gauge, constant current strain gauge and strain gauge bridge circuit.

(Use of Steam tables, Mollier chart and Psychrometric chart are permitted)

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES

Upon completion of this course, the students will be able:

1) To understand fundamental concepts and definitions of thermodynamics, thermodynamic principles in engineering applications.
2) To study the fundamentals properties of steam, gas and gas mixtures.
3) To understand the functioning and evaluate the performance of IC engines.
4) To apply the principles of refrigeration and air conditioning.
5) To distinguish the different modes of heat transfer.
6) To explain the basics of metrology and measurement systems.

<table>
<thead>
<tr>
<th>Cos</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO6</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>06PC403</th>
<th>ELECTRONIC CIRCUITS</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

- To study MOSFET structure and second order effects.
- To determine the circuit parameters of single stage MOSFET amplifier, Differential amplifier and Operational amplifier.
- To know the current mirror techniques.
- To study the different types of feedback used in oscillator and classification of oscillators.

**Unit–I : MOSFET Basics and Second Order Effects**


**Unit–II : Single Stage MOSFET Amplifiers**

Common Source (CS) stage - CS stage with resistive load - CS stage with diode connected load - CS stage with current source load - CS stage with Triode load - CS stage with source degeneration - Source Follower - Common Gate stage - Cascade stage - Folded cascad.

**Unit–III : Basic Differential Amplifiers and Single Stage OP-AMPS**


**Unit–IV : Current Mirrors**

Unit–V : Feedback types and Oscillators


TEXT BOOK

REFERENCE BOOK

COURSE OUTCOMES
At the end of the course the students will be able to
1) Understand the fundamental concepts of MOSFETs and their applications for analog electronics circuits. (Unit I)
2) Independently design MOSFET amplifier and Operational amplifier using current mirror techniques. (Unit II, III & IV)
3) Independently design oscillator for different kind of applications. (Unit V)
4) Solve problems on amplifiers and oscillator circuits. (Unit II, III & V)

Mapping with Programme Outcomes

<table>
<thead>
<tr>
<th>Cos</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

06PC404 DIGITAL ELECTRONICS

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- To impart a thorough understanding of the fundamental concepts and techniques used in digital electronics.
- To gain an intuitive understanding of the role of digital logic levels and application of knowledge to understand digital logic families.
- To understand, analyze and design digital systems using combinational logic.
- To illustrate the concept of synchronous and asynchronous sequential circuits.
- To design and study counter applications using Flip-Flops.
- To introduce the concept of memories and programmable logic devices.

Unit–I : Number Systems

Review of number system - conversion algorithm - binary arithmetic in computers- binary codes - weighted binary codes - non weighted binary codes - signed numbers - complement codes - error detecting and error correcting codes - alphanumeric codes. Boolean algebra: Basic logic operations - laws of Boolean algebra - reducing Boolean expressions - Boolean expressions and logic diagrams - universal building blocks - negative logic.
Unit–II : Logic Families

Specifications of a logic circuit - basic logic circuit, operation and characteristics of RTL, DTL, HTL, TTL, ECL, MOS, CMOS and I\textsuperscript{2}L families-comparison of logic families. TTL gate circuits- open collector - totem pole - tri state gate - buffers - schottky TTL configurations - strobed gate and expanders. Interfacing CMOS and TTL gates. Logic packages.

Unit–III : Combinational Logic

Boolean functions - canonical and standard forms - incompletely specified functions (don’t cares) - simplification of Boolean functions using Karnaugh maps - Sum of Product (SOP) reduction - Product of Sum (POS) reduction - multiple output minimization - Implementation using NAND-NOR gates. Combinational circuit design - Half adder - Full Adder - Half subtractor - Full subtractor - Parallel binary adder, parallel binary subtractor - Fast Adder - Carry Look Ahead adder, code converters, magnitude comparator, parity generators and parity checkers.

Unit–IV : Sequential Circuits


Unit–V : Memory Devices

Classification of memories - ROM - ROM organization - PROM - EPROM - EEPROM - EAPROM, RAM - RAM organization - Write operation - Read operation - Memory cycle - Memory decoding - memory expansion - Static RAM Cell - Bipolar RAM cell - MOSFET RAM cell - Dynamic RAM cell - Programmable Logic Devices - Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Implementation of combinational logic circuits using ROM, PLA.

TEXT BOOKS


REFERENCE BOOKS

COURSE OUTCOMES

On completion of this course the students can apply creativity in the design of digital systems, components, or processes appropriate to program objectives and will be able to:
1) Review number systems, learn binary codes and learn the Boolean algebra. (Unit I)
2) Analyze the logic families and study its significance. (Unit II)
3) Design combinational digital logic circuits. (Unit III)
4) Design sequential digital logic circuits. (Unit IV)
5) Gain knowledge on Programmable Logic devices and to analyze and implement the designed combinational logic circuit in PLDs. (Unit V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- To study the IC fabrication procedure and characteristics of different ICs.
- To realize circuits using ICs.
- To design for signal analysis using Op-amp ICs.
- To study the applications of Op-amp.
- To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, ADCs.

Unit-I: Operational Amplifier (Op-Amp.)


Unit-II: Comparators and Converters

Unit–III : Data Conversion Techniques


Unit–IV : Active Filters and Oscillators


Unit–V : Multivibrators, Oscillators and Regulators

Astable, monostable, triangular wave and sawtooth wave generators. VCO, Timer 555 and applications. Phase-Locked Loops (PLLs): Principle, building blocks and characteristics of a PLL - Applications: frequency multiplier, modulator, FSK demodulator, synchronizer, voltage regulators.

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES

At the end of the course the students will be able to
1) Analyze the functions and characteristics of different op-amps. (Unit I)
2) Design and realize different types of devices using op-amp comparators.(Unit II)
3) Study and analyze different types of data conversion techniques. (Unit III)
4) Design different types of analog filters with ICs. (Unit–IV)
5) Able to design and implement op-amp circuits for different applications such as waveform generators, oscillators and regulators and PLL. (Unit V).

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To learn about the science of measurement system and its properties.
- To acquire knowledge about characteristics of measurement systems subjected to time invariant and time variant inputs.
- To understand the principle and characteristics of resistive, capacitive and inductive transducers.
- To study about characteristics and applications of fiber optics, MEMS based transducers and transducers governed by other principles such as hall effect and piezoelectric effect.

Unit–I : Science of Measurements

Methods of measurement - Generalized scheme of a measurement system - Errors in measurement - types of errors- limiting error-probable error- Statistical analysis of measurement data – mean and standard deviation- Probability of errors - Gaussian distribution- Reliability of measurement systems.

Unit–II : Performance Characteristics

Static and dynamic characteristics of measurement system - transfer function – characteristics of zero, first and second order type of instruments - impulse, step, ramp and frequency responses of the above types of instruments.

Unit–III : Resistance Transducers

Transducer- Difference between sensor and transducer- basic requirements of a transducer-classification of transducers-selection of transducer.

Resistance potentiometer – types of potentiometers - Loading effect – strain gauges - gauge factor - types of strain gauges - strain measuring circuits – temperature compensation and error cancellation techniques in strain measurement system.

Principle of RTD, Thermocouple and Thermister- Hot wire anemometer - constant current and constant temperature operation.

Unit–IV : Capacitance and Inductance Transducers

Capacitive transducers - variable area type - variable air gap type - variable permittivity type - signal conditioning circuit- capacitor microphone.

Variable inductance and Variable reluctance transducers – LVDT – RVDT - Eddy current non contacting transducers.

Unit–V : Other Types of Transducers

Introduction to fibre optic sensors -types of configurations-application in temperature, pressure, flow and displacement measurements. Hall effect transducers - IC sensor for temperature and pressure measurement-Piezoelectric transducers - piezoelectric crystals, Charge amplifier-Silicon Micro sensors-Smart sensors-characteristics and applications.
TEXT BOOKS
2) A.K. Sawhney, A course in Electrical and Electronics measurement and instrumentation, Dhanpatrai and sons, 1996.

REFERENCE BOOKS

COURSE OUTCOMES
At the end of the course the students will be able to
1) Select a measurement system to meet the requirements and will be knowledgeable about its characterization based on the type of input. (Unit I&II)
2) Choose among the various types of transducers for particular application depending on the principle, range, cost and commercial availability. (Unit III, IV&V)
3) Understand the recent trends in the development of transducers and the engineering involved in it. (Unit V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>06CP407</th>
<th>LINEAR AND DIGITAL ICs LAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>T</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- Testing of logic gates with their truth tables.
- Simplification of complex logic functions using reduction techniques.
- Design of analog and digital electronic circuits for industrial applications.
- Study of Electronic Work Bench Software to simulate various electronic circuits.
- Identification of malfunctioning of circuits/components and to troubleshoot the same.
LIST OF EXPERIMENTS
1) Verification of logic gates using integrated circuits.
2) Simplification of logic expressions using Karnaugh map techniques.
3) Implementation of half adder and full adder circuits using logic gates.
4) Design and verification of parity generator circuits.
5) Design and verification of electronic pendulum circuit.
6) Simulation of simple operational amplifier configurations using Electronic Work Bench (EWB) software.
7) Design of multivibrator circuits using 555 timer IC.
8) Design of low pass and high pass filter circuits.
9) Design of precision full wave rectifier circuit.
10) Design of instrumentation amplifier circuit.

COURSE OUTCOMES
At the end of the course the students will be able to
1) Test and understand the logic gates using their truth tables which is very useful in the design of Integrated Circuits.
2) Simplify the complex logic function into simplest one so that it is possible to reduce the size of the circuit.
3) Design of various electronic circuits using the fundamental concepts both in analog and digital electronic systems for various industrial applications.
4) Simulate various electronic circuits using Electronic Work Bench Software without the use of physical electronic components so that it is possible to reduce the time, energy and cost.
5) Troubleshoot the malfunctioning of electronic circuits and to identify the compatibility of system components in the design of Integrated Circuit.

Mapping with Programme Outcomes

<table>
<thead>
<tr>
<th>Cos</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- To familiarize the students with principle and characteristics of various transducers.
- To design and implement signal conditioning circuits for temperature, pressure and displacement.
- To impart knowledge about the design and implementation of analog and digital filters using Matlab software.
- To learn the design and development procedure for V/I and I/V convertors and implementation using EWB software.
LIST OF EXPERIMENTS

1) Characteristics of Potentiometer and Potentiometer as error detector.
2) Characteristics of Synchro and application of Synchro as error detector.
3) Simulation of signal conditioning circuit for LVDT.
4) Design of Analog and Digital filters using MATLAB software.
5) Characteristics and Transfer function of RTD and Thermocouple.
6) Design, construction and testing of a signal conditioning circuit for temperature Measurement using RTD.
7) Simulation of Voltage to Current converter and its practical implementation.
8) Simulation of Current to Voltage converter and its practical implementation.
9) Measurement of pressure using strain gauge.
10) Design and testing of signal conditioning circuits using EWB software.

COURSE OUTCOMES

At the end of the practical course the students will be able to

1) Select and use the proper transducer for the required application.
2) To design and implement signal conditioning circuits for process variables such as temperature, pressure and displacement.
3) Apply the Matlab and EWB software packages for the design and verification of signal conditioning circuits.

<table>
<thead>
<tr>
<th>Mapping with Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>__</td>
</tr>
</tbody>
</table>

FIFTH SEMESTER

06PC501  CONTROL SYSTEMS  L  T  P

<table>
<thead>
<tr>
<th>06PC501</th>
<th>CONTROL SYSTEMS</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- To provide a sound knowledge in the basic concepts of linear control theory and design.
- To acquire knowledge in the basics of control system and its components.
- To understand the time response and frequency response analysis.
- To study about stability analysis.
- To understand the design of compensators.

Unit–I : Control Systems and Components

- Introduction to Control System Components: Potentiometers - DC tacho generators - DC servomotors - electronic servo amplifiers.
Unit–II : Time Response Analysis


Unit–III : Stability Analysis


Root locus concept: Guidelines for sketching root loci - root contours. Root-Locus plots for continuous-time systems using MATLAB.

Unit–IV : Frequency Response Analysis


Unit–V : Compensator Design

Introduction to design - lag, lead and lag-lead configurations: Effects on system response and their realization - design of cascade compensators in the time domain - design of cascade compensators in the frequency domain.

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
At the end of the course the students will be able to
1) Understand the basics of control system for the design and analysis (Unit I)
2) Understand the issues related to time response analysis. (Unit II)
3) Perform frequency response and stability analysis. (Unit–III : & IV)
4) Design compensators in time and frequency domain. (Unit V)
COURSE OBJECTIVES

- To understand load cell, strain gauge and torque measurement.
- To understand pressure measuring devices like Manometers, Bourdon gauge and vacuum pressure measurement.
- To analyze the concept of temperature sensors like RTD, Thermocouple and Pyrometers.
- To study the variable head type and variable area type flow meters.
- To understand air purge system and boiler drum level measurement.

Unit–I : Measurement of Force, Torque and Speed

Electric balance - Load cell - Hydraulic, Pneumatic, strain gauge- Magnetoelastic and Piezoelectric load cells - Torque measurement- Relative angular twist-Speed measurement-Capacitive tacho-Drag cup type tacho-D.C and A.C tachogenerators - Stroboscope.

Unit–II : Pressure Measurement

Units of pressure - Manometers, different types, Elastic type pressure gauges, Bourdon tube, bellows and diaphragms - Electrical methods- Elastic elements with LVDT and strain gauges - Capacitive type pressure gauge - Piezo resistive pressure sensor-Resonator pressure sensor - Measurement of vacuum-McLeod gauge- Thermal conductivity gauge-Ionization gauges - Cold cathode type and hot cathode type - Calibration of pressure gauges - Dead weight tester.

Unit–III : Temperature Measurement

Definitions and standards - Primary and secondary fixed points - Calibration of thermometers - Different types of filled in system thermometers - Sources of errors in - filled in systems and their compensation - Bimetallic thermometers - RTD - characteristics and signal conditioning-3 lead and 4 lead RTDs – Thermistors- Thermocouples - Laws of thermocouple- Commercial circuits for cold junction compensation - Response of thermocouple, Radiation methods of temperature measurement - Total radiation pyrometers - Optical pyrometers.

Unit–IV : Flow Measurement


Unit–V : Level Measurement

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
At the end of the course the student attains the
1) Ability to understand Load cell, strain gauge, Speed measurement (Unit I)
2) Ability to understand and apply Manometers, Bourdon tube, Mcleod gauge, Piezo resistive, Ionization gauge, dead weight tester to pressure measurement. (Unit II)
3) Ability to understand temperature sensors like thermometers, RTD, thermistors, thermocouple and pyrometers. (Unit III)
4) Ability to understand and apply variable head type, variable area type flow meters, electromagnetic, ultrasonic, laser Doppler and solid type to flow measurement. (Unit–IV)
5) Ability to understand level sensors like float type, air purge, Capacitive, Nucleonic and Ultrasonic gauge, boiler drum level and viscosity, humidity and moisture measurement. (Unit V)
06PC503  ELECTRONIC INSTRUMENTATION AND MEASUREMENT TECHNIQUES

<table>
<thead>
<tr>
<th>COURSE OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ To introduce different types of electronic meters and their applications.</td>
</tr>
<tr>
<td>▪ To introduce different types of waveform generators, analyzers and their applications.</td>
</tr>
<tr>
<td>▪ To introduce digital instruments and intelligent instruments.</td>
</tr>
<tr>
<td>▪ To provide knowledge of cathode ray oscilloscope, other display devices &amp; their applications.</td>
</tr>
<tr>
<td>▪ To introduce different types of recorders and to educate interference and screening.</td>
</tr>
<tr>
<td>▪ To introduce computer controlled system and to give exposure on virtual instrumentation.</td>
</tr>
</tbody>
</table>

Unit–I : Measurement of Voltage and Current


Component measuring instruments

Q-meter - vector impedance meter - Power meter.

Signal sources and Wave analyzers

Basic standard Signal generator (sine wave) – Square and pulse generator, Sweep generator. Wave analyzer - harmonic distortion analyzer- spectrum analyzer.

Unit–II : Digital Measurements

Digital methods of measuring frequency, period, phase difference, pulse width, time interval, total count, AC and DC voltage and current, true r.m.s voltage. DMM, DPM. Comparison between analog and digital techniques of measurement.

Introduction to intelligent instruments. Digital displacement transducers, incremental and absolute types – measurement of velocity, acceleration- Moire fringe transducer.

Unit–III : Oscilloscope and Display devices


LED, LCD – annunciators, numeric, alphanumerics, graphics.
Unit–IV : Recorders and Interference Effects


Interference and screening - component impurities and their effects on signals - electrostatic and electromagnetic interference - multiple earths and earth loops. Practical aspects of interference reduction.

Unit–V : Computer Controlled Test Systems and Virtual Instrumentation


TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
At the end of the course the students will be able to
1) Understand different types of electronic meters and their applications. (Unit I)
2) Understand different types of waveform generators, analyzers and their applications. (Unit I)
3) Understand digital instruments and intelligent instruments. (Unit II)
4) Gain knowledge of cathode ray oscilloscope, recorders and other display devices with their applications. (Unit III & IV)
5) Understand computer controlled system and virtual instrumentation. (Unit V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To study the architecture of 8085 microprocessor and its programming.
- To learn the design aspects of I/O and memory interfacing circuits.
- To study interfacing devices like 8255, 8253, 8259 and 8251
- To study the architectures of 8051 microcontroller.
- To learn about the 8085 and 8051 based applications.

Unit–I : 8085 Microprocessor

Microprocessor architecture and assembly language - Organization of 8085 microprocessor – memory and I/O devices - Memory mapping - Memory interfacing - Instructions set - Instruction format, Addressing modes, counters and time delays - Stack – subroutine - interrupts - Assembly Language Programming.

Unit–II : Peripherals

8255 programmable peripheral interface - 8253 programmable interval timer - 8259 programmable interrupt controller - direct memory access (DMA) and 8257 DMA controller - 8279 programmable keyboard display interface - 8251 and serial I/O and data communication.

Unit–III : 8051 Microcontroller

Microcontrollers Vs Microprocessors – 8051 Architecture – memory organization - register bank and stack - Special function register (SFR's) - Instruction set - Addressing Modes - Assembly language programming.

Unit–IV : 8051 Peripherals


Unit–V : Applications of Microprocessor and Microcontroller

Stepper motor control - DC motor position/speed measurement and control - Data transfer between two Microprocessor/Microcontrollers - Interfacing LCD display - Temperature ON/OFF control – Traffic light control.

TEXT BOOKS

1) Ramesh Gaonkar, Microprocessor Architecture Programming and Application with the 8085/8080a, Fifth edition, Penram International Publishing (India), 2011.

REFERENCE BOOKS


COURSE OUTCOMES

At the end of the course the students will be able to

1) Learn basic concept of microprocessor and architecture and implement programs on 8085 microprocessor. (Unit I)

2) Design of peripheral interfacing circuits. (Unit II)

3) Understand architecture of microcontrollers and develop simple assembly language program. (Unit III)

4) Programming the on-chip peripherals of microcontroller. (Unit IV)

5) Understand the recent trends and make use of microprocessor and microcontroller for different applications. (Unit V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- To understand the different methods of system representation and obtain the model of the system in time and frequency domains.
- To impart necessary knowledge in the time domain response and steady state response.
- To give basic knowledge in obtaining the open loop and closed loop time and frequency responses.

LIST OF EXPERIMENTS

1) Determination of transfer function of a DC Servomotor and its speed control.
2) Solving Control Engineering problems using MATLAB software.
3) Study of DC Position control system.
4) Design and implementation of a Phase Lead Compensator using MATLAB software.
5) Identification of a given system using frequency response characteristics.
6) Characteristics of Sample and Hold circuit.
7) Simulation of a Sampled data control system.
8) Sensitivity analysis of open loop and closed loop systems using Process Control Simulator.
9) Stability characteristics of feedback systems using Process Control Simulator.
10) Time response analysis of a Second order type-0 and type-1 system using Process Control Simulator.

COURSE OUTCOMES
After successful completion of this course, the students should be able to
1) To identify the model of any system using various techniques and investigate its performances in open and closed loops.
2) To obtain desired performance by designing and implementing suitable compensators for the taken up system.
3) To identify any type of control system with respect to system stability in time domain as well as frequency domain.

<table>
<thead>
<tr>
<th>CO1</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

06CP508 MICROPROCESSOR LAB

COURSE OBJECTIVES
- To become familiar with the architecture and Instruction set of Intel 8085 microprocessor.
- To provide practical hands on experience with Assembly Language Programming.
- To provide solid foundation on interfacing the external devices to the 8085 microprocessor according to the user requirements and solutions for the real time problems.

LIST OF EXPERIMENTS
1) a) Multiplication by repeated addition and subtraction.
   b) Multibyte Decimal addition and subtraction.
2) Code conversion.
3) a) Finding Smallest/Largest number from an Array of ‘n’ numbers.
   b) Sorting an array of numbers in Ascending/Descending order.
4) a) Block movement of data.
   b) Interrupt using RST 5.5.
5) Switches and LED Interface.
6) ADC and DAC Interface with microprocessor.
7) 8253 Timer Interface.
8) 8259 programmable Interrupt controller.
9) Kit to Kit data transfer using USART 8251.
10) Stepper motor Interface.
COURSE OUTCOMES

1) Understand the architecture of 8085.
2) Familiarize with the assembly level programming and impart the knowledge about the instruction set.
3) Work with standard microprocessor interfaces like Timers, Programmable peripheral interface, Programmable Interrupt controller, serial ports, digital-to-analog converters and analog-to-digital converters etc.
4) An in-depth knowledge of applying the concepts on real-time applications.

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SIXTH SEMESTER

06PC601 DIGITAL SIGNAL PROCESSING L T P

COURSE OBJECTIVES

- To learn about discrete time signals and system properties.
- To acquire knowledge in the design of digital filters.
- To understand the need for frequency transformation and to implement the same by efficient computational algorithm.
- To study about the architecture and features of generic digital signal processors and their applications.

Unit-I: Discrete Time Signals and Systems


Unit-II: Design of IIR Digital Filter


Unit-III: Design of FIR Digital Filter


Unit-IV: Fast Fourier Transform (FFT) Algorithms

Decimation–in–frequency FFT algorithm – IDFT using Direct FFT Algorithm –
Quantization noise due to FFT computation – finite register length effects in DFT
computation – Application of FFT in linear filtering.

**Unit–V : Digital Signal Processors**
- Generic DSP Architecture – Features of TMS 320C50 processor – Memory and
  I/O Organization – Addressing modes – Fixed point and floating point representation
- Introduction to commercial DSP processors.

**TEXT BOOKS**
1) John G Proakis and Dimitris G Manolakis, “Digital Signal Processing – Principles,

**REFERENCE BOOKS**
1) Oppenheim A.V and Schaffer R.W, “Digital Signal Processing”, First edition,
   PrenticeHall India, 2015.
   India, 2009.
   Hall of India, New Delhi, 2009.
6) Simon Haykin and Barry Van Veen, “Signals and Systems”, Second edition,
7) Venkatramani B and Bhaskar M, “Digital Signal Processors: Architecture,
   Programming and Applications”, Second edition, Tata McGraw-Hill Education,
   2002.

**COURSE OUTCOMES**
At the end of the course the students will be able to
1) Develop a discrete time system to meet the requirements. (Unit I)
2) Design a filter that solves the specific problem. (Unit II)
3) Understand the issues related to implementation of digital filters. (Unit III)
4) Implement frequency transformation of signals efficiently using FFT. (Unit–IV)
5) Understand the recent trends in digital signal processor and processing
   technology. (Unit V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To introduce the dynamics of various processes and modelling of physical process using first principles.
- To get adequate knowledge about the non linear systems.
- To educate the effect of various control actions and the methods of tuning the controller.
- To study about the construction, and characteristics of control valves.
- To introduce the concept of various complex control schemes.
- To study the state space modelling approach.

Unit–I : Mathematical Modelling of Processes


Common non-linear elements and their models – time and frequency response characteristics unique to non-linear systems – singular points – limit cycle behavior.

MATLAB program to study inverse response, S-type response and the response of first-order system with delay.

Unit–II : Controllers and Final Control Elements


Control valve – characteristics of control valves – valve positioned.

Simulation study of control modes for simple systems using SIMULINK.

Unit–III : Optimum Controller Settings

Tuning of controllers by process reaction curve method – continuous cycling method – damped oscillation method – Ziegler-Nichol’s tuning – 1/4 decay ratio.

Feed Forward control – Ratio control – Cascade control – Averaging control.

Simulation study of controller tuning using SIMULINK and TUTSIM.

Unit–IV : State Variable Analysis

Concept of state variables and state models – State models for linear continuous time systems – Diagonalization – Solution of state equations – Concept of controllability and observability.

State space representation of discrete time systems, Solution of discrete time state space equations, Pulse transfer function matrix, Eigen Values.

MATLAB program to study the response of sampled data system.
Unit–V: Case Study


TEXT BOOKS:

REFERENCE BOOKS
2) TUTSIM Simulation Language Manual, TUTSIM Products Ltd., U.S.A.

COURSE OUTCOMES
At the completion of this course, students will be able to:
1) Understand basic principles and importance of process control in industrial process plants. (Unit I)
2) Acquire knowledge of dynamic modelling and system behaviour. (Unit II)
3) Understand the need for mathematical basis for the design of control systems. (Unit III)
4) Design and tune PID controllers. (Unit II)
5) Specify the required instrumentation and final control elements to ensure well tuned control. (Unit–II and III)
6) Understand the state space modelling approach. (Unit–IV)
7) Apply the control system in various complex processes. (Unit V)

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>COs</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
<tr>
<td>CO5</td>
</tr>
<tr>
<td>CO6</td>
</tr>
<tr>
<td>CO7</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To impart knowledge about the modelling principle of level process and the characteristics of final control element and Controller.
- To design and implement tuning techniques of PID controller and verify in Matlab/Simulink environment.
- To design and implement closed loop control for processes like Air temperature, Air flow and Level.
- To familiarize the students with design and simulate cascade control for the given process.
- To Study the applications of Programmable Logic Controller.

LIST OF EXPERIMENTS

1) Modelling and simulation of a Level process using TUTSIM.
2) (a) Study of Control Valve characteristics.
   (b) Study of P&I Diagram
3) Controller tuning using Process Reaction Curve method.
4) Determination of characteristics of a PID controller using Matlab (Simulink) software.
5) Design and simulation of Cascade control system using Matlab (Simulink) software
6) Determination of Transfer function (Experimental model) of Level process.
7) Controller tuning using Continuous Cycling method.
8) Control of Air flow Process.
9) Design and Implementation of P and PI controller for an Air temperature control system.
10) Study of Programmable Logic Controller and its applications.

COURSE OUTCOMES

At the end of the practical course the students will be able to
1) To model and design controllers for different processes.
2) To design and implement advanced control techniques.
3) Familiarize with TUTSIM and MATLAB software for process control applications.

<table>
<thead>
<tr>
<th>Mapping with Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>**Cos</td>
</tr>
<tr>
<td><strong>CO1</strong></td>
</tr>
<tr>
<td><strong>CO2</strong></td>
</tr>
<tr>
<td><strong>CO3</strong></td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To understand the basic concepts of embedded system
- To become familiar with the architecture and Instruction set of Intel 8051 and PIC microcontroller.
- To develop skill in simple program writing for 8051 and PIC microcontroller
- To develop and demonstrate how to accomplish a given task using Assembly and “C” language on a microcontroller
- To familiarize the interfacing of various peripheral devices with 8051 and PIC microprocessor.

LIST OF EXPERIMENTS

1) Arithmetic Exercises in 8051 using RIDE package (Assembly Language Program).
2) Simple Programs in 8051 using RIDE package (Assembly Language Program).
3) Arithmetic Exercises in 8051 using RIDE package (Embedded C).
4) Simple programs in PIC Microcontroller using MPLAB.
5) Interfacing switches and LED with 8051 Microcontroller.
6) Interfacing Push button and Buzzer with 8051 Microcontroller.
7) Programming the on-chip Timer of 8051 Microcontroller.
8) Stepper motor control using 8051 Microcontroller.
9) Programming the on-chip ADC and PWM of PIC Microcontroller using MPLAB.
10) Implementation of Logic Gates and MUX/DEMUX in FPGA.

COURSE OUTCOMES

1) Understand the architecture of 8051 and PIC microcontroller.
2) Familiarize with the assembly level programming, Embedded C and impart the knowledge
3) about the instruction set.
4) Develop software for embedded system using Cross compliers like RIDE , MP lab.
5) Students will have the knowledge through hands-on experimentation the Xilinx tools for FPGA.
6) Design as well as the basics of VHDL to design, simulate and implement the digital systems.

<table>
<thead>
<tr>
<th>Cos</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SEVENTH SEMESTER

<table>
<thead>
<tr>
<th>00HS701</th>
<th>ENGINEERING ETHICS</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- To understand the moral and ethical dimensions in engineering.
- To take balanced decisions.

Unit–I


Unit–II


Unit–III


Unit–IV


Unit–V


TEXT BOOKS


REFERENCE BOOKS

COURSE OUTCOMES
1) Understand the relationship between the engineer and the society.
2) Learn the importance of codes in engineering practice.
3) Acquire knowledge on the legal, moral and ethical aspects in engineering.

06PC702  COMPUTER CONTROL OF PROCESSES  

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- To understand the need for computers in process control.
- To study the fundamentals required for computer control of a process.
- To expose the students the stability analysis of discrete time system.
- To design and analyze digital controllers.
- To study some of the methods to identify the process.
- To know about programmable logic controller.

Unit–I : Introduction to Computer Control System

Need for computer in a control system- Building blocks of a computer control system, Representation and analysis of Sampled data control systems-Pulse Transfer function-Zero Order Hold and First Order Hold- Sampling Theorem-Sampling frequency Consideration- stability analysis: Jury's test and bilinear transformation. Modified Z transform of systems with dead time.

Unit–II : Digital Control Algorithms


Unit–III : System Modeling and Identification

Mathematical model for processes: first order, second order processes with and without delay - higher order systems-process modeling from step test data - pulse testing for process identification - time-domain identification-linear least square algorithm.

Unit–IV : Programmable Logic Controllers (PLCs)

PLC Hardware components: discrete, analog and digital I/O modules: typical input and output field devices and their modules - I/O signal types and typical signal conditioning circuits - common electrical devices and symbols - intelligent I/O modules - Communication I/O modules- network communication module - distributed I/O - Central Processing Unit-

Unit–V : PLC Programming

Programming Languages: Ladder Diagram(LD) - Function Blocks Diagram (FBD) - Sequential Function Chart (SFC) - Instruction List (IL) - Structured Text (ST). programming devices: hand-held programmer - personal computer based programmer - Memory types used in PLCs - memory map - assigning I/O address and internal address - scan sequence.-Basic Programming: Relay-Type Instruction-Internal Relay instruction- timers-counters- program control instruction-data manipulation
instruction-math instruction-sequencer and shift register instruction-development of programmes for typical applications -PLC Installation and maintenance.

TEXT BOOKS

REFERENCE BOOKS
5) W. Bolton, Programmable Logic Controllers, Elsevier Newnes, 2006

COURSE OUTCOMES
At the end of the course, the students will be able to
1) Analyze a system in discrete domain using Z-transform and modified Z-transform. (Unit I)
2) Design and develop algorithms for sampled data control system. (Unit II)
3) Understand various system identification and modeling techniques in time domain and in frequency domain. (Unit III)
4) Appreciate the application and hardware parts of a Programmable Logic Controller. (Unit-IV :)
5) Develop and implement logical programs in PLC and trouble shoot, install and maintain a PLC system. (Unit V)

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>COs</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
<tr>
<td>CO5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>06CP706</th>
<th>COMPUTER PROCESS CONTROL LAB</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- To understand the need for computers in process control and fundamentals required for computer control of processes with MATLAB software.
- To study and implement an algorithm to identify the process parameters.
- To design and implement digital controllers using TUTSIM software.
- To study programmable logic controller with GE Fanuc make.
- To study data acquisition system using LABVIEW software.
LIST OF EXPERIMENTS

1) Open loop and closed loop response of the discrete time system.
2) Design of sampled data control system with Dead-beat controller using TUTSIM.
3) Design of Dead-time compensator using smith predictor algorithm and simulation using SIMULINK.
4) Process identification using Least Square Estimator algorithm using MATLAB.
5) Design and simulation of Kalman’s Controller using TUTSIM.
6) Design and realization of digital filter.
7) Design of sampled data control system with Dhalin’s controller and simulation using TUTSIM.
8) Study of LABVIEW software and Data acquisition using Lab View.
9) a) Design of inverse response compensator and simulation using SIMULINK.
10) b) Study of Bio signals.
11) Study of PLC (GE Fanuc make).

COURSE OUTCOMES

1) Able to design and implement a closed loop system in discrete domain.
2) Able to understand and develop ladder logics PLC.
3) Ability to use the software tools like LABVIEW, MATLAB and TUTSIM.

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cos</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
</tbody>
</table>

EIGHTH SEMESTER

06PV803 PROJECT WORK AND VIVA VOCE

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

METHOD OF EVALUATION

1) The students in a group of 3 to 4 works on a topic approved by the Head of the Department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor.
2) The progress of the project is evaluated based on a minimum of three reviews. The review committee will be constituted by the Head of the Department.
3) A project report is required at the end of the semester.
4) The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES
1) On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology
2) Carrying out any experimental works on concrete and steel or any other construction material to know the behavior and properties
3) Understand the modelling, analysis and design concepts by taking up a structure.

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
</tbody>
</table>

PE - PROFESSIONAL ELECTIVES

<table>
<thead>
<tr>
<th>06PEXXX</th>
<th>ELECTRICAL MEASUREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- To motivate the students to gain knowledge about the basic principles and the laws governing the operation of electrical measuring instruments.
- To familiarize the students about the functioning of different types of instruments.
- To understand the concepts of various measuring techniques.

Unit–I

D'Arsonal galvanometer, Principle, operation and constructional details of Moving-coil, Moving-iron, dynamometer type, thermal type instruments, errors and compensations, extension of range using shunt, multiplier, Principle of C.T. and V.T.

Unit–II

Power measurement – Ammeter and Voltmeter method - Electrodynamometer wattmeter, errors and compensation, thermal type wattmeter, single and 3- phase power measurements.

Energy measurement - Induction type energy meter, principle, construction, errors and compensation. Calibration of wattmeters and energymeters.

Unit–III

Resistance Measurement - Series and shunt type ohmmeter. Wheatstone bridge, Kelvin bridge, Megger.
AC bridges - Maxwell bridge, Wien bridge, Anderson bridge, Hays bridge, Schering bridge - Campbell bridge to measure mutual inductance - detectors in bridge measurements.

**Unit–IV**

DC potentiometer – Standardization - student type, Leeds and Northrup potentiometer, Vernier potentiometer, Brooks deflection potentiometer.

AC potentiometer - Drysdale potentiometer, Gall potentiometer. Applications of AC and DC potentiometers. Maximum demand meter, Power factor meter.

**Unit–V**

Magnetic measurements - flux meter - testing of ring specimen - B-H curve by method of reversal and step by step method - testing of bar specimen - Hopkinson’s permeameter - Iron loss measurement by Lloyd Fisher square.

**TEXT BOOKS**


**REFERENCE BOOKS**


**COURSE OUTCOMES**

At the end of the course the students will be able to

1) Understand the internal structure of the instruments used in electrical measurements and to decide the types of instruments to be used for measuring AC and DC quantities. (Unit-I)

2) Understand the practical application of Wattmeters and Energy meters. (Unit-II)

3) Construct and determine the circuit parameters using AC and DC bridges. (Unit-III)

4) Construct and determine the circuit parameters using AC and DC potentiometers. (Unit-IV)

5) Explain the importance of Magnetism in electrical measuring instruments. (Unit-V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To study the basic theory behind electrical machines.
- To know the different types of AC and DC machines and their applications.
- To understand the construction, principle and operation of single phase and three phase transformers, classification and their applications.

Unit–I

Magnetic circuit: Magnetomotive force - magnetic field strength - permeability of free space- relative permeability - reluctance - comparison of electric and magnetic circuits - composite magnetic circuit - magnetic leakage and fringing - Kirchoff's laws for the magnetic circuit - magnetization curve - hysteresis loop - current-ring theory of magnetism - hysteresis loss - minimum volume of a permanent magnet - load line of a permanent magnet - magnetic field of a long solenoid - magnetic energy in a non-magnetic medium - magnetic pull. Inductance of a coil and factors determining inductance of a coil.

Unit–II

DC Machines: Construction details of machine - operation of DC generators - EMF equation - characteristics of different types of DC generators - commutation - armature reaction - operation of DC motors - torque equation - characteristics of different types of DC motors. Starters - breaking and speed control of DC motors.

Unit–III

Transformers: Principle - types - general constructional features of single phase transformers - phasor diagram and equivalent circuit - regulation, efficiency and all-day efficiency - open circuit and short circuit tests - applications. Auto-transformer and three phase transformer - types and applications.

Unit–IV


Unit–V


TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
At the end of the course the students will be able to
1) Acquire knowledge on magnetic circuits. (Unit-I)
2) Get the knowledge of electrical DC machines and transformers for different industrial applications. (Unit-II & Unit-III)
3) Acquire knowledge on Induction Machines. (Unit-IV)
4) Understand the applications of Synchronous Machines. (Unit-V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- To learn about continuous and discrete time signals and system properties.
- To acquire knowledge about the analysis of continuous and discrete time systems.
- To understand the need for frequency transformation and to learn the difference between various representations for continuous and discrete time signals.

Unit–I : Basics of Signals and Systems
Continuous time (CT) signal- Shannon’s sampling theorem-Discrete time signal (DT)- Standard test signals (CT & DT)-Classification of signals – CT and DT systems-Classification of systems.

Unit–II : Analysis of CT Signals
Fourier series representation of continuous time periodic signals – Evaluation of Fourier coefficients-Exponential Fourier series-Properties of continuous time Fourier series – Fourier representation of aperiodic signals-Continuous time Fourier transform(CTFT)- Fourier transform (FT) of standard signals-properties of CTFT.
Unit–III : Continuous Time Systems and its Analysis

Properties of continuous time systems – Representation of continuous time Linear time invariant (LTI) systems using differential equations – Transfer function model – Analysis of continuous time LTI systems using Laplace transform – Unit impulse response of CTLTI system – Unit step response of LTI system - Convolution integral – Frequency response analysis of CTLTI system.

Unit–IV : Analysis of DT signals

Analysis of discrete time periodic signal using Discrete Fourier Series (DFS)- Analysis of discrete time aperiodic signal using Discrete time Fourier transform (DTFT) – Properties of DTFT – Discrete Fourier transform (DFT) – Circular convolution-Properties of DFT.

Unit–V : Discrete time systems and its analysis


TEXT BOOKS


REFERENCE BOOKS


COURSE OUTCOMES

At the end of the course the students will be able to

1) Distinguish between continuous time and discrete time signals. (Unit I)
2) Apply the characteristics and properties of continuous and discrete systems for the design and development to meet the requirements. (Unit III&V)
3) Implement frequency transformation of continuous time and discrete time signals to extract the useful information, analyze continuous and discrete time signals and systems and to use various types of system representations to solve the problems effectively. (Unit II,&IV)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To understand the basic components of Virtual Instrumentation system.
- To learn to develop VIs based on Lab VIEW software.
- To learn to develop applications based on Virtual Instrumentation system.
- To know about various VI Tool sets.
- To impart knowledge pertaining to Data Acquisition System.

Unit–I : Introduction

Review of Digital Instrumentation, Concept of Virtual Instrumentation- Historical perspective - need of VI advantages- definition of VI- Block diagram and architecture of a Virtual Instrument – Traditional Instruments versus Virtual Instruments - dataflow techniques, graphical programming in data flow, VI Debugging Techniques.

Unit–II : Data Acquisition and Communication Hardware

PC based data acquisition- Typical on board DAQ card- Organisation of the DAQ VI system-Data acquisition interface requirements – Embedded system buses-Selection of Data acquisition cards–Buffered data acquisition - VI Chassis requirements.

Data acquisition cards with serial and parallel communication system controllers. Ethernet - Networking basics for office & Industrial applications - VI customization-Instrument Drivers.

Unit–III : Programming Techniques

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formulae nodes, local and global variables, State machine, string and file I/O, Publishing measurement data in the web, Internet Connectivity.

Unit–IV : Analysis Tools and Application of VI


Application of VI in process control designing of equipments like oscilloscope, Multimeter, Design of digital Voltmeters with transducer input- Applications of VI for Process Control and Instrumentation.

Unit–V : Smart Sensors

Definition – Sensor classification- General architecture of smart sensors- Description of smart sensor architecture- Block level design consideration for smart sensor-Importance and adoption of smart sensor-Types of smart sensors-compensation.

TEXT BOOKS

2) Skolkoff, Basic concepts of LABVIEW 4, PHI, 1998.
REFERENCE BOOKS

WEB RESOURCES
- www.ni.com
- www.ltrpub.com

COURSE OUTCOMES
At the end of the course, students should be able to
1) Engineering Knowledge on VI. (Unit I)
2) Data acquisition using DAQ VI’s. (Unit II)
3) Understand the Virtual Instruments basis concepts. (Unit III)
4) Incorporate various VI Toolsets based on the application. (Unit-IV : )
5) Get the knowledge of Smart Sensors. (Unit V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

06PEXXX DIGITAL SYSTEM DESIGN

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>06</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- To review digital design fundamentals and to emphasize VHDL in Digital design.
- To give an overview of PLD, CPLD & FPGA and basic principles in the construction of these programmable devices.
- To present several design examples with synthesizable VHDL code describing them at different levels.
- To present issues related to implementation of a digital system in FPGA.
- To introduce advanced features of VHDL, hardware testing of combinational and sequential logic and design for testability.
Unit–I : Logic Design Fundamentals

Review of logic design fundamentals - combinational logic - flip-flops and latches - Mealy sequential circuit design - Moore sequential circuit design - sequential circuit timing - tri-state logic and busses.

Unit–II : VHDL

Introduction to VHDL - VHDL description of combinational circuits - sequential statements and VHDL processes - modeling flip-flops using VHDL processes - processes using wait statements - VHDL delays - compilation, simulation and synthesis of VHDL code - VHDL data types and operators - VHDL libraries - behavioral and structural VHDL - variables, constants and signals - arrays and loops in VHDL - assert and repeat statements.

Unit–III : PLD


Unit–IV : FPGA


Unit–V : Design and Testing

VHDL functions - VHDL procedures - attributes - multi valued logic and signal resolution - IEEE 9-valued logic system - Generics. Hardware testing and design for testability: testing combinational logic - testing sequential logic - scan testing - boundary scan - built-in self test.

TEXT BOOKS
2) Ian Grout, Digital Systems Design with FPGAs and CPLDs, Newnes imprint of Elsevier Ltd., 2010.

REFERENCE BOOKS

COURSE OUTCOMES
At the end of the course the students will be able to
1) Design a digital system and develop VHDL code describing them at various levels (Unit–I : & II).
2) Implement the designed digital system using programmable devices (Unit III).
3) Utilize advanced features of VHDL with FPGA in their system design (Unit–IV).
4) Develop a digital system with testability (Unit V).

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>COs</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>06PEXXX</th>
<th>INSTRUMENTATION SYSTEM DESIGN</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

- To impart knowledge about the design methods using orifice and rotameter type of flow transducers for flow control system.
- To understand the basics of transmitter, design principles of signal conditioning circuits for RTD and thermocouple based temperature transmitter, methods of designing cold junction compensation circuit for thermocouple.
- To study about the design of bourdon tube for the measurement of pressure and factors governing its sensitivity and to learn the design procedures of air purge pressure measurement system.
- To learn the principle behind PID controllers and the design aspects for various types of control systems.
- To understand the principle and characteristics of control valves, positioners and pumps and the design criteria involved.
- To study about the design features of alarm circuits, interlocks and micro processor based data acquisition and implementation of PID control system.

**Unit–I**


**Unit–II**

Orifice meter - design of orifice for given flow condition - design of rotameter - design of signal conditioning circuit for RTD based temperature transmitter - design of cold junction compensation circuit for thermocouple based temperature transmitter - zero and span adjustment in D/P transmitters and temperature transmitters.

**unit–III**

Bourdon gauges - factors affecting sensitivity - design of Bourdon tube -design of Air purge system for level measurement. Electronic P+I+D controllers - design - adjustment of setpoint, bias and controller settings.
Unit–IV

Control valves - design of actuators and positioners - types of valve bodies - valve characteristics - materials for body and trim - sizing of control valves - selection of body materials and characteristics of control valves for typical applications. Types of pumps - pipe work calculation - selection of pumps. I/P and P/I converters- complete air supply system for pneumatic control equipments.

Unit–V

Design of logic circuits for alarm and annunciator circuits, interlocks-annunciator sequences - design of microprocessor based system for data acquisition - design of microprocessor based P+I+D controller.

TEXT BOOKS:

REFERENCE BOOKS

COURSE OUTCOMES

At the end of the course the student attains the
1) Ability to design signal conditioning circuit for Instrumentation systems.(Unit I)
2) Ability to design and develop flow measurement system using orifice & rotameter and to design signal conditioning circuit for temperature transmitters using RTD & thermocouple. (Unit II)
3) Ability to design and develop air purge type of level measurement system and to design electronic PID controllers. (Unit III)
4) Ability to design and select control valves and pumps for typical control applications. (Unit–IV :)
5) Ability to design alarm circuits, interlocks & the ability to develop microprocessor based data acquisition system and PID control system. (Unit V)

<table>
<thead>
<tr>
<th>C0s</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>C01</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C02</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C03</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C04</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C05</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To expose the students to the fundamentals of interaction of OS with a computer and user computation.
- To teach the fundamental concepts of how process are created and controlled with OS.
- To study on programming logic of modeling Process based on range of OS features.
- To compare types and Functionalities in commercial OS.
- To discuss the application development using RTOS.

Unit–I : Review of Operating Systems


Unit–II : Overview of RTOS


Unit–III : Real Time Models and Languages

Event Based – Process Based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements.

Unit–IV : Real Time Kernel

Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and Basic study of various RTOS like – VX works – Linux supportive RTOS – C Executive.

Unit–V : RTOs Application Domains

Case studies-RTOs for Image Processing – Embedded RTOs for Network communication – RTOs for fault-Tolerant Applications – RTOs for Control Systems.

TEXT BOOKS


REFERENCE BOOKS


**COURSE OUTCOMES**

1) Will get to know the fundamentals of interaction of OS with a computer and User computation. (Unit – I & II)

2) Will get to know the programming logic of modeling Process based on range of OS features. (Unit – III & IV)

3) To help the students to come with design and development of solutions using RTOS. (Unit V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

- To provide fundamental knowledge about computer networks.
- To provide comprehensive knowledge about the methods of internetworking.
- To give basic knowledge in the architecture and local control unit of distributed control system.
- To give adequate information in the interfaces used in DCS.
- To give basic knowledge about HART (Highway Addressable Remote Transducer) and field bus technology.

**Unit – I: Data Acquisition Systems (DAS)**


**Unit – II: Introduction to network**

MODEM - Data coding methods - Error detection, correction and encryption. Introduction to Networks - Network topology and media - Transmission Characteristics of network - Open System interconnection model of ISO - Data link Control protocol: HDLC.

**Unit – III: Network protocols**

Media access protocol: Command/response - Token passing - CSMA/CD, TCP/IP Bridges - Routers - Gateways - Standard ETHERNET configuration – Industrial ETHERNET- Special requirement for networks used for Control - Networking of PLC- Introduction to SCADA.
Unit–IV : DCS

Methods of Computer Control of Processes, their configuration and comparison: direct digital control, supervisory digital control and Distributed Control System (DCS). DCS - Local Control Unit (LCU) and architecture - LCU languages - Process interfacing issues. Operator interface - Requirements - displays - alarms and alarm management. Engineering interface - requirements. Factors to be considered in selecting a DCS.

Unit–V : HART and Field bus


Field Bus: General Field bus architecture - basic requirements of field bus standard - Field bus topology - Interoperability – Interchangeability - CAN bus.

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES

At the end of the course the students will be able to
1) Understand the basic principle of communication and the modes of data transmission. (Unit I)
2) Understand the various types of bus devices used for data communication in industry. (Unit II)
3) Implement the automation concepts in a process industry. (Unit II)
4) Understand about profibus for data communication. (Unit III)
5) Use HART andFiledBus protocols for process industries. (Unit–IV and V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To make the students understand basic theory and importance of instrumental analysis.
- To motivate the students learn the principles and the laws governing the operation of analytical instruments.
- To familiarize the students about the functioning of different types of analytical instruments.

Unit–I
Electromagnetic radiations - different regions - their wave lengths, frequencies and energies - interaction of EM radiations with matter - Principle of spectroscopy - emission, absorption, fluorescence spectroscopy - components of analytical instruments – radiation sources, variety and its types - monochromator - filters - detectors – photo emissive tube, PMT, photo diodes.

Unit–II
IR absorption spectroscopy – IR detectors – thermal detectors – golay pneumatic detector – sample handling techniques – Attenuated Total Reflectance – Lambert’s, beer’s law – single and double beam instruments – double beam spectrophotometer- non dispersive type.

Unit–III

Unit–IV

Unit–V

TEXT BOOKS
REFERENCE BOOKS

COURSE OUTCOMES
1) Gain adequate knowledge about the analytical tools.(Unit I).
2) Understand the principles and types of spectroscopy(Unit I).
3) Importance and applications of IR spectroscopy (Unit II).
4) Importance and applications of Magnetic resonance spectroscopy and mass analyzer (Unit III).
5) Importance and applications of X-ray spectroscopy and dilution tracer analysis (Unit–IV).
6) Separation of similar materials using Chromatograph. (Unit V).

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>COs</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
<tr>
<td>CO5</td>
</tr>
<tr>
<td>CO6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>06PEXXX</th>
<th>POWER ELECTRONICS DRIVES AND CONTROL</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- To learn about semi-conductor power devices.
- To acquire knowledge about the power converters for various loads.
- To implement the power converters for the drives by efficient control algorithms.
- To understand the need for the series & parallel connections and protection circuits.
- To study about the generation of control pulses for power electronic converters and their applications.

Unit–I : Semiconductor Power Devices
SCR characteristics - Two transistor analogy - Methods of turning on and turning off - Other members of SCR family - Series and parallel connection of SCRs - Thyristor protection. Other semiconductor devices: Power transistors, Power
MOSFETs, GTOs, IGBT. Generation of control pulses for power electronic converters.

**Unit–II : Phase Controlled Rectifiers**


**Unit–III : Single Phase Inverter**

Series, Parallel & Bridge inverters - Current source inverter.

**DC choppers**

Various types - Step-up, step down & step up/down chopper, chopper configuration – AC Chopper. AC voltage controller. Single phase Cycloconverter.

**Unit–IV : DC Motor Control**

Schemes for DC motor speed control, Single phase and three phase SCR drives - reversible SCR drives - chopper controlled DC drives. Closed loop control of DC drives.

**Unit–V : AC Motor Control**


**TEXT BOOKS**


**REFERENCE BOOKS**

2) C.N.Pauddar, Semi conductor Power Electronics (Devices and circuits), Jain Brothers, New Delhi, 1999.

**COURSE OUTCOMES**

At the end of the course the students will be able to

1) Understand the characteristics & applications of power semi-conductor devices. (Unit I)
2) Understand the AC to DC, DC to AC, and DC to DC converters. (Unit II)
3) To design a firing circuit that solves the specific control problem. (Unit III)
4) Understand the issues related implementation of drives & control. (Unit–IV and V )
5) Understand the recent trends in power converter technology. (Unit–I to V)
COURSE OBJECTIVES

- To provide knowledge about the advances in PID controller and adaptive PID control.
- To acquire knowledge in the basics of PID controller.
- To understand Anti-windup strategies.
- To study about PID controller design.
- To study about robust performance.
- To understand the need for Adaptive PID control.

Unit–I : Basics of PID Control


Unit–II : Anti-Windup Strategies and Setpoint Weighting


Set point Weighting: Introduction-Constant set point weight design-Variable set point weighting: Methodology- Simulation using Matlab.

Unit–III : PID Controller Design

ZN and related methods- rule based empirical tuning- pole placement- lambda tuning- algebraic design- optimization methods- robust loop shaping and frequency response methods- IMC based PID tuning- Design for disturbance rejection.

Unit–IV : Robust Performance and Performance Assessment


Unit–V : Adaptive PID Control

Auto tuning- Adaptive Technique-model based methods-rule based methods-Multi model based PID Controller design- nonlinear PID Controller design.
TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
At the end of the course the students will be able to:
1) Understand the basics of PID control. (Unit I)
2) Implement Anti-windup strategies. (Unit II)
3) Design a PID controller. (Unit III)
4) Understand the robust performance. (Unit IV)
5) Understand the need for Adaptive PID control. (Unit V)

Mapping with Programme Outcomes

<table>
<thead>
<tr>
<th>CO1</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CO2</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CO3</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CO4</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CO5</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- To expose the students to the concepts of Neural Networks, Fuzzy Logic and Genetic Algorithm.
- To provide adequate knowledge of application of neural network and Fuzzy logic controllers to real time systems.
- To expose the ideas of GA in optimization and control.

Unit I
Unit–II

Unit–III

Unit–IV

Unit–V
Fuzzy logic Control system- Fuzzy logic Controller for a temperature process-Introduction to neuro-fuzzy and fuzzy-neuro control systems-Introduction to GA.

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
At the end of the course the students will be able to
1) Understand the basics of neural networks.(Unit I)
2) Derive the different algorithms. (Unit II)
3) Understand the concept of neuro controller. (Unit III)
4) Understand the basics of fuzzy logic controller (Unit–IV)
5) Understand the concept of fuzzy control. (Unit V)
COURSE OBJECTIVES

- To provide a survey of VLSI design, emphasize on Intellectual property (IP) based design, introduce basic concepts and tools for layout design.
- To understand design of combinational logic gates and functions, IP based design at gate level.
- To learn the basic model, optimization, implementation, verification and testing methods for sequential machine design.
- To learn design of subsystem level components and building of subsystem level IP.
- To acquire the knowledge of floor plan design methodologies, chip-level layout and circuit design with area, delay and power optimization.
- To learn about register transfer design, architecture design for low power systems and IP components in architecture design.

Unit–I : Digital Systems and VLSI Design
Applications and advantages of VLSI systems- A survey of VLSI manufacturing and Design- CMOS technology-Integrated circuit design techniques-Intellectual property (IP) based design.

Unit–II : Layout Design and Logic Gates
Fabrication processes-Transistors- Wires and vias- Fabrication theory and practice- Layout design and tools. Combinational logic functions-static complementary gates-switch logic-Alternative Gate circuits-Low power gates- Delay through resistive interconnect- Delay through Inductive Interconnect- Gates as IP.

Unit–III : Combinational Logic Networks and Sequential Machines
Standard cell-based Layout - Combinational network delay - Logic and interconnect design - power optimization - switch logic networks. Latches and Flip-flops-sequential systems and clocking disciplines- Performance analysis - clock generation - Sequential system design- power optimization - design validation and sequential testing.

Unit–IV : Subsystem Design and Floor Planning
Introduction - Combinational Shifters - Adders - ALUs - Multipliers - High density memory - Image sensors - FPGAs - PLAs - Buses and networks On-chips -
Data paths - Subsystems as IP. Introduction - Floor planning methods - Global interconnects - Floor Plan design - Off-chip connections.

**Unit–V : Architecture Design**

Register Transfer Design- Pipelining - High level synthesis- Architectures for low power design - GAL systems - Architecture testing - IP components - Design methodologies- Multiprocessor system-on-chip design.

**TEXT BOOKS**


**REFERENCE BOOKS**


**COURSE OUTCOMES**

At the end of the course the students will be able to

1) Perform IP based design. (Unit I)
2) Handle technology dependent parameters in the fabrication process effectively. (Unit II)
3) Perform delay analysis and testability properties of combinational logic networks including both interconnect and gates.(Unit–III & Unit–IV)
4) Design an architecture that executes the desired function and that meets area, performance and testability constraints.(Unit V)

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cos</strong></td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To understand the physical foundations of biological systems and the various electrodes used in medical field.
- To have a detailed understanding about the various electro physiological measurements in the human body.
- To gain knowledge on the measurement of non-electrical parameter in the human body.
- To understand the basic concepts of various medical imaging techniques and their applications.
- Understand medical assisting and therapy equipments.

Unit–I

Introduction, generalized medical instrumentation system, components of instrumentation system, physiological systems of the body, cardiovascular system. Respiratory system, Nervous system, CNS, PNS, generation of bioelectric potentials, Action potential, Resting potential, Neuronal communication.

Unit II

The electrode – electrolyte interface, Polarization, Ag/Agcl Electrodes, Body surface electrodes, Internal Electrodes. Transducers in general, Pressure Transducers, Temperature transducers, pulse sensors, Basic recording system, Direct Writing recorder, UV recorders, Thermal array recorders, Electrostatic recorder, Instrumentation Tape recorder

Unit–III

Information content of an image, Modulation transfer function, Noise – equivalent bandwidth, generation of X-rays, X-ray machine, computed Tomography, Magnetic Resonance Imaging – Principle, Image reconstruction techniques, Basic NMR components, Ultrasonic Imaging systems – Types of ultrasound imaging, Applications of different scan, Bio Telemetry.

Unit IV


Unit–V

Pacemaker systems – Different pacing modes of operation, Transcutaneous Electrical Nerve stimulation (TENS) – Stimulation modes & application techniques, surgical diathermy, Heart lung machine, Hemo Dialysis, Lithotripsy, Laser applications in medicine, and introduction to electrical safety.
TEXT BOOKS
2) R.Anandanatarajan, Biomedical Instrumentation, PHI Learning, 2009.

REFERENCE BOOKS

COURSE OUTCOMES
1) To educate students on the various physiological systems of the human body. (Unit-I)
2) To impart knowledge on the electrodes and allied recorders so as to obtain measurements from the human body. (Unit-II)
3) To provide insight into advanced imaging systems. (Unit-III)
4) To study the various bio signals along with the principles of measurement. (Unit-IV).
5) To provide an exposure to the medical equipments/instruments used in various departments and laboratories of a hospital. (Unit-V)

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>COs</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
<tr>
<td>CO5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>06PEXXX</th>
<th>POWER PLANT INSTRUMENTATION</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- To introduce students to the general layout of thermal power plant and also construction and principle of operation of the different sensing and indicating devices used at thermal power plants.
- The combustion chemistry of boiler and its efficiency calculation will be explained to students and to study about the various control techniques used in thermal power plant.
To explain the function of steam turbine and its associated parameter measurement and to elaborate different types of safety methods involved in thermal power plant.

To introduce students the functions of nuclear power plant and also construction and principle of operation of the different sensing devices and control systems employed at nuclear power plants.

Unit–I : Overview of Thermal Power Generation and its Instrumentation


Unit–II : Boiler Combustion Process and its Efficiency Calculation

Boiler control objectives- combustion of fuels (gaseous, liquid and solid), excess air requirement, combustion chemistry and products of combustion, requirement for excess combustion air – calculation of efficiency of boilers: input/output method, heat loss method.

Various Control methods employed in water circuit

Controls in water circuit-Boiler drum level control-Superheated steam temperature control- superheaters-steam temperature control-water side steam temperature control-strategies of steam temperature control and de-superheaters-fire side steam temperature control-Steam pressure control.

Unit–III : Various Control Methods Employed in Air-Fuel Circuit

Control in air-fuel circuit-Combustion control and Furnace draft control. Flue gas analysis trimming of combustion control systems-combustion control for liquid and gaseous fuel boilers- coal or solid fuel stokers- combustion control for stoker fired boilers-pulverised coal burning systems- combustion control for pulverised coal fired boilers.

Unit–IV : Instrumentation & Control System Used for Turbine and Safety Aspects of Boiler


Unit–V : Nuclear Power Plant Instrumentation

Important components in instrumentation and control for nuclear power plant-Sensors and measurement systems for nuclear power plant-nuclear reactor control systems- Digital architectures in nuclear power plant-Radiation protection and monitoring.
TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
1) Ability to understand the function of boiler and also P&ID of thermal power plant. (Unit I)
2) Ability to understand the types of measuring equipment used in thermal power plant. (Unit I and II)
3) Ability to identify and analyze the specific features of different types of control techniques used in Boilers. (Unit III)
4) Ability to understand the function of turbine and its lubrication method and understand the various safety methods involved in the proper functioning of thermal power plant. (Unit IV)
5) Ability to understand the function of nuclear power plant, various sensors, control loops and safety measures employed in nuclear power plant. (Unit V)

<table>
<thead>
<tr>
<th>Co</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

06PEXXX | FIBER OPTICS AND LASER INSTRUMENTATION |
|        | L  | T  | P  |
|        | 4  | 0  | 0  |

COURSE OBJECTIVES
- To provide basic knowledge of optical fibers and their properties.
- To expose adequate knowledge about the Industrial applications of optical fibers.
- To disseminate the students, the fundamental characteristics and types of optical laser.
- To illustrate the industrial applications of optical laser.
- To provide adequate facts about holography and medical applications of optical laser.
Unit-I
Principles of light propagation through a fiber - Basic optical laws and definitions - Different types of fibers and their properties, fiber characteristics – Wave Propagation-Fiber Losses- Dispersion – Connectors and splicers – Optical sources and detectors.

Unit II

Unit–III

Unit–IV
Laser for measurement of distance, length, velocity, acceleration and current, voltage – Material processing: Laser heating, welding, melting and trimming of material – Laser spectroscopy.

Unit–V

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
1) Understand the Characteristics and properties of optical fibers. (Unit I)
2) Use of optical fibers in industries. (Unit II)
3) Identify the characteristics and principles of optical lasers. (Unit III)
4) Development of optical laser in industry applications. (Unit–IV : )
5) Applications of lasers in medical electronics. (Unit V)

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
<tr>
<td>CO5</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

The objectives of this course are to:

- Cover issues related to the definitions and principles of unit operations and unit systems.
- Provide thorough knowledge of fluid mechanics and its types of flow.
- Discuss about the heat transfer and its applications elaborately.
- Explain the concepts of mass transfer and its applications in detail.
- Learn thoroughly the concepts of control systems with multiple loops and plant wide control strategy and its implementation to the unit systems.

Unit–I : Introduction


Unit–II : Heat Transfer and its Applications


Unit–III : Mass Transfer and its Applications


Unit–IV : Control Systems with Multiple Loops

Cascade control: Cascade control for jacketed CSTR, Heat exchanger, Distillation column, Process furnace – Dynamic characteristics of cascade control – Selective control systems: Override control – Protection of boiler system, compressor system and steam distribution system –Auctioneering control and its examples – Split range control: Chemical reactor and Steam header.

Unit–V : Plant Wide Control

Plant wide control: Introduction – Block diagram descriptions only: Steady-state and dynamic effects of recycle- Unit operations: Supply side Vs Demand side – Compressor control – Heat exchangers – Adiabatic plug flow reactors – The control
and optimization hierarchy – Petroleum refining example - Case Study: Reactor / Flash unit plant and Distillation columns.

**TEXT BOOKS**

**REFERENCE BOOKS**

**WEB RESOURCES**
- nptel.ac.in
- www.unitoperation.com

**COURSE OUTCOMES**
At the end of the course the student will be able to:
1) Understand the definitions and basic principles of unit operations and unit systems.(Unit I)
2) Acquire a thorough knowledge of fluid mechanics and its types of flow.(Unit II)
3) Gain sound knowledge on heat transfer and its applications.(Unit III)
4) Imbibe the concepts of mass transfer and master its applications.(Unit IV)
5) Analyze the significance of control systems with multiple loops and plant wide control strategy.(Unit V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To give exposure to nonlinear control and to discuss about the stability and applications of non-linear systems.
- To acquire knowledge in the basics of nonlinear control.
- To understand the describing function analysis.
- To study about stability analysis.
- To study about nonlinear control system design.
- To understand the need for sliding mode control.

Unit–I : Non Linear Systems
Non-linear Systems - Behavior of non-linear systems, jump resonance, subharmonic oscillation- Phase plane analysis: Singular points - construction of phase portraits using isoclines and delta method - limit cycles-existence of limit cycles.

Unit–II : Describing Function Analysis

Unit–III : Stability Analysis

Unit–IV : Modelling and Control of Non-Linear Systems

Feedback Linearization-Input-state and Input-output linearization using Lie derivative and lie brackets.

Unit–V : Sliding Control
Sliding Control: Sliding Surfaces- sliding condition-Filippov’s construction of the equivalent dynamics –examples. Direct implementation of Switching control laws-Switching control in place of PWM and Dither signals. Continuous Approximations of switching control laws.

TEXT BOOKS
REFERENCE BOOKS

COURSE OUTCOMES
At the end of the course the students will be able to
1) Understand the basics of nonlinear systems.(Unit I)
2) Derive the describing function. (Unit II)
3) Understand the stability analysis of nonlinear systems. (Unit III)
4) Implement modelling of nonlinear systems and feedback linearization design. (Unit–IV)
5) Understand the recent trends in sliding mode control. (Unit V)

<table>
<thead>
<tr>
<th>COns</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES:
- To study about the statement of optimal control problem, formulation of optimal control problem and selection of performance measure.
- To introduce students to the fundamental concepts of calculus of variation.
- To understand the concepts of variational approach to optimal control problems.
- To derive the expression for continuous and discrete linear optimal regulator problem.
- To study about the concepts of dynamic programming and its application.

Unit–I : Optimal Control Problems and Performance Measures

Unit–II : Calculus of Variation
Fundamental concepts – extremum functionals involving single and several independent functions - piecewise smooth extremals - constrained extrema.
Unit–III : Variational Approach to Optimal Problems
   Necessary conditions for optimal control - Pontriagin’s minimum principle - state inequality constraints - minimum time problem - minimum control effort problems.

Unit–IV : LQ Control Problem

Unit–V : Dynamic Programming
   Principle of optimality - recurrence relation of dynamic programming for optimal control problem - computational procedure for solving optimal control problems - characteristics of dynamic programming solution - dynamic programming application to discrete and continuous systems - Hamilton Jacobi Bellman equation.

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES:
At the end of the course the students will be able to
1) Ability to understand the optimal control problem formulation and its selection of performance measures. (Unit I)
2) Ability to recognize and recall the fundamentals of calculus of variation. (Unit II)
3) Ability to implement optimal control concept for minimum time and minimum control effort problems. (Unit III)
4) Ability to apply Matrix Ricatti Equation for real world problem. (Unit–IV)
5) Ability to understand the concepts of dynamic programming. (Unit V)

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cos</strong></td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
<tr>
<td>CO5</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To understand the fundamentals of model predictive control.
- To study the methods of predictive control.
- To analyse the implementation issues of MPC.
- To design and implement MPC algorithm for the given process.

Unit-I: Model Predictive Control


Unit-II: Model Predictive Control Schemes

Dynamic matrix control – Model algorithmic control - Predictive functional control - Formulation of generalized model predictive control – Closed loops relationships.

Unit-III: Constrained model predictive control scheme

Constraints Handling: Amplitude Constraints and Rate Constraints – Constraints and Optimization – Constrained Model Predictive Control Scheme – Case Studies.

Unit-IV: Methods for implementing Model Predictive Control

Model predictive control and multi-parametric programming - Implementation of model predictive control for uncertain systems - Implementing Nonlinear Model Predictive Control Scheme-Closed loop min-max model predictive control implementation and dead time consideration.

Unit-V: Case studies

Self tuning GPC strategy and gain scheduling GPC for solar power plant – Design of MPC for a petrochemical industries.

TEXT BOOKS

REFERENCE BOOK

REFERENCE JOURNAL

COURSE OUTCOMES

After completion of this paper the student will understand
1) The basics of MPC including tuning parameters such as prediction horizon, control horizon and control weight. (Unit I)
2) The basics of Dynamic matrix control and model algorithmic control. (Unit II)
3) Effect of tuning parameters on control performance, stability and ability to handle constraints. (Unit III)
4) Development of various methods of MPC algorithm. (Unit IV)
5) Implementation issues and applications of MPC in industry. (Unit V)

<table>
<thead>
<tr>
<th>COS</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

- To understand different faults that occurs in sensors and actuators.
- To identify kind, size and magnitude of the fault by model based and model free methods.
- To understand the structured residuals and directional structured residuals.
- To understand the methods to estimates the faults.

**Unit–I : Introduction to Fault Detection and Diagnosis (FDD)**

Scope of FDD: Types of faults and different tasks of Fault Diagnosis and Implementation - Different approaches to FDD: Model free and Model based approaches. Classification of Fault and Disturbances - Different issues involved in FDD Typical applications.

**Unit–II : Analytical Redundancy Concepts**


**Unit–III : Design of Structured Residuals**


**Unit–IV : Design of Directional Structured Residuals**

Unit–V : Data Driven Methods
Principal Component Analysis – Partial Least Squares - Canonical Variate Analysis – Knowledge Based Methods.

TEXT BOOKS

REFERENCE BOOKS

COURSE OUTCOMES
1) Ability to understand different approaches to Fault Detection and Diagnosis. (Unit I)
2) Ability to estimate the kind, size, type and time of occurrence of faults by analytical methods. (Unit II)
3) Ability to design and detect single and multiple faults using structured residual approach. (Unit III)
4) Ability to design and detect single and multiple faults using directional structured residual approach. (Unit–IV)
5) Ability to understand the data driven methods like principle, partial least square methods etc., (Unit V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>06PEXXX</th>
<th>MICROCONTROLLER BASED SYSTEM DESIGN</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES:
- To study architecture of ARM processor.
- To introduce the concept assembly programming for ARM using THUMB instruction set.
- To understand the concept of interfacing of memory and peripherals to ARM PROCESSOR.
- To design operating system for ARM.
Unit–I : ARM Architecture

ARM architecture - RISC processor - ARM programming model - ARM development tools – Arm organization and implementation - 3 stage and 5 stage pipeline ARM organization – ARM instruction execution - ARM implementation – ARM co processor interface.

Unit–II : ARM Assembly Programming


Unit–III : THUMB Instruction Set

The THUMB Instruction set - Thumb programmer’s model – Thumb branch instruction – Thumb software interrupt and data processing instructions – Thumb single and multiple register data transfer instructions – Thumb implementation – Thumb applications.

Unit IV System Development


Unit V Operating System


TEXT BOOK

REFERENCE BOOKS
2) Andrew sloss,Dominicsymes and chris wright, ARM system developers guide Morgan Kaufmann.

COURSE OUTCOMES
1) Understand the basis of RSIC processor. (Unit I)
2) Programming the ARM processors.(Unit II)
3) Design of operating system for advanced microcontrollers.(Unit III)
4) By the end of this course, the students will be able to know about the functions and operations of the ARM processor and develop assembly code for various applications.(Unit–IV and V)
Mapping with Programme Outcomes

<table>
<thead>
<tr>
<th>Co</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

06PEXXX | EMBEDDED SYSTEMS | L | T | P |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- To study the basis of embedded system components
- To learn concept of embedded networking and various buses
- To study embedded programming using embedded C
- To study basis RTOs
- To design embedded system for real time applications

Unit-I: Introduction to Embedded Systems


Unit-II: PIC Microcontroller


Unit-III: Embedded Programming


Unit-IV: Real Time Operating System

Real Time operating system – operating system services – network operating system – multiple tasks and multiple processes – processes – context switching – scheduling polices – Interprocess communication mechanisms – evaluating operating system performance – power optimization strategies for process – use of Micro C/OS-II and Vx Works.

Unit-V: System Design Techniques

TEXT BOOKS

REFERENCE BOOKS
2) David E. Simon, An Embedded Software Primer, Pearson Education.
4) Todd D. Morton, Embedded microcontroller pearson education - 2003

COURSE OUTCOMES
1) Understand the basis of embedded system and embedded networking. (Unit I)
2) Learn the architecture and programming of PIC18, (Unit II)
3) Design of embedded networking, (Unit III)
4) Design of embedded system using Embedded C and RTOS, (Unit IV)
5) By the end of this course, the students will be able to formulate design and analyze any embedded system for real time applications. (Unit V)

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

LIST OF PROFESSIONAL ELECTIVES LAB (EP-LAB)

<table>
<thead>
<tr>
<th>06EPXXX</th>
<th>ELECTRICAL MEASUREMENTS LAB</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- To equip students with knowledge about B-H characteristics and determination of characteristics of ring specimen and transformer core.
- To familiarize the calibration methods for the calibration of various types of Energy meter, ammeter, voltmeter, wattmeter and DC potentiometer.
- To impart knowledge about various bridge circuit measurement methods for important electrical parameters such as resistance, inductance and capacitance.
LIST OF EXPERIMENTS

1) Determination of B-H curve of a given ring specimen using Ballistic Galvanometer.
2) Determination of B-H loop in a transformer core using C.R.O.
3) Calibration of single phase Energy meter.
4) Inductance measurements.
   a) Anderson’s bridge
   b) Hay’s bridge
6) Calibration of Three Phase three wire Energy meter.
7) Calibration of three phase four wire Energy meter.
8) Measurement of capacitance using
   a) Schering Bridge
   b) Desauty Bridge
9) a) Three ammeter three voltmeter methods.
   b) Measurement of ABCD constant of a short transmission line.
    a) Kelvin’s double bridge
    b) Wheat’s stone bridge

COURSE OUTCOMES
At the end of the practical course the students will be able to
1) Select and apply proper measuring bridge circuit for the measurement of various electrical parameters such as resistance, inductance and capacitance.
2) Incorporate the knowledge gained on B-H characteristics for the selection of materials and design of systems.
3) Apply the calibration methods for the calibration of various types of Energy meter, ammeter, voltmeter, wattmeter and DC potentiometer.
4) Design and develop measuring systems suited for any branch of engineering.

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To impart knowledge about the implementation of Auto/Manual switch in PID controller.
- To study and implement anti-reset windup scheme and various practical forms of PID controller.
- To design and implement an electronic PID controller.
- To design and implement signal conditioning circuits for various processes.
- To learn the design and development procedure of cold junction compensation scheme using RTD.

LIST OF EXPERIMENTS

1) A) Implementation of Auto/Manual switch in PID controller
2) B) Design of an Annunciator circuit using PLC
3) A) Implementation of anti-reset windup scheme
4) B) Implementation of practical forms of PID controller
5) Design and implementation of electronic PID controller
6) Realization of first order and second order systems with dead time using electronic circuits
7) Design and implementation of cold junction compensation scheme using RTD
8) A) Design and simulation of two position controller for a Thermal process using Electronic Work Bench (EWB) software
   B) Design of Alarm circuit using Logic gates.
9) Design of Signal conditioning circuit for the given process
10) A) Design of control valve sizing
    B) Design of an orifice

COURSE OUTCOMES

At the end of the practical course the students will be able

1) To implement the Auto/Manual switch in PID controller
2) To design practical forms of PID and anti reset windup scheme.
3) To design and implement electronic PID controller and to familiarize with cold junction compensation for Thermocouple using RTD.

<table>
<thead>
<tr>
<th>Mapping with Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cos</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To understand the analog and digital measurement principles.
- Understanding Virtual Instrumentation concepts.
- To develop the basic skills in data acquisition operation.
- To motivate for creating virtual instruments for practical operations.

LIST OF EXPERIMENTS

1) Basic LabVIEW Programming - Part1.
2) Basic LabVIEW Programming - Part2.
3) Design of Virtual Digital Voltmeter using LabVIEW.
4) Design of Virtual Function Generator using LabVIEW.
5) Hardware & Firmware design for Programmable Digital Voltmeter.
6) Hardware & Firmware design for Programmable Function Generator.
7) DAQ Post processing and Report Generation.
8) Design of GUI using MATLAB.
9) Implementation of ECG signal processing algorithms using LabVIEW.
10) Realization of PID controllers using LabVIEW.

COURSE OUTCOMES

At the end of this course, the students will be able to

1) Develop ability for programming in LabVIEW using different data structures and program structures.
2) Apply the basic knowledge of interfacing for GUI development.
3) Learn to acquire, condition, analyze and present the data from field instruments.
4) Develop LabVIEW skills to engineer advanced computer based instrumentation.

<table>
<thead>
<tr>
<th>CoS</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mapping with Programme Outcomes
COURSE OBJECTIVES

- To study the characteristics of convertors, square root extractor and transmitters
- To design and implement ON/OFF control, single speed floating control and averaging control
- To study the P&I diagram
- To study pneumatics
- To design and implement pH measurement system
- To linearize thermocouple using LABVIEW software

LIST OF EXPERIMENTS

1) Study of characteristics of I/P and P/I convertors.
2) Study of characteristics of Square root extractor.
3) Design and implementation of ON/OFF temperature control system.
4) (a) Characteristics of Single speed floating control.
   (b) Study of P & I Diagram
5) Characteristics of strain measurement system using cantilever beam set up.
6) (a) Design & simulation of Averaging Control.
   (b) Study of Pneumatics.
7) Determination of characteristics of capacitive level transmitter.
8) Design and Determination of characteristics of temperature transmitter.
9) Design and implementation of pH measurement system.
10) Study of Linearization of Thermocouple using Lab View.

COURSE OUTCOMES

1) Ability to design components of control system like transmitters, convertors and controllers
2) Ability to analyze and design the characteristics of ON/OFF, single speed floating and averaging control.
3) Ability to design signal conditioning circuits.
4) Ability to use both software and hardware tools.

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cos</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
</tbody>
</table>

L | T | P
0 | 0 | 3
COURSE OBJECTIVES

- To introduce students, the broad knowledge of essential component of present industrial Automation Industry such as Programmable Logic Controller (PLC), Distributed Control System (DCS), Supervisory Control and Data Acquisition (SCADA)
- To Design and implement advanced control techniques
- To enable the students to connect and make use of Data Acquisition cards and connect them with the processes.

LIST OF EXPERIMENTS

1) Study of Closed loop Air flow control system.
2) Study of Programmable Logic Controller.
3) Design and implementation of P and PI controller for an Air temperature control system.
4) Design and simulation of Cascade Control System using MATLAB software.
5) Programmable Logic Controller Applications using KV – 16 Ladder builder software.
6) Study of SCADA software
7) PC based control of Air flow/pressure process using V-MAT data acquisition card.
8) Study of DCS.
9) Design and implementation of Feed forward – Feedback controller using SIMULINK.
10) Simulation and closed loop control of temperature process using LabView.

COURSE OUTCOMES

At the end of the course the students will be able to,
1) Describe working of various blocks of basic industrial automation system.
2) Connect the peripherals with the PLC
3) Use various PLC functions and develop small PLC programs
4) Summarize Distributed control system and SCADA system
5) Use Data Acquisition cards and control real time processes.

Mapping with Programme Outcomes

<table>
<thead>
<tr>
<th>Cos</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To develop skills to design and analyse object oriented program.
- To strengthen the ability to identify and apply the suitable object oriented concept for the given real world problem.
- To gain knowledge in practical applications of object oriented concept.
- Developing the logic to find solution to a given problem from semantic point of view.
- Importance of space and time complexity to enable writing a program which meets requirements of memory constraints and time constraints.

LIST OF EXPERIMENTS

1) Simple Exercise using C++
   i) Check for ODD or EVEN
   ii) Sum of the Digits
   iii) Print in words of the given number
   iv) Generate the Fibonacci series
   v) Conversion Algorithm

2) Find the Area of two Objects (Circle & Rectangle) using Function Overloading

3) Add ‘N’ Complex numbers using Operator Overloading

4) To add two Numbers using Single Inheritance

5) To Read and Write the information of Books using File in C++

6) To draw the Bar Chart for Student Result

7) To check where the given string is palindrome or not using pointers

8) To study different MATLAB Commands for Matrix Operations and Logical Operations

COURSE OUTCOMES

1) Competences to design, write, compile, test and execute straightforward programs using a high level language.

2) An awareness of the need for a professional approach to design and the importance of good documentation to the finished programs.

3) The students will learn to write, compile & execute basic c++ program.

4) The student will learn the use of data types & variables, decision control structures: if, nested if etc.

5) The student will learn the use loop control structures: do, while, for etc.
COURSE OBJECTIVES

This course prepares students to work professionally in the area of designing digital systems.

- To develop skills in digital systems design using HDL.
- To understand the concepts of HDL, structural, data flow and behavioral models.
- To understand fundamentals of digital circuit simulation.
- FPGA implementation

LIST OF EXPERIMENTS

1) Introduction to FPGA design tool Xilinx ISE 14.
2) Implementation of simple combinational logic, a three-bit binary adder.
3) Implementation of multiplexer, decoder and demultiplexer.
4) Implementation of RAM and ROM.
5) Implementation of flip-flops.
6) Implementation of shift register and sequence counter.
7) Implementation of an arithmetic unit.
8) Implementation of a control unit and data paths.
9) Implementation of a finite state machine.
10) Memory BIST.

COURSE OUTCOMES

This course makes significant emphasis on practical design techniques required for digital logic design, hardware engineering and implementation:

1) An ability to design a component, or a system to meet desired needs.
2) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
3) Use industry standard tools to analyze, design, develop and test computer-based systems containing both hardware and software components.
4) Continue to develop their knowledge and skills after graduation in order to succeed personally and contribute to employer success.
Mapping with Programme Outcomes

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
</tbody>
</table>

06EPXXX MEMS SIMULATION LABORATORY

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>06EPXXX MEMS SIMULATION LABORATORY</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

- To study the IntelliSuite and CoventorWare MEMS CAD tools.
- To study the fabrication procedure of MEMS devices.
- To fabricate various MEMS devices using MEMS design tools and test their performance characteristics by FEM analysis.

**LIST OF EXPERIMENTS**

Fabrication and Simulation of MEMS Devices using MEMS CAD Tools

1) Pressure sensor.
2) Electrostatic switch.
3) Capacitive pressure sensor.
4) Electrostatic cantilever actuator.
5) Piezoresistive pressure sensor.
6) Capacitive accelerometer.

**COURSE OUTCOMES**

At the end of the course the students will be able to

1) Expertise knowledge of using IntelliSuite and CoventorWare MEMS CAD tools.
2) Understand the fabrication procedure of MEMS devices.
3) Fabricate various MEMS devices using MEMS design tools and improve their performance characteristics by FEM analysis.

Mapping with Programme Outcomes

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

06EPXXX BIOMEDICAL INSTRUMENTATION LAB

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>06EPXXX BIOMEDICAL INSTRUMENTATION LAB</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

- To train students in the practice of design, and analysis of biomedical systems, devices, diagnostics, and therapeutics.
- To learn the sources of bio-potentials in the human body, understand the techniques used for obtaining measurement of several electrical potentials.
- To introduce a wireless, multi-channel physiological recording platform of a bioelectric signal.
- To quickly analyze gait without the restraints of a gait laboratory, such as limited walking space with a portable and easy to use wireless wearable system.
- To determine a subject’s hearing levels and also to measure the ability to discriminate between different sound intensities with the aim to diagnose hearing loss.
- To perform a treadmill test to determine how well the heart responds during times when it is stressed.

**LIST OF EXPERIMENTS**

1. Analysis of Standard ECG, Respiratory and Pulse Signals using Bio Simulator
2. Measurement of Cardiac Electrical Activity using single lead system
4. Testing of ultrasound and interferential therapy.
5. Measuring the pulse of a person using pulse plethysmograph.
8. Measurement of Cardiac Electrical Activity by TMT.
9. Testing and Analysis of Physiology of Brain using BIOPAC – EEG module and finding the power spectrum of the obtained EEG using Matlab.
10. Experimental analysis of the working principle of diathermy therapeutic equipment.

**COURSE OUTCOMES**

1. To introduce student to basic biomedical engineering technology.
2. To familiarize the students to understand, design and evaluate systems and devices that can measure, test and/or acquire biological information from the human body.
3. To make students familiar with the design/usage of sophisticated medical devices.
4. To provide an exposure and hands on training to the wired/wireless recording platform of medical equipments/instruments used in hospital laboratories.
5. To provide students with opportunities for an experiential learning approach based on biomedical applications.

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Mapping with Programme Outcomes**
COURSE OBJECTIVES

- To understand the basic anatomy of robots and trajectory planning
- To enable students to understand about the work envelopes of robots and its role in automation
- To give an overview of the various methods of control of robots
- To know about Factory automation
- To select robots based on their applications and their related issues in industrial automation

Unit–I : Fundamentals of Robots


Unit–II : Robot End Effectors, Sensors

**End Effectors:** Types-Mechanical grippers-Magnetic grippers, Vacuum cups, Adhesive gripper, Hooks and Scoops- Tools as end effectors - Robot/ End-effectors interface- Consideration in Gripper selection and Design.

**Sensors:** Transducers and Sensors – Sensors in Robotics: Tactile, Proximity and Range Sensors, Miscellaneous sensors and sensor based systems- Machine Vision System.

Unit–III : Programming and Control of Robots

**Robot Programming:** Methods of Programming:- Leadthrough Methods, Robot program as a path in space- Motion interpolation, WAIT, SIGNAL and DELAY Commands, Branching, Capabilities and limitations of Leadthrough Methods- Textual Robot Programming- structure, Motion, End effectors and Sensor commands, Program control communication, Monitor mode commands

**Robot Control:** Open and Closed loop control- control Problem- Linear control Schemes- Design of Partitioned PD, PID and Adaptive Controllers for Linear Second order SISO Model of robot and their Block schematic representation- Control of Industrial Robots Using PLCs.

Unit–IV : Automation

**Factory Automation:** Fixed Automation, Flexible Automation and Programmable Automation. Intelligent Industrial Automation, Industrial Networking, Bus Standards

**Unit-V : Applications of Robots**

Factors influencing the selection of Robots – Robots for Welding, Painting, Assembly, Nuclear, Thermal and Chemical Plants.


**TEXT BOOKS**


**REFERENCE BOOKS**


**COURSE OUTCOMES**

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

1) Expertise in fundamentals of Robotics (Unit I)
2) Understand the issues related to end effectors and sensors (Unit II)
3) Acquire knowledge in Programming and control of Robots (Unit III)
4) Understand the issues related to implementation of Industrial Automation with Robot Application (Unit–IV : )
5) Gain an in depth understanding of the selection of robots for various application and their safety issues (Unit V)

<table>
<thead>
<tr>
<th>CoS</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co2</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co3</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co4</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

- To expose the students about the basics of Nanotechnology and its applications.
- To provide adequate knowledge on Nanomaterial properties, Quantum Mechanics and Nano electronics.
- To expose the knowledge on Nano electronics devices and its applications.

Unit–I


Unit–II


Unit III


Unit–IV


Unit–V

TEXT BOOKS
2) Lessons from Nano electronics. A New Perspective on Transport-Supriyo Datta, Purdue University, USA, 2012.

REFERENCE BOOKS

COURSE OUTCOMES
1) Will get to know the future of electronics and its applications. (Unit I, II & IV)
2) Updates the students with the recent advancements in the nanotechnology. (Unit I, II & IV)
3) To introduce the students the concepts of quantum mechanics for analysis of nanoelectronic devices. (Unit III)

<table>
<thead>
<tr>
<th>Mapping with Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>06OEXXX</th>
<th>MICRO ELECTRO MECHANICAL SYSTEMS</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES

- To expose the students to the fundamentals Micro electromechanical systems.
- To teach the fundamental concepts MEMS Fabrication process.
- To study the design concepts of MEMS devices.
- To compare types and Functionalities of various methods of micromachining.

Unit–I : Miniaturization of Systems

Need for miniaturization, Microsystems versus MEMS, Need for micro fabrication, smart materials, Structure and Systems, Application of smart material and Micro system. Scaling in mechanical domain, Scaling in Electrostatic domain, Scaling in thermal domain.

Unit–II : Micromachining Technology

Silicon as a material for micromachining-Crystal Structure, Silicon Wafer Preparation- Thin Film Deposition –Evaporation, Sputtering, CVD, Epitaxial

**Unit–III : Silicon Capacitive Accelerometer**

Overview, advantages of silicon capacitive accelerometer, typical applications, an example of a prototype, material used, fabrication process, principle of operation.

Piezoresistive pressure sensor: overview, advantages of piezoresistive pressure sensor, typical applications, material used, fabrication process, principle of operation, An example commercial Products.

**Unit–IV : Modelling of Solids in Microsystems**

The simplest Deformable Element: a bar- Transversely deformable Element: a beam- energy methods for elastic bodies- Bimorph effects.

**Unit–V : MEMS Actuators and their Applications**


**TEXT BOOKS**


**REFERENCE BOOKS**


**COURSE OUTCOMES**

At the end of the course the students will be able to

1) The fundamentals of Micro electromechanical systems and their applications will be studied. (Unit I)
2) The fundamental concepts of MEMS Fabrication process will be gained. (Unit II)
3) The design concepts of MEMS devices will be developed. (Unit II, III & IV)
4) The Functionalities of various methods of micromachining involved in different MEMS devices will be studied. (Unit V)
### Mapping with Programme Outcomes

<table>
<thead>
<tr>
<th>CoS</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>06OEXXX</th>
<th>CLOUD COMPUTING</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### COURSE OBJECTIVES

- Gives the Idea Of Evolution Of Cloud Computing
- Provides knowledge about Its Services Available Today
- Helps to the Design And Development Of Simple Cloud Service.

### Unit-I : Introduction


### Unit-II : Cloud Services

Types of Cloud services: Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service – Communication as services. Service providers- Google, Amazon, Microsoft Azure, IBM, Sales force.

### Unit-III : Collaborating Using Cloud Services


### Unit-IV : Virtualization for Cloud

Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization –System Vm, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM , VMWare, Virtual Box, Hyper-V.

### Unit-V : Security, Standards and Applications


### TEXT BOOKS


REFERENCES BOOKS
2) Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May 2011.

<table>
<thead>
<tr>
<th>07OEXXX</th>
<th>BIOLOGY FOR ENGINEERS</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- The course acts as a bridge between engineering and biology to provide basic understanding of biological mechanisms of living systems from engineering perspective.
- It will illustrate the many possible means to utilize living things’ relevance to engineering principles.
- With substantial knowledge and continuing interest will make a student into a specialist in the technical diversity.

Unit—I : Requirements of Biological Systems
- Biological Units Need Water; Biological Units Need the Right Amount of Oxygen; Biological Units Need Food and Nutrients; Biological Units Become Ill in the Presence of Wastes; Biological Units Need Heat Sources and Sinks.

Unit—II : Behavior of Biological Systems
- Biological Units Adapt to Their Environments; Biological Units Modify Their Environments; Adaptations Require Extra Energy and Resources; Biological Units, If Possible, Move to Friendlier Environments; Biological Units Evolve under Environmental Pressures.

Unit—III : Response to Stress by Biological Systems
- Crowding of Biological Units Produces Stress; Biological Units Are Affected by Chemical Stresses; Biological Units Respond to Mechanical Stresses; Optimization Is Used to Save Energy and Nutrient Resources; Biological Units Alter Themselves to Protect against Harsh Environments.

Unit—IV : Existence of Biological Systems
- Biological Units Cooperate with Other Biological Units; Biological Units Compete with Other Biological Units; Biological Units Reproduce; Biological Units Coordinate Activities through Communication; Biological Units Maintain Stability
with Exquisite Control; Biological Units Go through Natural Cycles; Biological Units Need Emotional Satisfaction and Intellectual Stimulation; Biological Units Die.

**Unit–V : Scaling Factors and Biological Engineering Solutions**

Allometric Relationships from Evolutionary Pressure; Dimensional Analysis; Golden Ratio; Fractal Scaling within an Organism; Self-Similarity for Tissues and Organs; Self-Similarity in Populations; Systems Approach; Relationships between Engineering and Biology; The Completed Design.

**TEXT BOOKS**


**REFERENCE BOOKS**

1) Aydin Tözeren, Stephen W. Byers, New Biology for Engineers and Computer Scientists, Pearson/Prentice Hall, 2004


**COURSE OUTCOMES**

1) The ability to understand the information known about familiar living systems.
2) The ability to anticipate the properties of an unfamiliar group of living things from knowledge about a familiar group.
3) The ability to demonstrate the relevance of engineering to biological systems.
4) The knowledge about the biological responses and it is scaling with respect to scientific principles that cannot be related back.
5) The knowledge of biological principles and generalizations that can lead to useful products and processes.
6) The ability to avoid or mitigate unintended consequences of dealing with any and all living system.

<table>
<thead>
<tr>
<th>02OEXXX</th>
<th>DISASTER MANAGEMENT</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**COURSE OBJECTIVES**

This course helps in providing the basic concepts of disasters and also gives a thorough knowledge and experience to reduce disaster risks.

**Unit–I**

Introduction – Disaster- Characteristics and types of Disasters- Causes and effects of Disaster -Risk- Vulnerability – Preparedness- Disaster mitigation and disaster management- Classification of mitigation measures-Vulnerability Analysis- Observation and Perception of Vulnerability- Socio-Economic Factors of Vulnerability- Vulnerability in India- Disaster related policy goals of UNDP UNDRO and Govt. of India- Appraising disaster needs- Needs for technical expertise- Role of various Agencies in Disaster Management and Development -Disaster risk reduction planning- Role of Developmental Planning for disaster Management

**Unit–II**

Earthquake - Cause of Earthquake- General characteristics- Measuring Earthquakes- Distribution pattern of Earthquakes in India- Earthquake prone areas- case studies of important Indian earthquakes - Forecasting techniques and
risk analysis- Possible risk reduction measures- earthquake resistance buildings and re-engineering techniques in India.

Unit–III

Tsunamis- Causes of a Tsunami- General Characteristics- Tsunami warning system-Distribution pattern of Tsunami in India- Possible risk reduction measures- Integrated coastal zone management.


Unit–IV

Tropical cyclones- Structure of tropical cyclones- Nature of tropical cyclones- Cyclone experience in India and Tamilnadu- Preparedness- Tropical cyclones and their warning systems- Tropical cyclone warning strategy in India special nature of the problem in the region- Classification- Protection of buildings from cyclones of India- Precautions during and before cyclones.

Unit–V

Coastal floods- Intensification of hazards due to human interference- Management-River and coastal floods- Temperature extremes and wild fires- Physiological hazards- Flood forecasting-mitigation- planning- management- flood prone areas the Indian scenario- Flood experience in India and Tamilnadu.

Environmental hazards- Typology- Assessment and response- Strategies -The scale of disaster-Vulnerability- Disaster trends- Paradigms towards a balanced view- Chemical hazards and toxicology-Biological hazards- Risk analysis- Other technological disasters.

TEXT BOOKS


REFERENCE BOOKS


3) Sinha, P.C. *Technological Disasters*, 1997, 516 pp Anmol Publications Trivedi,

COURSE OUTCOMES
1) Develop an understanding of the key concepts, definitions key perspectives of all Hazards Emergency Management.

2) Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery.
COURSE OBJECTIVES

- Develop an entrepreneurship sprit
- Help to identify business opportunities within an organization or independently
- Initiate action on the business plan from the prospective business through EDC.

Unit–I

Unit–II

Unit–III
Meaning and nature of direction – Principles of directing – Leadership and leadership style – Motivation – Communication – Need and feedback in communication – Importance of communication – Channels of communication – Types of communication – Forms of communication.

Unit–IV
Evolution of concept of entrepreneur – Concept of entrepreneur – Characteristics of entrepreneur – Distinction between entrepreneur and manager – Technical entrepreneur – Charms of being an entrepreneur – Types of entrepreneur – Role of entrepreneurship in economic development – Barriers in entrepreneurship.

Unit–V

TEXT BOOKS
REFERENCE BOOKS
1) “Creativity, innovation, entrepreneurship and enterprise in construction and development”, University of Reading, Alan Barrell – Entrepreneur in Residence Entrepreneur in Residence, University of Xiamen, Xiamen 2012.

COURSE OUTCOMES
- At the end of this course the student should have an understanding about entrepreneurship. The students should have knowledge about the principles of business Plan.

<table>
<thead>
<tr>
<th>00OEXXX</th>
<th>HUMAN RIGHTS</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- At the end of this course the student is expected to understand what is human rights, how to obey the rights, what is the role of a human being in making a good society for the future generations.

Unit–I

Unit–II

Unit–III

Unit–IV

Unit–V

TEXT BOOKS
REFERENCE BOOKS
2) Human Rights, Questions and Answers, UNESCO, 1982
3) Mausice Cranston- What is Human Rights
5) Human Rights, A Selected Bibliography, USIS.
6) Cheous K (Ed) - Social Justice and Human Rights (Vols 1-7).
7) Devasia, V.V. - Human Rights and Victimology.

<table>
<thead>
<tr>
<th>00OEXXX</th>
<th>NATIONAL SERVICE SCHEME</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

COURSE OBJECTIVES
- Understand the community in which they work and their relation
- Identify the needs and problems of the community and involve them in problem-solving
- Develop capacity to meet emergencies and natural disasters
- Practice national integration and social harmony and
- Utilize their knowledge in finding practical solutions to individual and community problems.

Unit–I : National Service Scheme
A) History and its Objectives
B) Organizational structure of N.S.S. at National, State, University and College Levels
C) Advisory committee and their functions with special reference to college principal, Programme officer, N.S.S. group leader and N.S.S. volunteers in the implementation.

Unit–II : National Integration
A) Need of National integration
B) Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc.

Unit–III : Special Programme
A) Legal awareness
B) Health awareness
C) First-aid
D) Career guidance
E) Leadership training - cum - Cultural Programme

Unit–IV : Special Camping Programme
A) Nature and its objectives
B) Selection of camp site and physical arrangement
C) Organization of N.S.S. camp through various committees and discipline in the camp.
D) Activities to be undertaken during the N.S.S. camp.
E) Use of the mass media in the N.S.S. activities.

Unit-V: N.S.S. Regular Activities
A) Traffic regulation
B) Working with Police Commissioner's Office
C) Working with Corporation of Chennai
D) Working with Health Department
E) Blind assistance
F) Garments collection
G) Non-formal education
H) ‘Environmental Education, Awareness and Training (EEAT)’
I) Blood donation

REFERENCE BOOKS
2) Training Programme on National Programme scheme, TISS.
3) Orientation Courses for N.S.S. Programme officers, TISS.
4) Case material as Training Aid for field workers, Gurmeet Hans.
5) Social service opportunities in Hospitals, KapilK.Krishan, TISS.
6) Social Problems in India, Ram Ahuja.