ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
R - 2013
B. E. PETROCHEMICAL ENGINEERING

PROGRAMME OBJECTIVES:

1. To produce employable graduates with the knowledge and competency in Petrochemical Engineering complemented by the appropriate skills and attributes.
2. To meet the world's ever-increasing demand for hydrocarbon fuel, thermal energy, and waste and pollution management.
3. To produce creative and innovative graduates with design and soft skills to carry out various problem solving tasks.
4. To enable the students to work as teams on multidisciplinary projects with effective communication skills, individual, supportive and leadership qualities with the right attitudes and ethics.
5. To produce graduates who possess interest in research and lifelong learning, as well as continuously striving for the forefront of technology.

PROGRAMME OUTCOMES:

The graduates of this programme would have

1. Ability to apply knowledge of mathematics, science, and engineering in core industry
2. Ability to design and conduct experiments, as well as to analyze and interpret data
3. Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. Ability to identify, formulate, and solve engineering problems related to petrochemical industry
5. Understanding of professional and ethical responsibility
6. Recognition of the need and ability to engage in life-long learning
## ANNA UNIVERSITY, CHENNAI
### AFFILIATED INSTITUTIONS
#### R - 2013
##### B. E. PETROCHEMICAL ENGINEERING
### I – VIII SEMESTERS CURRICULUM AND SYLLABUS

### SEMESTER - I

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS6151</td>
<td>Technical English - I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>MA6151</td>
<td>Mathematics – I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH6151</td>
<td>Engineering Physics – I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CY6151</td>
<td>Engineering Chemistry – I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>GE6151</td>
<td>Computer Programming</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>GE6152</td>
<td>Engineering Graphics</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

### PRACTICAL

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE6161</td>
<td>Computer Practices Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>GE6162</td>
<td>Engineering Practices Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>GE6163</td>
<td>Physics and Chemistry Laboratory - I</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**TOTAL** 17 2 11 26

### SEMESTER – II

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS6251</td>
<td>Technical English - II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>MA6251</td>
<td>Mathematics - II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH6251</td>
<td>Engineering Physics - II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CY6251</td>
<td>Engineering Chemistry - II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>GE6252</td>
<td>Basic Electrical and Electronics Engineering</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>GE6253</td>
<td>Engineering Mechanics</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

### PRACTICAL

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE6261</td>
<td>Computer Aided Drafting and Modeling Laboratory</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>GE6262</td>
<td>Physics and Chemistry Laboratory - II</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>GE6263</td>
<td>Computer Programming Laboratory</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL** 19 5 6 27
### SEMESTER – III

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EL6302</td>
<td>Organic Chemistry</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH6404</td>
<td>Mechanical Operations</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EE6351</td>
<td>Electrical Drives and Controls</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>MA6351</td>
<td>Transforms and Partial Differential Equations</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>CH6403</td>
<td>Chemical Process Calculations</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH6303</td>
<td>Physical Chemistry</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**PRACTICALS**

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH6311</td>
<td>Organic Chemistry Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>EI6411</td>
<td>Electrical Machines Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>PM6311</td>
<td>Machine Drawing</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL** 18 1 9 25

### SEMESTER – IV

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CE6402</td>
<td>Strength of Materials</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PM6401</td>
<td>Fluid Mechanics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PC6501</td>
<td>Heat Transfer</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>MA6459</td>
<td>Numerical Methods</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PC6301</td>
<td>Industrial Chemical Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PC6402</td>
<td>Engineering Thermodynamics</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

**PRACTICALS**

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH6413</td>
<td>Physical Chemistry Laboratory</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>PM6412</td>
<td>Mechanical Operations Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>PM6411</td>
<td>Fluid Mechanics Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL** 18 4 10 28

### SEMESTER – V

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GE6351</td>
<td>Environmental Science and Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PM6501</td>
<td>Mass Transfer I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PC6503</td>
<td>Petroleum Exploration and Exploitation Techniques</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PM6502</td>
<td>Chemical Reaction Engineering</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PE6606</td>
<td>Natural Gas Engineering</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PC6401</td>
<td>Materials Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**PRACTICALS**

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH6611</td>
<td>Heat Transfer Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CH6411</td>
<td>Technical Analysis Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>GE6674</td>
<td>Communication and Soft Skills- Laboratory Based</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL** 18 3 10 27
### SEMESTER – VI

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM6601</td>
<td>Mass Transfer II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>EL6605</td>
<td>Process Dynamics and Control</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PM6602</td>
<td>Equipment Design and Drawing-I</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>PC6606</td>
<td>Petroleum Crude Processing Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PM6603</td>
<td>Water Treatment and Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PM6605</td>
<td>Instrumentation and Instrumental Analysis</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRACTICALS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PM6611</td>
<td>Mass Transfer Laboratory</td>
</tr>
<tr>
<td>PM6612</td>
<td>Petroleum Physical Properties Testing Laboratory</td>
</tr>
<tr>
<td>PC6712</td>
<td>Chemical Reaction Engineering Laboratory</td>
</tr>
</tbody>
</table>

**TOTAL** 17 2 11 26

### SEMESTER – VII

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH6702</td>
<td>Transport Phenomena</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PM6701</td>
<td>Equipment Design and Drawing-II</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>PM6702</td>
<td>Petroleum Secondary Processing Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PM6703</td>
<td>Petrochemical Unit Processes</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PM6704</td>
<td>Refinery Process Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Elective – I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRACTICALS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EL6713</td>
<td>Process Dynamics and Control Laboratory</td>
</tr>
<tr>
<td>PM6711</td>
<td>Petrochemical Analysis Laboratory</td>
</tr>
<tr>
<td>PC6711</td>
<td>Petroleum Product Testing Laboratory</td>
</tr>
</tbody>
</table>

**TOTAL** 17 0 11 25

### SEMESTER – VIII

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM6801</td>
<td>Process Engineering Economics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PM6802</td>
<td>Safety and Risk Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Elective -II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRACTICALS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PM6811</td>
<td>Project Work*</td>
</tr>
</tbody>
</table>

**TOTAL** 9 0 12 15

**TOTAL NO OF CREDITS: 199**
# LIST OF ELECTIVES

## B. E. PETROCHEMICAL ENGINEERING

### VII SEMESTER

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH6016</td>
<td>Process Modelling and Simulation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CH6009</td>
<td>Fertilizer Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PC6002</td>
<td>Petroleum Process Equipment Auxiliaries</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>MG6091</td>
<td>Industrial management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>GE6757</td>
<td>Total Quality Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>GE6084</td>
<td>Human Rights</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### VIII SEMESTER

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH6002</td>
<td>Fluidization Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PC6005</td>
<td>Energy Management in Chemical Industries</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PC6004</td>
<td>Novel Separation Processes</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PC6006</td>
<td>Multicomponent Distillation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PC6008</td>
<td>Polymer Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>GE6083</td>
<td>Disaster Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

UNIT I

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one’s leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading - Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences – Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time
reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-
materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film
scenes - dialogue writing.

UNIT V 9+3
Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to
broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making
presentations on given topics; Reading - Email communication - Reading the attachment files
having a poem/joke/proverb - Sending their responses through email; Writing - Creative
writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items
(fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
Learners should be able to
• speak clearly, confidently, comprehensibly, and communicate with one or many
listeners using appropriate communicative strategies.
• write cohesively and coherently and flawlessly avoiding grammatical errors, using a
wide vocabulary range, organizing their ideas logically on a topic.
• read different genres of texts adopting various reading strategies.
• listen/view and comprehend different spoken discourses/excerpts in different accents

TEXTBOOKS:
1. Department of English, Anna University. Mindscapes: English for Technologists and
Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and
Engineering. Orient Blackswan, Chennai. 2011

REFERENCES:
1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and
2. Regional Institute of English. English for Engineers. Cambridge University Press, New
Delhi. 2006.
2005

EXTENSIVE Reading (Not for Examination)

WEBSITES:

TEACHING METHODS:
• Lectures
• Activities conducted individually, in pairs and in groups like self introduction, peer
introduction, group poster making, grammar and vocabulary games, etc.
• Discussions
• Role play activities
• Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

**EVALUATION PATTERN:**

**Internal assessment: 20%**

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

- Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

**End Semester Examination: 80%**

---

**MA6151 MATHEMATICS – I**

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

**OBJECTIVES:**

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

**UNIT I MATRICES**

9+3

UNIT II  SEQUENCES AND SERIES  9+3

UNIT III  APPLICATIONS OF DIFFERENTIAL CALCULUS  9+3
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

UNIT IV  DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES  9+3

UNIT V  MULTIPLE INTEGRALS  9+3

OUTCOMES:
- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

TEXT BOOKS:

REFERENCES:
UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9
Elasticity - Hooke’s law - Relationship between three modulii of elasticity (qualitative) – stress-strain diagram – Poisson’s ratio – Factors affecting elasticity – Bending moment – Depression of a cantilever – Young’s modulus by uniform bending - I-shaped girders

UNIT III QUANTUM PHYSICS 9

UNIT IV ACOUSTICS AND ULTRASONICS 9
Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C –scan displays, Medical applications - Sonogram

UNIT V PHOTONICS AND FIBRE OPTICS 9
Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

OUTCOMES:
- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXT BOOKS:
1. Arumugam M. Engineering Physics. Anuradha publishers, 2010

REFERENCES:
1. Searls and Zemansky. University Physics, 2009
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011
OBJECTIVES:

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

UNIT I POLYMER CHEMISTRY

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

UNIT II CHEMICAL THERMODYNAMICS

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van’t Hoff isotherm and isochore (problems).

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY


UNIT IV PHASE RULE AND ALLOYS


UNIT V NANO CHEMISTRY

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

TOTAL : 45 PERIODS

OUTCOMES:
The knowledge gained on polymer chemistry, thermodynamics, spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

TEXT BOOKS:

REFERENCES:

GE6151 COMPUTER PROGRAMMING

OBJECTIVES:
The students should be made to:
- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION

UNIT II C PROGRAMMING BASICS

UNIT III ARRAYS AND STRINGS
UNIT IV FUNCTIONS AND POINTERS
9
Function – definition of function – Declaration of function – Pass by value – Pass by reference –
Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays-
Example Problems.

UNIT V STRUCTURES AND UNIONS
9
Introduction – need for structure data type – structure definition – Structure declaration –
Structure within a structure - Union - Programs using structures and Unions – Storage classes,
Pre-processor directives.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:

• Design C Programs for problems.
• Write and execute C programs for simple applications.

TEXTBOOKS:


REFERENCES:
2. Dromey R.G., “How to Solve it by Computer”, Pearson Education, Fourth Reprint,
   2007.

GE6152 ENGINEERING GRAPHICS
L T P C
2 0 3 4

OBJECTIVES:

• To develop in students, graphic skills for communication of concepts, ideas and
design of Engineering products.
• To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)
1
Importance of graphics in engineering applications – Use of drafting instruments – BIS
conventions and specifications – Size, layout and folding of drawing sheets – Lettering and
dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING
5+9
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction
of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 5+9
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+9
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+9
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+9
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only) 3
Introduction to drafting packages and demonstration of their use.  
TOTAL : 75 PERIODS

OUTCOMES:
On Completion of the course the student will be able to
• perform free hand sketching of basic geometrical constructions and multiple views of objects.
• do orthographic projection of lines and plane surfaces.
• draw projections and solids and development of surfaces.
• prepare isometric and perspective sections of simple solids.
• demonstrate computer aided drafting.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

GE6161                        COMPUTER PRACTICES LABORATORY     L T P C
                                  0 0 3 2

OBJECTIVES:
The student should be made to:
• Be familiar with the use of Office software.
• Be exposed to presentation and visualization tools.
• Be exposed to problem solving techniques and flow charts.
• Be familiar with programming in C.
• Learn to use Arrays, strings, functions, structures and unions.

LIST OF EXPERIMENTS:
1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Apply good programming design methods for program development.
• Design and implement C programs for simple applications.
• Develop recursive programs.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:
Standalone desktops with C compiler 30 Nos.

(or)
Server with C compiler supporting 30 terminals or more.

GE6162 ENGINEERING PRACTICES LABORATORY

OBJECTIVES:
- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 9

Buildings:
(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
   Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
   Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 13

Welding:
(a) Preparation of arc welding of butt joints, lap joints and tee joints.
(b) Gas welding practice

Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:
(a) Forming & Bending:
(b) Model making – Trays, funnels, etc.
(c) Different type of joints.

**Machine assembly practice:**
- (a) Study of centrifugal pump
- (b) Study of air conditioner

**Demonstration on:**
- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS)**

**III ELECTRICAL ENGINEERING PRACTICE**
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

**IV ELECTRONICS ENGINEERING PRACTICE**
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EOR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 45 PERIODS**

**OUTCOMES:**
- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

**REFERENCES:**

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**
CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos
   (b) Demolition Hammer 2 Nos
   (c) Circular Saw 2 Nos
   (d) Planer 2 Nos
   (e) Hand Drilling Machine 2 Nos
   (f) Jigsaw 2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

ELECTRICAL

1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos
   (b) Digital Live-wire detector 2 Nos

ELECTRONICS

1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply
OBJECTIVES:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. (a) Determination of Wavelength, and particle size using Laser  
   (b) Determination of acceptance angle in an optical fiber.  
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.  
3. Determination of wavelength of mercury spectrum – spectrometer grating  
5. Determination of Young’s modulus by Non uniform bending method  
6. Determination of specific resistance of a given coil of wire – Carey Foster’s Bridge

OUTCOMES:
- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Diode laser, lycopodium powder, glass plate, optical fiber.  
2. Ultrasonic interferometer  
3. Spectrometer, mercury lamp, grating  
4. Lee’s Disc experimental set up  
5. Traveling microscope, meter scale, knife edge, weights  
6. Carey foster’s bridge set up  
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY- I

OBJECTIVES:
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.  
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1 Determination of DO content of water sample by Winkler’s method.  
2 Determination of chloride content of water sample by argentometric method.  
3 Determination of strength of given hydrochloric acid using pH meter.  
4 Determination of strength of acids in a mixture using conductivity meter.  
5 Estimation of iron content of the water sample using spectrophotometer.  
   (1,10- phananthroline / thiocyanate method).  
6 Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.  
7 Conductometric titration of strong acid vs strong base.  

TOTAL: 30 PERIODS

OUTCOMES:
- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.
REFERENCES:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Iodine flask - 30 Nos
2. pH meter - 5 Nos
3. Conductivity meter - 5 Nos
4. Spectrophotometer - 5 Nos
5. Ostwald Viscometer - 10 Nos

Common Apparatus : Pipette, Burette, conical flask, pelasine tile, dropper (each 30 Nos.)

HS6251 TECHNICAL ENGLISH II L T P C
3 1 0 4

OBJECTIVES:
- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

UNIT I 9+3
Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using ‘emojis’ as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. ‘can’) - Homophones (e.g. ‘some’, ‘sum’); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II 9+3
Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for
his / her success, thanking one’s friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students’ dialogues.

UNIT III
9+3
Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. ‘rock’, ‘train’, ‘ring’); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

UNIT IV
9+3
Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V
9+3
Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
Learners should be able to
- speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
• listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

TEXTBOOKS:

REFERENCES:

EXTENSIVE Reading (Not for Examination)

Websites
2. http://owl.english.purdue.edu

TEACHING METHODS:
• Lectures
• Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
• Long presentations using visual aids
• Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
• Projects like group reports, mock interviews etc using a combination of two or more of the language skills

EVALUATION PATTERN:

Internal assessment: 20%
3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like
• Project
• Assignment
• Report
• Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.
✓ Speaking assessment: Individual presentations, Group discussions
✓ Reading assessment: Reading passages with comprehension questions graded following Bloom’s taxonomy
Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom’s taxonomy.

End Semester Examination: 80%

MA6251 MATHEMATICS – II L T P C
3 1 0 4

OBJECTIVES:
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS 9+3
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green’s theorem in a plane, Gauss divergence theorem and Stokes’ theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 9+3
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy’s and Legendre’s linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III LAPLACE TRANSFORM 9+3

UNIT IV ANALYTIC FUNCTIONS 9+3
Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w = z+k, kz, 1/z, z², eᶻ and bilinear transformation.

UNIT V COMPLEX INTEGRATION 9+3
Complex integration – Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula – Taylor’s and Laurent’s series expansions – Singular points – Residues – Cauchy’s residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).
OUTCOMES:
- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

TEXT BOOKS:

REFERENCES:

PH6251 ENGINEERING PHYSICS – II
L T P C
3 0 0 3

OBJECTIVES:
- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I  CONDUCTING MATERIALS 9

UNIT II  SEMICONDUCTING MATERIALS 9

UNIT III  MAGNETIC AND SUPERCONDUCTING MATERIALS 9
Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.
UNIT IV  DIELECTRIC MATERIALS  9

UNIT V  ADVANCED ENGINEERING MATERIALS  9

TOTAL: 45 PERIODS

OUTCOMES:
- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

TEXT BOOKS:

REFERENCES:

CY6251  ENGINEERING CHEMISTRY - II  L T P C
3 0 0 3

OBJECTIVES:
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

UNIT I  WATER TECHNOLOGY  9
Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

UNIT II  ELECTROCHEMISTRY AND CORROSION  9
Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors-types-chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control -
material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

UNIT III ENERGY SOURCES 9
Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H₂ -O₂ fuel cell- applications.

UNIT IV ENGINEERING MATERIALS 9
Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refactoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement– properties and uses. Glass - manufacture, types, properties and uses.

UNIT V FUELS AND COMBUSTION 9

OUTCOMES:
• The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:
2. DaraS.S,UmareS.S.”Engineering Chemistry”, S. Chand & Company Ltd., New Delhi , 2010

REFERENCES:
OBJECTIVES:
- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

UNIT I  ELECTRICAL CIRCUITS & MEASUREMENTS  12
Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II  ELECTRICAL MECHANICS  12

UNIT III  SEMICONDUCTOR DEVICES AND APPLICATIONS  12

UNIT IV  DIGITAL ELECTRONICS  12
Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V  FUNDAMENTALS OF COMMUNICATION ENGINEERING  12
Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 PERIODS

OUTCOMES:
- ability to identify the electrical components explain the characteristics of electrical machines.
- ability to identify electronics components and use of them to design circuits.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I  BASICS AND STATICS OF PARTICLES  12

UNIT II  EQUILIBRIUM OF RIGID BODIES  12

UNIT III  PROPERTIES OF SURFACES AND SOLIDS  12

UNIT IV  DYNAMICS OF PARTICLES  12

UNIT V  FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS  12
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. 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.

TOTAL : 60 PERIODS

OUTCOMES:
- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To develop skill to use software to create 2D and 3D models.

List of Exercises using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

OUTCOMES:
- ability to use the software packers for drafting and modeling
- ability to create 2D and 3D models of Engineering Components

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description of Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pentium IV computer or better hardware, with suitable graphics facility</td>
<td>30 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Licensed software for Drafting and Modeling.</td>
<td>30 Licenses</td>
</tr>
<tr>
<td>3.</td>
<td>Laser Printer or Plotter to print / plot drawings</td>
<td>2 No.</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of Young’s modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid – Poiseuille’s method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

OUTCOMES:
- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY - II

OBJECTIVES:
- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of alkalinity in water sample
2. Determination of total, temporary & permanent hardness of water by EDTA method
3. Estimation of copper content of the given solution by EDTA method
4. Estimation of iron content of the given solution using potentiometer
5. Estimation of sodium present in water using flame photometer
6. Corrosion experiment – weight loss method
7. Conductometric precipitation titration using BaCl₂ and Na₂SO₄

OUTCOMES:
• The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

REFERENCES:

• Laboratory classes on alternate weeks for Physics and Chemistry.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Potentiometer - 5 Nos
2. Flame photo meter - 5 Nos
3. Weighing Balance - 5 Nos
4. Conductivity meter - 5 Nos

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (30 Nos each)

GE6263 COMPUTER PROGRAMMING LABORATORY L T P C
0 1 2 2

OBJECTIVES:
The Students should be made to
• Be exposed to Unix shell commands
• Be familiar with an editor on Unix
• Learn to program in Shell script
• Learn to write C programme for Unix platform

LIST OF EXPERIMENTS
1. UNIX COMMANDS 15
Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING 15
Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX 15
Dynamic Storage Allocation- Pointers- Functions- File Handling

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students should be able to:
• Use Shell commands
- Design of Implement Unix shell scripts
- Write and execute C programs on Unix

**HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS**

**Hardware**
- 1 UNIX Clone Server
- 3 3 Nodes (thin client or PCs)
- Printer – 3 Nos.

**Software**
- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

**EL6302 ORGANIC CHEMISTRY**

**OBJECTIVE:**
To enable the students to learn the type of components in which organic reactions take place and also to know the preparation of the essential organic compounds.

**UNIT I ORGANIC REACTION MECHANISM**
Electrophilic reactions-Friedel crafts reaction, Riemer Tiemenn reaction, Beckmann rearrangements; nucleophilic reactions- aldol condensation, perkin reaction, benzoin condensation; free radical reaction-halogenation of alkane, addition of HBr on alkene in presence of peroxide; allylic halogenation - using N-Bromo Succinamide (NBS), thermal halogenation of alkene CH₃–CH = CH₂

**UNIT II CARBOHYDRATES**
Introduction – mono and disaccharides – important reactions – polysaccarides – starch and cellulose – derivatives of cellulose – carboxy methyl cellulose and gun cotton – structural aspects of cellulose

**UNIT III POLYNUCLEAR AROMATICS AND HETEROCYCLES**
Classification of polynuclear aromatics. naphthalene preparation, properties and uses. Classification of heterocyclic compounds. Furan, thiophene, pyridine preparation, properties and uses

**UNIT IV AMINO ACIDS AND PYRROLE**

**UNIT V DRUGS, PESTICIDES & DYES**
Classification and properties of drugs. Penicilian sulpha drugs, mode of action, synthesis of sulphanilamide, chloroquine and chloroamphenicol, pesticides - classes. Synthesis of DDT and methoxychlor.

**TOTAL: 45 PERIODS**

**OUTCOMES:**
At the end of the course students will have knowledge on various reaction mechanism, preparation of organic compounds and their properties.

**TEXT BOOKS:**
CH6404 MECHANICAL OPERATIONS LT CPC 3 0 0 3

OBJECTIVE:
The students will learn characterization of solids, size reduction, techniques of solid fluid separation and mixing

UNIT I 9
General characteristics of solids, different techniques of size analysis, shape factor, surface area determination, estimation of particle size. Screening methods and equipment, screen efficiency, ideal and actual screens.

UNIT II 9
Laws of size reduction, energy relationships in size reduction, methods of size reduction, classification of equipments, crushers, grinders, disintegrators for coarse, intermediate and fine grinding, power requirement, work index; size enlargement - principle of granulation, briquetting, pelletisation, and flocculation.

UNIT III 9
Gravity settling, sedimentation, thickening, elutriation, double cone classifier, rake classifier, bowl classifier. Centrifugal separation - continuous centrifuges, super centrifuges, design of basket centrifuges; industrial dust removing equipment, cyclones and hydro cyclones, electrostatic and magnetic separators, heavy media separations, floatation, jigging

UNIT IV 9
Theory of filtration, Batch and continuous filters, Flow through filter cake and filter media, compressible and incompressible filter cakes, filtration equipments - selection, operation and design of filters and optimum cycle of operation, filter aids.

UNIT V 9
Mixing and agitation - Mixing of liquids (with or without solids), mixing of powders, selection of suitable mixers, power requirement for mixing. Storage and Conveying of solids - Bunkers, silos, bins and hoppers, transportation of solids in bulk, conveyer selection, different types of conveyers and their performance characteristics.

TOTAL : 45 PERIODS

OUTCOME:
The students would understand about solids, their characterization, handling and various processes involving solids. The students will have knowledge on basic theory, calculations and machinery involved in various solid handling operations.

TEXT BOOKS:
EE6351 ELECTRICAL DRIVES AND CONTROLS

OBJECTIVES:
- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state drives.

UNIT I INTRODUCTION
Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

UNIT II DRIVE MOTOR CHARACTERISTICS
Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

UNIT III STARTING METHODS
Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES
Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C.DRIVES
Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications

TOTAL : 45 PERIODS

OUTCOME:
Students able to describe the structure of Electric Drive systems and their role in various applications such as flexible production systems, energy conservation, renewable energy, transportation etc., making Electric Drives an enabling technology.

TEXT BOOKS:

REFERENCES:
MA6351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

OBJECTIVES:
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS
Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS
Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV FOURIER TRANSFORMS

UNIT V Z-TRANSFORMS AND DIFFERENCE EQUATIONS

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOKS:
REFERENCES:

CH6403 CHEMICAL PROCESS CALCULATIONS

OBJECTIVE:
To teach concept of degree of freedom and its application to solution of mass and energy balance equations for single and network of units and introduce to process simulators.

UNIT I
Units, dimensions and conversion; Process variables and properties; Stoichiometric Equations, Degrees of freedom.

UNIT II
Introduction to material balances. Material balance problems for single units; Stoichiometry and Chemical reaction equations; material balance for processes involving reaction bypass, purging, recycle operations.

UNIT III
Ideal gases, Real gases, Single component two phase systems, Multiple component phase systems, Phase rule, Phase equilibria, Combustion processes.

UNIT IV

UNIT V
Application of energy balances. Unsteady state material and energy balances. Solving material and energy balances using process simulators.

TOTAL: 45 PERIODS

OUTCOME:
The students would be able to understand chemical engineering calculations, establish mathematical methodologies for the computation of material balances, energy balances.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
To enable the students to acquire knowledge in the field of electrochemistry, solubility behaviour, chemical reaction kinetics, photochemical reactions and colloidal chemistry towards different applications.

UNIT I ELECTROCHEMISTRY


UNIT II CHEMICAL KINETICS


UNIT III PHOTOCHEMISTRY


UNIT IV COLLOIDS


UNIT V THE DISTRIBUTION LAW


TOTAL : 45 PERIODS

OUTCOME:
Upon completion of this course, the students would understand the chemical equilibria, phase equilibria, electrochemical equilibria and biochemical reactions equilibria towards different applications.
TEXT BOOKS:

REFERENCES:

CH6311 ORGANIC CHEMISTRY LABORATORY

OBJECTIVE:
To learn basic principles involved in analysis and synthesis of different organic derivatives.

LIST OF EXPERIMENTS
1. Quantitative analysis of organic compounds – Identification of aliphatic/aromatic, saturated/unsaturated compounds.
2. Identification and characterization of various functional groups by their characteristic reactions:
   a) alcohol, b) aldehyde, c) ketone, d) carboxylic acid, e) phenol, f) ester, g) primary, secondary and tertiary amines h) imide i) nitro compounds.
5. Analysis of proteins.
6. Methodology of filtration and recrystallization.
7. Introduction to organic synthetic procedures:
   i. Acetylation – Preparation of acetanilide from aniline.
   ii. Hydrolysis – Preparation of salycilic acid from methyl salycilate. iii. Substitution – Conversion of acetone to iodoform.
   iv. Nitration – Preparation of m-dinitrobenzene from nitrobenzene.
   v. Oxidation – Preparation of benzoic acid from benzaldehyde/ benzyl alcohol

TOTAL : 45 PERIODS

OUTCOME:
The student is able to identify what distinguishes a strong and weak nucleophile and recall the rules of reactions. The student shows their mastery of nomenclature since ethyl bromide is not drawn out. The student analyzes a list of compounds and determines their reactivity.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS
1. Silica Crucible
2. Heating Mantle
3. Muffle Furnace
4. Hot air oven
5. Desiccator
6. Vacuum pump
7. Condenser
8. Reflux Condenser
REFERENCES:

EI6411  ELECTRICAL MACHINES LABORATORY  L T P C
                                  0 0 3 2

OBJECTIVE:
To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics and simulation of time response. To expose the students to the basic operation of electrical machines and help them to develop experimental skills.

LIST OF EXPERIMENTS
1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator.
3. Load test on D.C. shunt motor.
4. Load test on D.C. series motor.
5. Swinburne’s test
7. Load test on single phase transformer
8. Open circuit and short circuit tests on single phase transformer (Determination of equivalent circuit parameters).
9. Load test on single phase induction motor.
10. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
11. Load test on Three phase induction motor.
12. Study of Starters

TOTAL: 45 PERIODS

OUTCOME:
Ability to understand and analyze Instrumentation systems and their applications to various industries

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
1. DC Shunt Motor with Loading Arrangement – 3 nos
2. Single Phase Transformer – 4 nos
3. DC Series Motor with Loading Arrangement – 1 No.
4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 1 No.
6. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
7. DC Shunt Motor Coupled With DC Shunt Generator – 1 No.
8. Tachometer -Digital/Analog – 8 nos
9. Single Phase Auto Transformer – 2 nos
10. Three Phase Auto Transformer – 1 No.
11. Single Phase Resistive Loading Bank – 2 nos
12. Three Phase Resistive Loading Bank – 2 nos
13. SPST switch – 2 nos
OBJECTIVE:
The main objective is to make the engineering students well trained in drawing. So that he may be able to work in different fields such as in industry, department of sales or services or in the department of drawing and design etc.

DRAWING OF MACHINE
1. One drawing sheet of symbols and basic conventions of machine elements, materials and processes as per Indian and International Standards.
2. One drawing sheet of screw threads, screwed fastenings, cotter pin joints, pipe joints, knuckle joint, riveted and welded joints etc. (minimum two views of each component)
3. One drawing sheet on detail parts and their assembly of valves, couplings, clutches, brakes, pulleys, engine parts etc.
4. One drawing sheet based on AutoCAD with all three views for at least two machine elements / components mentioned above.

TOTAL : 45 PERIODS

OUTCOMES:
- Students will be able to understand the theory of projection.
- Students will be able to know and understand the conventions and the methods of machine drawing.
- Students will be able to improve their visualization skills so that they can apply these skills in developing new products.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
1. Pentium IV Computer or better hardware, with suitable graphics facility – 30 No.
2. Licensed software for drafting and modeling – 30 Licenses
3. Laser Printer or plotter to print / lot drawings – 2 No.

TEXT BOOKS:

REFERENCES:
- To know the method of finding slope and deflection of beams and trusses using energy theorems and to know the concept of analysing indeterminate beam
- To estimate the load carrying capacity of columns, stresses due to unsymmetrical bending and various theories for failure of material.

UNIT I  ENERGY PRINCIPLES  9
Strain energy and strain energy density – strain energy due to axial load, shear, flexure and torsion – Castiglialino’s theorems – Maxwell’s reciprocal theorems - Principle of virtual work – application of energy theorems for computing deflections in beams and trusses - Williot Mohr’s Diagram.

UNIT II  INDETERMINATE BEAMS  9
Concept of Analysis - Propped cantilever and fixed beams-fixed end moments and reactions – Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

UNIT III  COLUMNS AND CYLINDER  9
Euler’s theory of long columns – critical loads for prismatic columns with different end conditions; Rankine-Gordon formula for eccentrically loaded columns – Eccentrically loaded short columns – middle third rule – core section – Thick cylinders – Compound cylinders.

UNIT IV  STATE OF STRESS IN THREE DIMENSIONS  9

UNIT V  ADVANCED TOPICS IN BENDING OF BEAMS  9
Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Shear Centre - curved beams – Winkler Bach formula.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- students will have through knowledge in analysis of indeterminate beams and use of energy method for estimating the slope and deflections of beams and trusses.
- they will be in a position to assess the behaviour of columns, beams and failure of materials.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
To impart to the student knowledge on fluid properties, fluid statics, dynamic characteristics for through pipes and porous medium, flow measurement and fluid machineries

UNIT I  PROPERTIES OF FLUIDS AND CONCEPT OF PRESSURE  9

UNIT II  MOMENTUM BALANCE AND ITS APPLICATIONS  9

UNIT III  FLOW OF INCOMPRESSIBLE FLUIDS THROUGH DUCTS  9

UNIT IV  FLOW OF FLUIDS THROUGH SOLIDS  9

UNIT V  TRANSPORTATION AND METERING  9

TOTAL : 45 PERIODS

OUTCOME:
To develop a student’s skills in analyzing fluid flows through the proper use of modeling and the application of the basic fluid-flow principles.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
To learn heat transfer by conduction, convection and radiation and heat transfer equipments like evaporator and heat exchanger

UNIT I CONDUCTION

UNIT II CONVECTION

UNIT III RADIATION

UNIT IV HEAT EXCHANGERS
Heat exchanger types – Parallel and counter flow heat exchangers – Overall heat transfer coefficient – Log mean temperature difference for single pass – Correction factor for multi pass heat exchangers – Heat exchanger effectiveness – Number of transfer units – Chart for different configurations – Dirt factor.

UNIT V EVAPORATORS

TOTAL (L : 45 + T : 15) : 60 PERIODS

OUTCOME:
Students gain knowledge in various heat transfer methodology in process engineering and to design heat transfer equipments such as furnace, boilers, heat exchangers evaporator.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in Engineering and Technology.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 10+3

UNIT II INTERPOLATION AND APPROXIMATION 8+3
Interpolation with unequal intervals - Lagrange interpolation – Newton’s divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton’s forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One-dimensional heat-flow equation by explicit and implicit (Crank Nicholson) methods – One-dimensional wave equation by explicit method.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOME:
It helps the students to have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
To gain Knowledge on various aspects of production engineering and understand the practical methods of production in a chemical factory.

UNIT I  SULFUR, SULFURIC ACID AND CEMENT  9
Sulfur, Raw materials Sources, Mining and production of Sulfur – Sulfuric acid, Methods of production of Sulfuric acid – Contact process – Chamber process. Cement – properties of Cement – Methods of production – Overall factors for Cement industry.

UNIT II  FERTILIZER INDUSTRY, FUEL AND INDUSTRIAL GASES  9

UNIT III  PULP, PAPER, SUGAR AND STARCH INDUSTRIES  9

UNIT IV  PETROLEUM AND PETRO CHEMICAL INDUSTRIES  9

UNIT V  RUBBERS, POLYMERS AND SYNTHETIC FIBRE  9

TOTAL : 45 PERIODS

OUTCOME:
Student can classify the chemical process industry into industrial categories of base, intermediate end-products and specialty chemicals manufacturers.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
Students will learn PVT behaviour of fluids, laws of thermodynamics, thermodynamic property relations and their application to fluid flow, power generation and refrigeration processes.

UNIT I ZEROTH AND FIRST LAWS, PROPERTIES OF PURE SUBSTANCES 9

UNIT II APPLICATION OF I LAW TO STEADY - STATE PROCESSES, II LAW 9

UNIT III POWER CYCLES, THERMODYNAMIC POTENTIALS, EQUILIBRIA AND STABILITY 9

UNIT IV PROPERTIES OF PURE COMPONENTS AND MIXTURES 9

UNIT V PHASE EQUILIBRIA AND CHEMICAL REACTION EQUILIBRIA 9
Phase Equilibria of Mixtures. Osmotic pressure and Osmotic coefficients. Boiling point elevation and freezing point depression. Chemical Reaction Equilibria. Reaction extent and Independent reactions. Equilibrium criteria and equilibrium constant. Standard enthalpies and Gibbs free energy, temperature and pressure effects on reactions, heterogeneous reaction, multiple chemical reactions

TOTAL (L : 45 + T : 15) : 60 PERIODS

OUTCOME:
Understand the terminology associated with engineering thermodynamics. Understand the concepts of heat, work and energy conversion, and can calculate heat and work quantities for industrial processes.

TEXT BOOKS:
OBJECTIVE:
To improve the practical knowledge on the properties and characteristics of solvents and mixtures.

LIST OF EXPERIMENTS
1. Partition coefficient of iodine between two immiscible solvents,
2. Equilibrium constant of \( \text{KI} \) + \( \text{I}_2 \) \( \rightleftharpoons \) \( \text{KI}_3 \)
3. Phase diagram of binary system
4. Solubility curve for a ternary system
5. Verification of Ostwald dilution law
6. Galvanostatic / Potentiostatic polarisation measurements
7. Impedence measurements
8. Adsorption isotherm
9. Heat of solution
10. Determination of acid value in the given oils
11. Molecular weight determination

TOTAL: 60 PERIODS

OUTCOME:
The student is able to determine the properties and characteristics of solvents and mixtures.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS
1. Micro Calorimeter
2. Beckman Thermometers. Glasswares,
3. Thermometers 0 to 110 – 0°. Bottle Shakers .pH meters
5. Viscometers-Ostwald Cannan Ubbelholde. Voltage Stabiliser
6. Stalalmometer
7. Surface Tension Meter .Tape Heaters
8. Mantle Heaters
9. DC Power Supply. Thermostat. Cyrostats

REFERENCE:
AIM
To impart knowledge on mechanical operations by practice

OBJECTIVE:
Students develop a sound working knowledge on different types of crushing equipments and separation characteristics of different mechanical operation separators.

LIST OF EXPERIMENTS
1. Sieve analysis
2. Batch filtration studies using a Leaf filter
3. Batch filtration studies using a Plate and Frame Filter press
4. Characteristics of batch Sedimentation
5. Reduction ratio in Jaw Crusher
6. Reduction ratio in Ball mill
7. Separation characteristics of Cyclone separator
8. Reduction ratio of Roll Crusher
9. Separation characteristics of Elutriator
10. Reduction ratio of Drop weight crusher
11. Size separation using Sub-Sieving

TOTAL : 45 PERIODS

OUTCOME:
Student’s gain the practical knowledge and hands on various separation techniques like filtration, sedimentation, screening, elutriation, centrifugation principles which is having wide applications in various industries

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS
1. Sieve shaker
2. Leaf filter
3. Plate and Frame Filter Press
4. Sedimentation Jar
5. Jaw Crusher
6. Ball Mill
7. Cyclone Separator
8. Roll Crusher
9. Elutriator
10. Drop Weight Crusher

OBJECTION:
To learn experimentally to calibrate flow meters, find pressure loss for fluid flows and determine pump characteristics.

LIST OF EXPERIMENTS
1. Viscosity measurement of non Newtonian fluids
2. Calibration of constant and variable head meters
3. Calibration of weirs and notches
4. Open drum orifice and draining time
5. Flow through straight pipe
6. Flow through annular pipe
7. Flow through helical coil and spiral coil
8. Losses in pipe fittings and valves
9. Characteristic curves of pumps
10. Pressure drop studies in packed column
11. Hydodynamics of fluidized bed
12. Drag coefficient of solid particle

TOTAL : 45 PERIODS

OUTCOME:
Practical knowledge on the measurement of fluid flow and their characteristics at different operating conditions.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS
1. Viscometer
2. Venturi meter
3. Orifice meter
4. Rotameter
5. Weir
6. Open drum with orifice
7. Pipes and fittings
8. Helical and spiral coils
9. Centrifugal pump
10. Packed column
11. Fluidized bed

GE6351 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C 3 0 0 3

OBJECTIVES
To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12
Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem
diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II  ENVIRONMENTAL POLLUTION  10
Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry; Mitigation procedures- Control of particulate and gaseous emission, Control of SO2, NOx, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies –
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES  10
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – 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. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT  7
Public awareness.

UNIT V  HUMAN POPULATION AND THE ENVIRONMENT  6

TOTAL : 45 PERIODS

50
OUTCOMES:
Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS:

REFERENCES:

PM6501 MASS TRANSFER I

OBJECTIVE:
Students will learn to determine mass transfer rates under laminar and turbulent conditions.

UNIT I DIFFUSION

UNIT II INTERPHASE MASS TRANSFER
Interphase Mass Transfer – Local and overall mass transfer coefficients – Steady state co current and counter current mass transfer process – Stage and stage efficiencies – Concept of NTU and HTU – Equilibrium and operating lines – JD Factor– Equipments for gas-liquid contact operations – Bubble columns – Tray towers and packed towers.

UNIT III ABSORPTION

UNIT IV DRYING
Drying – Principle and definitions – Estimation of drying rates, drying rate curve – Critical and equilibrium moisture content – Calculation of drying time under constant drying conditions – Different types of dryers.
UNIT V  HUMIDIFICATION AND CRYSTALLIZATION


TOTAL : 45 PERIODS

OUTCOME:
Students apply the mass transfer concepts in the design of humidification columns, dryers and crystallisers.

TEXTBOOKS:

REFERENCES:

PC6503  PETROLEUM EXPLORATION AND EXPLOITATION TECHNIQUES  L T P C  3 1 0 4

OBJECTIVE:
To understand the stages of oil and gas exploration and production

UNIT I  ORIGIN AND OCCURRENCE OF PETROLEUM AND SEDIMENTARY ENVIRONMENT

UNIT II  EXPLORATION METHODS, WELL PROGNOSIS AND ECONOMIC ANALYSIS

UNIT III  GEOLOGICAL STRUCTURE AND GEOLOGGING

UNIT IV  DRILLING FLUIDS AND WORK COMPLETION

UNIT V OFF – SHORE TECHNOLOGY
Seismic technology – Sniffer survey – Drilling technology – Off-shore rigs – Primary and secondary enhanced oil recovery techniques and methods – Major well complication and Remedies.

TOTAL : 60 PERIODS

OUTCOME:
The student will get exposed to different geological and geophysical methods for exploration and exploitation of oil and gas

TEXT BOOKS:

REFERENCES:

PM6502 CHEMICAL REACTION ENGINEERING

OBJECTIVE:
To gain knowledge on different types of chemical reactors, the design of chemical reactors under isothermal and non-isothermal conditions

UNIT I NON – IDEAL REACTORS
Residence time distribution function and its measurement – Characteristics of tracer – Mean residence time – Conversion in non-ideal flow reactors.

UNIT II HETEROGENEOUS PROCESS AND SOLID CATALYSIS
Rate equation for heterogeneous reactions – Nature of catalysis – Adsorption isothermal and rates of adsorption – Desorption and surface reaction analysis of rate equation – Rate controlling steps.

UNIT III GAS – SOLID CATALYTIC REACTORS

UNIT IV GAS – SOLID NON – CATALYTIC REACTORS
UNIT V  GAS – LIQUID REACTIONS  9

TOTAL (L : 45 + T : 15) : 60 PERIODS

OUTCOME:
Students gain knowledge on the selection of the reactor for the reaction and its design.

TEXT BOOKS:

REFERENCES:

PE6606  NATURAL GAS ENGINEERING  L T P C
3 1 0 4

OBJECTIVE:
The objective of studying this subject is that student will be understanding the basic concept and applications of Natural Gas Engineering.

UNIT I  PROPERTIES AND COMPOSITION OF NATURAL GAS  9

UNIT II  ESTIMATION AND PRODUCTION OF NATURAL GAS  9

UNIT III  GAS FROM CONDENSATE OIL FIELDS  9
Processing of condensate well fluids – Cycling of gas condensate reservoirs – Sweep patterns – Katy cycling plant.

UNIT IV  ACID GAS TREATING OF NATURAL GAS  9
Acid gas removal: Metal oxide process – Slurry process – Amine process – Carbonate washing process – Methanol based process and other process – Sulphur recovery process.

UNIT V  DEHYDRATION OF NATURAL GAS AND NGL RECOVERY  9
Dehydration: Glycol dehydration – Solid desiccant dehydration.

TOTAL (L : 45 + T : 15) : 60 PERIODS

OUTCOME:
Students learn the Natural gas processing, Gas Compression, Gas Gathering and Transport Installation, Operation and trouble shooting of natural gas pipelines.

**TEXT BOOKS:**

**REFERENCES:**

---

**PC6401 MATERIALS TECHNOLOGY**

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**OBJECTIVE:**
To provide students with a strong foundation in materials science with emphasis on the fundamental scientific and engineering principles which underlie the knowledge and implementation of material structure, processing, properties, and performance of all classes of materials used in engineering systems.

**UNIT I STRUCTURE OF MATERIALS**
9
Introduction-classification of materials, selection of materials, properties of materials, x-ray crystallography, Bragg’s law, x-ray diffraction, electron diffraction, neutron diffraction, structure of NaCl and diamond, Crystal defects - point, line, surface and volume defects, alloy formation, solid solution types, solidification of castings, structural examination using microscopy.

**UNIT II METALLURGICAL PROPERTIES OF MATERIALS**
9

**UNIT III TYPES OF MATERIALS**
9

**UNIT IV PHYSICAL CHARACTERISTICS OF MATERIALS**
9

**UNIT V NON-METALLIC MATERIALS**
9

**TOTAL : 45 PERIODS**
OUTCOME:
Students will be able to understand various material and its properties and manufacturing methods.

TEXT BOOKS:

REFERENCES:

CH6611 HEAT TRANSFER LABORATORY L T P C
0 0 3 2

OBJECTIVE:
Students develop a sound working knowledge on different types of heat transfer equipments.

LIST OF EXPERIMENTS
1. Performance studies on Cooling Tower
2. Batch drying kinetics using Tray Dryer
3. Heat transfer in Open Pan Evaporator
4. Boiling Heat Transfer
5. Heat Transfer through Packed Bed
6. Heat Transfer in a Double Pipe Heat Exchanger
7. Heat Transfer in a Bare and Finned Tube Heat Exchanger
8. Heat Transfer in a Condenser
9. Heat Transfer in Helical Coils
10. Heat Transfer in Agitated Vessels

TOTAL : 45 PERIODS

OUTCOME:
Student should be able to calculate heat transfer by conduction, different types of convection using classical models for these phenomena

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS
1. Cooling Tower
2. Tray Dryer
3. Open Pan Evaporator
4. Boiler
5. Packed Bed
6. Double Pipe Heat Exchanger
7. Bare and Finned Tube Heat Exchanger
8. Condenser
9. Helical Coil
10. Agitated Vessel

CH6411 TECHNICAL ANALYSIS LABORATORY L T P C
0 0 3 2

OBJECTIVE:
To learn basic principles involved in estimation and characterization of industrially important materials.

**LIST OF EXPERIMENTS**

I. **Soap Analysis**
   a. Estimation of total fatty acid
   b. Estimation of percentage alkali content

II. **Oil Analysis**
   a. Estimation of free acid
   b. Determination of Saponification value
   c. Determination of iodine value

III. **Cement Analysis**
   a. Estimation of Silica content
   b. Estimation of mixed oxide content
   c. Estimation of calcium oxide content
   d. Estimation of calcium oxide by rapid method

IV. **Coal Analysis**
   a. Estimation of Sulphur present in coal
   b. Ultimate analysis of coal
   c. Proximate analysis of coal

V. **Analysis of Bleaching Powder**
   a. Estimation of available chlorine

VI. **Analysis of Glycerol**
   a. Estimation of purity of glycerol

VII. **Analysis of fuels**
   a. Flash point b. Fire point c. Cloud point d. Pour point e. Aniline point.

VIII. Determination of the molecular weight of the polymer by viscometry.
IX. **Calorimetric measurements**
X. **Conductivity measurement of an electrolyte solution**
XI. **pH measurements**

**TOTAL : 45 PERIODS**

**OUTCOME:**
At the end of this practical course, the student would have a thorough understanding on the estimation and analysis of chemical compounds.

**LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS**
1. Silica Crucible
2. Heating Mantle
3. Muffle Furnace
4. Hot air oven
5. Desiccator
6. Vacuum pump
7. Condenser
8. Reflux Condenser
9. Pensky martens closed cup apparatus
10. Cleveland open cup apparatus
11. Cloud point apparatus
12. Aniline point apparatus
13. Saybolt Viscometer
14. Redwood viscometer
15. Bomb Calorimeter
16. Junkers gas Calorimeter
17. Conductivity meter
18. pH meter

GE6674 COMMUNICATION AND SOFT SKILLS- LABORATORY BASED


OBJECTIVES:

To enable learners to,

- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

UNIT I LISTENING AND SPEAKING SKILLS

Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.

UNIT II READING AND WRITING SKILLS

Reading different genres of tests ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS

International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service(Language related)- Verbal Ability.

UNIT IV INTERVIEW SKILLS

Different types of Interview format- answering questions- offering information- mock interviews-body language( paralinguistic features)- articulation of sounds- intonation.

UNIT V SOFT SKILLS

Motivation- emotional intelligence-Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership straits-team work- career planning - intercultural communication- creative and critical thinking

TOTAL: 60 PERIODS
Teaching Methods:

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for graining proficiency and better participation in the class.

Lab Infrastructure:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description of Equipment (minimum configuration)</th>
<th>Qty Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Server</strong></td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>• PIV System</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 1 GB RAM / 40 GB HDD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• OS: Win 2000 server</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Audio card with headphones</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• JRE 1.3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><strong>Client Systems</strong></td>
<td>60 Nos.</td>
</tr>
<tr>
<td></td>
<td>• PIII or above</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 256 or 512 MB RAM / 40 GB HDD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• OS: Win 2000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Audio card with headphones</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• JRE 1.3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Handicam</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>Television 46”</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>Collar mike</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>Cordless mike</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Audio Mixer</td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td>DVD recorder/player</td>
<td>1 No.</td>
</tr>
<tr>
<td>9</td>
<td><strong>LCD Projector with MP3/CD/DVD provision for Audio/video facility</strong></td>
<td>1 No.</td>
</tr>
</tbody>
</table>

Evaluation:

**Internal: 20 marks**

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

**External: 80 marks**
<table>
<thead>
<tr>
<th>Assessment</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Test</td>
<td>35</td>
</tr>
<tr>
<td>Interview</td>
<td>15</td>
</tr>
<tr>
<td>Presentation</td>
<td>15</td>
</tr>
<tr>
<td>Group Discussion</td>
<td>15</td>
</tr>
</tbody>
</table>

**Note on Internal and External Evaluation:**

1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking – example for role play:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics.
4. Discussion – topics of different kinds; general topics, and case studies.

**OUTCOMES:**

At the end of the course, learners should be able to

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews.

**REFERENCES:**

2. *Graded Examinations in Spoken English and Spoken English for Work* downloadable materials from Trinity College, London.
4. Interactive Multimedia Programs on Managing Time and Stress.

**Web Sources:**

http://www.slideshare.net/rohitjsh/presentation-on-group-discussion
http://www.washington.edu/doit/TeamN/present_tips.html
http://www.oxforddictionaries.com/words/writing-job-applications
http://www.kent.ac.uk/careers/cv/coveringletters.htm
http://www.mindtools.com/pages/article/newCDV_34.htm
OBJECTIVE:
Students will learn to design absorber and stripper, distillation column, extraction and leaching equipments and adsorber.

UNIT I  ABSORPTION  9
Gas Absorption and Stripping – Equilibrium; material balance; limiting gas-liquid ratio; tray tower absorber - calculation of number of theoretical stages, tray efficiency, tower diameter; packed tower absorber – rate based approach; determination of height of packing using HTU and NTU calculations.

UNIT II  DISTILLATION  9
Vapour liquid equilibria - Raoult’s law, vapor-liquid equilibrium diagrams for ideal and non-ideal systems, enthalpy concentration diagrams. Principle of distillation - flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by McCabe - Thiele method and Ponchan - Savarit method, Total reflux, minimum reflux ratio, optimum reflux ratio. Introduction to multi-component distillation, azeotropic and extractive distillation

UNIT III  LIQUID-LIQUID EXTRACTION  9
Liquid - liquid extraction - solvent characteristics-equilibrium stage wise contact calculations for batch and continuous extractors- differential contact equipment-spray, packed and mechanically agitated contactors and their design calculations-packed bed extraction with reflux. Pulsed extractors, centrifugal extractors-Supercritical extraction

UNIT IV  LEACHING  9
Solid-liquid equilibria- leaching equipment for batch and continuous operations- calculation of number of stages - Leaching - Leaching by percolation through stationary solid beds, moving bed leaching, counter current multiple contact (shank’s system), equipments for leaching operation, multi stage continuous cross current and counter current leaching, stage calculations, stage efficiency.

UNIT V  ADSORPTION AND ION EXCHANGE & MEMBRANE SEPARATION PROCESS  9
Adsorption - Types of adsorption, nature of adsorbents, adsorption equilibria, effect of pressure and temperature on adsorption isotherms, Adsorption operations - stage wise operations, steady state moving bed and unsteady state fixed bed adsorbers, break through curves. Principle of Ion exchange, techniques and applications. Solid and liquid membranes; concept of osmosis; reverse osmosis; electro dialysis; ultrafiltration.

TOTAL (L : 45 + T : 15) : 60 PERIODS

OUTCOME:
Students will learn to design absorber and stripper, distillation column, extraction and leaching equipments and adsorber

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
To introduce of open and closed loop systems and its responses, control loop components and stability of control systems along with instrumentation.

UNIT I INSTRUMENTATION
Principles of measurements and classification of process instruments, measurement of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity, pH, concentration, electrical and thermal conductivity, humidity of gases.

UNIT II OPEN LOOP SYSTEMS
Laplace transformation and its application in process control. First order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag.

UNIT III CLOSED LOOP SYSTEMS
Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatory problems, transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transient response of closed-loop control systems and their stability.

UNIT IV FREQUENCY RESPONSE
Introduction to frequency response of closed-loop systems, control system design by frequency response techniques, Bode diagram, stability criterion, tuning of controllers Z-N tuning rules, C-C tuning rules.

UNIT V ADVANCED CONTROL SYSTEMS
Introduction to advanced control systems, cascade control, feed forward control, Smith predictor, control of distillation towers and heat exchangers, introduction to computer control of chemical processes.

OUTCOME:
Students will understand and discuss the importance of process control in process operation and the role of process control engineers. They also understand and design the modern hardware and instrumentation needed to implement process control.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
To develop skill to design and install process equipments used widely in a chemical industry. All Tables/ Chemical Engineers’ Handbook/Data Books/Graph Sheets are permitted during the Examination.

UNIT I DESIGN OF PIPE FITTINGS AND JOINTS 9
Design and schematic of simple bolts and screws – Riveted joints – Design and drawing of shafts and couplings.

UNIT II DESIGN OF REACTION VESSEL AND STORAGE TANK 9
Design and schematic of storage tank, (vertical and horizontal) supports, agitated vessel.

UNIT III DESIGN OF HIGH PRESSURE SYSTEMS 9
Design of high pressure vessels and reactors.

UNIT IV DESIGN OF PHASE SEPARATION EQUIPMENT 9
Design of physical separation equipments such as cyclones, centrifuges, thickeners, filtration equipment

UNIT V DRAWING OF HEAT EXCHANGERS AND COLUMNS 9
Drawing of physical process equipments such as double pipe heat exchangers – Shell and tube heat exchangers – Plate and frame heat exchangers – Distillation columns and reactors.

TOTAL : 45 PERIODS

OUTCOME:
Students skill to design and install process equipments used widely in a chemical industry.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
To learn the testing of petroleum products, crude processing and treatment techniques

UNIT I  GENERAL  9

UNIT II  TESTING OF PETROLEUM PRODUCTS  9

UNIT III  CRUDE PROCESSING  9

UNIT IV  LUBE DISTILLATE TREATMENT TECHNIQUES  9
Treatment techniques for vacuum distillates with different processes like solvent extraction – Deasphalting, dewaxing, hydrofining, catalytic dewaxing and clay contact process – Production of lubricating oils.

UNIT V  BITUMEN PROCESSING and FINAL TREATMENT TECHNIQUES  9
Asphalt manufacture, Air blowing technology, Bitumen Types and their properties, Acid gas removal and sulphur removal techniques.

TOTAL : 45 PERIODS

OUTCOME:
Students able to understand the principles of crude processing and various treatment techniques.

TEXT BOOKS:

REFERENCES:

PM6603  WATER TREATMENT AND MANAGEMENT  L T P C  3 0 0 3

OBJECTIVE:
To focus on the wastewater transport system and the theory and design technique for the wastewater treatment process.

UNIT I  INTERNAL TREATMENT PROCESS  9

UNIT II  EXTERNAL TREATMENT PROCESS  9

UNIT III  BOILER WATER AND COOLING WATER  9

UNIT IV  WASTE WATER TREATMENT  9

UNIT V  WATER MANAGEMENT IN INDIA  9

TOTAL : 45 PERIODS

OUTCOME:
The students would have learnt the physical/chemical/biological characteristics and evaluation technique for sewage. They would understand the theory, engineering application, and design technique for the wastewater treatment unit process

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
To understand the working principles of different instruments, and its applications.

UNIT I  INTRODUCTION TO INSTRUMENTS, CHARACTERISTICS AND SIGNAL CONDITIONING
Introduction to Instruments and Their representation: Introduction, Elements, Classification, Standards, Calibration procedures Static and Dynamic Characteristics of Instruments, Specification of static characteristics, Selection of instruments, Forcing functions, Formulation of First order and second order system equations, Dynamic response Principals of Analog signal conditioning, converters, guidelines for analog signal conditioning design, Principles of digital signal conditioning, computer interface, DACs, ADCs, DAS hardware, DAS software, characteristics of digital data

UNIT II  TEMPERATURE, PRESSURE, LEVEL MEASUREMENTS
Temperature measurement: Temperature scales, Non electrical methods, Electrical methods, Radiation methods
Pressure measurement: Moderate pressure measurement, High pressure measurement, vacuum measurement
Level measurement: measurement techniques for Liquids and slurries, advance measurement techniques

UNIT III  FLOW MEASUREMENTS AND STUDY OF VALVES
Flow measurement: Introduction, Review of Venturimeter, orifice meters, rotameters, Pitot tube, working of turbine, vortex shedding, electromagnetic flow meters
Introduction to Advanced flow measurement techniques: Hot Wire anemometer, Laser Doppler anemometer, Ultrasound, Particle image Velocimetry
Study of Valves: Types of Valves, Actuators, Positioners, Valve characteristics, Controllability and Rangeability, Cavitation, Flashing, choking, Valve Sizing for incompressible fluids, compressible fluids, Two phase flows

UNIT IV  INTRODUCTION TO QUALITY CONTROL AND ANALYTICAL TECHNIQUES
Miscellaneous measurements and analysis: density, viscosity, Refractometer, pH and redox potential measurements. Thermal conductivity gas analyzers. Oxygen determination. Orsat analysis

UNIT V  WORKING AND INTERPRETATION OF INSTRUMENTAL ANALYTICAL METHODS : I
Spectroscopic techniques: Atomic Absorption, X-ray, inductively coupled argon plasma (ICAP), ultraviolet – visible (UV-VIS), fluorescence, infrared (IR), Raman spectroscopy, mass spectrometry (MS), nuclear magnetic resonance (NMR)
Chromatographic Techniques: gas chromatography (GC), high pressure liquid chromatography, gel permeation chromatography (GPC), thin layer chromatography (TLC), super criticle fluid chromatography (SFC)
Classification of spectroscopic and chromatographic techniques for Analysis of fuels

Working and Interpretation of Instrumental analytical methods: II
Lubricant Analysis: constituents of lubricants, characterization of lubricants by analytical techniques, importance of elemental analysis in lubricants

TOTAL : 45 PERIODS
OUTCOME:
Students gain an knowledge about the Qualitative and quantitative instrument analysis of different materials.

TEXT BOOKS:

REFERENCES:

PM6611 MASS TRANSFER LABORATORY L T P C 0 0 3 2

OBJECTIVE:
Students develop a sound working knowledge on different types of mass transfer equipments.

LIST OF EXPERIMENTS

1. Separation of binary mixture using Simple distillation
2. Separation of binary mixture using Steam distillation
3. Separation of binary mixture using Packed column distillation
4. Measurement of diffusivity
5. Liquid-liquid extraction
6. Drying characteristics of Vacuum dryer
7. Drying characteristics of Tray dryer
8. Drying characteristics of Rotary dryer
9. Water purification using ion exchange columns
10. Mass transfer characteristics of Rotating disc contactor
11. Estimation of mass/heat transfer coefficient for cooling tower
12. Demonstration of Gas – Liquid absorption

TOTAL : 45 PERIODS

OUTCOME:
Students will impart knowledge on the determination of important data for the design and operation of the process equipment's like distillation, extraction, diffusivity, drying principles which are having wide applications in various industries

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS
1. Simple distillation setup
2. Steam distillation setup
3. Packed column
4. Liquid-liquid extractor
5. Vacuum Dryer
6. Tray dryer
7. Rotary dryer
8. Ion exchange column
9. Rotating disc contactor
10. Cooling tower
11. Absorption column

Minimum 10 experiments shall be offered.

PM6612 PETROLEUM PHYSICAL PROPERTIES TESTING L T P C
LABORATORY 0 0 3 2

OBJECTIVE:
Students learn the determination of flash point, cloud point, smoke point, viscosity etc.

LIST OF EXPERIMENTS
1) Determination of flash point using Abel's Flash Point Apparatus.
2) Determination of flash point using Pensky Marten Flash Point Apparatus.
3) Determination of viscosity using Red Wood Viscometer
4) Determination of viscosity using Engler Viscometer.
5) Determination of viscosity using Saybolt Viscometer.
6) Determination of Cloud and Pour Point
7) Determination of Smoke Point
8) Penetration Test
9) Copper Strip Corrosion Test
10) Junker's Gas Calorimeter

TOTAL : 45 PERIODS

OUTCOME:
Students gain the practical knowledge on different petroleum testing methods

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS
1. Abel's Flash Point Apparatus
2. Pensky Marten Flash Point Apparatus.
3. Pensky Marten Flash Point Apparatus
4. Red Wood Viscometer
5. Engler Viscometer.
7. Junker's Gas Calorimeter

PC6712 CHEMICAL REACTION ENGINEERING LABORATORY L T P C
LABORATORY 0 0 3 2

OBJECTIVE:
To gain knowledge in the design of reactors.

LIST OF EXPERIMENTS
1. Kinetic studies in a Batch reactor
2. Kinetic studies in a Plug flow reactor
3. Kinetic studies in a CSTR
4. Kinetic studies in a Packed bed reactor
5. Kinetic studies in a PFR followed by a CSTR
6. RTD studies in a PFR  
7. RTD studies in a Packed bed reactor  
8. RTD studies in a CSTR  
9. Studies on micellar catalysis  
10. Study of temperature dependence of rate constant using CSTR.  
11. Kinetic studies in Sono chemical reactor  
12. Batch reactive distillation  
13. Kinetics of photochemical reaction  
14. Demonstration of heterogeneous catalytic reaction  
15. Demonstration of gas-liquid reaction  

TOTAL : 45 PERIODS

OUTCOME:  
Students develop a sound working knowledge on different types of reactors.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS  
1. Batch Reactor  
2. Plug flow reactor  
3. CSTR  
4. Sono-chemical reactor  
5. Photochemical reactor  
6. Packed bed reactor  

*Minimum 10 experiments shall be offered.

CH6702 TRANSPORT PHENOMENA L T P C  
3 0 0 3

OBJECTIVE:  
Different types of Fluids, their flow characteristics and different mathematical models are analysed and applied to actual situations. This subject helps the students to understand the mechanism of fluids in motion under different conditions.

UNIT I TRANSPORT PHENOMENA BY MOLECULAR MOTION  
Importance of transport phenomena; analogous nature of transfer process; basic concepts, conservation laws; continuous concept, field, reference frames, substantial derivative and boundary conditions; methods of analysis; differential, integral and experimental methods. Phenomenological laws of transport properties Newtonian and non Newtonian fluids; rheological models; theories of transport properties of gases and liquids; effect of pressure and temperature.

UNIT II ONE DIMENSIONAL TRANSPORT IN LAMINAR FLOW (SHELL BALANCE)  
General method of shell balance approach to transfer problems; Choosing the shape of the shell; most common boundary conditions; momentum flux and velocity distribution for flow of Newtonian and non-Newtonian fluids in pipes for flow of Newtonian fluids in planes, slits and annulus heat flux and temperature distribution for heat sources such as electrical, nuclear viscous and chemical; forced and free convection; mass flux and concentration profile for diffusion in stagnant gas, systems involving reaction and forced convection.

UNIT III EQUATIONS OF CHANGE AND THEIR APPLICATIONS  
Conservation laws and equations of change; Development of equations of continuity motion and energy in single multicomponents systems in rectangular co-ordinates and the forms in curvilinear co-ordinates; simplified forms of equations for special cases, solutions of
momentum mass and heat transfer problems discussed under shell balance by applications of equation of change, scale factors; applications in scale-up

UNIT IV TRANSPORT IN TURBULENT AND BOUNDARY LAYER FLOW

Turbulents phenomena; phenomenological relations for transfer fluxes; time smoothed equations of change and their applications for turbulent flow in pipes; boundary layer theory; laminar and turbulent hydrodynamics thermal and concentration boundary layer and their thicknesses; analysis of flow over flat surface.

UNIT V ANALOGIES BETWEEN TRANSPORT PROCESSES

Importance of analogy; development and applications of analogies between momentum and mass transfer; Reynolds, Prandtl, Von Karman and Colburn analogies.

OUTCOME:
Students gain the knowledge of fundamental connections between the conservation laws in heat, mass, and momentum in terms of vector and tensor fluxes.

TEXT BOOKS:

REFERENCES:

PM6701 EQUIPMENT DESIGN AND DRAWING II

L T P C
2 0 2 4

AIM
To gain practical knowledge on the shape and drawing of the process equipments

OBJECTIVE:
To become a design engineers on process equipments design and drawing consideration of the following:-

UNIT I THERMODYNAMIC PROPERTIES EVALUATION FOR DESIGN

UNIT II  HEAT EXCHANGER DESIGN  9

UNIT III  EVAPORATOR DESIGN  9

UNIT IV  COLUMN DESIGN  9
Design of distillation columns and Absorption columns.

UNIT V  PUMPS, FANS AND COMPRESSORS  9
Pumps, fans and compressors – Types and its applications – Characteristics – Piping and pressure drop calculations – Performance analysis of pumps, fans and compressors.

TOTAL : 45 PERIODS

OUTCOME:
Students gain the knowledge to develop key concepts and techniques to design, process equipment in a process plant. These key concepts can be utilized to make design and operating decisions.

TEXT BOOKS:

REFERENCES:

PM6702  PETROLEUM SECONDARY PROCESSING TECHNOLOGY  L T P C  3 0 0 3

OBJECTIVE:
Students learn the refining operations like cracking, reforming, alkylation, isomerization and coking

UNIT I  CRACKING  9
UNIT II CATALYTIC REFORMING 9

UNIT III ALKYLATION AND ISOMERIZATION 9

UNIT IV COKEING 9
Methods of Petroleum Coke Production – Koppers, Thermal Cracking, Delaye Coking, Fluid Coking and Contact Coking. Hydro Cracking- principles, reactions in Hydro Cracking, Catalyst, Hydro Cracking Reaction Conditions, Iso Max Processes and Hydro Desulphurization Processes.

UNIT V ASPHALT TECHNOLOGY 9

TOTAL : 45 PERIODS

OUTCOME:
Student attain the detailed knowledge on petroleum refining operations.

TEXT BOOKS:

REFERENCES:

PM6703 PETROCHEMICAL UNIT PROCESSES L T P C
3 0 0 3

OBJECTIVE:
To design and conduct experiments and analyze and interpret data related to petrochemical Unit processes

UNIT I FEED STOCK AND SOURCE OF PETROCHEMICALS 9
Overview of Petrochemical Industry – The key growth area of India, Economics – Feed stock selections for Petrochemicals – Steam cracking of Gas and Naphtha to produce Olefins, Diolefins and Production of Acetylene – Cracker product separation and BTX separation.

UNIT II SYNTHESIS GAS PRODUCTION 9
Steam reforming of Natural gas – Naphtha and Heavy distillate to produce Hydrogen and Synthesis gas – Production of Methanol – Oxo process.
UNIT III  UNIT PROCESSES I
Fundamental and Technological principles involved in Alkylation – Oxidation – Nitration and Hydrolysis.

UNIT IV  UNIT PROCESSES II
Fundamental and Technological principles involved in Sulphonation, Sulfation and Isomerisation.

UNIT V  UNIT PROCESSES III
Fundamental and Technological principles involved in Halogenation and Esterification

TOTAL : 45 PERIODS

OUTCOME:
Students able to understand the principles of various unit processes in the petrochemical industry.

TEXT BOOKS:

REFERENCES:

PM6704  REFINERY PROCESS DESIGN  L T P C
3 0 0 3

OBJECTIVE:
To get acquainted with process design of distillation columns involving multicomponent and complex mixtures. To learn methodologies practiced in rating and designing heat transfer equipment used in refining and process industry.

UNIT I  MULTICOMPONENT DISTILLATION
Dew point and bubble point for multi component mixtures. Design of multi component distillation column, Number of variables, Selection of key components, Selection of column pressure, Feed condition, Plate-to-plate calculations, Empirical short cut methods, Introduction to rigorous solution procedures.

UNIT II  PETROLEUM REFINERY DISTILLATION
TBP, EFV, ASTM distillation curves and their relevance, Material balance and flash zone calculations for petroleum refinery distillation columns, Pump around and pump back calculations, Overall energy requirements, Estimation of number of equilibrium stages, Design using Packie charts and Watkins method, Introduction to rigorous solution procedure based on pseudo components.

UNIT III  COLUMN DESIGN
UNIT IV    FIRED HEATERS
Heat load calculations for furnace heaters used in crude refining, Basic constructional features, Different furnace types, Review of factors to be considered in the design of fired heaters, Introduction to manual calculations methods.

UNIT V    PUMPS AND COMPRESSORS
Types of pumps and compressors. Selection criteria. Power rating calculations based on process duty. Use of operating curves of centrifugal pump. NPSHR and NPSHA. Pump Cavitation. Surge problem in compressors.

TOTAL : 45 PERIODS

OUTCOME:
Students learn process design aspects related to distillation column, Fired Heaters, pumps and compressors

TEXT BOOKS:

EL6713    PROCESS DYNAMICS AND CONTROL LABORATORY

OBJECTIVE:
To train the students to determine experimentally the methods of controlling the processes including measurements using process simulation techniques.

LIST OF EXPERIMENTS
1. Response of first order system
2. Response of second order system
3. Response of Non-Interacting level System
4. Response of Interacting level System
5. Open loop study on a thermal system
6. Closed loop study on a level system
7. Closed loop study on a flow system
8. Closed loop study on a thermal system
9. Tuning of a level system
10. Tuning of a pressure system
11. Tuning of a thermal system
12. Flow co-efficient of control valves
13. Characteristics of different types of control valves
14. Closed loop study on a pressure system
15. Tuning of pressure system
16. Closed loop response of cascade control system
*Minimum 10 experiments shall be Offered.

TOTAL : 45 PERIODS

OUTCOME:
Upon completion of this practical course, the students would know development and use of right type of control dynamics for process control under different operative conditions.
LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

1. U tube manometer with controller
2. Interacting Tank
3. Non Interacting Tank
4. Open loop control system
5. Closed loop control system
6. ON/OFF controller
7. Control valve characteristics
8. Pressure Tuner
9. Temperature Tuner
10. Proportional Controller
11. Flow Transmitter
12. Level Transmitter
13. Cascade control system

PM6711 PETROCHEMICAL ANALYSIS LABORATORY

OBJECTIVE:
To learn basic principles involved in analysis of petrochemical products.

LIST OF EXPERIMENTS
1. Sulphur content determination
2. Flue gas Analysis – Orsat Apparatus
3. Aromatic Content determination
4. Hydrogen sulphide content determination
5. Mercaptan as sulphur estimation apparatus
6. Determination of Lead, Acid and Salt content
7. separation from lubricating Grease (Oil Separation Apparatus)
8. Analysis of petrochemicals using UV spectrophotometer
9. Analysis of petrochemicals using NMR with MS
10. Analysis of petrochemicals using Gas chromatography
11. Biodegradation of petrochemicals
12. Bioremediation of petrochemicals
13. Refractive index of petrochemicals
14. Determination of moisture content – KF titrator
15. Total acidity determination

TOTAL : 45 PERIODS

OUTCOME:
Students would have knowledge about characterization of oil and lubricants and apply their knowledge in industries.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS
1. Bomb calorimeter
2. Orsat apparatus
3. Aniline point apparatus
4. UV- Visible spectrophotometer.
5. Gas Chromatography.
OBJECTIVE:
To learn basic principles involved in determination of flash point, cloud point, aniline point, viscosity etc.

LIST OF EXPERIMENTS

1. Determination of aniline point and diesel index
2. Softening point of bitumen by ring and ball method
3. Ductility and penetration number of bitumen
4. Rust preventing characteristics of lube oil
5. Drop point of greases
6. Cloud and pour point determination
7. Smoke point determination
8. Copper corrosion testing of petroleum products
9. Sediment content of crude oil and fuel oils
10. Coking tendency of oil
11. Saybolt color of petroleum products / lovi band tintometer
12. Water separability of petroleum products
13. Refractive index of petroleum products
14. Hydrocarbon types in petroleum products
15. Carbon residue determination
16. Oxidation stability of gasoline and ATF
17. Bearing and grease noise characteristics

TOTAL: 45 PERIODS

OUTCOME:
Students would have knowledge about the lubricants and use of right type of lubricant in different machines.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

1. Abel’s Flash point apparatus
2. Penky morten Flash point apparatus
3. Red wood viscometer
4. Sayboh viscometer
5. Cloud and pour point apparatus.

OBJECTIVE:
The objective of this course is to teach principles of cost estimation, feasibility analysis, management, organization and quality control that will enable the students to perform as efficient managers.

UNIT I  ENGINEERING FLOW DIAGRAMS AND SAFETY ASPECTS  9
selection, color code of pipeline, Equipment datasheets, Layout engineering (Plot Plan)

Safety in Process and Plant Design: Intrinsic / extrinsic safety, Safety of personnel, equipment
and plant classification of plant areas, Fire protection systems, Flare systems, Safety relief
valves, Flame arrestors, rupture disc and explosion venting etc., Health, Safety and
Environmental hazards, Loss Prevention: Hazard Assessment Techniques: HAZOP, HAZAN,
Fault Tree Analysis, etc

UNIT II PROJECT ENGINEERING
Project Management and Statutory Regulations: Site Layout, Plant Layout, Battery Limits
and Off Site Facilities, Stages of project, Use of Milestone chart / GANT chart/BAR chart,
PERT and CPM techniques for project monitoring and control, Preparation of project reports
(Feasibility Reports), Annual report of a company.

UNIT III OVERVIEW OF PROCESS ECONOMICS
Economic decision making in the CPI, Process plant components, elements of costing and
principles of accounting, Total cost components, Types and methods of cost estimation, Cost
estimation for equipment and plant, Direct / indirect manufacturing costs.

UNIT IV MANUFACTURING COST ESTIMATION
Various cost indices, William’s sixth tenth rule, methods of estimation of fixed capital, product
cost estimation, Financing, Interest and investment cost, present worth and discount annuities,
Source of capital, Depreciation, Taxes and Insurances, Balance Sheets, Perpetuity, Inflation.

UNIT V PROFITABILITY: ALTERNATIVE INVESTMENTS AND REPLACEMENTS
Profitability:
Alternative investments and replacements, profitability standards, discounted cash flow, rate
of return, capitalized cost, payment period, alternative investments, analysis with small
investments, increments and replacements, Break Even Analysis.

TOTAL : 45 PERIODS

OUTCOME:
Students gain the knowledge on cost and asset accounting, time value of money, profitability,
alternative investments, minimum attractive rate of return, sensitivity and risk analysis.

TEXT BOOKS:
4. R. Turton, R. C. Bailie, W. B. Whiting, and J. A. Shaeiwitz, “Analysis, Synthesis, and
UNIT II  HAZARD IDENTIFICATION AND CONTROL  9
HAZOP, job safety analysis – Fault tree analysis – Event tree analysis – Failure modes and
effect analysis and relative ranking techniques – Safety audit – Plant inspection – Past
accident analysis.

UNIT III  RISK MANAGEMENT  9
Overall risk analysis – Chapains model, E and FI model– Methods for determining
consequences effects: Effect of fire, Effect of explosion and toxic effect – Disaster
management plan – Emergency planning – Onsite and offsite emergency planning – Risk
management – Gas processing complex, refinery – First aids.

UNIT IV  SAFETY PROCEDURES  9
Safety in plant design and layout – Safety provisions in the factory act 1948 – Indian explosive

UNIT V  SAFETY IN HANDLING AND STORAGE OF CHEMICALS  9
Safety measures in handling and storage of chemicals – Fire chemistry and its control –
Personnel protection – Safety color codes of chemicals.

TOTAL : 45 PERIODS

OUTCOME:
Students get acquainted with risk assessment, process safety auditing and management
systems in the petrochemical Industry

TEXT BOOKS:
   1996.

REFERENCES:
   2003.

CH6016  PROCESS MODELLING AND SIMULATION  L T P C  3 0 0 3

OBJECTIVE:
To give an overview of various methods of process modeling, different computational
techniques for simulation. The focus shall be on the techniques themselves, rather than
specific applications so that the student can take up modeling and simulation challenges in his
profession.

UNIT I  INTRODUCTION  6
Introduction to modeling and simulation, classification of mathematical models, conservation
equations and auxiliary relations.

UNIT II  STEADY STATE LUMPED SYSTEMS  9
Degree of freedom analysis, single and network of process units, systems yielding linear and
non-linear algebraic equations, flow sheeting – sequential modular and equation oriented
approach, tearing, partitioning and precedence ordering, solution of linear and non-linear
algebraic equations.
UNIT III UNSTEADY STATE LUMPED SYSTEMS
Analysis of liquid level tank, gravity flow tank, jacketed stirred tank heater, reactors, flash and distillation column, solution of ODE initial value problems, matrix differential equations, simulation of closed loop systems.

UNIT IV STEADY STATE DISTRIBUTED SYSTEM
Analysis of compressible flow, heat exchanger, packed columns, plug flow reactor, solution of ODE boundary value problems.

UNIT V UNSTEADY STATE DISTRIBUTED SYSTEM & OTHER MODELLING APPROACHES

TOTAL : 45 PERIODS

OUTCOME:
Upon completing the course, the student should have understood the development of process models based on conservation principles and process data and computational techniques to solve the process models.

TEXT BOOKS:

REFERENCES:

CH6009 FERTILIZER TECHNOLOGY

OBJECTIVE:
To enable the students to learn the fertilizer manufacturing including new or modified fertilizer products and new techniques

UNIT I NITROGENOUS FERTILISERS
Methods of production of nitrogenous fertilizer-ammonium sulphate, nitrate, urea and calcium ammonium nitrate; ammonium chloride and their methods of production, characteristics and specifications, storage and handling.

UNIT II PHOSPHATIC FERTILISERS
Raw materials; phosphate rock, sulphur; pyrites etc., processes for the production of sulphuric and phosphoric acids; phosphates fertilizers - ground rock phosphate; bone meal-single superphosphate, triple superphosphate, triple superphosphate, thermal phosphates and their methods of production, characteristics and specifications.

UNIT III POTASSIC FERTILISERS
Methods of production of potassium chloride, potassium schoenite, their characteristics and specifications.
UNIT IV  COMPLEX AND NPK FERTILISERS  9
Methods of production of ammonium phosphate, sulphate diammonium phosphate, nitrophosphates, urea, ammonium phosphate, mono-ammonium phosphate and various grades of NPK fertilizers produced in the country.

UNIT V  MISCELLANEOUS FERTILISERS  9
Mixed fertilizers and granulated mixtures; biofertilisers, nutrients, secondary nutrients and micro nutrients; fluid fertilizers, controlled release fertilizers, controlled release release fertilizers.

TOTAL: 45 PERIODS

OUTCOME:
Upon completion of this course, the students will be able to understand the chemical technology of various fertilizers and their methods of production, characteristics and specification.

TEXT BOOKS:

REFERENCES:

PC6002  PETROLEUM PROCESS EQUIPMENT AUXILIARIES  L T P C
3 0 0 3

OBJECTIVE:
To give an overview of various equipment auxiliaries involved in the petroleum processes.

UNIT I  ELECTRICAL MOTORS AND STARTERS  9

UNIT II  ROTARY EQUIPMENT  9

UNIT III  INDUSTRIAL VALVE  9
Needle valves – Globe, gate and ball valves – Butterfly valves – Check and needle valves – Piping system.

UNIT IV  INDUSTRIAL DRYERS  9

UNIT V  PROCESS UTILITY EQUIPMENTS  9
Vacuum devices – Filters – Cooling towers – Refrigeration systems – Flare system – Equipments for waste water treatment systems.
OUTCOME:
Student gain knowledge on the utility equipment’s and other auxiliaries and its applications.

TEXT BOOKS:

REFERENCES:

MG6091  INDUSTRIAL MANAGEMENT  LT P C
3 0 0 3

OBJECTIVE:
To provide an opportunity to learn basic management concepts essential for business.

UNIT I  INTRODUCTION

UNIT II  FUNCTIONS OF MANAGEMENT

UNIT III  ORGANIZATIONAL BEHAVIOUR

UNIT IV  GROUP DYNAMICS
Organizational Structures – Organizational Change and Development – Change Process – Resistance to Change – Culture and Ethics.

UNIT V MODERN CONCEPTS

TOTAL : 45 PERIODS

OUTCOME:
Students gain knowledge on the basic management principles to become management(s) professional.

TEXTBOOKS:

REFERENCES:

GE6757 TOTAL QUALITY MANAGEMENT

OBJECTIVE:
To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION

UNIT II TQM PRINCIPLES
Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II

UNIT V  QUALITY SYSTEMS  9

TOTAL: 45 PERIODS

OUTCOME:
The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXTBOOK:

REFERENCES:

GE6084  HUMAN RIGHTS  L T P C
OBJECTIVES:
- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I  9

UNIT II  9

UNIT III  9
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV  9
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V  9

TOTAL : 45 PERIODS

OUTCOME:
Engineering students will acquire the basic knowledge of human rights.

REFERENCES:


CH6002 FLUIDIZATION ENGINEERING L T P C
3 0 0 3

OBJECTIVE:
To learn the design Aspects of Heat and mass transfer in fluidized beds.

UNIT I BASICS OF FLUIDIZATION
Packed bed – Velocity – Pressure drop relations – Correlations of Ergun, Kozneykarman – On set of fluidization – Properties of fluidized beds – Development of fluidization from fixed bed.

UNIT II FLUIDIZED BED TYPES

UNIT III DESIGN ASPECTS

UNIT IV HEAT AND MASS TRANSFER IN FLUIDIZED BEDS
Heat and mass transfer in fluidized bed systems – Industrial applications and case studies of fluidized bed systems.

UNIT V OTHER TYPES OF FLUIDIZATION
Single stage and multistage fluidization – Collection of fines – Use of cyclones.

TOTAL : 45 PERIODS

OUTCOME:
Students gain the knowledge on fluidization phenomenon, behavior of fluidized beds and its industrial applications.

TEXT BOOKS:

REFERENCES:

PC6005 ENERGY MANAGEMENT IN CHEMICAL INDUSTRIES L T P C
3 0 0 3

OBJECTIVE:
UNIT I  ENERGY RESOURCES – A GLOBAL VIEW 9

UNIT II  ENERGY AND ENVIRONMENT 9

UNIT III  MANAGEMENT OF ENERGY CONSERVATION IN CHEMICAL INDUSTRIES 9
Chemical industries – Classification – Conservation in unit operation such as separation – Cooling tower – Drying – Conservation applied to refineries, petrochemical, fertilizers, cement, pulp and paper, food industries – Chloroalkali industries – Conservation using optimization techniques.

UNIT IV  ENERGY ALTERNATIVES 9

UNIT V  ECONOMIC BALANCE IN ENERGY CONSUMPTION 9

TOTAL : 45 PERIODS

OUTCOME:
Students have the ability to apply the fundamentals of energy conversion and applications.

TEXT BOOKS:

REFERENCES:

PC6004  NOVEL SEPARATION PROCESSES  L T P C
3 0 0 3

OBJECTIVE :
To learn the principle and technical concept of advanced separation processes.

UNIT I  BASICS OF SEPARATION PROCESS 9
Review of Conventional Processes, Recent advances in Separation Techniques based on size, surface properties, ionic properties and other special characteristics of substances, Process concept, Theory and Equipment used in cross flow Filtration, cross flow Electro Filtration, Surface based solid – liquid separations involving a second liquid.
UNIT II MEMBRANE SEPARATIONS 9
Types and choice of Membranes, Plate and Frame, tubular, spiral wound and hollow fiber
Membrane Reactors and their relative merits, commercial, Pilot Plant and Laboratory
Membrane permeators involving Dialysis, Reverse Osmosis, Nanofiltration, Ultra filtration and
Micro filtration, Ceramic- Hybrid process and Biological Membranes.

UNIT III SEPARATION BY ADSORPTION 9
Types and choice of Adsorbents, Adsorption Techniques, Dehumidification Techniques,
Affinity Chromatography and Immuno Chromatography, Recent Trends in Adsorption.

UNIT IV INORGANIC SEPARATIONS 9
Controlling factors, Applications, Types of Equipment employed for Electrophoresis,
Dielectrophoresis, Ion Exchange Chromatography and Eletrodialysis, EDR, Bipolar
Membranes.

UNIT V OTHER TECHNIQUES 9
Separation involving Lyophilisation, Pervaporation and Permeation Techniques for solids,
liquids and gases, zone melting, Adductive Crystallization, other Separation Processes,
Supercritical fluid Extraction, Oil spill Management, Industrial Effluent Treatment by Modern
Techniques.

TOTAL : 45 PERIODS

OUTCOME:
Fully understand key concepts of separation processes including equilibrium stages, reflux,
countercurrent contacting, limiting cases, efficiency and mass transport effects.

TEXT BOOKS:

REFERENCES:
1987

PC6006 MULTICOMPONENT DISTILLATION L T P C
3 0 0 3

OBJECTIVE:
To understand the concepts of Multicomponent distillation systems.

UNIT I THERMODYNAMIC PRINCIPLES 9
Fundamental Thermodynamic principles involved in the calculation of vapor – liquid equilibria
and enthalpies of multi component mixtures – Use of multiple equation of state for the
calculation of K values – Estimation of the fugacity coefficients for the vapor phase of polar gas

UNIT II THERMODYNAMIC PROPERTY EVALUATION 9
Fundamental principles involved in the separation of multi component mixtures –
Determination of bubble-point and Dew Point Temperatures for multi component mixtures –
equilibrium flash distillation calculations for multi component mixtures – separation of multi component mixtures at total reflux.

UNIT III  MINIMUM REFLUX RATIO FOR MCD SYSTEM  9

UNIT IV  VARIOUS METHODS OF MCD COLUMN DESIGN  9
Theta method of convergence – Kb method and the constant composition method – Application of the Theta method to complex columns and to system of columns – Lewis Matheson method –Stage and reflux requirements – Short cut methods and Simplified graphical procedures.

UNIT V  VARIOUS TYPES OF MCD COLUMNS  9
Design of sieve, bubble cap, valve trays and structured packing columns for multi component distillation – computation of plate efficiencies.

TOTAL : 45 PERIODS

OUTCOME:
Students able to design multicomponent distillation unit. They learn about various types of MCD column.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
Understand to compute molecular weight averages from the molecular weight distribution, Condensation polymerization and transition in polymers.

UNIT I INTRODUCTION
History of Macromolecules – structure of natural products like cellulose, rubber, proteins – concepts of macro molecules – Staudinger’s theory of macromolecules – difference between simple organic molecules and macromolecules.

UNIT II ADDITION POLYMERIZATION

UNIT III CONDENSATION POLYMERIZATION

UNIT IV MOLECULAR WEIGHTS OF POLYMERS

UNIT V TRANSITIONS IN POLYMERS

TOTAL : 45 PERIODS

OUTCOME:
Student should be able to demonstrate knowledge and understanding the principles related to the synthesis and characterization of polymers.

TEXTBOOKS:

REFERENCES:
OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I
INTRODUCTION TO DISASTERS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II
APPROACHES TO DISASTER RISK REDUCTION (DRR)
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of-community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III
INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV
DISASTER RISK MANAGEMENT IN INDIA
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V
DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context,
- Disaster damage assessment and management.

TEXTBOOKS:

REFERENCES
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005