Department of Mechanical Engineering
FACULTY OF ENGINEERING

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University Established Under Section 3 of UGC Act 1956)
Eachanari Post, Coimbatore – 641 021.INDIA
## B. E. MECHANICAL ENGINEERING (REGULAR) COURSE OF STUDY AND SCHEME OF EXAMINATIONS

(2017 and onwards)

### SEMESTER I

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<tr>
<td>17BEME891</td>
<td>Project Work - Phase II &amp; Viva-voce</td>
<td>--</td>
<td>0 0 24 12</td>
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## LIST OF ELECTIVES

### PROFESSIONAL ELECTIVES (PE)

#### SEMESTER V

**Elective I & II**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course title</th>
<th>Objectives &amp; Outcomes</th>
<th>Instruction Hours / Week</th>
<th>Credits</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>17BEME5E01</td>
<td>Material Aspects in Design</td>
<td>1,3</td>
<td>1,2,3,7,9,13</td>
<td>3 0 0 3 3</td>
<td>40 60 100</td>
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<tr>
<td>17BEME5E02</td>
<td>Computer Integrated Manufacturing</td>
<td>1,2</td>
<td>1,2,3,7,9,13</td>
<td>3 0 0 3 3</td>
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<tr>
<td>17BEME5E03</td>
<td>Automobile Engineering</td>
<td>1,3</td>
<td>1,2,3,7,9,13</td>
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<tr>
<td>17BEME5E04</td>
<td>Hydraulics and Pneumatics Power Control</td>
<td>1,3</td>
<td>1,2,3,7,9,13</td>
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<tr>
<td>17BEME5E05</td>
<td>Design of Jigs, Fixtures and Press Tools</td>
<td>1,3</td>
<td>1,2,3,7,9,12</td>
<td>3 0 0 3 3</td>
<td>40 60 100</td>
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<tr>
<td>17BEME5E06</td>
<td>Renewable Energy Sources</td>
<td>1,3</td>
<td>1,2,3,7,9,15</td>
<td>3 0 0 3 3</td>
<td>40 60 100</td>
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<tr>
<td>17BEME5E07</td>
<td>Industrial Robotics</td>
<td>1,3</td>
<td>1,2,3,7,13,15</td>
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<tr>
<td>17BEME5E08</td>
<td>Design and Analysis of Experiments</td>
<td>1,3</td>
<td>1,2,3,7,9,13</td>
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### SEMESTER VI
Elective III & IV

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<tbody>
<tr>
<td>17BEME6E01</td>
<td>Power Plant Engineering</td>
<td>1 1,2,3,7,13,15</td>
<td>3 0 0 3</td>
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<tr>
<td>17BEME6E02</td>
<td>Advanced Manufacturing Processes</td>
<td>1 1,2,3,7,9,13</td>
<td>3 0 0 3</td>
<td>40</td>
<td>60 100</td>
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<tr>
<td>17BEME6E03</td>
<td>Computational Fluid Dynamics</td>
<td>1,3 1,2,3,7,9,12</td>
<td>3 0 0 3</td>
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<td>60 100</td>
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<tr>
<td>17BEME6E04</td>
<td>Manufacture and Inspection of Gears</td>
<td>1 1,2,3,7,9,15</td>
<td>3 0 0 3</td>
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<tr>
<td>17BEME6E05</td>
<td>Design for Manufacture and Assembly</td>
<td>1 1,2,3,7,13,15</td>
<td>3 0 0 3</td>
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<td>17BEME6E06</td>
<td>Gas Dynamics and Jet Propulsion</td>
<td>1 1,2,3,7,9,13</td>
<td>3 0 0 3</td>
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<tr>
<td>17BEME6E07</td>
<td>Advanced I.C. Engines</td>
<td>1 1,2,3,7,9,15</td>
<td>3 0 0 3</td>
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<tr>
<td>17BEME6E08</td>
<td>Finite Element Methods</td>
<td>1 1,2,3,7,13,15</td>
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### SEMESTER VII
Elective V

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<th>Instruction Hours / Week</th>
<th>Credits</th>
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<tbody>
<tr>
<td>17BEME7E01</td>
<td>Machine Tool Design</td>
<td>1 1,2,3,7,9,15</td>
<td>3 0 0 3</td>
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<tr>
<td>17BEME7E02</td>
<td>Additive Manufacturing</td>
<td>1 1,2,3,7,13,15</td>
<td>3 0 0 3</td>
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<td>17BEME7E03</td>
<td>Composite Materials</td>
<td>1 1,2,3,7,9,13</td>
<td>3 0 0 3</td>
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<td>17BEME7E04</td>
<td>Refrigeration and Air Conditioning</td>
<td>1 1,2,3,7,9,12</td>
<td>3 0 0 3</td>
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### SEMESTER VIII
Elective VI

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<th>Course Code</th>
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<tr>
<td>17BEME8E01</td>
<td>Quality Control and Reliability Engineering</td>
<td>1 1,2,3,7,9,15</td>
<td>3 0 0 3</td>
<td>40</td>
<td>60 100</td>
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<tr>
<td>17BEME8E02</td>
<td>Production Planning and Control</td>
<td>1 1,2,3,7,13,15</td>
<td>3 0 0 3</td>
<td>40</td>
<td>60 100</td>
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<tr>
<td>17BEME8E03</td>
<td>Cogeneration and Waste Heat Recovery Systems</td>
<td>1 1,2,3,7,9,13</td>
<td>3 0 0 3</td>
<td>40</td>
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<tr>
<td>17BEME8E04</td>
<td>Energy Conservation Methods and Energy Audit</td>
<td>1 1,2,3,7,9,15</td>
<td>3 0 0 3</td>
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## OPEN ELECTIVES

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<th>P</th>
<th>C</th>
<th>CIA</th>
<th>ESE</th>
<th>TOTAL</th>
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</table>
### SCIENCE AND HUMANITIES
- **17BESHOE01** Probability and Random Process I 1,2,3,7,1 3,15 3 0 0 3 40 60 100
- **17BESHOE02** Fuzzy Mathematics I 1,2,3,7,9, 13 3 0 0 3 40 60 100
- **17BESHOE03** Linear Algebra I 1,2,3,7,9, 12 3 0 0 3 40 60 100
- **17BESHOE04** Engineering Acoustics I 1,2,3,7,9, 15 3 0 0 3 40 60 100
- **17BESHOE05** Solid Waste Management I 1,2,3,7,1 3,15 3 0 0 3 40 60 100
- **17BESHOE06** Green Chemistry I 1,2,3,7,9, 13 3 0 0 3 40 60 100
- **17BESHOE07** Applied Electrochemistry I 1,2,3,7,9, 15 3 0 0 3 40 60 100
- **17BESHOE08** Industrial Chemistry I 1,2,3,7,1 3,15 3 0 0 3 40 60 100
### COMPUTER SCIENCE AND ENGINEERING
- **17BECSOE01** Internet Programming I 1,2,3,7,9, 15 3 0 0 3 40 60 100
- **17BECSOE02** Multimedia and Animation I 1,2,3,7,1 3,15 3 0 0 3 40 60 100
- **17BECSOE03** PC Hardware and Troubleshooting I 1,2,3,7,9, 13 3 0 0 3 40 60 100
- **17BECSOE04** Java Programming I 1,2,3,7,9, 15 3 0 0 3 40 60 100
### ELECTRICAL AND ELECTRONICS ENGINEERING
- **17BEEEEO1** Electric Hybrid Vehicles I 1,2,3,7,9, 15 3 0 0 3 40 60 100
- **17BEEEEO2** Energy Management & Energy Auditing I 1,2,3,7,1 3,15 3 0 0 3 40 60 100
- **17BEEEEO3** Programmable Logic Controller I 1,2,3,7,9, 13 3 0 0 3 40 60 100
- **17BEEEEO4** Renewable Energy Resources I 1,2,3,7,9, 12 3 0 0 3 40 60 100
### ELECTRONICS AND COMMUNICATION ENGINEERING
- **17BEECOC01** Real Time Embedded Systems I 1,2,3,7,9, 15 3 0 0 3 40 60 100
- **17BEECOC02** Consumer Electronics I 1,2,3,7,1 3,15 3 0 0 3 40 60 100
- **17BEECOC03** Neural Networks and its Applications I 1,2,3,7,9, 13 3 0 0 3 40 60 100
- **17BEECOC04** Fuzzy Logic and its Applications I 1,2,3,7,9, 12 3 0 0 3 40 60 100
### BIOTECHNOLOGY
- **17BTBTOE01** Bioreactor Design I 1,2,3,7,9, 15 3 0 0 3 40 60 100
- **17BTBTOE02** Food Processing and Preservation I 1,2,3,7,1 3,15 3 0 0 3 40 60 100
- **17BTBTOE03** Basic Bioinformatics I 1,2,3,7,9, 13 3 0 0 3 40 60 100
- **17BTBTOE04** Fundamentals of Nano Biotechnology I 1,2,3,7,9, 15 3 0 0 3 40 60 100
### AUTOMOBILE ENGINEERING
- **17BEAOE01** Automobile Engineering I 1,2,3,7,9, 15 3 0 0 3 40 60 100
- **17BEAOE02** Basics of Two and Three Wheelers I 1,2,3,7,1 3,15 3 0 0 3 40 60 100
- **17BEAOE03** Automobile Maintenance I 1,2,3,7,9, 13 3 0 0 3 40 60 100
- **17BEAOE04** Introduction to Modern Vehicle Technology I 1,2,3,7,9, 15 3 0 0 3 40 60 100
### CIVIL ENGINEERING
- **17BECEO01** Housing, Plan and Management I 1,2,3,7,9, 15 3 0 0 3 40 60 100
- **17BECEO02** Building Services I 1,2,3,7,1 3,15 3 0 0 3 40 60 100
- **17BECEO03** Management of Irrigation Systems I 1,2,3,7,9, 13 3 0 0 3 40 60 100
- **17BECEO04** Advanced Construction Technology I 1,2,3,7,9, 3 0 0 3 40 60 100
### COURSES OFFERED TO OTHER DEPARTMENTS

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<tr>
<th>SUB. CODE</th>
<th>TITLE OF THE COURSE</th>
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<th>CIA</th>
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<td>17BEMEOE01</td>
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<td>2,3,7,9,15</td>
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<td>17BEMEOE02</td>
<td>Industrial Safety and Environment</td>
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<td>2,3,7,13,15</td>
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<td>17BEMEOE03</td>
<td>Transport Phenomena</td>
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<tr>
<td>17BEMEOE04</td>
<td>Introduction to Biomechanics</td>
<td>1</td>
<td>2,3,7,9,15</td>
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<td>40</td>
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**Total number of credits: 189**

**Note:**
1. The passing minimum for value added course is 50 marks out of 100 marks. There will be two tests, of which one will be class test covering 50% of syllabus for 50 marks and other for 50 marks.
2. Credits for value added courses are not counted for computation of CGPA.
3. Interested students can opt oneself study course in eighth semester from open electives which will be reflected in the mark sheet only if he/she passes.

**Programme Educational Objectives (PEO’s)**
- **PEO1:** Graduates will more conscious about their profession with social awareness and responsibility.
- **PEO2:** Graduates will be engineering experts, who would help solve industry's technological problems.
- **PEO3:** Graduates will be engineering professionals, consultants or entrepreneurs engaged in technology development.
- **PEO4:** Graduates will interact with their peers in other disciplines in industry and society and contribute to the economic growth of the country.

**Programme Outcomes (PO’s)**
- **PO1:** Ability to apply knowledge of mathematics and science in solving engineering problems.
- **PO2:** In-depth knowledge on the fundamental principles, construction and auxiliary systems of mechanical sciences.
- **PO3:** To understand the principles involved in evaluating the structural, functional and safety requirements of mechanical systems.
- **PO4:** Hands on knowledge to develop analytical skills for designing and analyzing various mechanical components and processes.
- **PO5:** To understand and apply appropriate techniques and IT tools for the design and analysis of mechanical systems.
- **PO6:** Understanding the mechanism of pollutant formation and its control techniques.
- **PO7:** Understanding of human and ethical responsibilities towards the profession and society.
- **PO8:** Ability to understand the economics and cost analysis in order to take economically sound decisions.
- **PO9**: Ability to apply modern techniques and tools necessary for engineering practice with appropriate considerations for public health, safety, cultural and environmental limitations.

- **PO10**: Understand the impact of engineering solutions in a societal context and to be able to respond effectively to the needs for sustainable development.

- **PO11**: Function effectively as an individual, and as a member or a leader in diverse teams, and in multidisciplinary situations.

- **PO12**: To recognize the need for, and have the ability to engage in independent and lifelong learning.

<table>
<thead>
<tr>
<th>Programme Educational Objectives</th>
<th>Programme Objectives</th>
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</thead>
<tbody>
<tr>
<td>PEO1</td>
<td>PO1</td>
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<tr>
<td>PEO2</td>
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<tr>
<td>PEO3</td>
<td>✓</td>
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<tr>
<td>PEO4</td>
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</table>
COURSE OBJECTIVES

1. To enable students to attain fluency and accuracy to inculcate proficiency in professional communication.
2. To make the students to meet the growing demand in the field of Global communication.
3. To help students acquire their ability to speak effectively in real life situations.
4. To inculcate the habit of reading and to develop their effective reading skills.
5. To ensure that students use dictionary to improve their active and passive vocabulary.
6. To enable students to improve their lexical, grammatical and communicative competence.

COURSE OUTCOMES

Students undergoing this course will be able to

1. Use English language for communication: verbal & non-verbal.
2. Enrich comprehension and acquisition of speaking & writing ability.
3. Ensure students proficiency in professional communication.
4. Developed their active and passive vocabulary.
5. Gain confidence in using English language in real life situations.
6. Improve word power: lexical, grammatical and communication competence.

UNIT I

Listening – Types of listening - Listening to class reading - Video tapes/ Audio tapes. Speaking – Introduction on self - Introduction on one’s friend. Reading - Reading for comprehension – Reading different kind of passages like descriptive, narrative, objective, conversational and argumentative. Writing – Formal and Informal letters - Freewriting on any topic – My favorite place, hobbies, dreams, goals, etc - To fill in different application forms. Grammar – Articles - WH questions – Yes/No Question - Subject Verb agreement. Vocabulary – Word Formation – Word expansion (Root word) - Prefix and Suffix.

UNIT II


UNIT III


UNIT IV

Listening – Responding to questions – Reading in class for complete understanding and for better pronunciation. Speaking – Debate- Presentations in seminars. Reading – Making inference from the reading passage – Predicting the content of reading passages. Writing - Interpreting visual materials (tables, graphs, charts, etc) Letters to the Editor. Grammar – Sentence pattern – Voice (active and passive voice). Vocabulary – One word substitution.

UNIT V


Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

TOTAL 45
### TEXT BOOK

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Author(s) Name</th>
<th>Title of the book</th>
<th>Publisher</th>
<th>Year of Publication</th>
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<tbody>
<tr>
<td>1</td>
<td>Sangeeta Sharma, Meenakshi Raman</td>
<td>Technical Communication: Principles And Practice 2nd Edition</td>
<td>OUP</td>
<td>2015</td>
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### REFERENCES

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<thead>
<tr>
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<th>Year of Publication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lakshminarayanam, K.R. &amp; Murugavel, T.</td>
<td>Communication Skills for Engineers</td>
<td>SCITECH Publications, Chennai</td>
<td>2009</td>
</tr>
</tbody>
</table>

### WEB REFERENCES
1. www.learnerstv.com – Listening/ Speaking/Presentation
2. www.usingenglish.com – Writing/Grammar
3. www.englishclub.com – Vocabulary Enrichment/Speaking
4. www.ispeakyouspeak.blogspot.com – Vocabulary Enrichment/Speaking
5. www.teachertube.com – Writing Technically
COURSE OBJECTIVES
1. To introduce the basic concepts of PDE for solving standard partial differential equations
2. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
3. To provide an overview of probability and statistics to engineers
4. To introduce the basic concepts of two-dimensional random variables
5. To acquaint the knowledge of testing of hypothesis for small and large samples.
6. To apply testing of hypothesis in important role in real life problems.

COURSE OUTCOMES
After successfully completing the course, the student will have a good understanding of the following topics and their applications
1. The fundamental concepts of partial differential equations and the various solution procedures for solving the first order non-linear partial differential equations.
2. Appreciate the physical significance of Fourier series techniques in solving one- and two-dimensional heat flow problems and one-dimensional wave equations.
3. Understand the basic concepts of one knowledge of the concepts of probability and have knowledge of standard distribution which can describe real life phenomenon.
4. Understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
5. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data
6. Apply the concept of testing of hypothesis for small and large samples in real life problems.

UNIT I  MATRICES

UNIT II  DIFFERENTIAL CALCULUS
Overview of Derivatives - Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolutes as Envelope of normals – Maxima and Minima of functions of two or more Variables – Method of Lagrangian Multipliers

UNIT III  DIFFERENTIAL EQUATIONS
Linear Differential equations of second and higher order with constant coefficients - Euler’s form of Differential equations – Method of variation parameters.

UNIT IV  FUNCTIONS OF SEVERAL VARIABLES

UNIT V  SEQUENCES AND SERIES

TOTAL 60

TEXT BOOK

<table>
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<tr>
<th>S. No.</th>
<th>Author(s) Name</th>
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<tr>
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<th>Title of the book</th>
<th>Publisher</th>
<th>Year of Publication</th>
</tr>
</thead>
</table>

### WEB REFERENCES

1. [www.efunda.com](http://www.efunda.com)
2. [www.mathcentre.ac.uk](http://www.mathcentre.ac.uk)
COURSE OBJECTIVES
1. To introduce the basic physics concepts relevant to different branches of Engineering and Technology.
2. To acquire the knowledge of Electromagnetic field theory.
3. To make the student to learn scientific, mathematical and engineering principles.
4. To make the students to understand the basics of vacuum science.
5. To make the students to understand the process of production and measurement.
6. To make the students to understand the working of Gauges like Pirani, McLeod and Penning.

COURSE OUTCOMES
1. Formulate potential problems within electrostatics, magneto statics.
2. Formulate stationary current distributions in linear, isotropic media.
3. Acquire knowledge on properties of matter, quantum physics.
4. Understand the basics of vacuum science.
5. Understand the process of production and measurement.
6. Understand the working of Gauges like Pirani, McLeod and Penning.

UNIT I PROPERTIES OF MATTER AND THERMODYNAMICS
Three types of modulus of elasticity – basic definitions, relation connecting the modulii (Derivation), poison ratio- Torsional pendulum- bending of beams- bending moment – basic assumption of moment – uniform and non uniform bending.
Concept of entropy- change of entropy in reversible and irreversible processes – refrigeration.

UNIT II LASER AND FIBEROPTICS
Introduction – emission and absorption process- Einstein’s coefficients derivation. Types of LASER -CO2, Semiconductor LASER- Applications of LASER in industry and medicine.
Total internal reflection – modes of propagation of light in optical fibers – numerical aperture and acceptance angle – derivations, types of optical fibers (Material, refractive index and mode) – fiber optical communication system (block diagram).

UNIT III QUANTUM PHYSICS
Introduction to quantum theory – Black body radiation-Photo electric effect- dual nature of matter and radiation – de Broglie wavelength, uncertainty principle – physical significance of wave function, Schrödinger’s wave equation – time dependent and time independent equations – particle in one dimensional box- scanning electron microscope.

UNIT IV CRYSTAL PHYSICS
Lattice – unit cell – Bravais lattice – lattice planes – Miller indices – calculation of number of atoms per unit cell, atomic radius, coordination number, packing factor for SC, BCC, FCC and HCP structures- crystal defects – point, line and surface defects.

UNIT V ULTRASONICS AND NUCLEAR PHYSICS
Production of ultrasonics by piezoelectric method – Non Destructive Testing – pulse echo system through transmission and reflection modes A, Band C- scandisplays, Medical applications- Sonogram.
Reactors – essentials of nuclear reactor- power reactor.

TOTAL 45
## TEXT BOOK

<table>
<thead>
<tr>
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<th>Publisher</th>
<th>Year of Publication</th>
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<tbody>
<tr>
<td>1</td>
<td>Ganesan.S and Baskar.T</td>
<td>Engineering Physics I</td>
<td>GEMS Publisher, Coimbatore-641 001</td>
<td>2015</td>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Serway and Jewett</td>
<td>Physics for Scientists and Engineers with Modern Physics</td>
<td>Thomson Brooks/Cole, Indian reprint, New Delhi</td>
<td>2010</td>
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</tbody>
</table>

## WEB REFERENCES

1. www.nptel.ac.in
2. www.physicsclassroom.com
3. www.oyc.yale.edu
COURSE OBJECTIVES
1. To understand the terminologies of atomic and molecular structure
2. To study the basics of Periodic properties, Intermolecular forces
3. To study about spectroscopic technique
4. To understand the working of electromagnetic spectrum and spectroscopic techniques
5. To understand the thermodynamic functions
6. To comprehend the basic organic chemistry and to synthesis simple drug.

COURSE OUTCOMES
1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
3. Understand the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.
4. Understand the concept of various spectroscopic techniques.
5. Rationalise bulk properties and processes using thermodynamic considerations.
6. List major chemical reactions that are used in the synthesis of molecules.

UNIT I WATER TECHNOLOGY

UNIT II ELECTROCHEMISTRY AND STORAGE DEVICES

UNIT III FUELS AND COMBUSTION

UNIT IV CORROSION SCIENCE
Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion - Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings – Organic coatings - Paints - Constituents and functions – Inorganic coatings- Metallic coatings - Electroplating (Au) and Electro less plating (Ni) - Surface conversion coating - Hotdipping.

UNIT V SURFACE CHEMISTRY AND PHASE RULE

Phase Rule: Definition - Phase diagrams – one component water system, two component Ag-Pb system.

TOTAL 45
TEXT BOOK

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<tbody>
<tr>
<td>1</td>
<td>Dr.S.Vairam</td>
<td>Engineering Chemistry</td>
<td>Gems Publishers, Coimbatore.</td>
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WEB REFERENCES

COURSE OBJECTIVES

1. To impart the basic knowledge of various basic fields of mechanical engineering.
2. To study about basic manufacturing and machining processes.
3. To study about power plants.
4. To study about automobile engineering.
5. To study about boiler and hydraulic machines.
6. To study about Refrigeration and Air conditioning.

COURSE OUTCOMES

1. Design different sheet metal working processes.
2. Select appropriate Joining Processes to join Work piece.
3. Differentiate various metal forming processes such as Hot and Cold Working, Rolling, Forging, Extrusion and Drawing Processes.
4. Students will be able to apply these basics in the designing of the automotive components and engines.
5. Students will be able to get employed in Private Companies like Automotive Sector involving Manufacturing and Design as Graduate Trainees Engineer also in government firms like pollution control board.
6. Students should be able to calculate cooling load for air conditioning systems used for various applications.

INTRODUCTION (Not included for examination)


UNIT I MANUFACTURING PROCESSES


UNIT II METAL FORMING AND JOINING PROCESSES

Metal forming process – Rolling, forging, drawing, extrusion and sheet metal operations fundamentals only. Metal joining processes – Welding-arc and gas welding, Soldering and Brazing.

UNIT III MACHINING OPERATIONS

Machining principles - Construction and working principles of basic machine tools - Lathe, Drilling, Shaper, Planer and Milling machine. Introduction to CNC machines.

Working principle of petrol and diesel engines - Four stroke and two stroke cycles - Comparison between four stroke and two stroke engines - Working principle of simple carburetor - Lubrication system and cooling system.

UNIT IV POWER PLANTS


UNIT V REFRIGERATION AND AIR CONDITIONING

Terminology of Refrigeration and Air Conditioning - Basic principles of Vapour Compression and Absorption Refrigeration System - Window and Split Room Air Conditioners.

TOTAL

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<tr>
<td>2</td>
<td>Rajput, R.K</td>
<td>Basic Mechanical Engineering</td>
<td>Laxmi Publications (P) Ltd, New Delhi</td>
<td>2008</td>
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<tbody>
<tr>
<td>2</td>
<td>Pravin Kumar</td>
<td>Basic Mechanical Engineering</td>
<td>Pearson</td>
<td>2013</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES
1. To provide an overview of various analog device
2. To provide an overview of Digital concepts
3. To learn working of amplifier and its application.
4. To understand the concept of RC-timing circuits.
5. To learn cellular concept and block diagram of GSM system.
6. To provide a review of communication system

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand the principles of semiconductor devices and their applications.
2. Understand the concept of voltage regulators
3. Design an application using Operational amplifier.
4. Understand the working of timing circuits and oscillators.
5. Understand logic gates, flip flop as a building block of digital systems.
6. Learn the basics of Electronic communication system.

UNIT I  ELECTRIC CIRCUITS & MEASUREMENTS  9
Ohm’s Law – Kirchoff’s Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits
Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced
Circuits.

UNIT II  ELECTRICAL MACHINES  9
Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single
Phase Transformer, Single phase induction Motor.

UNIT III  MEASURING INSTRUMENTS  9
Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer
type Watt meters and Energy meters.

UNIT IV  SEMICONDUCTOR DEVICES AND APPLICATIONS  9
Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and
Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and
Characteristics

UNIT V  DIGITAL ELECTRONICS  9
Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and
Counters – A/D and D/A Conversion (single concepts).

TOTAL 45

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<td>Sedha R.S</td>
<td>Applied Electronics</td>
<td>S. Chand &amp; Co</td>
<td>2006</td>
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<tr>
<td>4</td>
<td>Premkumar N</td>
<td>Basic Electrical Engineering</td>
<td>Anuradha Publishers</td>
<td>2003</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES
1. To know about different materials and their properties
2. To know about engineering aspects related to buildings
3. To know about importance of surveying and transportation systems
4. To get exposed to the rudiments of engineering related to dams, water supply, and sewagedisposal
5. To know about importance of drawings
6. To know about importance of electrical fittings.

COURSE OUTCOMES
1. Students are able to understand the property, use, advantage and disadvantage of different material used in construction
2. Students are able to understand the component of building with their function
3. Students are able to understand construction procedure of different components
4. After completion of this students will able to understand basic principles of building design and planning.
5. They will explore building drawing as a way of discovering and developing ideas for designing residential, commercial and public buildings.
6. Students will identify suitable method of irrigation and drainage of waterlogged area.

UNIT I BUILDING MATERIALS

UNIT II BUILDING COMPONENTS

UNIT III SURVEYING

UNIT IV WATER SUPPLY AND SEWAGE DISPOSAL

UNIT V BUILDING DRAWING
Types of drawing with appropriate scale & Uses of index map, key plan, village map, site plan, Layout plan – Types of Projection adopted in Building Drawing (Plan, Elevation and sections) – Scales for various types of Drawings – Working drawing, large scale drawing – Symbols, Conventions and Abbreviations for – Electrical fittings, water supply, sanitary fittings, materials of construction – Sizes of various standard papers.

TOTAL 45

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<tr>
<td>2</td>
<td>V. B. Sikka</td>
<td>Civil engineering drawing</td>
<td>B. D. KatariaSons , Ludhiana</td>
<td>2009</td>
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<tr>
<td>1</td>
<td>Civil Engineering</td>
<td>Ramesh Babu</td>
<td>VRB Publishers, Chennai</td>
<td>2010</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>Building Materials</td>
<td>National Building Code of India, Part V</td>
<td>2005</td>
</tr>
</tbody>
</table>
1. To learn the basic concepts in physics relevant to different branches of Engineering and Technology.
2. To study the concept of semiconductor and conductivity.
3. To learn the properties of materials.
4. To learn the basic concept of Numerical Aperture and acceptance angle.
5. To make the students to determination of wavelength using grating.
6. To learn the basic concept about viscosity of liquids.

COURSE OUTCOMES
1. Understand the basic concepts in physics relevant to different branches of Engineering and Technology.
2. Understand the concept of semiconductor and conductivity.
3. Acquire knowledge on the properties of materials.
4. Understand the basic concept of Numerical Aperture and acceptance angle.
5. Understand the students to determination of wavelength using grating.
6. Acquire knowledge on the basic concept about viscosity of liquids.

LIST OF EXPERIMENTS

PHYSICS

1. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of Young’s modulus of the material – Non uniform bending (or) Uniform bending.
5. Spectrometer Dispersive power of a prism.
7. Particle size determination using Diode Laser
10. Determination of thickness of a thin wire – Air wedge method
11. Determination of Band Gap of a semiconductor material.
12. Determination of Specific resistance of a given coil of wire – Wheatstone Bridge

TOTAL 45
COURSE OBJECTIVES
1. To understand the terminologies of atomic and molecular structure
2. To study the basics of Periodic properties, Intermolecular forces
3. To study about spectroscopic technique
4. To understand the working of electromagnetic spectrum and spectroscopic techniques
5. To understand the thermodynamic functions
6. To comprehend the basic organic chemistry and to synthesis simple drug.

COURSE OUTCOMES
1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
3. Understand the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.
4. Understand the concept of various spectroscopic techniques.
5. Rationalise bulk properties and processes using thermodynamic considerations.
6. List major chemical reactions that are used in the synthesis of molecules.

LIST OF EXPERIMENTS

CHEMISTRY
1. Estimation of alkalinity of Water sample
2. Estimation of hardness of Water by EDTA
3. Estimation of Chloride in Water sample (Argentometric method)
4. Determination of corrosion rate by weight loss method.
5. Determination of molecular weight and degree of polymerization using viscometry.
6. Conductometric Titration (Simple acidbase).
7. Conductometric Titration (Mixture of weak and strong acids).
8. Conductometric Titration using BaCl₂ vs Na₂SO₄.
10. Potentiometric Titration (Fe²⁺ / KMnO₄ or K₂Cr₂O₇).
11. Determination of water of crystallization of a crystalline salt (Coppersulphate).
12. Estimation of Ferric ion by spectrophotometry.

TOTAL 45
COURSE OBJECTIVES
1. To prepare the students to design a system, component, or process.
2. To meet desired needs within realistic constraints such as economic, environmental, social, and ethical.
3. To make the component with health and safety, manufacturability, and sustainability.
4. To prepare the students to communicate effectively and to use the techniques, and skills.
5. To make the students to use modern engineering tools necessary for engineering practice.
6. To make the students to assemble different components.

COURSE OUTCOMES
1. The students will gain knowledge of the different manufacturing processes.
2. Fabricate components using different materials.
3. Students will be able to fabricate components with their own hands.
4. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances.
5. By assembling different components with different processes.
6. They will be able to produce small devices of their interest.

PART – A (CIVIL & MECHANICAL)

1. WELDING 6
   i. Preparation of arc welding of butt joints, lap joints and tee joints.

2. BASICMACHINING 6
   i. Simple Turning and Tap turning
   ii. Drilling and Tapping

3. SHEETMETAL WORK 6
   i. Model making – Trays, funnels, etc.

4. DEMONSTRATION ON 4
   i. Smithy operations
   ii. Foundry operations
   iii. Plumbing Works
   iv. Carpentry Works

PART – B (ELECTRICAL & ELECTRONICS)

5. ELECTRICAL ENGINEERING 10
   i. Study of electrical symbols and electrical equipments.
   ii. Construct the wiring diagram for Stair case wiring and Fluorescent lamp wiring.
   iii. Construct the wiring diagram for Residential house wiring using switches, fuse, indicator, lamp and energymeter.
   iv. Measurement of electrical quantities – voltage, current, power & power factor in R load.
   v. Measurement of energy using single phase energymeter.

6. ELECTRONICS ENGINEERING 13
   i. Study of Electronic components – Resistor (color coding), capacitors and inductors.
   ii. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
   iii. Study of logic gates AND, OR, NOT, NOR and NAND.
   iv. Study of HWR and FWR.

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<tbody>
<tr>
<td>1</td>
<td>Jeyachandran, K. and Balasubramaniam, S</td>
<td>A Premier on Engineering Practices Laboratory</td>
<td>Anuradha Publications, Kumbakonam</td>
<td>2007</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES
1. To make the students to design a system, component, or process to meet desired needs.
2. To prepare the students to design the components with realistic constraints.
3. To make the students to consider economic, environmental, ethical, health and safety when they design.
4. To make the students to design the components with considering manufacturability, andsustainability
5. To prepare the students to communicate effectively using the techniques, skills, and modern engineering tools.
6. To make the students to understand to use necessary for engineeringpractice

COURSE OUTCOMES
The student will also learn:
1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design and engineering graphics standards
3. Exposure to engineering communication effectively.
4. Exposure to 3D free hand sketching.
5. Acquired the knowledge of projections of points, lines and plane surfaces.
6. Understand the basic concept of projection of solids.

UNIT I INTRODUCTION
Introduction to Engineering Drawing, Bureau of Indian Standards (BIS), Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice geometric constructions, principles of dimensioning– linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension.

UNIT II SCALES AND PLANE CURVES
SCALES: Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale. Conics – Construction of Ellipse, Parabola and Hyperbola by eccentricity method

UNIT III FREEHAND SKETCHING
Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT IV PROJECTION OF POINTS, LINES AND PLANE SURFACES
Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Traces–Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT V PROJECTION OF SOLIDS
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

TOTAL 45

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<tr>
<td>2</td>
<td>VTU</td>
<td>A Primer on Computer Aided Engineering Drawing</td>
<td>Belgaum</td>
<td>2006</td>
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WEB REFERENCES
COURSE OBJECTIVES
1. To know the value of being a human being and the value of being a useful citizen.
2. To develop a critical ability to distinguish between essence and form, or between what is of value and what is superficial, in life.
3. To move from discrimination to commitment.
4. To recognize and determine the role of engineers in the economic and social development of the society.
5. To develop social responsibility & human professional ethics.
6. To develop the knowledge of social impact of economic liberalization and technology.

COURSE OUTCOMES
1. Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field.
2. Identify the multiple ethical interests at stake in a real-world situation or practice.
3. Articulate what makes a particular course of action ethically defensible and assess their own ethical values and the social context of problems.
4. Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects.
5. Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.
6. Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.

UNIT-I
Introduction to Yoga—Meaning of Yoga—Concept of Yoga—Aim and Objectives of Yoga—History of Yoga—Systems of Yoga—Stages (Or) Limbs of Yoga

UNIT-II

UNIT-III

UNIT-IV

UNIT-V
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<tbody>
<tr>
<td>1.</td>
<td>Dr.K.Chandrasekaran</td>
<td>Sound Health Through Yoga</td>
<td>Prem Kalyan</td>
<td>2009</td>
</tr>
<tr>
<td>2.</td>
<td>B.K.S.Iyangar</td>
<td>Light On Pranayama</td>
<td>Crossroad Centuary</td>
<td>2013</td>
</tr>
<tr>
<td>3.</td>
<td>Thirumular</td>
<td>Thirumandhiram</td>
<td>Sriramakrishna Math</td>
<td>2016</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

1. To help students comprehend the role of listening skills in effective communication
2. To familiarize students with verbal and non-verbal communication
3. To expose students to neutral accent
4. To develop emotional intelligence skills in them for enhancing their self-esteem
5. To assist them in setting goals and developing positive attitude
6. To enable students to acquire decision making skills, problem solving skills and assertive skills

COURSE OUTCOMES

1. CO1. To be familiar with the complete course outline/Course Objectives/Learning Outcomes/ Evaluation Pattern & Assignments
2. To participate in an online learning environment successfully by developing the implication-based understanding of Paraphrasing, deciphering instructions, interpreting guidelines, discussion boards & Referencing Styles.
3. To demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary & Grammar.
4. To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as a process in an organization.
5. To draft effective business correspondence with brevity and clarity.
6. To stimulate their Critical thinking by designing and developing clean and lucid writing skills.

UNIT I

UNIT II

UNIT III

UNIT IV
Difference between goals and dreams - SMART goal setting - 3 Ds of goal setting- Determination, Discipline and Direction - Developing the right attitude - Motivation - Intrinsic and Extrinsic motivation - Dealing with change - Dedication - Taking responsibilities - Decision making.

UNIT V
Intrapersonal skills - Self-analysis - Thought process – Interpersonal skills - Confidence building - Resolving conflicts- Analytical skills - Team Building - Leadership skills - Planning/organizing - Ability to work independently - Professional ethics - Communicating via e-mail. Ethical perspectives and their implications for responsible communication - Proposal Presentation

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<td>Meenakshi Raman ; Prakash Singh</td>
<td>Business Communication</td>
<td>Oxford University Press</td>
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### WEBREFERENCES

2. www.ispeakyouspeak.blogspot.com
COURSE OBJECTIVES

1. To enable students to attain fluency and accuracy to inculcate proficiency in professional communication.
2. To make the students to meet the growing demand in the field of global communication.
3. To help students acquire their ability to speak effectively in real situations.
4. To inculcate the habit of reading and to develop their effective reading skills.
5. To ensure that students use dictionary to improve their active and passive vocabulary.
6. To enable students to improve their lexical, grammatical and communicative competence.

COURSE OUTCOMES

Students undergoing this course will be able to

1. Use English language for communication: verbal & non-verbal.
2. Enrich comprehension and acquisition of speaking & writing ability.
3. Ensure students proficiency in professional communication.
4. Developed their active and passive vocabulary.
5. Gain confidence in using English language in real situations.
6. Improve word power: lexical, grammatical and communication competence.

UNIT I


UNIT II


UNIT III

Listening - Barriers to listening (Physical, Psychological, Linguistic & Cultural). Speaking - Stress, Pause and Intonation. Reading - Rapid Reading - Skimming, Scanning and Surveying. (SQ3R) Writing - Essay writing - Minutes of Meeting - Agenda - Grammar - Active and Passive voice - Purpose Expression. Vocabulary - Same words used as noun and verb - often misspelt and confused words.

UNIT IV


UNIT V


TOTAL 45

Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

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<td>1</td>
<td>Sangeeta Sharma, Meenakshi Raman</td>
<td>Technical Communication: Principles And Practice 2nd Edition</td>
<td>OUP</td>
<td>2015</td>
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</table>

## WEB REFERENCES

1. [www.learnerstv.com](http://www.learnerstv.com)
2. [www.usingenglish.com](http://www.usingenglish.com)
3. [www.englishclub.com](http://www.englishclub.com)
COURSE OBJECTIVES
The objective of this course is
1. To familiarize the prospective engineers with techniques in Multivariate integration.
2. To familiarize the concept of ordinary and partial differential equations and complex variables.
3. To equip the students to deal with advanced level of mathematics and applications.
4. To make the students to formulate and solve problems involving random variables.
5. To equip the students to Understand the basic concepts of one- and two-dimensional random variables.
6. To understand the concept of testing of hypothesis for small and large samples in real life problems.

COURSE OUTCOMES
The students will learn:
1. The mathematical tools needed in evaluating multiple integrals and their usage.
2. The effective mathematical tools for the solutions of differential equations that model physical processes.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.
4. Understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
5. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data
6. Apply the concept of testing of hypothesis for small and large samples in real life problems.

UNITI  MULTIPLE INTEGRALS  11
Double integral – Cartesian coordinates – Polar coordinates – Change of order of integration – Triple integration in Cartesian co-ordinates – Area as double integrals.

UNITII  VECTOR CALCULUS  13
Gradient, Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green’s theorem, Gauss divergence theorem and Stoke’s theorems (Statement Only)- Surfaces : hemisphere and rectangular parallelopipeds.

UNITIII  PARTIAL DIFFERENTIAL EQUATIONS  11
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution 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.

UNITIV  ANALYTIC FUNCTIONS  12
Analytic functions - Cauchy-Riemann equations in Cartesian and polar forms – Sufficient condition for an analytic function (Statement Only) - Properties of analytic functions – Constructions of an analytic function - Conformal mapping: w = z+a, az, 1/z, and bilinear transformation.

UNITV  COMPLEX INTEGRATION  13
Complex Integration - Cauchy’s integral theorem and integral formula (Statement Only) – Taylor series and Laurent series - Residues – Cauchy’s residue theorem (Statement Only) - Applications of Residue theorem to evaluate real integrals around unit circle and semi circle (excluding poles on the real axis).

TOTAL  60

TEXTBOOKS

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<td></td>
<td>Ramaniah.G</td>
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2. [www.mathcentre.ac.uk](http://www.mathcentre.ac.uk)
3. [www.sosmath.com/diffeq/laplace/basic/basic.html](http://www.sosmath.com/diffeq/laplace/basic/basic.html)
4. [www.mathworld.wolfram.com](http://www.mathworld.wolfram.com)
COURSE OBJECTIVES
1. To create the awareness about environmental problems among people.
2. To develop an attitude of concern for the environment.
3. To motivate public to participate in environment protection and improvement.
4. To demonstrate proficiency in quantitative methods, qualitative analysis, and critical thinking.
5. To develop writing and oral communication needed to conduct high-level work as interdisciplinary scholars and/or practitioners.
6. To learn about the systems concepts and methodologies to analyze and understand interactions.

COURSE OUTCOMES
1. Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
2. Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
4. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to globalscales.
5. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
6. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES
Definition, Scope and Importance – Need for public awareness - Forest resources: Use and over-exploitation, deforestation - Water resources - Use and over-utilization of surface and ground water, floods, drought, conflicts over water - Land resources - Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources - Food resources - World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture - Energy resources - Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources - role of an individual in conservation of natural resources.

UNIT II ECOSYSTEM
Chemistry and Environment - Environmental segments, Composition and Structure of atmosphere - Concept of an ecosystem - Structure, components and function of an ecosystem Energy flow in the ecosystem - Food chain, Food web and Ecological pyramids, Structure and function of Terrestrial ecosystem (Forest, Desert and Grassland ecosystem) and Aquatic ecosystem (Fresh water and Marine ecosystem)

UNIT III BIODIVERSITY
Introduction to biodiversity, Definition - Genetic diversity, Species diversity and Ecosystem diversity, Biogeographical classification of India, Importance of biodiversity - Value of biodiversity - Hot Spots of biodiversity - Threats to biodiversity - Endangered and Endemic Species of India – Conservation of biodiversity - In-Situ and Ex-Situ conservation of biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION
Definition – causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution and Thermal pollution. Solid waste management - causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Disaster management-earthquake, tsunami, cyclone and landslides.

UNIT V SOCIAL ISSUES AND ENVIRONMENT

TOTAL 45
## TEXT BOOK

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<tr>
<td>1</td>
<td>Ravikrishnan, A</td>
<td>Environmental Science</td>
<td>Sri Krishna Hi tech Publishing Company Private Ltd., Chennai</td>
<td>2012</td>
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<tr>
<td>2</td>
<td>Anubhakaushik C.P. Kaushik</td>
<td>Environmental Science and Engineering</td>
<td>New Age International (p) Ltd., New Delhi.</td>
<td>2010</td>
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1. [http://people.eku.edu/ritchisong/envscinotes1.html](http://people.eku.edu/ritchisong/envscinotes1.html)
3. [www.unesco.org/ext/field/beijing/scienceb.htm](http://nptel.ac.in/courses.php?disciplineId=1203.)
4. [www.infinitepower.org/education.htm](http://nptel.ac.in/courses.php?disciplineId=1203.)
COURSE OBJECTIVES

1. To provide an awareness to Computing and C Programming
2. To know the correct and efficient ways of solving problems
3. To learn to develop algorithms for simple problem solving
4. To study, analyze and understand logical structure of a computer program
5. To be able to declare pointers of different types and use the mind defining self-referential structures.
6. To be able to create, read and write to and from simple text files.

COURSE OUTCOMES

1. Formulate the algorithms for simple problems
2. Translate given algorithms to a working and correct program
3. Be able to correct syntax errors as reported by the compilers
4. Be able to identify and correct logical errors encountered at runtime
5. Be able to write iterative as well as recursive programs
6. Be able to represent data in arrays, strings and structures and manipulate them through a program

THEORY:

What is computer- Computer Components- What is C- C Character set- Constants, Variables and Keywords- General form of C Program - Relational and Logical Operators - Selection Structures- If and nested if - Switch Case - Loops- Definition and types- Functions- Arrays- Introduction to Strings- Pointers.

PRACTICALS:

1. Working with word Processing, Spreadsheet and presentation software in Linux
2. Programming in Scratch:
   Practicing fundamental concepts of programming like sequence, selection decision statements, working of loops and event driven programming
3. C Programming:
   Practicing programs to get exposure to basic data types, algebraic expressions, Conditional statements, Input and Output Formatting, Decision Statements, Switch Case, Control structures, arrays, Strings and function, implementation of pointers.

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<td>Programming</td>
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<tr>
<td>2</td>
<td>Yashavant Kanetkar</td>
<td>Let us C</td>
<td>BPB Publications</td>
<td>2013</td>
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</tbody>
</table>
COURSE OBJECTIVES
1. To prepare the students to make section of solids like Prism, Cylinder, and Pyramid.
2. To prepare true shape of section.
3. To gain the knowledge on lateral surfaces.
4. To acquire the knowledge about development of surfaces like Prisms, pyramids, cylinders and cones.
5. To gain the knowledge on 2D drawing using CAD software.
6. To acquire the knowledge on basics of 3D modeling packages.

COURSE OUTCOMES
1. The students to draw section of solids like Prism, Cylinder, and Pyramid.
2. Students can prepare true shape of section.
3. Students gain the knowledge on lateral surfaces.
4. Students acquire the knowledge about development of surfaces like Prisms, pyramids, cylinders and cones.
5. Students gain the knowledge on 2D drawing using CAD software.
6. Students acquire the knowledge on basics of 3D modeling packages.

UNIT I SECTION OF SOLIDS
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

UNIT II DEVELOPMENT OF SURFACES
Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT III ISOMETRIC PROJECTIONS
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

UNIT IV PERSPECTIVE PROJECTIONS
Perspective projection of prisms, pyramids, cylinders and cone by visual ray method and vanishing point method.

UNIT V COMPUTER GRAPHICS
Introduction to 3D modeling packages. Drafting practices - modeling of simple engineering components, sections and extraction of 2D drawings.

TOTAL 45

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<td>2</td>
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<td>A Primer on Computer Aided</td>
<td>Belgaum</td>
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<td>2</td>
<td>Bureau of Indian Standards</td>
<td>Engineering Drawing Practices</td>
<td>BIS, New Delhi</td>
<td>2003</td>
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<td>for Schools and Colleges SP 46-2003</td>
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<td></td>
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<td>Drawing</td>
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WEB REFERENCES
SEMESTER III
17BEME301 METHODS OF APPLIED MATHEMATICS
3 1 0 4100

COURSE OBJECTIVES
1. To introduce the basic concepts of PDE for solving standard partial differential equations
2. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
3. To provide an overview of probability and statistics to engineers
4. To introduce the basic concepts of two-dimensional random variables
5. To acquaint the knowledge of testing of hypothesis for small and large samples.
6. To apply testing of hypothesis in important role in real life problems.

COURSE OUTCOMES
After successfully completing the course, the student will have a good understanding of the following topics and their applications
1. The fundamental concepts of partial differential equations and the various solution procedures for solving the first order non-linear partial differential equations.
2. Appreciate the physical significance of Fourier series techniques in solving one- and two-dimensional heat flow problems and one-dimensional wave equations.
3. Understand the basic concepts of one knowledge of the concepts of probability and have knowledge of standard distribution which can describe real life phenomenon.
4. Understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
5. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data
6. Apply the concept of testing of hypothesis for small and large samples in real life problems.

UNIT I LAPLACE TRANSFORM
13

UNIT II FOURIER SERIES
12

UNIT III FOURIER TRANSFORM
12

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS
12
Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded)

UNIT V Z-TRANSFORM AND DIFFERENCE EQUATIONS
11

TOTAL 60

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<tbody>
<tr>
<td></td>
<td>Ramaniah, G</td>
<td>Students. Volumes II and III,</td>
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</tbody>
</table>

## WEB REFERENCE

1. www.sosmath.com
3. www.nptel.ac.in
COURSE OBJECTIVES
1. To develop capacity to predict the effect of force and motion.
2. To understand the importance of free body diagram for complex machine structure.
3. To perform force analysis using law of mechanics.
4. To introduce the concepts of static equilibrium condition for particles and rigid bodies.
5. To understand the concepts of kinematics of particles and friction.
6. To make the students conversant to solve the problems using equation of motions.

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand the basic concepts of force and laws of mechanics.
2. Develop free body diagram for complex machine structure and to perform force analysis.
3. Apply static equilibrium condition for particles and rigid bodies.
4. Locate the center of gravity and moment of inertia for planes and solids.
5. Understand the concepts of kinematics of particles and friction.
6. Solve the problems using equation of motions.

UNIT I STATICS OF PARTICLES
Forces – system of forces – concurrent forces in plane and space– resultant – problems involving the equilibrium of a particle–free body diagram–equilibrium of particle in space.

UNIT II STATICS OF RIGID BODIES INTO TWO DIMENSIONS

UNIT III CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA
Centroids of areas, composite areas, determination of moment of inertia of plane figures, polar moment of inertia – radius of gyration – mass moment of inertia of simple solids.

UNIT IV KINEMATICS OF PARTICLES


UNIT V KINETICS OF PARTICLES AND FRICTION


TOTAL 60

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WEB REFERENCES
COURSE OBJECTIVES
1. To familiarize the students to apply suitable molding and casting methods for producing components.
2. To develop an understanding of types of metal joining processes.
3. To explain types of deformation processes.
4. To understand the concept of sheet metal operations and metal forming processes.
5. To provide an overview of various plastic component manufacturing processes for various applications.
6. To Study and acquire knowledge of process variables to manufacture defect free products

COURSE OUTCOMES
1. Apply suitable molding and casting methods for producing components.
2. Decide the type of metal joining processes.
3. Select the type of deformation processes.
4. Work with various sheet metal operations and metal forming processes.
5. Select the various plastic component manufacturing processes for various applications.
6. Identify the effect of process variables to manufacture defect free products.

UNITI   METALCASTING PROCESSES

UNITII   JOINING PROCESSES

UNITIII   BULK DEFORMATION PROCESSES

UNITIV   SHEET METAL PROCESSES

UNITV   MANUFACTURING OF PLASTIC COMPONENTS

TOTAL   45

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<td>1</td>
<td>Serope Kalpajian, Steven R. Schmid</td>
<td>Manufacturing Engineering and Technology (Second Indian Reprint)</td>
<td>Pearson Education, Inc., New Delhi</td>
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<td>Begman</td>
<td>Manufacturing Process Eighth Edition</td>
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1. www.themetalcasting.com
2. www.industrialmetalcastings.com
3. www.purolator-lp.com
4. www.manufacturercompanies.com/manufacturers
COURSE OBJECTIVES
1. To enrich the understanding of fluid properties
2. To make the students conversant with types of flow and calculate Major and minor loses in pipes.
3. To acquaint the student with the concepts of Buckingham’s π theorem.
4. To explain the working of different pumps
5. To explain the working of different turbines.
6. To equip students with skills to produce analytical solutions to various simple problems

COURSE OUTCOMES
1. Demonstrate basic knowledge of fluid properties
2. Find types of flow and calculate Major and minor loses in pipes.
3. Apply Buckingham’s π theorem for problem solving.
4. Understand the working of different pumps
5. Understand the working of different turbines.
6. produce analytical solutions to various simple problems

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 12
Fluid properties: Mass density, weight density, specific gravity, viscosity, compressibility, surface tension and capillarity. Buoyancy and floatation– metacentre and metacentric height (definition only)
Flow characteristics: concepts of system and control volume, application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR PIPES 12

UNIT III DIMENSIONAL ANALYSIS 12
Dimension and units, dimensional homogeneity, applications of Buckingham’s π theorem, model and similitude, similarity laws.

UNIT IV HYDRAULIC TURBINES 12

UNIT V HYDRAULIC PUMPS 12

TOTAL 60

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<td>Kumar K.L</td>
<td>Engineering Fluid Mechanics</td>
<td>S. Chand</td>
<td>2010</td>
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<td>Bansal. R.K</td>
<td>Fluid Mechanics and Hydraulics Machines</td>
<td>Laxmi publications (P) Ltd, New Delhi</td>
<td>2015</td>
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<td>3</td>
<td>Fox and McDonald</td>
<td>Fluid Mechanics</td>
<td>John Wiley</td>
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1. www.imeche.org
2. openlibrary.org
3. nptel.iitg.ernet.in
4. www.tecquipment.com
COURSE OBJECTIVES

1. To understand the basic concepts of different types of electrical machines and their performance.
2. To study the different methods of starting D.C motors and induction motors.
3. To study the conventional and solid-state drives.
4. To expose students to the operation, application and control of power conversion systems employing electric drive to cater to industrial needs.
5. To familiarize the operation principles, and design of starting, braking, and speed control arrangements for electric motors and their applications.
6. To provide strong foundation to assess performance of different industrial drives considering issues such as, energy efficiency, power quality, economic justification, environmental issues, and practical viabilities.

COURSE OUTCOMES

1. Examine various applications in industrial and domestic areas where use of electric drives is essential.
2. Classify types of electric drives systems based on nature of loads, control objectives, performance and reliability.
3. Combine concepts of previously learnt courses such as, electrical machines, Control and power electronics to cater to the need of automations in industries.
4. Select most suitable type and specification of motor drive combination for efficient conversion and control of electric power.
5. Identify the critical areas in application levels, and derive typical solutions.
6. Design and justify new control and power conversion schemes for implementing alternatives solutions considering the critical and contemporary issues.

UNIT I: INTRODUCTION

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors. Multi quadrant operation.

UNIT II: DRIVE MOTOR CHARACTERISTICS

Mechanical and electrical characteristics of various types of load and drive motors – Braking of Electrical motors – DC Shunt, series Motors – 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: SPEED CONTROL OF D.C. DRIVES

Speed control of D.C Series and shunt motors – Armature and field control, Ward-Leonard control system – Using controlled rectifiers and DC choppers – applications.

UNIT V: SPEED CONTROL OF A.C. DRIVES


TOTAL 45

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COURSE OBJECTIVES
1. To provide an overview of various analog device
2. To provide an overview of Digital concepts
3. To learn working of amplifier and its application.
4. To understand the concept of RC-timing circuits.
5. To learn cellular concept and block diagram of GSM system.
6. To provide a review of communications system

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand the principles of semiconductor devices and their applications.
2. Understand the concept of voltageregulators
3. Design an application using Operational amplifier.
4. Understand the working of timing circuits and oscilicators.
5. Understand logic gates, flip flop as a building block of digital systems.
6. Learn the basics of Electronic communicationsystem.

UNIT I SEMICONDUCTORS AND RECTIFIERS
Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction-Zenor effect-Zenor diode characteristicsHalf wave and full wave rectifiers -Voltage regulation

UNIT II TRANSISTORS AND AMPLIFIERS
Bipolar junction transistor- CB, CE, CC configuration and characteristics-Biasing circuits Class A, B and C amplifiers- Field effect transistor-Configuration and characteristic of FET amplifier-SCR, DIAC, TRIAC, UJT-Characteristics and simple applications-Switching transistors-Concept of feedback-Negative feedback-Application in temperature and motor speed control.

UNIT III DIGITAL ELECTRONICS
Binary number system - AND, OR, NOT, NAND, NOR circuits-Boolean algebra Exclusive OR gate - Flip flops-Half and full adders-Registers-Counters-A/D and D/A conversion.

UNIT IV 8085 MICROPROCESSOR
Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set Addressing modes-Simple programs using arithmetic and logical operations.

UNIT V INTERFACING AND APPLICATIONS OF MICROPROCESSOR
Basic interfacing concepts - Interfacing of Input and Output devices-Applications of microprocessor Temperature control, Stepper motor control, traffic light control.

TOTAL 45

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<td>Integrated Electronics</td>
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<td>Principles of Electronics</td>
<td>S. Chand and Company Ltd</td>
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<td>Microprocessor and Interfacing</td>
<td>Tata McGraw-Hill</td>
<td>1999</td>
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<td>4</td>
<td>Salivahanan S, Suresh Kumar N, Vallavaraj A</td>
<td>Electronic Devices and Circuits</td>
<td>Tata McGraw-Hill</td>
<td>1999</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES
1. To supplement the theoretical knowledge gained in Fluid Mechanics and Machinery with practical testing
2. To understand the concepts of coefficient of discharge for Orifice meter and Venturi meter.
3. To explain the Calibration of Rotameter.
4. To understand the importance of friction factor for flow through pipes.
5. To impart knowledge on the performance of various pumps.
6. To impart knowledge on the performance of turbines

COURSE OUTCOMES
1. Calculate the coefficient of discharge for Orifice meter and Venturimeter.
2. Calibrate the Rotameter
3. Estimate the friction factor for flow through pipes.
4. Asses the performance of centrifugal pump and submergible pump.
5. Asses the performance of reciprocating pump and gear pump.
6. Asses the performance of turbines

LIST OF EXPERIMENTS
1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturimeter.
3. Calculation of the rate of flow using Rotameter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump
6. Conducting experiments and drawing the characteristic curves of submersible pump
7. Conducting experiments and drawing the characteristic curves of reciprocating pump.
8. Conducting experiments and drawing the characteristic curves of Gear pump.
9. Conducting experiments and drawing the characteristic curves of Pelton wheel.
10. Conducting experiments and drawing the characteristics curves of Francis turbine.

TOTAL 45
COURSE OBJECTIVES
1. To explain the surfaces for sheet metal working applications.
2. To understand the representation of details in machine drawing.
3. To introduce tolerances and fits of machine elements.
4. To equip them with skills to construct an assembly drawing using part drawings of machine components.
5. To equip them with skills to construct an assembly drawing of machine components using 2D drafting.
6. To equip them with skills to construct an assembly drawing of jigs and fixtures.

COURSE OUTCOMES
1. To draw the surfaces for sheet metal working applications.
2. To understand the representation of details in machine drawing.
3. To represent tolerances and fits of machine elements.
4. To construct an assembly drawing using part drawings of machine components.
5. To construct an assembly drawing of machine components using 2D drafting.
6. To construct an assembly drawing of machine components of jigs and fixtures.

INTRODUCTION

CONVENTIONS
Code of practice for engineering drawing-conventional representation of details- drilled and tapped holes, countersunk and counter bored holes, internal and external threads, undercuts, grooves, chamfers, fillet radii and keyways. Conventions to represent standard components-bolts, nuts, washers, screws, cotters, pins, circlips, bearings, gears, springs and flanges.

FITS AND TOLERANCES

ASSEMBLY DRAWING PRACTICE
Making free hand sketches of typical subassemblies-flange coupling, stuffing box, journal bearings, rolling element bearings, keyed joints, cotter joints, C clamp.

ASSEMBLY USING 2D DRAFTING
Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe Tail stock, Machine vice, Pedestal bearing and Drill jigs and Milling fixture.

REFERENCES

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Gopalakrishna K R</td>
<td>Machine Drawing</td>
<td>Subhas Stores, Bangalore</td>
<td>2003</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

1. To provide students the creative application of scientific principles to design or develop structures, machines, apparatus or works.
2. To train students with good scientific and technical breadth so as to embody inventions and put his ideas in concrete terms and design something that promotes and helps in fulfilling the ever expanding energy requirements.
3. To inculcate in students professional and ethical attitude, Communication Skills, teamwork Skills, computer programming skill and an ability to relate engineering issues to broader social context.
4. To provide the excellent learning environment, which can enhance the learning ability of student to generate awareness of surrounding, attentiveness to details, experimental analysis.
5. To impart knowledge on Performance of the fundamental control practices associated with AC and DC machines (starting, reversing, braking, plugging, etc.) using power electronics
6. To evaluate the use of computer-based analysis tools to review the major classes of machines and their physical basis for operation

COURSE OUTCOMES

1. Graduates will demonstrate an ability to identify, formulate, pinpoint and solve Electrical engineering problems keeping in view the present-day power and energy requirement and its future prospect.
2. Graduates will demonstrate an ability to design study and analyze the digital and analog systems and components that serve as the fundamental components of the power engineering methods being increasingly used with the new technological advances.
3. Graduate will understand the impact of engineering solutions on the society and also be aware of contemporary issues relating to the exhausting resources and alternatives to continue uninterrupted power supply.
4. Graduate will be able to communicate effectively in both verbal and written form. They will develop a better presentation skill on academic and personal grounds that will enhance their personality in all aspects.
5. Graduates will demonstrate knowledge of professional and computer language skills that will eventually develop them into skilled researchers in an atmosphere that is technically advanced and conductive.
6. Graduates will demonstrate knowledge of advanced mathematics, science and electrical engineering with the ability to apply the theoretical knowledge and concepts to the disciplines of electrical engineering.

LIST OF EXPERIMENTS

ELECTRICAL MACHINES

1. Load Test on DC ShuntMotor
2. Load Test on DC SeriesMotor
3. Load Test on DC CompoundMotor
4. Speed control of D.C. motor. (Armature and Fieldcontrol)
5. Speed control of three phase Induction motor. (VoltageControl)
6. Speed control of three phase Induction motor. (Voltage / frequencyControl)
7. Load test on single phase InductionMotor.
8. Load test on three phase InductionMotor.
MICROPROCESSOR

1. Addition of two 8 – bit numbers, sum of 8 – bits and 16bits.
2. 8 - bitsubtraction.
3. Additional of two 16 – bit numbers, Sum: 16 bits or more.
4. 8 – bit Multiplication.
5. 8 – bit Division.

TOTAL 45
COURSE OBJECTIVES

1. To understand the basic concepts of QUANTITATIVE ABILITY
2. To understand the basic concepts of LOGICAL REASONING Skills
3. To acquire satisfactory competency in use of VERBAL REASONING
4. To solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
5. To solve off-campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
6. To compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

COURSE OUTCOMES

1. Understand the basic concepts of QUANTITATIVE ABILITY
2. Understand the basic concepts of LOGICAL REASONING Skills
3. Acquire satisfactory competency in use of VERBAL REASONING
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
5. Solve off-campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
6. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

UNIT I
Introduction, Speed Math’s, Problems on Numbers, Averages, Ratios and Proportions, Problems on Ages

UNIT II
Percentage, Data Interpretation, Profit and loss, Simple and Compound Interest

UNIT III
Time Speed and Distance, Time and Work, Pipes and Cistern, Geometry, Probability, Permutation and Combination

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<td>Agarwal.R.S</td>
<td>Quantitative Aptitude for Competitive Examinations</td>
<td>S.Chand Limited</td>
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<td>Abhijit Guha</td>
<td>Quantitative Aptitude for Competitive Examinations</td>
<td>Tata Mcgraw Hill</td>
<td>2011</td>
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TOTAL 15
SEMESTER IV

17BEME401 STRENGTHOFMATERIALS 3 1 0 4100

COURSE OBJECTIVES
1. To understand the concepts of stress and strain on deformation of solids.
2. To introduce the Concepts of safe working stresses and load carrying capacity of beams.
3. To enrich the understanding of deflection in beams and columns in engineering applications.
4. To understand the importance of the effect of torsion on shafts and springs.
5. To provide knowledge on principal stresses and analyze thin cylinders and shells subjected to pressure forces.
6. To provide knowledge on components subjected to various loadings with the help of various theories of failures.

COURSE OUTCOMES
1. Determine stress and strain on deformation of solids.
2. Compute safe working stresses and load carrying capacity of beams.
3. Estimate the deflection in beams and columns in engineering applications.
4. Analyze the effect of torsion on shafts and springs.
5. Determine principal stresses and analyze thin cylinders and shells subjected to pressure forces.
6. Design the components subjected to various loadings with the help of various theories of failures.

UNIT I STRESS, STRAIN AND DEFORMATIONOF SOLIDS 12
Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT II BEAMS – LOADS AND STRESSES 12
Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Relationship between load, shear force and bending moment – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shearflow.

UNIT III BEAMDEFORMATION 12

UNIT IV TORSION 12

UNIT V ANALYSIS OF STRESSES INTWODIMENSIONS 12
Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr’s circle for biaxial stresses – Maximum shear stress – Strain energy in bending and torsion.

TOTAL 60

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<td>Jindal U C</td>
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<td>Asian Books Pvt, Ltd, Chennai</td>
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<td>Bedi D S</td>
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## WEB REFERENCES

1. www.engineersedge.com
3. www.globalsources.com
4. www.dspace.cusat.ac.in
COURSE OBJECTIVES
1. To Explain the mechanics of metal cutting, cutting tool materials, tool wear and cutting fluids.
2. To understand the concept of constructional features of different types of lathe and their operations.
3. To provide knowledge on construction & working of shaping, milling & drilling machines and gear cutting & finishing process.
4. To expose students to various types of grinding machines and broaching machines.
5. To Explain the construction features of different types of CNC machine and manual part programming for a given component.
6. To Perform part programming for CNC machines.

COURSE OUTCOMES
1. Explain the mechanics of metal cutting, cutting tool materials, tool wear and cutting fluids.
2. Discuss about the constructional feature of different types of lathe and their operations.
3. Describe the construction & working of shaping, milling & drilling machines and gear cutting & finishing process.
4. Illustrate the various types of grinding machines and broaching machines.
5. Explain the construction feature of different types of CNC machine and manual part programming for a given component.
6. Perform part programming for CNC machines.

UNIT I THEORY OF METAL CUTTING AND CUTTING TOOLS

UNIT II CENTRE LATHE AND SEMIAUTOMATIC LATHES
Centre lathe – constructional features, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automats – single spindle, Swiss type, automatic screw type, multi spindle – Tool layout for Capstan, Turret and Automats.

UNIT III RECIPROCATING MACHINE TOOLS & MILLING MACHINES

UNIT IV OTHER MACHINETOOLS

UNIT V CNC MACHINES

TOTAL 45

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<td>Media Promotors Pvt Ltd., Mumbai</td>
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1. www.steelonline.co.in
3. www.waterjetindiana.com
4. www.teskolaser.com
5. www.cncinformation.com
6. www.cncmachineprogramming.net
COURSE OBJECTIVES
1. To understand the Model of physical systems into relevant thermodynamic system and apply energy balance equation for closed and open system.
2. To provide knowledge on entropy change in thermodynamic processes.
3. To Study and acquire knowledge on various thermodynamic properties of pure substances in real time problems.
4. To establish the basic thermodynamic relations and properties of ideal and real gases for physical systems.
5. To facilitate the understanding of properties of air using psychometric chart.
6. To acquaint the student with the concepts and applications of the thermodynamics to the various real-life systems

COURSE OUTCOMES
1. Model the physical systems into relevant thermodynamic system and apply energy balance equation for closed and open system.
2. Determine entropy change in thermodynamic processes.
3. Identify the various thermodynamic properties of pure substances in real time problems.
4. Establish the basic thermodynamic relations and properties of ideal and real gases for physical systems.
5. Calculate the properties of air using psychometric chart.
6. Explain the basic principles and applications of the thermodynamics to the various real-life systems

UNIT I BASIC CONCEPTS AND FIRST LAW

UNIT II SECOND LAW AND ENTROPY
Physical description of the second law - Kelvin-Planck and Clausius statements –Equivalence - Reversible processes and cycles- Carnot cycle – Corollaries - Absolute temperature scale – Clausius Theorem, inequality - Entropy- Principle, transfer, generation, balance - Third law of thermodynamics

UNIT III PROPERTIES OF PURE SUBSTANCE AND GAS MIXTURES

UNIT IV THERMODYNAMIC AVAILABILITY AND RELATIONS

UNIT V PSYCHROMETRY
Psychrometry - Psychrometric charts - Property calculations of air vapour mixtures- Psychrometric process-Adiabatic mixing - Evaporative cooling.

TOTAL 60

(Permitted to use standard thermodynamic table, Mollier diagram, and Psychometric chart in the examination)

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<td>Venwylen and Sontag</td>
<td>Classical Thermodynamics</td>
<td>Wiley Eastern, New Delhi</td>
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<td>Kothandaraman C P and Domkundwar S</td>
<td>Engineering Thermodynamics</td>
<td>Dhanpatrai&amp; Sons, New Delhi</td>
<td>2004</td>
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</tbody>
</table>

WEB REFERENCES

COURSE OBJECTIVES
1. To understand the metallurgical aspects of metals.
2. To provide knowledge to identify suitable heat treatment processes for various applications.
3. To understand the properties of ferrous and non-ferrous materials.
4. To expose students to suitable strengthening mechanisms for non-ferrous alloys.
5. To enrich the understanding of properties of non-metallic materials.
6. To provide knowledge on suitable materials for various applications.

COURSE OUTCOMES
1. Identify the metallurgical aspects of metals.
2. Identify suitable heat treatment processes for various applications.
3. Understand the properties of ferrous and non-ferrous materials.
4. Identify suitable strengthening mechanisms for non-ferrous alloys.
5. Understand the properties of non-metallic materials.
6. Select the suitable material for various applications.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

UNIT II HEAT TREATMENT 9

UNIT III FERROUS AND NONFERROUS METALS 9

UNIT IV NON-METALLIC MATERIALS 9
Polymers – types of polymer, commodity and engineering polymers – Properties and Applications of thermoplastics (PP, PVC, ABS, and PMMA) and thermosetting plastics (PF, UF, MF) –Engineering Ceramics.

UNIT V TESTING OF MECHANICAL PROPERTIES AND INSPECTION 9
Non Destructive Testing: Non Destructive Testing basic principles and testing method of Radiographic testing, Ultrasonic testing, Magnetic particle test and Liquid penetrant test, Eddy current testing.

TOTAL 45

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2. ocw.MIT.edu
3. www.istl.org
4. metalurgy-screw-tutorial.tobyavujo.com
COURSE OBJECTIVES

1. To impart knowledge on metallurgical aspects of metals.
2. To understand heat treatment processes on different grades of steel.
3. To familiarize on selection of ferrous and non-ferrous materials for various applications.
4. To impart knowledge on non-metallic materials.
5. To learn about the strengthening mechanisms for Non-ferrous alloys.
6. To comprehend the significance of Non Destructive Testing (NDT) methods.

COURSE OUTCOMES

Learners should be able to:

1. Identify the metallurgical aspects of metals.
2. Identify suitable heat treatment processes for various applications.
3. Select appropriate ferrous and non-ferrous materials for various applications.
4. Identify and select suitable non-metallic materials.
5. Identify suitable strengthening mechanisms for Non-ferrous alloys.
6. Work with non destructive testing methods.

UNIT I  INTRODUCTION TO ENGINEERING MATERIALS


UNIT II  FERROUS METALS AND THEIR PROPERTIES


UNIT III  NONFERROUS METALS

Properties, processing and applications of Aluminum, Magnesium & Titanium, Copper and its Alloys, Low Melting Temperature Alloys. Production, forming, and joining of metals. The Chemistry and prevention of corrosion

UNIT IV  CERAMIC MATERIALS

Microstructural features of ceramics and glasses - Mechanical properties of ceramics and glasses - Production, forming, and joining of ceramics

UNIT V  POLYMERS AND COMPOSITES

Microstructural features of polymers and composites - Mechanical behaviour of polymers and composites - Production, forming, and joining of polymers and composites.

TOTAL  45

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2. www.physicsclassroom.com
3. www.oyc.yale.edu
4. www.physics.org
COURSE OBJECTIVES
1. To understand the mobility of mechanisms in practice.
2. To understand the mechanism for displacement, velocity and acceleration at any point in a link.
3. To enrich the understanding of cam-follower principles for practical applications.
4. To make the students conversant in selecting appropriate gear trains for engineering applications.
5. To understand the friction concepts in machine parts and assembly.
6. To give exposure to the basic components and layout of linkages in the assembly of a system.

COURSE OUTCOMES
1. Compute the mobility of mechanisms in practice.
2. Analyze a mechanism for displacement, velocity and acceleration at any point in a link.
3. Apply cam-follower principles for practical applications.
4. Select appropriate gear trains for engineering applications.
5. Analyze friction concepts in machine parts and assembly.
6. Understand the basic components and layout of linkages in the assembly of a system.

UNIT I  BASIC SO F MECHANISMS  9
Terminology and Definitions – Degree of Freedom – Mobility – Kutzbach criterion – Grashoff’s law – Kinematic
Inversions of four bar chain and slider crank – Mechanical Advantage – Transmission angle – Single, double and
offset slider mechanisms – Quick return mechanisms – Ratchets and escapements – Indexing Mechanisms –
Straight line generators.

UNIT II  KINEMATICS  9
Displacement, velocity and acceleration – analysis in simple mechanisms – Graphical Method – velocity and
acceleration polygons – Kinematic analysis by Complex Algebra methods – Vector Approach, Instantaneous
center – Coriolis Acceleration.

UNIT III  KINEMATIC SO F CAM  9
Classifications – Displacement diagrams – parabolic, Simple harmonic and Cycloidal motions – Layout of plate
cam profiles – Derivatives of Follower motion – High speed cams – circular arc and tangent cams – Standard
cam motion – Pressure angle and undercutting.

UNIT IV  GEARS  9
Spur gear - Terminology and definitions – Fundamental Law of toothed gearing and involute gearing –
Interchangeable gears – gear tooth action – Terminology – Interference and undercutting – Non standard gear
teeth – Helical, Bevel, Worm, Rack and Pinion gears (Basics only) – Gear trains – Parallel axis gear trains –
Epicyclic gear trains.

UNIT V  FRICTION IN DRIVES  9
Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches –
Belt and rope drives, Friction aspects in Brakes.

TOTAL 45

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<td>2011</td>
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</table>
IS 2458 : 2001, Vocabulary of Gear Terms – Definitions Related to Geometry
COURSE OBJECTIVES
1. To Understand and apply the principles of science, technology, engineering, and math to solve industry–related problems.
2. To Understand the concepts and terminologies in industries
3. To Study and acquire knowledge in creating an industrial design layout
4. To introduce the methods involved in materials handling
5. To understand the knowledge in analysis of work processing happening in industries
6. To equip them with skills to perform work measurement in an industry

COURSE OUTCOMES
Upon completion of this course, the student can able to
1. Understand the concepts and terminologies in industries
2. apply their knowledge in creating an industrial design layout
3. understand the methods involved in materials handling
4. apply their knowledge in analysis of work processing happening in industries
5. perform work measurement in an industry
6. understand the role of human involvement in industrial work system design

UNIT I INTRODUCTION TO INDUSTRIAL ENGINEERING
for layout study – types of layout. Plant location analysis – factors, costs, location decisions – simple problems in single facility location models, network location problems.

UNIT II LAYOUT DESIGN
Design cycle – SLP procedure manpower, machinery requirements – computer algorithms – ALDEP, CORELAP, CRAFT

UNIT III QUANTITATIVE METHODS AND MATERIALS HANDLING
Group technology – Production Flow analysis (PFA), ROC (Rank Order Clustering) – Line balancing. Principles, unit load concept, material handling system design, handling equipment types, selection and specification, containers and packaging, Material Handling—Automatic Storage and Retrieval System (ASRS)

UNIT IV OPERATIONS ANALYSIS AND WORK MEASUREMENT
Productivity and living standards, Productivity measurement, work design and Productivity – process planning – types. Total time for a job or operation, total work content and ineffective time, methods and motions, graphic tools. Stop watch time study – time study through video graphy, Standard data, methods time measurement (MTM), Development of Production Standards, learning effect.

UNIT V HUMAN FACTORS IN WORK SYSTEM DESIGN
Human factors, Engineering/Ergonomics, human performance in physical work, anthropometry, design of work station, design of displays and controls.

TOTAL 45

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<td>McGraw Hill</td>
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</table>

WEB REFERENCES
COURSE OBJECTIVES
1. To understand the concept of measurements in practical applications.
2. To expose students to linear and angular measurements.
3. To facilitate the understanding of profile measurements in engineering components.
4. To study and acquire knowledge of measurements in practice using LASER and CMM.
5. To equip students with skills to perform measurements on mechanical and thermal quantities.
6. To equip students with skills to select suitable measuring methods for different applications.

COURSE OUTCOMES
1. Apply the concept of measurements in practical applications.
2. Measure linear and angular measurements.
3. Carry out profile measurements in engineering components.
4. Exhibit measurements in practice using LASER and CMM.
5. Perform measurements on mechanical and thermal quantities.
6. Select suitable measuring methods for different applications

UNIT I CONCEPT OF MEASUREMENT
9
General concept – Generalised measurement systems – units and standards–measuring instruments–
sensitivity, readability, range of accuracy, precision–static and dynamic response–repeatability–systematic and

UNIT II LINEAR AND ANGULAR MEASUREMENT
9
Definition of metrology–Linear measuring instruments: Vernier, micrometer, interval measurement, Slip
gauges and classification, limit gauges– Comparators: Mechanical, pneumatic and electrical types, applications
– Angular measurements: –Sine bar, auto-collimeter, angle Decker.

UNIT III FORM MEASUREMENT
9
Measurement of screw threads – Thread gauges, floating carriage micrometer–measurement of gears–tooth
thickness – constant chord and base tangent method – Eccentricity Measurements – radius measurements–
surface finish, straightness, flatness and roundness measurements.

UNIT IV LASER AND ADVANCES IN METROLOGY
9
Precision instruments based on laser–Principles– laser interferometer–application in linear, angular
measurements and machine tool metrology - Coordinate measuring machine (CMM) – computer aided
inspection - Nano metrology, techniques and applications- TEM, SEM, STM, XRD, AFM.

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE RELATED PROPERTIES
9
Force, torque, strain:– mechanical and electrical type – Flow measurement: Venturi, orifice, rotometer, –
Electrical pressure transducers, Temperature: Thermocouples, Resistance temperature detectors, bimetallic
strip thermometers, thermister, pyrometry

TOTAL 45

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2. www.arci.res.in/
3. www.fbh–berlin.com
4. www.lasermetrology.com/
5. www.lasermetrology.com/
COURSE OBJECTIVES
1. To understand the concept of measurements in practical applications.
2. To expose students to linear and angular measurements.
3. To facilitate the understanding of profile measurements in engineering components.
4. To Study and acquire knowledge of measurements in practice using LASER and CMM.
5. To equip students with skills to perform measurements on mechanical and thermal quantities.
6. To equip students with skills to select suitable measuring methods for different applications.

COURSE OUTCOMES
1. Apply the concept of measurements in practical applications.
2. Measure linear and angular measurements.
3. Carry out profile measurements in engineering components.
4. Exhibit measurements in practice using LASER and CMM.
5. Perform measurements on mechanical and thermal quantities.
6. Select suitable measuring methods for different applications.

UNIT I  BASICS OF MEASUREMENT, DEVICES AND QUALITY STANDARDS  12
Definition of metrology, economics of measurement, measurement as a comparative process, dimensional properties, terminology and accuracy of measurement, measuring errors, Abbe’s Principle, Principle of interferometry- flatness testing, optical interferometer, laser interferometer. Holography and speckle metrology.

UNIT II  LINEAR MEASUREMENTS  8
Material length standards – line and end measurement – calibration of end bars, datum and reference surfaces, surface plates, gauges – feeler gauges, micrometers, dial test indicator, slip gauges, care of gauge blocks, Comparators- mechanical, electrical, optical and pneumatic, optical projector.

UNIT III  GEOMETRICAL MEASUREMENT  9
Angular measurement – plain vernier and optical protractors, sine bar, optical instruments, flatness, parallelism and roundness measurement, need for limit gauge, design of plug gague, Taylor’s principle, three basic types of limit gauges, surface texture, reasons for controlling surface texture, parameters used, specification of surface texture, drawing and symbols, Tomilson surface meter.CMM.

UNIT IV  METROLOGY OF MACHINE ELEMENTS  8
Types of screw threads, terminology, proportions of ISO metric thread, measurement of major, minor and effective diameters. Gear terminology and standard proportions, spur gear measurement, checking of composite errors, base pitch measurement, clean room environment.

UNIT V  MACHINE INSTALLATION AND TESTING  8
Equipment erection, commissioning, testing procedure for lathe, milling, continuous process line. First aid, safety precautions in installation of equipment, protocol for repair and testing, inspection check list.

TOTAL  45

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<td>Quality Management</td>
<td>Oxford University Press, Chennai</td>
<td>2007</td>
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WEB REFERENCES
1. www.tms.org
2. www.arci.res.in/
3. www.fbb–berlin.com
4. www.lasermetrology.com/
5. www.lasermetrology.com/
COURSE OBJECTIVES
1. To understand the principles of solid mechanics and to determine the behavior of components for applied load.
2. To facilitate the understanding of shear force and bending moment for different types of beams with various load conditions.
3. To give exposure to strain energy, stress distribution & deformation in spring and shaft.
4. To understand the importance of microstructure of hardened and tempered samples.
5. To familiarize the students to understand the effect of various treatments.
6. To explain about low carbon steel and medium carbon steel.

COURSE OUTCOMES
1. Apply the principles of solid mechanics, to determine the behavior of components for applied load.
2. Compute the shear force and bending moment for different types of beams with various load conditions.
3. Calculate the strain energy, stress distribution & deformation in spring and shaft.
4. Examine the microstructure of hardened and tempered samples.
5. Compare the effect of various treatments.
6. Explain about low carbon steel and medium carbon steel.

LIST OF EXPERIMENTS
1. Tensile test on metals–stress strain characteristics
2. Cupping test on metal sheets–load deformation characteristics, cupping load, cupping number.
3. Hardness test on metals–Brinell and Rockwell Hardness tests.
4. Impact test on metals–Charpy, Izod impact tests.
5. Shear test on metals–direct shear strength, single shear, double shear.
7. Torsion test on beams–torque and angle of twist characteristics, shear stress, modulus of rigidity, energy.
8. Microscopic examination of i) Hardened samples ii) Hardened and tempered samples.
9. Tempering – Improvement of Mechanical properties – Comparison for i) Unhardened specimen ii) Quenched specimen iii) Quenched and tempered specimen.
10. Study of low carbon steel and medium carbon steel.

TOTAL 45
17BEME412  MANUFACTURING TECHNOLOGY LABORATORY  0 0 4 2100

COURSE OBJECTIVES
1. To facilitate the understanding of shaping operation in shaper.
2. To provide practical knowledge on Preparing a flat and contour surface using milling machine.
3. To provide practical knowledge on Preparing holes with higher finish by Drilling / Tapping / Reaming.
4. To facilitate the understanding of surface and cylindrical grinding operations for surface finish.
5. To introduce single and multi point cutting tools.
6. To impart knowledge on the operations in Capstan and Turret Lathe.

COURSE OUTCOMES
1. Perform shaping operation in shaper.
2. Prepare a flat and contour surface using milling machine.
3. Prepare holes with higher finish by Drilling / Tapping / Reaming.
4. Perform surface and cylindrical grinding operations for surface finish.
5. Prepare the single and multi point cutting tools.
6. Perform operations in Capstan and Turret Lathe.

EXERCISES
1. Exercises in shaping.
2. Exercises in Milling.
3. Exercises in slotting.
4. Exercises in Drilling / Tapping / Reaming.
5. Exercises in Surface grinding and cylindrical grinding process.
7. Exercises in Capstan and Turret Lathe.

TOTAL 45

17BEME413  COURSE ORIENTED PROJECT II  0 0 2 1100
COURSE OBJECTIVES
1. To gain knowledge in sequence of process planning and cost estimation of various products.
2. To introduce the concepts of dimensional and tolerance analysis.
3. To expose students to manufacturing drawings.
4. To equip them with skills to apply their knowledge in re-dimensioning and tolerance charting.
5. To understand the process chart for a given component.
6. To estimate the cost of a given component.

COURSE OUTCOMES
Upon completion of this course, the student can able to
1. Apply the various standards and conventions used in a drawing sheet.
2. Perform dimensional and tolerance analysis.
3. Understand the manufacturing drawings.
4. Apply their knowledge in re-dimensioning and tolerance charting.
5. Prepare process chart for a given component.
6. Estimate the cost of a given component.

UNIT I
Geometric Dimensioning and Representation - Tolerancing, Tolerancing of form, orientation, location and run-outs, Datums and Datum Systems.

UNIT II

UNIT III
Cost Estimation of setting time and machining time - estimation of material cost, labour cost and overhead cost based on supplied data.

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<td>Wade, O</td>
<td>Tolerance Control in design and manufacturing</td>
<td>Industrial Press</td>
<td>1972</td>
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</table>

TOTAL 15
COURSE OBJECTIVES
1. To make the students conversant on performance of various gas power cycles and IC engines.
2. To make the student acquire sound knowledge on working principles of different types of steam generators, mountings and accessories.
3. To understand the importance of shape of blades, work output of typical turbine stages with its velocity diagram.
4. To provide knowledge on difference in working principle and performance of reciprocating and rotary compressors.
5. To expose students to Perform the cooling and heating load calculations of refrigeration.
6. To expose students to Perform the cooling and heating load calculations of air conditioning.

COURSE OUTCOMES
1. Analyze the performance of various gas power cycles and IC engines.
2. Understand the working principles of different types of steam generators, mountings and accessories.
3. Understand the shape of blades, work output of typical turbine stages with its velocity diagram.
4. Show the difference in working principle and performance of reciprocating and rotary compressors.
5. Perform the cooling and heating load calculations for a specified application.
6. Apply the basic thermodynamic concepts in various engineering applications.

UNIT I  GAS POWER CYCLES AND IC ENGINES  9

UNIT II  BOILER AND STEAM POWER CYCLES  9

UNIT III  STEAM NOZZLES AND STEAM TURBINES  9
Steam nozzles – flow through steam nozzles, effect of friction, critical pressure ratio, super saturated flow – Steam turbines– impulse and reaction turbine, compounding, velocity diagram, condition for maximum efficiency – multi stage turbines, cycles with reheating and regenerating heating – reheat factor, degree of reaction - governing of turbines.

UNIT IV  AIR COMPRESSORS  9

UNIT V  REFRIGERATION AND AIR CONDITIONING  9

TOTAL  45

(Permitted to use standard thermodynamic table, Mollier diagram, Psychometric chart and Refrigeration property table in the examination)

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2. www.grc.nasa.gov
3. www.poweronsite.org
4. www.machinerylubrication.com
5. www.tpub.com
COURSE OBJECTIVES
1. To understand the various types of stresses induced in different machine members.
2. To Study and acquire knowledge on design shaft and couplings for effective transmission of power.
3. To study the features of welded joints and fasteners required for various industrial applications.
4. To give exposure to design springs and flywheels for various engineering applications.
5. To understand the importance design bearings and levers for engineering applications.
6. To make the students conversant to implement design procedure for designing a machine.

COURSE OUTCOMES
1. Determine various types of stresses induced in different machine members.
2. Design shaft and couplings for effective transmission of power.
3. Select the type of welded joints and fasteners required for various industrial applications.
4. Design springs and flywheels for various engineering applications.
5. Design bearings and levers for engineering applications.
6. Implement design procedure for designing a machine.

UNIT I  STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 12

UNIT II  DESIGN OF SHAFTS AND COUPLINGS 12

UNIT III  DESIGN OF FASTENERS AND WELDED JOINTS 12

UNIT IV  DESIGN OF SPRINGS AND FLYWHEEL 12
Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs – Belleville springs – Design of flywheels involving stresses in rim and arm.

UNIT V  DESIGN OF BEARINGS AND LEVERS 12
Selection of bearings – sliding contact and rolling contact types – Cubic mean load – Selection of journal bearings – McKees equation – Lubrication in journal bearings – calculation of bearing dimensions – Design of Levers.

TOTAL 60

(Permitted to use PSG design data book in the examination)

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WEB REFERENCES
1. www.roymech.co.uk
3. www.engineersedge.com
4. www.bearings.machinedesign.com
5. www.efunda.com
COURSE OBJECTIVES

1. To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism and cam mechanisms for specified output motions.
2. To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.
3. To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
4. To understand the undesirable effects of unbalances resulting from prescribed motions in mechanisms.
5. To expose students to vibration phenomenon and its types along with the vibration terminologies.
6. To understand the effect of Dynamics of undesirable vibrations.

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Identify the type and mechanism and will be able to perform velocity and acceleration analysis
2. Classify the types of friction and understand the friction applications used in screw threads, clutches, brakes.
3. Specify the gear terminology and to select appropriate gear trains for engineering applications.
5. Describe the vibration phenomenon and its types along with the vibration terminologies.
6. Analyze the systems subjected to vibration

UNIT I  FORCE ANALYSIS


UNIT II  BALANCING


UNIT III  FREE VIBRATION


UNIT IV  FORCED VIBRATION AND TORSIONAL VIBRATION


Torsional systems; Natural frequency of free torsional vibrations, Natural frequency of two and three rotor systems.

UNIT V  MECHANISMS FOR CONTROL


Gyroscopes – Gyroscopic forces and Torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes

TOTAL 45

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4. [http://www.roymech.co.uk/Useful_Tables/Vibrations/Free_Vibrations.html](http://www.roymech.co.uk/Useful_Tables/Vibrations/Free_Vibrations.html)
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6. To understand the effect of Dynamics of undesirable vibrations.

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Identify the type and mechanism and will be able to perform velocity and acceleration analysis
2. Classify the types of friction and understand the friction applications used in screw threads, clutches, brakes.
3. Specify the gear terminology and to select appropriate gear trains for engineering applications.
5. Describe the vibration phenomenon and its types along with the vibration terminologies.
6. Analyze the systems subjected to vibration

UNIT I  KINEMATIC ANALYSIS 9
Introduction- General concepts, Introduction of Simple mechanism, Different types of Kinematics pair, Grublers rule for degree of freedom, Grashof’s Criterion for mobility determination.
Kinematic Analysis- Concepts of vectorial analysis. Velocity and Acceleration Analysis of planar mechanisms

UNIT II  CAMS AND GEARS 9
Gears- Geometry of tooth profiles, Law of gearing, Involute profile, interference, helical, spiral and worm gears, simple, compound gear trains. Epicyclic gear trains

UNIT III  DYNAMIC ANALYSIS 9
Dynamic Analysis of Slider-crank mechanisms, turning moment computations.
Balancing- Static and Dynamic balancing Balancing of revolving & reciprocating masses in single and multi-cylinder engines.

UNIT IV  VIBRATION 9
Vibration analysis of SDOF systems, Natural, damped forced vibrations, Based-excited vibrations, transmissibility ratio.

UNIT V  MECHANISMS FOR CONTROL 9
Gyroscopes – Gyroscopic forces and Torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes

TOTAL 45

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4. [http://www.roymech.co.uk/Useful_Tables/Vibrations/Free_Vibrations.html](http://www.roymech.co.uk/Useful_Tables/Vibrations/Free_Vibrations.html)
COURSE OBJECTIVES
1. To introduce the scientific computing, covering some important aspects of solving algebraic equations, IVP, BVP.
2. To implement the methods using the spreadsheet in Excel.
3. To make students familiar with the concepts of programming and the get them accustomed with high-level languages like Matlab, Mathematica, etc.
4. To provide an overview of some of the issues and problems that arise in scientific computation, such as (non-)linear systems, numerical and symbolic integration.
5. To provide an overview of some of the issues and problems that arise in scientific computation, such as (non-)linear systems, numerical and differential equations and simulation.
6. To make students to get knowledge about real-time problem-solving skill.

COURSE OUTCOMES
1. Apply numerical methods to find our solution of algebraic equations using different methods.
2. Understand the different conditions, and numerical solution of system of algebraic equations.
3. Apply various interpolation methods and finite difference concepts.
4. Can apply numerical differentiation and integration whenever and wherever routine methods are not applicable.
5. Work numerically on the ordinary differential equations using different methods through the theory of finite differences.

LIST OF EXPERIMENTS
1. Finding solution of Transcendentalequation
   i) Newton – Raphson Method
   ii) Bisection method
   iii) Iterative method by reducing the equation to the form x=f(x)

2. Finding the dominant eigenvalue and eigenvector by power method

3. Numerical integration
   i) Gauss 2 point and 3 point formulae
   ii) Trapezoidal method
   iii) Simpson’s 1/3 rule

4. Solution of initial value problems governed by ODE
   i) Runge - Kutta 4th order method
   ii) Modified Euler’s method
   iii) Milne’s method
   iv) Adam – Bashforth method

5. Solution of BVP governed by PDE
   i) Laplace Equation
   ii) One – dimensional heat equation
      a) Explicit method : Bender – Schmidt’s method
      b) Implicit method : Crank - Nicolson’s method
   iii) One dimensional wave equation Implicit method
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<td>Applied Numerical Analysis</td>
<td>Pearson Education, South Asia</td>
<td>2009</td>
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COURSE OBJECTIVES
1. To Understand the working of various governors.
2. To introduce jump speed and profile of the cam.
3. To understand the importance of moment of inertia by oscillation method for connecting rod and flywheel.
4. To introduce the concepts to characterize and calibrate measuring devices.
5. To expose students to measuring taper angle straightness, flatness, surface finish and thread parameters.
6. To explain the limits of dimensional tolerances using comparators.

COURSE OUTCOMES
1. Understand the working of various governors.
2. Determine jump speed and profile of the cam.
3. Determine moment of inertia by oscillation method for connecting rod and flywheel.
5. Measure taper angle straightness, flatness, surface finish and thread parameters.
6. Examine the limits of dimensional tolerances using comparators.

LIST OF EXPERIMENTS

DYNAMICS
1. Governors–Determination of sensitivity, effort, etc. for Watt, Porter, Proell, and spring-controlled Governors
2. Cam – Determination of jump speed and profile of the cam.
5. Balancing of rotating and reciprocating masses.
7. Vibrating system – spring mass system – Determination of damping coefficient of single degree of freedom system.
8. Determination of torsional frequencies for compound pendulum and flywheel system with lumped moment of inertia.
10. Strain gauge measurement system.

METROLOGY
1. Calibration of Vernier / Micrometer / Dial gauge
2. Checking dimensions of part using slip gauges
3. Measurement of gear tooth dimensions – addendum, dedendum, pitch circle diameter and tooth thickness
4. Measurement of taper angle using sine bar / tool makers microscope
5. Measurement of straightness and flatness
6. Measurement of thread parameters
7. Checking the limits of dimensional tolerances using comparators (Mechanical / Pneumatic / Electrical)
8. Surface finish measurement

TOTAL 45
COURSE OBJECTIVES
1. To impart knowledge on valve timing diagram and port timing diagram for single cylinder four stroke diesel engine and two stroke petrol engines.
2. To understand the importance of mechanical efficiency of four stroke SI engine by Morse test.
3. To provide an overview of performance of four stroke single cylinder CI engine.
4. To provide an overview of performance of steam generator and steam turbines.
5. To expose students to the flash and fire point of various fuel.
6. To expose students to the flash and fire point of various lubricants.

COURSE OUTCOMES
1. Sketch the valve timing diagram for four stroke diesel engine and petrol engines.
2. Sketch the port timing diagram for single cylinder two stroke diesel engine and petrol engines.
3. Calculate the mechanical efficiency of four stroke SI engine by Morse test.
4. Evaluate the performance of four stroke single cylinder CI engine.
5. Evaluate the performance of steam generator and steam turbines.
6. Measure the flash and fire point of various fuel/lubricants.

LIST OF EXPERIMENTS
2. Performance Test on 4–stroke Diesel Engine.
4. Load test on 4–stroke Diesel Engine.
5. Morse Test on multicylinder Petrol Engine.
6. Retardation Test to find Frictional Power of a Diesel Engine.
8. Determination of Flash Point and Fire Point.
9. Study of Steam Generators and Turbines.
10. Performance and energy balance test on a steam generator.

TOTAL 45
COURSE OBJECTIVES
1. To expose students to problem definitions
2. To understand the Fabricate device/system/component(s) for problem solving.
3. To equip them subject knowledge to solve real world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE OUTCOMES
1. Formulate problem definitions
2. Fabricate device/system/component(s) for problem solving.
3. Apply subject knowledge to solve real world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

Students will undergo industrial training for four weeks during the vacation at the end of IV semester and a report with the training completion certificate from the industry will be subsequently submitted to the department within a week after completion. Viva – Voce exam will be conducted at the end of V semester and 100 marks will be awarded.
COURSE OBJECTIVES

1. To understand the concepts of geometrical dimensioning and Tolerancing
2. To study the physical importance of them in industrial point of view
3. To know the various types of Tolerancing, its measurement and design.
4. To translate geometric callouts into plain English with one meaning.
5. To explain the major rules found in ASME Y14.5-2009
6. To understand the hierarchy of geometric tolerancing.

COURSE OUTCOMES

1. Ability to learn and apply geometric dimensioning and tolerance standards to communicate design intent
2. Ability to learn how the knowledge of certain processes can affect part design and documentation
3. Gain added insight on working in a team design environment.
4. Translate geometric callouts into plain English with one meaning.
5. Explain the major rules found in ASME Y14.5-2009
6. Understand the hierarchy of geometric tolerancing

UNIT I    INTRODUCTION TO GD AND T


UNIT II    FORM AND ORIENTATION TOLERANCE

and design considerations – Flatness and Circularity measurement concepts – Orientation tolerance specification and application design.

UNIT III   POSITION AND RUNOUT TOLERANCE

Profile of surface and line tolerance design and application – Location tolerance, Position, applied and material condition consideration – Coaxial controls and design – Concentricity, Symmetry – Measurement and application – Design considerations – Position, Composite tolerance concept, design and Measurement – Runout, Total Runout tolerances – Measurement and considerations.

REFERENCES

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<thead>
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<td>,Subhas Stores</td>
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<td>3</td>
<td>Wade, O</td>
<td>Tolerance Control in design and manufacturing</td>
<td>Industrial Press</td>
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</table>

WEB REFERENCE

1. IS :10714,10715,10716,10717,11669,10719,813,919,2709,8000 pt 1 to 10721,11158 and AWS/ISO
COURSE OBJECTIVES
1. To Formulate and solve engineering and managerial situations as LPP.
2. To understand the Engineering and Managerial situations in Transportation.
3. To Study and acquire knowledge on engineering and Managerial solutions in Assignment and scheduling problems.
4. To give exposure to inventory in industry.
5. To make the student acquire sound knowledge on sequences to perform operation among various alternatives.
6. To provide an overview of various tools in various sections of industries like marketing, material handling etc.

COURSE OUTCOMES
At the end of the course, student will be able to understand the
1. Formulate and solve engineering and managerial situations as LPP.
2. Solve Engineering and Managerial situations in Transportation.
3. Give Engineering and Managerial solutions in Assignment and scheduling problems.
4. Manage inventory in industry.
5. Select better sequence to perform operation among various alternatives.
6. Apply the various tools in various sections of industries like marketing, material handling etc.

UNIT I  INTRODUCTION TO OPERATIONS RESEARCH

UNIT II  TRANSPORTATION PROBLEMS
Least cost method, North west corner rule, Vogel’s approximation method, modified distribution method, optimization models, unbalance and degeneracy in transportation model.

UNIT III  ASSIGNMENT MODELS AND SCHEDULING
Assignment models - Hungarian algorithm, unbalanced assignment problems - maximization case in assignment problems, traveling salesman problem. Scheduling – processing n jobs through two machines, processing n jobs through three machines, processing two jobs through ‘m’ machines, processing n jobs through m machines.

UNIT IV  INVENTORY CONTROL AND QUEUING THEORY
Variables in inventory problems, inventory models with penalty, shortage and quantity discount, safety stock, multi item deterministic model.
Queuing Models: Queues – Notation of queues, performance measures, The M/M/1 queue, The M/M/m queue, batch arrival queuing system, queues with breakdowns.

UNIT V  PROJECT MANAGEMENT, GAME THEORY, REPLACEMENT MODELS
Basic terminologies, constructing a project network, network computations in CPM and PERT, cost crashing – Replacement Models: Replacement of Items due to deterioration with and without time value of Money, Group replacement policy, Staff replacement

TEXT BOOKS

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<tr>
<td>1</td>
<td>Kanti Swarup, Gupta P.K and Manmohan</td>
<td>Operations Research</td>
<td>Sultan Chand and Sons, New Delhi</td>
<td>2010</td>
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<td>2</td>
<td>Prem kumar Gupta and Hira D.S</td>
<td>Operation Research</td>
<td>S Chand and Company Limited, New Delhi</td>
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2. [http://www.informs.org/Pubs/OR](http://www.informs.org/Pubs/OR)
3. [http://www.me.utexas.edu/~jensen/ORMM/models/unit/network/subunits/special_cases/transportation.html](http://www.me.utexas.edu/~jensen/ORMM/models/unit/network/subunits/special_cases/transportation.html)
COURSE OBJECTIVES

1. To Study and acquire knowledge on design the power transmission components like belts, pulleys, ropes, chains and sprockets.
2. To Study and acquire knowledge on design spurs and parallel axis helical gears.
3. To give exposure to dimensions for bevel and worm gears.
4. To provide an overview of design procedures of gear boxes for industrial applications.
5. To provide an overview of clutches and brakes for engineering applications.
6. To make the student acquire sound knowledge of mechanical system.

COURSE OUTCOMES

Upon completion of this course, the students will able to

1. Design the power transmission components like belts, pulleys, ropes, chains and sprockets.
2. Design spurs and parallel axis helical gears.
3. Estimate the dimensions for bevel and worm gears.
4. Practice the design procedures of gear boxes for industrial applications.
5. Design clutches and brakes for engineering applications.
6. Design a mechanical system.

UNIT I DESIGN OF TRANSMISSION SYSTEM FOR FLEXIBLE ELEMENTS


UNIT II DESIGN OF SPUR AND HELICAL GEARS


UNIT III DESIGN OF BEVEL AND WORM GEARS


UNIT IV DESIGN OF GEARBOXES


UNIT V DESIGN OF CLUTCHES AND BRAKES

Design of plate clutches – axial clutches – cone clutches – internal expanding rim clutches – internal and external shoe brakes.

TOTAL 45

(Permitted to use PSG design data book in the examination)

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<tr>
<td>3</td>
<td>Prabhu. T.J</td>
<td>Design of Transmission Elements</td>
<td>Mani Offset, Chennai</td>
<td>2002</td>
</tr>
</tbody>
</table>

WEB REFERENCES

COURSE OBJECTIVES
1. To Study and acquire knowledge on heat transfer for conduction.
2. To introduce the concepts of heat transfer coefficients for natural and forced convection for different fluid flows.
3. To understand the performance of heat exchanger.
4. To study the features of radiation heat transfer between the surfaces.
5. To give exposure to mass transfer.
6. To make the students conversant to solve complex problems where heat and mass transfer takes place.

COURSE OUTCOMES
1. Determine the rate of heat transfer for conduction.
2. Evaluate heat transfer coefficients for natural and forced convection for different fluid flows.
4. Estimate the radiation heat transfer between the surfaces.
5. Calculate the coefficient of mass transfer.
6. Solve complex problems where heat and mass transfer takes place.

UNIT I CONDUCTION 12

UNIT II CONVECTION 12

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 12

UNIT IV RADIATION 12

UNIT V MASS TRANSFER 12

TOTAL 60

(Permitted to use standard Heat and Mass Transfer Table in the examination)

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## WEB REFERENCES

COURSE OBJECTIVES
1. To enable students to understand the fundamental economic concepts applicable to engineering
2. To learn the techniques of incorporating inflation factor in economic decision making.
3. To understand the measures of national income, the functions of banks and concepts of globalization
4. To apply the concepts of financial management for project appraisal
5. To understand accounting systems and analyze financial statements using ratio analysis
6. To understand financial planning, economic basis for replacement.

COURSE OUTCOMES
1. Evaluate the economic theories, cost concepts and pricing policies.
2. Understand the market structures and integration concepts
3. Understand the measures of national income, the functions of banks and concepts of globalization
4. Apply the concepts of financial management for project appraisal
5. Understand accounting systems and analyze financial statements using ratio analysis
6. Understand the impact of inflation, taxation, depreciation. Financial planning, economic basis for replacement, project scheduling, and legal and regulatory issues are introduced and applied to economic investment and project-management problems

UNIT I  FUNDAMENTALS OF ENGINEERING ECONOMICS
9

UNIT II  COMMERCIAL BANKING
9

UNIT III  CAPITAL MARKET
9

UNIT IV  FINANCIAL CONCEPTS
9

UNIT V  COST ANALYSIS AND BREAK-EVEN ANALYSIS
9

TOTAL 45

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<td>M.L.Jhingan</td>
<td>Principles of Economics</td>
<td>Konark Publications</td>
<td>2010</td>
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## WEB REFERENCES

1. [http://economictimes.indiatimes.com](http://economictimes.indiatimes.com)
COURSE OBJECTIVES
1. To gain practical experience in handling 2D drafting and 3D modeling softwaresystems.
2. To impart training on SOLID WORKS for modelling
3. To provide knowledge on assembly of components
4. To facilitate the understanding of manufacturing drawings from the models created
5. To understand the importance of MAT Lab for simulating different systems
6. To acquaint the student with the concepts of mat lab for performing various mathematical operations

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. use computer and CAD software's for modeling of mechanical components
2. use various options in SolidWorks for modeling of given components
3. create assembly of components
4. prepare manufacturing drawings from the models created
5. Use MAT Lab for simulating different systems like hydraulic and pneumatic circuits
6. Use mat lab for performing various mathematical operations

COMPUTER AIDED DESIGN
1. 3D modeling of various machine elements using various options like protrusion, cut, sweep, draft, loft, blend, rib.
2. Assembly – creating assembly from parts – assembly constraints
3. Conversion of 3D solid model to 2D drawing – different views, sections, isometric view and dimensioning.
4. Introduction to Surface Modeling.
5. Introduction to File Import, Export – DXF, IGES, STL, STEP

Note: Any one of the 3D MODELING software’s like SOLIDWORKS, CREO, CATIA, NX Software, AutoCAD etc.

COMPUTER AIDED SIMULATION
1. Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using Software
2. Simulation of Hydraulic / Pneumatic cylinder using Software
3. Simulation of cam and follower mechanism using Software
4. MATLAB basics, Dealing with matrices, Graphing- Functions of one variable and two variables
5. Use of MATLAB to solve simple problems invibration

TOTAL 45
COURSE OBJECTIVES
1. To impart knowledge on thermal conductivity of various engineering materials.
2. To acquaint the student with the concepts of heat transfer rate in free and forced convection environment.
3. To study and acquire knowledge of grey surface.
4. To study the features of Stefan–Boltzmann constant.
5. To provide an overview of the effectiveness of parallel and counter flow heat exchanger.
6. To provide an overview of COP of refrigeration and air conditioning system and performance of air compressor and fluidized bed cooling tower.

COURSE OUTCOMES
1. Conduct a test to find thermal conductivity of various engineering materials.
2. Measure heat transfer rate in free and forced convection environment.
3. Measure emissivity of grey surface.
4. Determine Stefan–Boltzmann constant.
5. Measure the effectiveness of parallel and counter flow heat exchanger.
6. Measure COP of refrigeration and air conditioning system and performance of air compressor and fluidized bed cooling tower.

LIST OF EXPERIMENTS
HEAT TRANSFER
1. Heat transfer through a composite wall
2. Thermal conductivity measurement by guarded plate method
3. Natural convection heat transfer from a vertical cylinder
4. Heat transfer from pin-fin (natural and forced convection modes)
5. Effectiveness of Parallel/counter flow heat exchanger
6. Determination of Stefan–Boltzmann constant
7. Determination of emissivity of a grey surface

REFRIGERATION AND AIR CONDITIONING
1. Performance test on single/two stage reciprocating air compressor.
2. Determination of COP of a refrigeration system
3. Experiments on air conditioning system

TOTAL 45

17BEME613 COURSE ORIENTED PROJECT

17BEME651 MINIPROJECT

COURSE OBJECTIVES
1. To expose students to problem definitions
2. To understand the Fabricate device/system/component (s) for problem solving.
3. To equip them subject knowledge to solve real world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE OUTCOMES
1. Formulate problem definitions
2. Fabricate device/system/component (s) for problem solving.
3. Apply subject knowledge to solve real world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.
The students may be grouped into 2 to 4 and work under a project supervisor. The device/system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

17BEME652  TECHNICALPRESENTATION  1 0 0 -100

COURSE OBJECTIVES

1. To equip the students with effective technical presentation
2. To understand the barriers and bridges to communication
3. To improve the public speaking capabilities, body language and posture.
4. To improve the literature survey skill.
5. To develop presentation skill using power point presentation
6. To improve skill to face viva voce examination.

COURSE OUTCOMES

1. Develop the ability to fabrication skill.
2. Ability to make literature review till the successful solution.
3. Ability to identify specific problems.
4. Gain the knowledge about data collection and conducting experiments.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

During the seminar session each student is expected to prepare and present a topic on engineering/technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

TOTAL 15
COURSE OBJECTIVE
1. To understand objectives, Strategies, Policies and Plan.
2. To introduce plans by directing and controlling.
3. To Understand the need of Engineering Ethics.
4. To Understand the forces that shape culture.
5. To develop the entrepreneurial skills.
6. To make the students conversant to execute an engineering plan with ethics.

COURSE OUTCOMES
2. Execute plans by directing and controlling.
3. Understand the need of Engineering Ethics.
4. Understand the forces that shape culture.
5. Show the entrepreneurial skills.
6. Execute an engineering plan with ethics.

UNIT I  HISTORICAL DEVELOPMENT, PLANNING, ORGANISING 9

UNIT II  DIRECTING AND CONTROLLING 9

UNIT III  ENGINEERING ETHICS 9

UNIT IV  FACTORS OF CHANGES 9
Forces that shape culture, social control – Meaning, Agencies, Institution, Customs, Values, Folkways, Norms and Laws. Social changes – Meaning and nature – Theories.

UNIT V  ENTREPRENEURSHIP AND MOTIVATION 9

TOTAL 45

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2. [http://tutor2u.net/business/gcse/people_motivation_theories.htm](http://tutor2u.net/business/gcse/people_motivation_theories.htm)
COURSE OBJECTIVES
1. To introduce the concepts of sensors and transducers.
2. To familiarize the students to understand the actuation systems.
3. To understand the importance of architecture of microprocessors.
4. To study and acquire knowledge of the PLC program using ladder logic.
5. To introduce the concepts of design mechatronic systems.
6. To provide an overview of developing the controller model for electrical, mechanical and thermal systems.

COURSE OUTCOMES
1. Implement the concepts of sensors and transducers.
2. Design the actuation systems.
3. Understand the architecture of microprocessors.
4. Create the PLC program using ladder logic.
5. Design mechatronic systems.
6. Develop the controller model for electrical, mechanical and thermal systems.

UNITI MECHATRONICS SENSORS AND TRANSUCERS

UNIT II ACTUATORS AND SYSTEM MODELS
Introduction to system models – Building block of Mechanical, Electrical, Fluid and Thermal Systems.

UNIT III MICROPROCESSORS IN MECHATRONICS

UNIT IV CONTROLLERS

UNIT V DESIGN OF MECHATRONIC SYSTEMS

TOTAL 45

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<td>2009</td>
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### WEB REFERENCE

1. [www.cs.indiana.edu](http://www.cs.indiana.edu)
(i) COURSE OBJECTIVES
1. To perform simple structural analysis and thermal analysis using simulation software’s.
2. To perform structural analysis of bars and trusses.
3. To perform structural analysis of beams and frames.
4. To perform 2D analysis of plate and shells.
5. To perform modal analysis of simple systems.
6. To perform thermal analysis of simple systems.

COURSE OUTCOMES
Upon completion of this course, the Students will be able to
1. Perform structural analysis of bars and trusses.
2. Perform structural analysis of beams and frames.
3. Perform 2D analysis of plate and shells.
4. Perform modal analysis of simple systems.
5. Perform thermal analysis of simple systems.
6. Perform fluid and failure analysis of simple systems.

LIST OF EXPERIMENTS
COMPUTER AIDED ENGINEERING (Simple Analysis using ANSYS Tool)
1. Stress analysis of rectangular L bracket.
2. Stress analysis of beams (Cantilever, Simply supported, Fixed ends).
3. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends).
5. Thermal stress analysis of a 2D component.
6. Modeling a 3D component. (Single point cutting tool, I beams, etc.)

COMPUTER AIDED MANUFACTURING (CAM)
1. MANUAL PART PROGRAMMING (Using G and M Codes) in CNC Machine.
2. Part programming for Linear, Circular interpolation, and Contour motions.
3. Part programming using standard canned cycles for Thread cutting, Drilling, Peck drilling, and Boring.
4. NC code generation using software’s like Edge CAM, CREO, etc. CNC Controllers like FANUC, Siemens, and Hiedenhain etc.
COURSE OBJECTIVES
1. To introduce the program for arithmetic functions and the program for sorting, code conversion functions.
2. To enrich the understanding of the program codes to interface with stepper motor.
3. To understand the importance of set speed with actual speed of DC motor by interfacing suitable speed sensors.
4. To introduce the concepts of hydraulic, pneumatic by using simulation software.
5. To introduce the concepts of electro pneumatic circuits by using simulation software.
6. To understand the concept of displacement, force and temperature measurement.

COURSE OUTCOMES
1. Create the program for arithmetic functions.
2. Create the program for sorting, code conversion functions.
3. Formulate the program codes to interface with stepper motor.
4. Compare the set speed with actual speed of DC motor by interfacing suitable speed sensors.
5. Integrate all the hydraulic, pneumatic and electro pneumatic circuits by using simulation software.
6. Perform the displacement, force and temperature measurement.

LIST OF EXPERIMENTS
1. Design and testing of fluid power circuits to control
   (i) Velocity (ii) direction and (iii) force of single and double acting actuators
2. Design of circuits with logic sequence using Electro pneumatic trainerkits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software.
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
5. Servo controller interfacing for open loop.
6. PID controller interfacing.
7. Stepper motor interfacing with 8051 Microcontroller
   (i) Full step resolution (ii) Half step resolution.
8. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LABVIEW.
9. Computerized data logging system with control for process variables like pressure, flow and temperature.
10. Measurement of displacement using LVDT.

TOTAL 45

COURSE OBJECTIVES
1. To expose students to problem definitions.
2. To understand the Fabricate device/system/component (s) for problem solving.
3. To equip them subject knowledge to solve real world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports.
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE OUTCOMES
1. Formulate problem definitions.
2. Fabricate device/system/component (s) for problem solving.
3. Apply subject knowledge to solve real world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports.
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.
The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL 120
COURSE OBJECTIVES
1. To develop the student’s knowledge in various robot structures and their workspace.
2. To develop student’s skills in performing spatial transformations associated with rigid body motions.
3. To develop student’s skills in perform kinematics analysis of robot systems.
4. To provide the student with knowledge of the singularity issues associated with the operation of robotic systems.
5. To provide the student with some knowledge and analysis skills associated with trajectory planning.
6. To provide the student with some knowledge and skills associated with robot control.

COURSE OUTCOMES
 Upon completion of this course, the students will be able to
1. Understand the fundamentals of the robots
2. Describe the robot cell design
3. Know the safety considerations in robotic applications.
4. The student with knowledge of the singularity issues associated with the operation of robotic systems.
5. The student with some knowledge and analysis skills associated with trajectory planning.
6. The student with some knowledge and skills associated with robot control.

UNIT I  FUNDAMENTALS OF ROBOT

UNIT II  ROBOTCELLDESIGN

UNIT III  SAFETY CONSIDERATIONS

REFERENCES

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Author(s) Name</th>
<th>Title of the book</th>
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<th>Year of Publication</th>
</tr>
</thead>
</table>
COURSE OBJECTIVES
1. To understand the working principles of pumps
2. To understand the working principles and motors
3. To develop the system curve
4. To calculate the Net Positive Suction Head
5. To calculate the pump Total Head versus Rate of Flow characteristic
6. To match pumps to variable, parallel and series pumping systems

COURSE OUTCOMES
1. Understand the working principles of pumps.
2. Understand the working principles and motors.
3. Develop the system curve.
4. Calculate the Net Positive Suction Head.
5. Calculate the pump Total Head versus Rate of Flow characteristic.
6. Match pumps to variable, parallel and series pumping systems.

UNIT I  SINGLE PHASE INDUCTION MOTOR  5

UNIT II  THREE PHASE INDUCTION MOTOR  5

UNIT III  PUMPS  5
Pumps: definition and classifications – Sewage, fire fighting and Pressure boosting pumps
Classification, working principle, indicator diagram, work saved by air vessels and performance curves – cavitations in pumps – rotary pumps: working principles of gear and vane pumps

REFERENCES

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</thead>
<tbody>
<tr>
<td>2</td>
<td>Bimbhra, P. S</td>
<td>Electrical Machinery</td>
<td>Khanna Publishers, New Delhi</td>
<td>2003</td>
</tr>
</tbody>
</table>

TOTAL 15
COURSE OBJECTIVES
1. To introduce the concepts of essentiality of quality.
2. To understand the importance of various TQM principles.
3. To introduce the concepts of the various TQM principles.
4. To understand the techniques for quality management.
5. To introduce the standard quality systems in industries.
6. To familiarize the students to understand the various techniques to improve the quality in industries.

COURSE OUTCOMES
1. Understand the essentiality of quality.
2. Summarize various TQM principles.
3. Understand the various TQM principles.
4. Understand the techniques for quality management.
5. Implement standard quality systems in industries.
6. Apply various techniques to improve the quality in industries.

UNIT I ESSENTIALS OF TQM
Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES

UNIT III TQM TOOLS
The new seven management tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma – APQP.

UNIT IV TQM TECHNIQUES

UNIT V QUALITY AND ENVIRONMENT SYSTEMS

TOTAL
45

TEXTBOOKS

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<tr>
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<tbody>
<tr>
<td>1</td>
<td>Dale H.Besterfiled</td>
<td>Total Quality Management</td>
<td>Pearson Education, Delhi</td>
<td>2011</td>
</tr>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>Narayana V. and Sreenivasan N.S</td>
<td>Quality Management – Concepts and Tasks</td>
<td>New Age International Ltd., New Delhi</td>
<td>2007</td>
</tr>
<tr>
<td>4</td>
<td>Zairi</td>
<td>Total Quality Management for Engineers</td>
<td>WoodHead Publishers, New Delhi</td>
<td>1996</td>
</tr>
</tbody>
</table>

**WEB REFERENCES:**

1. [http://auciello.tripod.com/14tqm.html](http://auciello.tripod.com/14tqm.html)
3. [http://www.businessgyan.com/node/5409](http://www.businessgyan.com/node/5409)
5. [http://tutor2u.net/business/strategy/benchmarking.htm](http://tutor2u.net/business/strategy/benchmarking.htm)
COURSE OBJECTIVES
1. To understand the concept and basics of thrust areas of Mechanical Engineering.
2. To explain the Review literature to identify gaps and define objectives & scope of the work.
3. To make the student appreciate the purpose of innovative ideas for social benefit.
4. To understand the importance of prototypes/models, experimental set-up and software systems necessary to meet the objectives.
5. To familiarize the students to understand the methods and materials to carry out experiments/develop code.
6. To Reorganize the procedures with a concern for society, environment and ethics

COURSE OUTCOMES
1. Identify thrust areas of Mechanical Engineering.
2. Review literature to identify gaps and define objectives & scope of the work.
3. Generate and implement innovative ideas for social benefit.
4. Develop prototypes/models, experimental set-up and software systems necessary to meet the objectives.
5. Identify methods and materials to carry out experiments/develop code.
6. Reorganize the procedures with a concern for society, environment and ethics

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

TOTAL 480
COURSE OBJECTIVES
1. To select Material Properties have to suit the purpose of an application.
2. To designing a machine or component, many factors have to be considered and optimised.
3. To covers most issues for mechanical design optimisation.
4. To know about the selective assembly process
5. To know about the fracture mechanism.
6. To know about spring design.

COURSE OUTCOMES
1. Students able to select material properties have to suit the purpose of an application.
2. create designing a machine or component, many factors have to be considered and optimised.
3. Solve most issues for mechanical design optimisation.
4. selective assembly process
5. Finding of fracture mechanism of given material
6. Create spring design for Absorption system.

UNIT I MATERIAL SELECTION IN DESIGN

UNIT II MATERIALS PROCESSING AND DESIGN
Role of Processing in Designing – classification of manufacturing processes – types of processing systems – factors determining process selection. Design for manufacturability, assembly, machining, casting, forging and welding

UNIT III MANUFACTURING CONSIDERATIONS IN DESIGN
Surface finish – texture – dimensional tolerances in fitting – interchangeability – selective assembly – geometric tolerance. Selection of fits and tolerances

UNIT IV MATERIALS PROPERTIES AND DESIGN
Stress – Strain diagram – design for strength, rigidity – design under static loading, variable loading, eccentric loading – stress concentration. Design examples with shaft design, spring design and C frames.

UNIT V MATERIALS IN DESIGN
Design for brittle fracture, fatigue failure, corrosion resistance. Designing with plastics, brittle materials

TOTAL 45

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</table>
COURSE OBJECTIVES
1. To understand the application of computers in various aspects of Manufacturing viz., Design, proper planning, Manufacturing cost, Layout & Material Handlingsystem.
2. To know the application of principles of group technology in computer aided processplanning.
3. To impart knowledge on working of the shop floorcontrol
4. To Study and acquire knowledge on data collection system in FMS.
5. To familiarize the students to understand CIM architecture for practicalapplication.
6. To expose students to generate database for computer integrated manufacturingprocesses.

COURSE OUTCOMES
Upon completion of this course, the student can able to
1. Implement computer integrated manufacturing concepts inindustries.
2. Apply the principles of group technology in computer aided processplanning.
3. Understand the working of the shop floorcontrol
4. Implement automated data collection system in FMS.
5. Develop CIM architecture for practicalapplication.
6. Generate database for computer integrated manufacturingprocesses.

UNITI  INTRODUCTION

UNITII  GROUPTECHNOLOGY
Group technology– part families – Classification and coding – Approaches to computer aided process planning –variant approach and generative approaches

UNITIII SHOP FLOOR CONTROL AND INTRODUCTIONOFFMS

UNITIV CIM IMPLEMENTATION ANDDATACOMMUNICATION

UNITV OPEN SYSTEM AND DATABASEFORCIM
Open systems–open system inter connection – manufacturing automations protocol and technical office protocol (MAP /TOP).

TOTAL 45

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<tbody>
<tr>
<td>1</td>
<td>Mikell.P.Groover</td>
<td>Automation, Production Systems and computer integrated manufacturing</td>
<td>Pearson Education, Delhi</td>
<td>2015</td>
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<tr>
<td>2</td>
<td>Kant Vajpayee S</td>
<td>Principles of computer integrated manufacturing</td>
<td>Prentice Hall India, New Delhi</td>
<td>2003</td>
</tr>
</tbody>
</table>

WEB REFERENCES

COURSE OBJECTIVES
1. To make the student acquire sound knowledge on the types of vehicle structures, cooling and lubrication systems required.
2. To acquaint the student with the concepts of type of engines to be used for modern automobiles.
3. To familiarize the students to Distinguish between the manual transmissions systems with automatic transmission systems.
4. To provide knowledge on appropriate transmission systems for the optimal power transmission.
5. To provide knowledge on steering, brakes and suspension systems for effective functioning.
6. To acquaint the student with advanced technologies in automotive Engineering.

COURSE OUTCOMES
1. Identify the types of vehicle structures, cooling and lubrication systems required.
2. Determine the type of engines to be used for modern automobiles.
3. Distinguish between the manual transmissions systems with automatic transmission systems.
4. Select appropriate transmission systems for the optimal power transmission.
5. Select steering, brakes and suspension systems for effective functioning.
6. Implement the advanced technologies in automotive Engineering.

UNIT I AUTOMOBILE ARCHITECTURE AND PERFORMANCE 9
Automotive components, subsystems and their positions – Chassis, frame and body, front, rear and four wheel drives – Operation and performance – Traction force and traction resistance, Power required for automobile– Rolling, air and gradient resistance.

UNIT II TYPES OF ENGINES 9

UNIT III TRANSMISSION SYSTEMS 9
Clutch : Types – coil spring and diaphragm type clutch, single and multi plate clutch, centrifugal clutch, Gear box : Types – constant mesh, sliding mesh and synchronesh gear box, layout of gear box, gear selector and shifting mechanism, overdrive, automatic transmission, Propeller shaft, universal joint, slip joint, differential and real axle arrangement, hydraulic coupling.

UNIT IV WHEEL AND TYRES AND SUSPENSION SYSTEM 9
Types of wheels, construction, wired wheels, Tyres– construction, Radial, bias and belted bias, slip angle, Tread patterns, Tyre retreading - cold and hot, Tubeless tyases, Types–front and rear suspension, conventional and independent type suspension, leaf springs, coil springs, dampers, torsion bars, stabilizer bars, arms, air suspension systems – Balancing of Wheels.

UNIT V STEERING SYSTEM AND BRAKING SYSTEM 9
Types of steering systems, Ackermann principle, Davis steering gear, steering gear boxes, steering linkages, power steering, wheel geometry–caster, camber, toe–in, toe out etc., wheel Alignment. Braking System – Forces on vehicles, tyre grip, load transfer, braking distribution between axles, stopping distance, Types of brakes, Mechanical, Hydraulic, Air brakes, Disc and Drum brakes, Engine brakes and Anti lock braking system.

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<tbody>
<tr>
<td>1</td>
<td>Gupta R.B</td>
<td>Automobile Engineering</td>
<td>Laxmi Publications, Chennai</td>
<td>2004</td>
</tr>
<tr>
<td>2</td>
<td>Kirpal Singh</td>
<td>Automobile Engineering Vol–I and II</td>
<td>Standard publishers, Delhi</td>
<td>2007</td>
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<tr>
<td>1</td>
<td>Julian Happian Smith</td>
<td>An introduction to modern vehicle design</td>
<td>Butterworth Heinemann, New Delhi</td>
<td>2004</td>
</tr>
<tr>
<td>3</td>
<td>Heniz Heisler</td>
<td>Vehicle and Engine Technology</td>
<td>Society of Automotive Engineers</td>
<td>2002</td>
</tr>
</tbody>
</table>

### WEB REFERENCES:

COURSE OBJECTIVES
1. To recognize symbols and fundamentals in fluid power generation and distribution.
2. To identify power source for hydraulic systems.
3. To select appropriate components used in various hydraulic systems.
4. To design hydraulic circuits for given applications.
5. To distinguish the components used in pneumatic circuits.
6. To create the logic circuits for controlling electro-hydraulic/pneumatic systems.

COURSE OUTCOMES
At the end of the course, the students will be able to
1. Recognize symbols and fundamentals in fluid power generation and distribution.
2. Identify power source for hydraulic systems.
3. Select appropriate components used in various hydraulic systems.
4. Design hydraulic circuits for given applications.
5. Distinguish the components used in pneumatic circuits.
6. Create the logic circuits for controlling electro-hydraulic/pneumatic systems.

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS

UNIT II HYDRAULIC SYSTEMS AND COMPONENTS

UNIT III DESIGN OF HYDRAULIC CIRCUITS

UNIT IV PNEUMATIC SYSTEMS AND COMPONENTS

UNIT V DESIGN OF PNEUMATIC CIRCUITS
Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

TOTAL 45
### TEXT BOOKS

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<tbody>
<tr>
<td>1</td>
<td>Anthony Esposito</td>
<td>Fluid Power with Applications</td>
<td>Pearson Education, New Delhi</td>
<td>2013</td>
</tr>
<tr>
<td>2</td>
<td>Majumdar S.R</td>
<td>Oil Hydraulics</td>
<td>Tata McGraw–Hill, New Delhi</td>
<td>2002</td>
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<tbody>
<tr>
<td>2</td>
<td>Anthony Lal</td>
<td>Oil hydraulics in the service of industry</td>
<td>Allied publishers, New Delhi</td>
<td>1982</td>
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<tr>
<td>3</td>
<td>Michael J, Prinches and AshbyJ.G</td>
<td>Power Hydraulics</td>
<td>Prentice Hall of India, New Delhi</td>
<td>1996</td>
</tr>
</tbody>
</table>

### WEB REFERENCES

1. http://www.g-w.com/PDF/SampChap/60525_0816_Ch02.pdf
COURSE OBJECTIVES
1. To impart knowledge on the principles of locating and clamping devices in machining process.
2. To familiarize the students to understand design of jigs for a given component.
3. To Study and acquire knowledge on design fixtures for a given component.
4. To make the student acquire sound knowledge on appropriate type of press tool for a given component.
5. To expose students to drawing die for a given component.
6. To give exposure to the use computer aids for sheet metal forming analysis

COURSE OUTCOMES
1. Summarize the principles of locating and clamping devices in machining process.
2. Design jigs for a given component.
3. Design fixtures for a given component.
4. Design an appropriate type of press tool for a given component.
5. Develop a drawing die for a given component.
6. Use computer aids for sheet metal forming analysis

UNIT I PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES

UNIT II JIGS

UNIT III FIXTURES
General principles of boring, lathe, milling and broaching fixtures– Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures– Modular fixtures, Quick change fixtures. Design and development of fixtures for given component.

UNIT IV PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAY OUT

UNIT V DESIGN AND DEVELOPMENT OF DIES

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<table>
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<tr>
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<tbody>
<tr>
<td>1</td>
<td>Edward G Hoffman</td>
<td>Jigs and Fixture Design</td>
<td>Thomson – Delmar Learning, Singapore</td>
<td>2012</td>
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<td>2</td>
<td>Donaldson C</td>
<td>Tool Design</td>
<td>Tata McGraw–Hill, New Delhi</td>
<td>2012</td>
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<td>Jigs and Fixture</td>
<td>Tata McGraw–Hill, New Delhi</td>
<td>2003</td>
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</tbody>
</table>

### WEB REFERENCES

1. www.wisetool.com
2. www.invert-a-bolt.com
3. www.diemech.com
4. www.schaeffertools.com
5. www.steelsmith.com
COURSE OBJECTIVES
1. To explain importance of renewable energy resources.
2. To understand the importance of basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
3. To understand the importance of principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas and hydrogen.
4. To study the features of design principles of biogas plants.
5. Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.
6. To give exposure to power plants working with non-conventional energy

COURSE OUTCOMES
1. Understand the importance of renewable energy resources.
2. Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
3. Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas and hydrogen.
4. Implement design principles of biogas plants.
5. Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.
6. Get exposure on the power plants working with non-conventional energy.

UNIT I ENERGY AND ENVIRONMENT
9
Primary energy sources – world energy resources – Indian energy scenario – energy cycle of the earth – environmental aspects of energy utilisation, CO₂ emissions and Global warming – renewable energy resources and their importance. Potential impacts of harnessing the different renewable energy resources.

UNIT II SOLAR ENERGY
9

UNIT III WIND, TIDAL AND GEOTHERMAL ENERGY
9
Energy from the wind – general theory of windmills – types of windmills – design aspects of horizontal axis windmills – applications. Energy from tides and waves – working principles of tidal plants and ocean thermal energy conversion plants – power from geothermal energy – principle of working of geothermal power plants.

UNIT IV BIOENERGY
9

UNIT V OTHER RENEWABLE ENERGY SOURCES
9
Direct energy conversion (Description, principle of working and basic design aspects only) – Magneto hydrodynamic systems (MHD) – thermoelectric generators – thermionic generators – fuel cells – solar cells – types, Emf generated, power output, losses and efficiency and applications. Hydrogen conversion and storage systems

TOTAL 45

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<td>AnNon conventional Energy sources</td>
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<tr>
<td>1</td>
<td>Sukhatme S.P</td>
<td>Solar Energy</td>
<td>Tata McGraw Hill, New Delhi</td>
<td>2010</td>
</tr>
</tbody>
</table>

## WEB REFERENCES
2. [http://www.solarserver.de/wissen/sonnenkollektoren–e.html](http://www.solarserver.de/wissen/sonnenkollektoren–e.html)
COURSE OBJECTIVES
1. To understand the anatomy, basic concepts and applications of robot.
2. To learn the drives and end effectors used in robot.
3. To study the various types of sensors used in robot.
4. To familiarize robot kinematics and robot programming
5. To provide knowledge on simple offline robot program
6. To impart knowledge on economic analysis of robots

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Identify the various types of robots.
2. Select appropriate drive systems and end effectors for industrial application.
3. Decide the types of sensors required according to the applications of robot.
4. To identify the different types of machine vision technologies
5. Develop simple offline robot program for different applications.
6. Calculate the economic analysis of robots.

UNIT I  FUNDAMENTALS OF ROBOT

UNIT II  ROBOT DRIVE SYSTEMS AND ENDEFFECTORS
Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of all these Drives
End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

UNIT III  SENSORS AND MACHINEVISION

UNIT IV  ROBOT KINEMATICS AND ROBOT PROGRAMMING
Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems.
Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs

UNIT V  IMPLEMENTATION ANDROBOT ECONOMICS

TOTAL 45

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</thead>
</table>

### WEB REFERENCE

1. [www.learnaboutrobots.com/industrial.htm](http://www.learnaboutrobots.com/industrial.htm)
COURSE OBJECTIVES
1. To provide foundations on design of experiments and statistical analysis of experimental data obtained from laboratory and/or industrial processes.
2. To understand the important concepts of single factorial designs
3. To Study and acquire knowledge on various methodologies involved in single factorial designs
4. To know the application of testing of factorial experiment
5. To enrich the understanding of special experimental designs
6. To impart knowledge on basic concepts of Taguchi method in parameter design

COURSE OUTCOMES
Upon successful completion of the course, students will be able to:
1. Understand the knowledge of various techniques for experimental planning
2. Understand the concepts of single factorial designs
3. List the various methodologies involved in single factorial designs
4. Apply the concept of testing of factorial experiment
5. Solve the partial and ordinary differential equations special experimental designs
6. Apply the basic concepts of Taguchi method in parameter design

UNIT I INTRODUCTION 9

UNIT II SINGLE FACTOR EXPERIMENTS 9
ANOVA rationale - Sum of squares – Completely randomized design, Randomized block design, effect of coding, Comparison of treatment means – Newman Kuel’s test, Duncan’s Multiple Range test, Latin Square Design, Graeco-Latin Square Design, Balanced incomplete design.

UNIT III FACTORIAL EXPERIMENTS 9
Main and interaction effects – Two and three Factor full factorial Designs, 2 k designs with Two and Three factors-Unreplicated design- Yate’s Algorithm

UNIT IV SPECIAL EXPERIMENTAL DESIGNS 9
Blocking in factorial design, Confounding of 2k design, nested design-Response Surface Methods.

UNIT V TAGUCHI TECHNIQUES 9
Fundamentals of Taguchi methods, Quality Loss function, orthogonal designs, application to Process and Parameter design.

TOTAL 45

TEXTBOOKS

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<th>Author(s) Name</th>
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<tbody>
<tr>
<td>1</td>
<td>Montgomery, D.C</td>
<td>Design and Analysis of Experiments</td>
<td>John Wiley and Sons</td>
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<td>Holt, Rinehart and Winston</td>
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<tr>
<td>2</td>
<td>Bagchi. T.P</td>
<td>Taguchi Methods explained</td>
<td>PHI</td>
<td>2002</td>
</tr>
</tbody>
</table>
WEB REFERENCES

1. http://cran.r-project.org
COURSE OBJECTIVES
1. To give exposure to accessories and layout required for a steam power plant depending upon the requirements.
2. To study performance of steam power plant.
3. To make the student acquire sound knowledge of working of nuclear and hydel power plant.
4. To study the features of gas turbine power plant.
5. To make the student acquire sound knowledge of economics of the power plant.
6. To make the student acquire sound knowledge on renewable energy technologies and availability.

COURSE OUTCOMES
1. Select the accessories and layout required for a steam power plant depending upon the requirements.
2. Compute performance of steam power plant.
3. Explain the working of nuclear and hydel power plant.
5. Calculate the economics of the power plant.
6. Apply appropriate type of renewable energy technologies depending upon the application and availability.

UNIT I INTRODUCTION TO POWER PLANTS AND BOILERS
Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants – Combined Power Cycles – Comparison and Selection, Load Duration Curves.

UNIT II STEAM POWERPLANT
Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitator, Draught – different types, Surface Condenser Types, Cooling Towers

UNIT III NUCLEAR AND HYDEL POWERPLANTS

UNIT IV DIESEL AND GAS TURBINE POWERPLANT

UNIT V OTHER POWER PLANTS AND ECONOMICS OF POWERPLANTS

TOTAL 45

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<tr>
<td>1</td>
<td>Arora S.C and Domkundwar S</td>
<td>A course in Power Plant Engineering</td>
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<td>2</td>
<td>Rajput R.K</td>
<td>Power Plant Engineering</td>
<td>Laxmi Publications, Chennai</td>
<td>2015</td>
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<td>3</td>
<td>Morse Frederick T</td>
<td>Power Plant Engineering</td>
<td>Prentice Hall of India, New Delhi</td>
<td>1998</td>
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### WEB REFERENCES

1. www.solarpaces.org
2. www.igcar.gov.in
3. ga.water.usgs.gov
4. www.mapsofindia.com
COURSE OBJECTIVES
1. To provide knowledge on different aspects of powder metallurgy parameters.
2. To understand the importance of principle of advanced welding processes and its application.
3. To understand the importance of advanced forming processes and its application.
4. To familiarize the students to advanced manufacturing process for processing of different materials.
5. To acquaint the student to apply the suitable rapid prototyping mechanism for industry need.
6. To provide knowledge on optimum parametric for advanced manufacturing process.

COURSE OUTCOMES
1. Understand different aspects of powder metallurgy parameters.
2. Understand basic principle of advanced welding processes and its application.
3. Understand basic principle of advanced forming processes and its application.
4. Select the best suitable advanced manufacturing process for processing of different materials.
5. Apply the suitable rapid prototyping mechanism for industry need.
6. Select the optimum parametric for advanced manufacturing process.

UNIT I  POWDERMETALLURGY PROCESS

UNIT II ADVANCEDWELDING PROCESSES

UNIT III SHEET METAL AND FORMING PROCESS

UNIT IV ADVANCEDMACHININGPROCESS
Modern machining process: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, Electro chemical Machining, Electro chemical Grinding, Electro Discharge Machining, wire cut EDM, Electron Beam Machining, plasma arc machining, Laser Beam Machining, Ultrasonic Machining, High speed machining process – deep hole drilling process.

UNIT V RAPID PROTOTYPING

TOTAL 45

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<td>1</td>
<td>P.N. Rao</td>
<td>Manufacturing technology Volume I</td>
<td>TMH Ltd</td>
<td>2013</td>
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<td>2</td>
<td>Singh, M.K</td>
<td>Unconventional Manufacturing Process</td>
<td>New age international</td>
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<tr>
<td>3</td>
<td>Vijay K Jain</td>
<td>Advanced Machining Processes</td>
<td>Allied Publishers Pvt. Ltd</td>
<td>2009</td>
</tr>
</tbody>
</table>

WEB REFERENCES

3. http://www.me.psu.edu/lamancusa/rapidpro/rpintro2.pdf
## COURSE OBJECTIVES

1. To introduce Governing Equations of viscous fluidflows
2. To introduce numerical modeling and its role in the field of fluid flow and heat transfer
3. To enable the students to understand the various discretization methods, solution procedures and turbulencemodeling.
4. To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speedcomputers.
5. To equip them with skills to solve convection and diffusion problems
6. To understand the importance continuity and momentum equations for different types of fluid flow

## COURSE OUTCOMES

Upon completion of this course, the students can able
1. Identify, solve engineering problems by computational fluiddynamics.
2. Understand the importance of governing equations involved in CFD
3. Formulate and solve problems in the field of fluid flow and heat transfer.
4. Solve the heat conduction problems using finite differencemethod.
5. Analyze and provide solutions for convection and diffusion problems.
6. Develop continuity and momentum equations for different types of fluidflow

## UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS


## UNIT II DISCRETIZATION AND SOLUTION METHODOLOGIES

Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

## UNIT III HEAT CONDUCTION

Finite difference and finite volume formulation of steady/transient one–dimensional conduction equation, Source term linearization, Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problems

## UNIT IV CONVECTION AND DIFFUSION

Finite volume formulation of steady one–dimensional convection and Diffusion problems, Central, upwind, hybrid and power–law schemes – Discretization equations for two dimensional convection and diffusion.

## UNIT V CALCULATION OF FLOWFIELD


## TOTAL

45

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<td>Versteeg H.K and Malalasekera.W</td>
<td>An Introduction to Computational Fluid Dynamics</td>
<td>Pearson education ltd, UK</td>
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<td>Bose T.K. Jain</td>
<td>Numerical Fluid Dynamics</td>
<td>Narosa publishing House, New Delhi</td>
<td>2005</td>
</tr>
</tbody>
</table>

## WEB REFERENCES

2. http://www.cham.co.uk/website/new/cfdintro.htm
 COURSE OBJECTIVES
1. To gain knowledge in production, gear material selection
2. To introduce the concepts of gear manufacturing
3. To Study and acquire knowledge on mechanism in conical gears
4. To Study and acquire knowledge on the procedures that involves in gear material selection
5. To expose students to detailed view of gear finishing methods
6. To impart knowledge modern gear production methods

COURSE OUTCOMES
Upon the completion of this course the students will be able to
1. Understand the overview on classification of gears and its terminology
2. Explain the various methods of gear manufacturing
3. Understands the concepts and mechanism involve in conical gears
4. Understand the procedures that involves in gear material selection
5. Attain a detailed view of gear finishing methods
6. Understanding the modern gear production methods

UNIT I INTRODUCTION TO GEARS

UNIT II PRODUCTION OF CONICAL GEARS
Production of straight bevel gears by bevel gear generator, duplex rotary cutter method, Gleason Reva cycle method, spiral and hybrid bevel gear generation. Description of machine, cutter and machine setting.

UNIT III GEAR MATERIAL SELECTION AND HARDENING METHODS
Properties of gear materials-non-metallic, non-ferrous and plastic gears, selection of material for power transmission, high speed application. Selection of material for worm and wheel. Hardening by through hardening, case hardening, induction hardening, flame hardening, nitriding and tuftriding, hardening defects.

UNIT IV GEAR FINISHING METHODS
Gear finishing advantages, finishing of gears by grinding, shaving, lapping and honing methods, cold rolling of gears - description of process, machine, cutters and process parameters setting.
Gear Inspection: Type of gear errors-gear quality standards and allowable limits-tooth thickness, base tangent length measurement, pitch error, radial run out, involute profile error measurements methods and analysis, composite error measurement, computerized gear inspection, gear failure reasons and remedies.

UNIT V MODERN GEAR PRODUCTION METHODS
Gear production by stamping, die casting, powder metal process, injection and compression moulding of plastic gears, cold and hot rolling. Mass production methods, shear speed shaping, gear broaching, Gleason G-TRAC – gear generation methods. Economical and Quality Production of Gears: Gear production systems – batch production, gear production cells, lean and agile production practices, automobile gear and gear boxes, heavy engineering gear production, gear for instruments and appliances, process and cutter selection for quantity, cost and quality criteria.

TOTAL 45

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<td>Modern Gear Production</td>
<td>Persman Press, Oxford</td>
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<td>2</td>
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<td>Production Technology</td>
<td>Tata McGraw Hill Co., New Delhi</td>
<td>1992</td>
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</tr>
</thead>
</table>

WEB REFERENCES

1. www.geartechnology.com
2. www.gearsolutions.com
COURSE OBJECTIVES

1. To understand the importance of the DFM approach and guidelines
2. To enrich the understanding of the selective assembly and Datum systems
3. To introduce the concepts of demonstrate true Position tolerancing theory.
4. To develop an understanding of the standard techniques and redesigning cast members using weldments and plastic component manufacturing.
5. To equip them with skills on Tolerance Charting Technique.
6. To Study and acquire knowledge of the various factors influencing the manufacturability of components and the use of tolerances in manufacturing

COURSE OUTCOMES

Upon completion of this course, the students will be able to,
1. Understand the DFM approach and guidelines
2. Understand the selective assembly and Datum systems
3. Demonstrate true Position tolerancing theory.
4. Understand redesigning cast members using weldments and plastic component manufacturing.
5. Demonstrate the Tolerance Charting Technique.
6. Know the various factors influencing the manufacturability of components and the use of tolerances in manufacturing

UNIT I DFM APPROACH, SELECTION AND SUBSTITUTION OF MATERIALS IN INDUSTRY

DFM approach, DFM guidelines, standardisation, group technology, value engineering, comparison of materials on cost basis, design for assembly, DFA index, Poka – Yoke principle; 6σ concept; Tolerance Analysis: Process capability, process capability metrics, Cp, Cpk, cost aspects, feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law.

UNIT II SELECTIVE ASSEMBLY

Interchangeable and selective assembly, deciding the number of groups, Model–I: group tolerances of mating parts equal; Model–II: total and group tolerances of shaft, control of axial play.
Datum Systems: Grouped datum systems–different types, two and three mutually perpendicular grouped datum planes, grouped datum system with spigot and recess, pin and hole, and tongue–slot pair, computation of translational and rotational accuracy.

UNIT III TRUE POSITION TOLERANCING THEORY

Comparison between co–ordinate and convention method of feature location tolerancing and true position tolerancing, zero true position tolerance, virtual size concept, floating and fixed fasteners, projected tolerance zone, functional gauges, paper layout gauging, compound assembly, examples.

UNIT IV FORM DESIGN OF CASTINGS AND WELDMENTS

Redesign of castings based on parting line considerations, minimising core requirements, redesigning cast members using weldments, use of welding symbols – design considerations for plastic component manufacturing.

UNIT V TOLERANCE CHARTING

Tolerance Charting Technique: Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples, design features to facilitate machining. Datum features – functional and manufacturing, component design–machining considerations, redesign for manufacture, examples.

TOTAL 45
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<td>Tolerance Control in Design and Manufacturing</td>
<td>Industrial press Inc., New York</td>
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</table>

### WEB REFERENCES

1. [www.dfma.com](http://www.dfma.com)
2. [www.design4manufacturability.com](http://www.design4manufacturability.com)
COURSE OBJECTIVES
1. To understand the basic difference between incompressible and compressible flow.
2. To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.
3. To introduce the concepts of various conditions of compressible fluid flows.
4. To Study and acquire knowledge on performance analysis of subsonic and supersonic inlets, combustors, afterburners and exhaust nozzles.
5. To understand the concept of working of various types of rocket engines.
6. To study the features of thrust equation for rocket propulsion system.

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Analyze various conditions of compressible fluid flows.
2. Calculate mass flow rate in flow through variable area ducts.
4. Perform performance analysis of combustors, afterburners and exhaust nozzles.
5. Understand the working of various types of rocket engines.
6. Use thrust equation for rocket propulsion system.

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS

UNIT II FLOW THROUGH DUCTS
Flow through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – Variation of flow properties – Isothermal flow with friction in constant area ducts – Use of tables and charts – Generalised gas dynamics.

UNIT III NORMAL AND OBLIQUE SHOCKS
Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Use of table and charts – Applications.

UNIT IV JET PROPULSION

UNIT V ROCKET PROPULSION

TOTAL 45

(Permitted to use standard Gas Tables in the examination)

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<td>Gas Dynamics</td>
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<td>Fundamentals of Gas Dynamics</td>
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<td>Gas Turbines</td>
<td>Tata McGraw–Hill, New Delhi</td>
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</tbody>
</table>

## WEB REFERENCES

COURSE OBJECTIVES

1. To understand the underlying principles of operation of different IC Engines and components.
2. To provide knowledge on pollutant formation, control, alternate fuels etc.
3. To Study and acquire knowledge to identify parts, terminology and fuel supply system of internal combustion engine.
4. To introduce the concepts of cooling and lubrication systems of IC engines.
5. To make the student acquire sound knowledge on combustion, knocking and super charging of internal combustion engines.
6. To expose students to recent trends associated with IC engines.

COURSE OUTCOMES

Upon completion of this course, the students can able to
1. Explain the construction and operation of internal combustion engine.
2. Identify parts, terminology and fuel supply system of internal combustion engine.
3. Recognize the component used in cooling and lubrication systems of IC engines.
4. Describe the function of combustion, knocking and super charging of internal combustion engines.
5. Implement strategies for pollution control.
6. Know about the recent trends associated with IC engines.

UNIT I SPARKIGNITION ENGINES


UNIT II COMPRESSIONIGNITION ENGINES


UNIT III POLLUTANT FORMATION AND CONTROL


UNIT IV ALTERNATIVE FUELS

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

UNIT V RECENT TRENDS


TOTAL 45

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<td>TMH</td>
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<td>2</td>
<td>Duffy Smith</td>
<td>Auto Fuel Systems</td>
<td>The Good Heart Willcox Company, Inc.</td>
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<td>Eric Chowenitz</td>
<td>Automobile Electronics</td>
<td>SAE Publications</td>
<td>1995</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES
1. To explain the steps involved in FEA and also the types of weight residual methods
2. To impart knowledge to formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. To enrich the understanding of two dimensional thermal and torsion problems.
4. To enrich the understanding of axisymmetric bodies, plate and shell.
5. To develop an understanding of the standard techniques on matrix solution techniques to dynamic problems.
6. To impart knowledge on FE equation for structural, heat transfer and vibration problems.

COURSE OUTCOMES
1. Explain the steps involved in FEA and also the types of weight residual methods
2. Formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. Predict finite element equations for two dimensional thermal and torsion problems.
4. Predict finite element equations for axisymmetric bodies, plate and shell.
5. Apply matrix solution techniques to dynamic problems.
6. Formulate FE equation for structural, heat transfer and vibration problems.

UNIT I  INTRODUCTION

UNIT II  ONE DIMENSIONAL PROBLEMS
Finite element modeling – Coordinates and shape functions – Potential energy approach – Galerkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses

UNIT III  TWODIMENSIONAL CONTINUUM

UNIT IV  AXISYMMETRIC CONTINUUM
Axisymmetric formulation – Element stiffness matrix and force vector – Galerkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures

UNIT V  ISOPARAMETRIC ELEMENTS FOR TWODIMENSIONAL CONTINUUM

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<td>The Finite Element Method in Engineering</td>
<td>Butter worth Heinemann imprint, USA</td>
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<td>Khanka S.S</td>
<td>A First course in the Finite Element Method</td>
<td>Cengage Learning, Stamford, USA</td>
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4. [http://www.asiri.net/courses/meng412/m412sm04ex1sol.pdf](http://www.asiri.net/courses/meng412/m412sm04ex1sol.pdf)
5. [http://hyperphysics.phy-astr.gsu.edu/hbase/electric/laplace.html](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/laplace.html)
COURSE OBJECTIVES

1. To gain knowledge in design and material selection of various machine tools.
2. To provide an overview of regulation of speeds and feeds
3. To study the features of machine tool structures
4. To understand the importance of constructional features of machine tool structures
5. To expose students to design in machine tool structures, guide ways, power screws and spindles
6. To expose students to design spindles and spindle supports

COURSE OUTCOMES

Upon the completion of this course the students will be able to

1. Discuss the basics of machine tool drives and mechanisms
2. Get knowledge on regulation of speeds and feeds
3. Understand the importance of machine tool structures
4. Explain the constructional features of machine tool structures
5. Design in machine tool structures, guide ways, power screws and spindles
6. Design spindles and spindle supports

UNIT I INTRODUCTION TO MACHINE TOOL DRIVES AND MECHANISMS

Introduction to the course, Working and Auxiliary Motions in Machine Tools, Kinematics of Machine Tools, Motion Transmission

UNIT II REGULATION OF SPEEDS AND FEEDS

Aim of Speed and Feed Regulation, Stepped Regulation of Speeds, Multiple Speed Motors, Ray Diagrams and Design Considerations, Design of Speed Gear Boxes, Feed Drives, Feed Box Design

UNIT III DESIGN OF MACHINE TOOL STRUCTURES


UNIT IV DESIGN OF GUIDEWAYS, POWER SCREWS AND SPINDLES


UNIT V DESIGN OF SPINDLES AND SPINDLE SUPPORTS


TOTAL 45

TEXTBOOKS

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<tr>
<td>1</td>
<td>Chernov N</td>
<td>Machine Tools</td>
<td>Mir publishers Moscow</td>
<td>1984</td>
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<tr>
<td>5</td>
<td>N. S. Acherkhan</td>
<td>Machine Tool Design</td>
<td>MIR publications</td>
<td>1968</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES
1. To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturing technologies.
2. To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.
3. To introduce process involved in Additive manufacturing technology.
4. To understand the importance of knowledge on software’s used in additive manufacturing technology.
5. To understand the working of the working of SLS and other techniques.
6. To provide an overview of additive manufacturing technology in medical field and biostream.

COURSE OUTCOMES
On completion of this course, students will be able to
1. Understand the need for additive manufacturing technology.
2. Explain the process involved in Additive manufacturing technology.
3. Get knowledge on software’s used in additive manufacturing technology.
4. Describe the working of SLS and other techniques.
5. Apply the additive manufacturing technology in medical field.
6. Applications of additive manufacturing technology in biostream.

UNIT I INTRODUCTION

UNIT II CAD & REVERSE ENGINEERING

UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS

UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS

UNIT V MEDICAL AND BIO-ADDITIVE MANUFACTURING

TOTAL 45

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<td>2</td>
<td>Gebhardt A</td>
<td>Rapid prototyping</td>
<td>Hanser Gardener Publications</td>
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<td>1</td>
<td>Liou L.W., Liou F.W</td>
<td>Rapid Prototyping and Engineering applications</td>
<td>CRC Press</td>
<td>2007</td>
</tr>
<tr>
<td>3</td>
<td>Hilton P.D, Jacobs P.F</td>
<td>Rapid Tooling: Technologies and Industrial Applications</td>
<td>CRC Press</td>
<td>2000</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES
1. To understand the fundamentals of composite material strength and its mechanical behavior
2. Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
3. Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
4. Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.
5. To introduce the concepts of carbon-carbon composite for different industrial application
6. To impart knowledge on various advances in composites

COURSE OUTCOMES
Learners should be able to
1. Select the various types of composite matrix required for an application.
2. Choose appropriate manufacturing process for polymer matrix composite.
4. Use the concepts of ceramic composites and its production techniques.
5. Identify the type of carbon-carbon composite for different industrial application.
6. Explain the various advances in composites

UNIT I INTRODUCTION TO COMPOSITES
– Matrix - Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

UNIT II POLYMER MATRIX COMPOSITES

UNIT III METAL MATRIX COMPOSITES

UNIT IV CERAMIC MATRIX COMPOSITES
Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics- Needfor CMC

UNIT V ADVANCES IN COMPOSITES

TOTAL 45

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<td>2</td>
<td>Strong A.B</td>
<td>Fundamentals of Composite Manufacturing</td>
<td>Society of Manufacturing Engineering</td>
<td>2008</td>
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<td>3</td>
<td>Sharma S.C</td>
<td>Composite materials</td>
<td>Narosa Publications, New Delhi</td>
<td>2000</td>
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1. [http://www.metu.edu.tr/~ckaynak/METE%20470.htm](http://www.metu.edu.tr/~ckaynak/METE%20470.htm)
2. [http://www.springerlink.com/content/978-1-4020-8771-4](http://www.springerlink.com/content/978-1-4020-8771-4)
3. [http://www.virginia.edu/bohr/mse209/chapter17.htm](http://www.virginia.edu/bohr/mse209/chapter17.htm)
COURSE OBJECTIVES
1. To understand the underlying principles of operations in different Refrigeration & Air conditioning systems and components.
2. To provide knowledge on design aspects of Refrigeration & Air conditioning systems.
3. To introduce the concepts on use of unconventional refrigerant system for industrial application.
4. To expose students to properties of air using psychrometric chart.
5. To provide knowledge on cooling load for a given system.
6. To know the application of air conditioning system for industrial and domestic purpose.

COURSE OUTCOMES
1. Calculate COP of various refrigeration cycles.
2. Choose appropriate refrigerants for various applications.
3. Identify the use of unconventional refrigerant system for industrial application.
4. Calculate the properties of air using psychrometric chart.
5. Calculate cooling load for a given system.
6. Select the appropriate air conditioning system for industrial and domestic applications.

UNIT I REFRIGERATION CYCLE

UNIT II REFRIGERANTS, SYSTEM COMPONENTS AND BALANCING

UNIT III PSYCHROMETRY

UNIT IV COOLING LOAD CALCULATIONS

UNIT V AIR CONDITIONING

TOTAL 45

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<tr>
<td>1</td>
<td>Manohar Prasad</td>
<td>Refrigeration and Air Conditioning</td>
<td>New Age International Ltd, New Delhi</td>
<td>2011</td>
</tr>
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<td>2</td>
<td>Arora. C.P</td>
<td>Refrigeration and Air Conditioning</td>
<td>Tata McGraw–Hill, New Delhi</td>
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<td>Principles of Refrigeration</td>
<td>Pearson Education, New Delhi</td>
<td>2002</td>
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<td>Jordon and Prister</td>
<td>Refrigeration and Air Conditioning</td>
<td>Prentice Hall of India PVT Ltd., New Delhi</td>
<td>1981</td>
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<td>3</td>
<td>Stoecker N. F and Jerold W. Jones</td>
<td>Refrigeration and Air Conditioning</td>
<td>McGraw Hill, New Delhi</td>
<td>1986</td>
</tr>
</tbody>
</table>

**WEB REFERENCES**

COURSE OBJECTIVES
1. To Understand the concept of SQC.
2. To enrich the understanding of control charts to analyze for improving the process quality.
3. To familiarize the students to understand different sampling plans
4. To Understand the importance of need and types of life testing.
5. To introduce the reliability of a system.
6. To introduce the concepts of quality control and reliability techniques in industries.

COURSE OUTCOMES
Upon the completion of this course the students will be able to
1. Understand the concept of SQC.
2. Use control charts to analyze for improving the process quality.
3. Describe different sampling plans
4. Understand the need and types of life testing.
5. Improve the reliability of a system.
6. Implement quality control and reliability techniques in industries.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES
Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost—Variation in process—factors – process capability – process capability studies and simple problems – Theory of control chart– uses of control chart – Control chart for variables – X chart, R chart and σ chart.

UNIT II PROCESS CONTROL FOR ATTRIBUTES
Control chart for attributes –control chart for proportion or fraction defectives – P chart and NP chart – control chart for defects – C and U charts, State of control and process out of control identification in charts.

UNIT III ACCEPTANCE SAMPLING

UNIT IV LIFE TESTING – RELIABILITY

UNIT V QUALITY AND RELIABILITY

Note: Permitted to use approved statistical table in the examination.

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<td>2</td>
<td>Srinath L.S</td>
<td>Reliability Engineering</td>
<td>Affiliated East west press New Delhi</td>
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<td>Manohar Mahajan</td>
<td>Statistical Quality Control</td>
<td>Dhanpat Rai and Sons, New Delhi</td>
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<td>Besterfield D.H</td>
<td>Quality Control</td>
<td>Prentice Hall, New Delhi</td>
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<td>4</td>
<td>Connor P.D.T.O</td>
<td>Practical Reliability Engineering</td>
<td>John Wiley, New Delhi</td>
<td>2012</td>
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</table>

## WEB REFERENCES

2. [http://www.isixsigma.com/library/content/c010806a.asp](http://www.isixsigma.com/library/content/c010806a.asp)
3. [http://www.statgraphics.com/control_charts.htm](http://www.statgraphics.com/control_charts.htm)
COURSE OBJECTIVES
1. To impart knowledge of need for planning and control in various aspects.
2. To develop an understanding of the standard techniques in various work study methodologies.
3. To familiarize the students to understand the product and process plan.
4. To introduce the concepts of a production schedule based on different facets.
5. To enrich the understanding of the level of inventory
6. To understand the importance the recent advancements in production planning and control.

COURSE OUTCOMES
1. Indicate the need for planning and control in various aspects.
2. Understand various work study methodologies.
3. Construct product and process plan.
4. Prepare a production schedule based on different facets.
5. Estimate the level of inventory
6. Understand the recent advancements in production planning and control.

UNIT I INTRODUCTION

UNIT II WORKSTUDY

UNIT III PRODUCT PLANNING AND PROCESS PLANNING

UNIT IV PRODUCTIONSCHEDULING

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC

TOTAL 45

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<td>Elements of production planning and control</td>
<td>Macmillan, India</td>
<td>1981</td>
</tr>
</tbody>
</table>

## WEB REFERENCES

2. http://src.edu/work--study
COURSE OBJECTIVES

1. To study the significance of waste heat recovery systems and carry out its economic analysis.
2. To know the concepts of cogeneration, its types and probable areas of applications.
3. To enrich the understanding of thermodynamics, heat transfer, and fluid Mechanics principles to design and analysis of this emerging technology.
4. To impart knowledge on operational issues and challenges cogeneration technologies.
5. To understand the impact of this technology in waste heat recovery systems.
6. To introduce the concepts of various systems involved in waste heat recovery process.

COURSE OUTCOMES

The student will be able to:

1. Understand the various methods of cogeneration.
2. Apply knowledge of thermodynamics, heat transfer, and fluid Mechanics principles to design and analysis of this emerging technology.
3. Have thorough understanding, operational issues and challenges cogeneration technologies.
4. Understand the impact of this technology in waste heat recovery systems.
5. Get the knowledge over various systems involved in waste heat recovery process.
6. Begin a career as an engineer in an organization economic analysis.

UNIT I INTRODUCTION


UNIT II COGENERATION TECHNOLOGIES


UNIT III ISSUES AND APPLICATIONS OF COGENERATION TECHNOLOGIES


UNIT IV WASTE HEAT RECOVERY SYSTEMS


UNIT V ECONOMIC ANALYSIS


TOTAL 45

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<td>R. Kehlhofer, B. Rukes, F. Stirnimann</td>
<td>Combined-cycle gas &amp; steam turbine power plants</td>
<td>PennWell Books</td>
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<td>A. Thumann, D. Paul Mehta</td>
<td>Handbook of energy engineering</td>
<td>The Fairmont Press Inc</td>
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<td>3</td>
<td>B.F. Kolanowski</td>
<td>Small-scale cogeneration handbook</td>
<td>Fairmont Press</td>
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<td>M.P. Boyce</td>
<td>Handbook for cogeneration and combined cycle power plants</td>
<td>ASME Press</td>
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<td>Educogen</td>
<td>The European Educational tool for cogeneration</td>
<td>Fairmont Press</td>
<td>2001</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES
1. To understand and analyze the energy data of industries
2. To carryout energy accounting and balancing
3. To conduct energy audit and suggest methodologies for energy savings
4. To utilize the available resources in optimal ways
5. To make the students conversant with concepts of industrial furnaces
6. To equip them with skills to perform Energy audit

COURSE OUTCOMES
At the end of the course, student will be able to
1. Understand the Environmental aspects of energy utilization
2. Perform combustion analysis
3. Explain the concepts of industrial boiler
4. understand how to work with the steam generated from the boilers in the industrial point of view
5. Explain the concepts of industrial furnaces
6. Perform Energy audit

UNIT I  ENERGY SCENARIO
Present status, rate of growth, energy utilization (sector wise), concept of energy conservation, energy economics.

COMBUSTION: Fuel analysis, combustion calculations, air requirements, theoretical and excess air requirements, excess air control, flue gas analysis and measurement, types of draught, draught calculations, chimney size calculations. F.D and I.D fan draught requirements and power requirements, furnace pressure requirements.

UNIT II  INDUSTRIAL BOILERS
Types and characteristics of industrial boilers, heat balance in boilers, efficiency trials in boilers, energy conservation opportunities in boilers operation and maintenance, water treatment requirements, soot blowing requirements, super heaters and superheat controls, waste heat recovery systems.

STEAM: Distribution requirements of steam and streamlines, efficient utilization of steam, steam trapping and air venting, flash steam recovery, condensate recovery, thermal insulation for systems including HVAC, steam balance calculations.

UNIT III  INDUSTRIAL FURNACES
Furnace types and characteristics, heat balance in furnaces, furnace efficiency calculations, energy conservation opportunities in furnaces, refractories types and properties, waste heat recovery system, insulating refractories, ceramic fibers, heat loss reduction calculations, wall and stored heat loss reduction.

UNIT IV  DRYING
Principle of drying and types of driers, mass and heat balance in driers, energy conservation opportunities in drying operations.

EVAPORATION: Principle of evaporation and types of evaporations, mass and heat balance, single and multiple effect evaporation, capacity and steam economy calculations, vapour recompression system.

UNIT V  ENERGY AUDIT AND APPLICATIONS
Types, methodology, questionnaire development, specific energy consumption (unitwise/section wise), identification of energy conservation measures/technologies, economic and cost benefit analysis, case studies, Energy rating for thermal equipment, Energy saving measurement – Star status – National awards.

TOTAL 45

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WEB REFERENCES

1. www.energyconservation.co.in
2. www.energymanagertraining.com
3. www.nrel.gov
OPEN ELECTIVES
(COURSES OFFERED BY OTHER DEPARTMENTS)
SCIENCE AND HUMANITIES

17BESHOE01 PROBABILITY AND RANDOM PROCESS 3 0 0 3100

COURSE OBJECTIVES
1. To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
2. To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
3. To understand the basic concepts of random processes which are widely used in IT fields.
4. To understand the concept of correlation and spectral densities.
5. To understand the significance of linear systems with random inputs.
6. To understand the response of random inputs to linear time invariant systems.

COURSE OUTCOMES
Upon successful completion of the course, students should be able:
1. To understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
2. To understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
3. To apply the concept random processes in engineering disciplines.
4. To understand and apply the concept of correlation and spectral densities.
5. The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable.
6. To analyze the response of random inputs to linear time invariant systems.

UNIT I MEASURES OF CENTRAL TENDENCY AND PROBABILITY 9
Measures of central tendency – Mean, Median, Mode - Standard Deviation Probability - Random variable - Axioms of probability - Conditional probability - Total probability – Baye’s theorem.

UNIT II STANDARD DISTRIBUTIONS 9
Functions of a random variable - Binomial, Poisson, Uniform, Exponential, Gamma(one Parameter only) and Normal distributions - Moment generating functions, Characteristic function and their properties – Chebyshev’s inequality.

UNIT III TWO DIMENSIONAL RANDOM VARIABLES 9
Joint distributions - Marginal and conditional distributions - Probability mass function - Probability density functions – Covariance - Correlation and regression

UNIT IV CLASSIFICATION OF RANDOM PROCESS 9
Definition and examples - first order, second order, strictly stationary, wide – sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process.

UNIT V CORRELATION AND SPECTRAL DENSITIES 9

TOTAL 45

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<td>Ross, S</td>
<td>A first Course in Probability</td>
<td>Pearson Education, New Delhi (Chap 2 to 8)</td>
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</tbody>
</table>

**WEB REFERENCES**
1. www.cut-theknot.org/probability.shtml
2. www.mathcentre.ac.uk
3. www.mathworld. Wolfram.com
COURSE OBJECTIVES

1. Be able to understand basic knowledge of fuzzy sets
2. Be able to understand basic knowledge of fuzzy logic
3. Be able to apply basic knowledge of fuzzy operations.
4. To know the basic definitions of fuzzy relations
5. Be able to apply basic fuzzy inference and approximate reasoning
6. To know the applications of fuzzy Technology.

COURSE OUTCOMES

1. To gain the main subject of fuzzy sets.
2. To understand the concept of fuzziness involved in various systems and fuzzy set theory.
3. To gain the methods of fuzzy logic.
4. To comprehend the concepts of fuzzy relations.
5. To analyze the application of fuzzy logic control to real time systems.
6. The Engineers will have an exposure on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology.

UNIT I Fuzzy Sets

UNIT II Operations on Fuzzy Sets
Operations on Fuzzy Sets Operations on [0,1] – Fuzzy negation, triangular norms, tconorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

UNIT III Fuzzy Relations
Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

UNIT IV Fuzzy Measures

UNIT V Fuzzy Inference
Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

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<td>Addison Wesley Longman</td>
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<td>Springer Verlag, Heidelberg</td>
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1. www.mathcentre.ac.uk
2. www.mathworld. Wolfram.com
3. www.doc.ic.ac.uk
4. www.calvin.edu/~pribeiro/othrlnks/Fuzzy/fuzzysets.htm
COURSE OBJECTIVES
1. To introduce the basic concepts of vector space
2. To introduce the fundamental concepts in their respective engineering fields
3. To know the fundamentals of linear Algebra
4. To solve system of linear equations
5. To study about the linear transformations
6. To introduce the concepts of inner product spaces

COURSE OUTCOMES
1. To explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
2. To describe the fundamental concepts of Eigen values and Eigen vectors by using Power method.
3. To apply the fundamental concepts in their respective engineering fields
4. To visualize linear transformations as matrix form
5. To recognize the underlying theory of vector spaces over a field and inner product spaces over real or complex numbers
6. To articulate the importance of Linear Algebra and its applications in branches of Mathematics.

UNIT I VECTOR SPACES 9
General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space

UNIT II EIGEN VALUES AND EIGENVECTORS 9
Eigen values and Eigen vectors - diagonalization - Power method - QR decomposition

UNIT III SYSTEM OF LINEAR EQUATIONS 9

UNIT IV LINEAR TRANSFORMATIONS 9
Linear Transformations - The Null Space and Range - Isomorphisms - Matrix Representation of Linear Transformations – Similarity - Eigenvalues and Eigenvectors Eigen values and Eigen vectors - Diagonalization

UNIT V INNER PRODUCT SPACES 9
The Dot Product on R^n and Inner Product Spaces - Orthonormal Bases - Orthogonal Complements - Application : Least Squares Approximation - Diagonalization of Symmetric M - Application: Quadratic Forms

TOTAL 45

REFERENCES

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<td>2</td>
<td>Anton and Rorres</td>
<td>Elementary Linear Algebra, Applications version</td>
<td>Wiley India Edition</td>
<td>2012</td>
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<tr>
<td>3</td>
<td>Jim DeFranza, Daniel Gagliardi</td>
<td>Introduction to Linear Algebra with Application</td>
<td>Tata McGraw-Hill</td>
<td>2008</td>
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</tbody>
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WEB REFERENCES

1. www.sosmath.com
2. www.linear.ups.edu
3. www.mathworld.wolfram.com
4. www.tutorial.math.lamar.edu
COURSE OBJECTIVES
1. To disseminate the fundamentals of acoustic waves.
2. To inculcate the characteristics of radiation and reception of acoustic waves.
3. To teach the concepts of radiation and reception of acoustic waves.
4. To divulge knowledge on the basics of pipe resonators and filters.
5. To introduce the features of architectural acoustics.
6. To impart the basic knowledge of transducers and receivers.

COURSE OUTCOMES
1. Develop the idea of the fundamentals of acoustic waves.
2. Apply the concepts of radiation and reception of acoustic waves.
3. Explain the basic ideas of pipe resonators and filters.
4. Illustrate the basics of architectural acoustics.
5. Illustrate the transducers and receivers and its applications in various electronic devices.
6. Apply the knowledge inputs of the course for engineering applications.

UNIT I INTRODUCTION

UNIT II RADIATION AND RECEPTION OF ACOUSTIC WAVES
Radiation from a pulsating sphere – Acoustic reciprocity – continuous line source radiation impedance - Fundamental properties of transducers. Absorption and attenuation of sound. Absorption from viscosity – complex sound speed and absorption – classical absorption coefficient

UNIT III PIPES RESONATORS AND FILTERS

UNIT IV ARCHITECTURAL ACOUSTICS

UNIT V TRANSDUCTION
Transducer as an electives network – canonical equation for the two simple transducers transmitters – moving coil loud speaker – loudspeaker cabinets – horn loud speaker, receivers – condenser – microphone – moving coil electrodynamics microphone piezoelectric microphone – calibration of receivers

TOTAL 45

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1. www.acousticalsociety.org
2. www.acoustics-engineering.com
3. www.nptel.ac.in
4. www.ocw.mit.edu
COURSE OBJECTIVES
1. To make the students conversant with basics of Solid wastes
2. To learn the solid waste classification.
3. To make the student acquire sound knowledge of different treatments of solid wastes.
4. To acquaint the student with concepts of waste disposals.
5. To develop an understanding of the basic concepts of Hazardous waste managements.
6. To acquaint the students with the basics of energy generation from waste materials.

COURSE OUTCOMES
1. Outline the basic principles of Solid waste and separation of wastes (K).
2. Identify the concepts of treatment of solid wastes (S).
3. Identify the methods of wastes disposals. (S)
4. Examine the level of Hazardousness and its management. (S)
5. Examine the possible of the energy production using waste materials. (S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A).

UNIT I SOLIDWASTE

UNIT II WASTETREATMENT
Size Reduction – Aerobic Composting – Incineration – batch type and continuous flow type, Medical/Pharmaceutical Waste Incineration – Environmental Impacts – Measures of Mitigate Environmental Effects due to Incineration

UNIT III WASTEDISPOSAL

UNIT IV HAZARDOUS WASTEMANAGEMENT

UNIT V ENERGY GENERATION FROM WASTE

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<td>3</td>
<td>Shah, L. Kanti</td>
<td>Basics of Solid &amp; Hazardous Waste Management Technology</td>
<td>Prentice Hall</td>
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</tr>
</tbody>
</table>

WEB REFERENCES

2. http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/
4. nzic.org.nz/ChemProcesses/environment/
COURSE OBJECTIVES
1. To make the students conversant about the green chemistry
2. To make the student acquire sound knowledge of the atom efficient process
3. To make the student acquire sound knowledge of the synthesis elaborately.
4. To acquaint the student with concepts of green technology.
5. To develop an understanding of the basic concepts of renewable energy resources.
6. To acquaint the students with the basic’s information on catalysis.

COURSE OUTCOMES
1. Outline the basic principles of green chemistry.
2. Examine the different atom efficient process and synthesis elaborately.
3. Apply the concepts combustion of green technology.
4. Identify and apply the concepts of renewable energy.
5. Apply the concepts of green catalysts in the synthesis.
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I  INTRODUCTION TO GREEN CHEMICAL PRINCIPLES
Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorous solvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

UNIT II  ATOM EFFICIENT PROCESSES
Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis

UNIT III  BIOTECHNOLOGY AND GREEN CHEMISTRY
Bio technology and its applications in environmental protection-Bio informatics-Bio remediation, biological purification of contaminated air. Green chemistry for clean technology-Significance of green chemistry-Basic components of green chemistry, Industrial applications of green chemistry, green fuels-e-green propellants and bio catalysts.

UNIT IV  RENEWABLE RESOURCES
Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomass conversion

UNIT V  CATALYSIS IN GREEN CHEMISTRY
Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

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<tr>
<td>2</td>
<td>Sanjay K. Sharma, Ackmez Mudhoo</td>
<td>Green Chemistry for Environmental Sustainability</td>
<td>CRC Press</td>
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<td>Dr. Sunita Ratan</td>
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<td>S.K. Kataria and Sons</td>
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<td>3</td>
<td>A. S. Matlack</td>
<td>Introduction to Green Chemistry</td>
<td>Marcel Dekker: New York</td>
<td>2001</td>
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<td>4</td>
<td>Mukesh Doble</td>
<td>Green Chemistry and Engineering</td>
<td>Academic Press</td>
<td>2007</td>
</tr>
</tbody>
</table>

## WEB REFERENCES

COURSE OBJECTIVES
1. To get the information on electrochemical material.
2. To study about the conducting polymers.
3. To study about electrochemistry in storage devices
4. To acquaint the student with concepts of Energy storage devices.
5. To gain knowledge on the batteries and power sources.
6. To develop energy storage devices.

COURSE OUTCOMES
1. Outline the basic principles of chemistry in electrochemical material.
2. Examine the properties of conducting polymers.
3. Apply the concepts of electrochemistry in storage devices.
4. Identify the concepts of storage devices and its applications.
5. Apply the suitable materials for the manufacturing of storage devices.
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

UNIT I   METALFINISHING

UNIT II   CONDUCTING POLYMERSANDELECTROCHEMICALS
Electropolymerisation- anodic and cathodic polymerization-effect of reaction parameters on the course of the reaction- Electrochemical preparation of conducting polymers-poly acetylene- Electrolytic production of perchlorates and manganese dioxide- Electro organic chemicals- constant current electrolysis.

UNIT III  BATTERIES ANDPOWERSOURCES-I
Principles of energy conservation- electrochemical energy conservation- thermodynamic reversibility, Gibbs equation. EMF- battery terminology, energy and power density- Properties of anodes, cathodes, electrolytes and separators- Types of electrolytes.

UNIT IV  BATTERIES ANDPOWERSOURCES-II
Primary batteries- Dry Leclanche cells, alkaline primary batteries, Lithium batteries- construction, characteristics, problems associated with system- Secondary batteries- Lead acid, nickel cadmium- Fuel cells-Introduction, types of fuel cells, advantages.

UNIT V   ELECTROCHEMICALMATERIALSCIENCE
Solar cells- Preparation of CdS/Cu2S solar cells by screen printing techniques and their characteristics - Amorphous silicon solar cells - Photo electrochemical cells(PEC) for conversion of light energy to electrical energy - PEC cells based on Cd/Se and Ga/As characteristics.

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<td>D.Pletcher and F.C.Walsh</td>
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<td>Chapman and Hall, London</td>
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<td>Organic electrochemistry</td>
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<td>I.EEE series, Peter Peregrinius Ltd, Steverage, U.K.</td>
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<td>Applications of Electroactive polymers</td>
<td>Chapman &amp; Hall, London</td>
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2. [http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html](http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html)
3. [http://inventors.about.com/od/sstartinventions/a/solar_cell.htm](http://inventors.about.com/od/sstartinventions/a/solar_cell.htm)
COURSE OBJECTIVES
1. To make the students conversant with cement and lime
2. To make the students to aware about uses of cement and lime.
3. To make the student acquire sound knowledge of abrasives and refractories.
4. To acquaint the student with concepts of inorganic chemicals.
5. To develop an understanding of the basic concepts explosives.
6. To acquaint the students with the basics of agriculture chemicals.

COURSE OUTCOMES
1. Outline the basic chemistry of cement and lime.
2. Examine the uses of abrasives and refractories.
3. Identify the usage of the inorganic chemicals.
4. Identify the concepts of explosives and smoke screens.
5. Identify the usage of the agriculture chemicals.
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology.

UNIT I CEMENT AND LIME
9

UNIT II ABRASIVES AND REFRACTORIES
9

UNIT III INORGANIC CHEMICALS
9

UNIT IV EXPLOSIVES
9

UNIT V AGRICULTURE CHEMICALS
9

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<td>Industrial Chemistry</td>
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# WEB REFERENCES

COURSE OBJECTIVES
1. To study concepts of Internet, IP addresses and protocols
2. To explain the concept of web page development through HTML
3. To introduce the PERL and explore its current strengths and Weaknesses
4. To write working Java code to demonstrate the use of applets for client side programming
5. To study Internet telephony and various multimedia applications
6. To Elaborate on the principles of web page development

COURSE OUTCOMES
Upon completion of this course, the student will be able to:
1. Learn the advanced concepts& techniques of Internet and Java.
2. Analyze the requirements for and create and implement the principles of web page development
3. Understand the concepts of PERL
4. Implement client side programming using java applets
5. Generate internet telephony based upon advanced concepts
6. Develop applications on internet programming based on java applets and scripts

UNIT I INTRODUCTION

UNITII HTML
Introduction, Editors, Elements, Attributes, Heading, Paragraph, Formatting, Link, Head, Table, List, Block, Layout, CSS, Form, Iframe, Colors, Colorme, Colorvalue. Image Maps- map, area, attributes of image area- Extensible Markup Language (XML)- Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts- Introduction- Environment Variable, GET and POST Methods

UNITIII PERL

UNITIV CLIENT-SERVERPROGRAMMING

UNITV INTERNETTELEPHONY

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<td>Paul Deitel, Harvey Deitel &amp; Abby Deitel</td>
<td>Internet and World Wide Web-How to Program</td>
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<td>N.P. Gopalan and J. Akilandeswari</td>
<td>Web Technology: A Developer's Perspective</td>
<td>PHI Learning, Delhi</td>
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<td>Rahul Banerjee</td>
<td>Internetworking Technologies, An Engineering Perspective</td>
<td>PHI Learning, Delhi</td>
<td>2011</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

1. To impart the fundamental concepts of Computer Animation and Multimedia
2. To study the graphic techniques and algorithms using flash
3. Explain various concepts available in 3D animation
4. Explain various devices available for animation
5. To study the multimedia concepts and various I/O technologies for concept development
6. To understand the three-dimensional graphics and their transformations

COURSE OUTCOMES

Upon completion of this course, the student will be able to:

1. Develop their creativity using animation and multimedia
2. Understand the concepts of Flash and able to develop animation using it
3. Understand about various latest interactive 3D animation concepts
4. Know the various devices and software available in motion capture
5. Understand the concept development process
6. Develop an interactive multimedia presentation by using multimedia devices and identify theoretical and practical aspects in designing multimedia applications surrounding the emergence of multimedia technology.

UNIT I INTRODUCTION


UNIT II CREATING ANIMATION IN FLASH


UNIT III 3D ANIMATION & ITS CONCEPTS

Types of 3D Animation – Skeleton & Kinetic 3D Animation – Texturing & Lighting of 3D Animation – 3D Camera Tracking – Applications & Software of 3D Animation

UNIT IV MOTION CAPTION


UNIT V CONCEPT DEVELOPMENT

Story Developing – Audio & Video – Color Model – Device Independent Color Model – Gamma and Gamma Correction - Production Budgets- 3D Animated Movies.

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<td>Malay K. Pakhira</td>
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<td>3</td>
<td>Pankaj Dhaka</td>
<td>Encyclopedia of Multimedia and Animations</td>
<td>Anmol Publications</td>
<td>2011</td>
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</tbody>
</table>
COURSE OBJECTIVES
1. To study the basic parts of computer in detail
2. Introduce various peripheral devices available for computer and its detailed working concepts
3. Overview of various interfaces and other hardware overview
4. Assemble/setup and upgrade personal computer systems and discuss about power supplies and the skills to troubleshoot various power-related problems.
5. To study basic concepts and methods in troubleshooting
6. To study the installation/connection and maintenance of computer and its associated peripherals.

COURSE OUTCOMES
Upon completion of this course, the student will be able to:
1. Identify the main components for the PC, familiarize themselves with PC memories such as RAM and ROM devices and so on.
2. Identify various peripheral devices available and its working
3. Understand various concepts of hardware and its interface and control
4. Perform basic installation of PC. Importance of maintenance is understood
5. Understand Various faults and failures are identified and troubleshooting in detail
6. Understand overall PC hardware, interfacing, maintenance and troubleshooting

UNIT I  INTRODUCTION

UNIT II  PERIPHERAL DEVICES

UNIT III  PC HARDWARE OVERVIEW
Introduction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC.

UNIT IV  INSTALLATION AND PREVENTIVE MAINTENANCE

UNIT V  TROUBLESHOOTING

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<td>IBM PC Clones Hardware, Troubleshooting and Maintenance</td>
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<td>IMB PC Assembly Language and Programming</td>
<td>Pearson Education</td>
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<td>2</td>
<td>Scott Mueller</td>
<td>Repairing PC's</td>
<td>PHI</td>
<td>1992</td>
</tr>
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</table>
COURSE OBJECTIVES
1. To understand the basic history and genres of games
2. To demonstrate an understanding of the overall game design process
3. To explain the design tradeoffs inherent in game design
4. To design and implement basic levels, models, and scripts for games
5. To describe the mathematics and algorithms needed for game programming
6. To design and implement a complete three-dimensional videogame

COURSE OUTCOMES
Upon completion of the course, students will be able to:
1. Develop Java programs using OOP principles
2. Develop Java programs with the concepts inheritance and interfaces
3. Build Java applications using exceptions and I/O streams
4. Develop Java applications with threads and generics classes and swings
5. Understand various aspects for motivation of generic programming
6. Develop various interactive Java programs using OOP concepts of Java

UNIT I  INTRODUCTION TO JAVA
– methods – access specifiers – static members – constructors – finalize method

UNIT II  PACKAGES

UNIT III  I/O STREAMS

UNIT IV  EXCEPTION HANDLING
Exceptions – Syntax of exception handling code – Multiple catch statements – Using finally statements – Throwing our own exceptions – Using exceptions for debugging

UNIT V  THREADS
Introduction, Creating Threads, The Life Cycle of a Thread, Thread Methods, Using Threads, Synchronization of Threads, Summary

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<td>Cay S. Horstmann and Gary Cornell</td>
<td>Core Java: Volume I – Fundamentals</td>
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<td>Timothy Budd</td>
<td>Understanding Object-oriented programming with Java Updated Edition</td>
<td>Pearson Education</td>
<td>2002</td>
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WEB REFERENCES

COURSE OBJECTIVES
1. To understand the basic concepts of electric hybrid vehicle.
2. To gain the knowledge about electric propulsion unit.
3. To gain the concept of Hybrid Electric Drive-Trains.
4. To gain the different Energy Management Strategies.
5. To study about the efficiency manipulation in drives
6. To understand and gain the knowledge about various energy storage devices

COURSE OUTCOMES
1. Summarize the basic concepts in bioprocess Engineering.
2. Explain the concept of Hybrid Electric Vehicles.
3. Understand the concept of Hybrid Electric Drive-Trains.
4. Identify the different Energy Management Strategies.
5. Understand the concept of different Energy Storage devices.
6. Analyze the different motor drives used in Hybrid Electric Vehicles.

UNITI INTRODUCTION
History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNITII HYBRIDELECTRICDRIVE-TRAiNS
Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNITIII ELECTRICPROPELlSIONUNIT
Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNITIV ENERGYSTORAGE
Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNITV ENERGYMANAGEMENTSTRATEGIES
Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

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<td>1</td>
<td>Iqbal Hussein</td>
<td>Electric and Hybrid Vehicles: Design Fundamentals</td>
<td>CRC Press</td>
<td>2010</td>
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</table>
COURSE OBJECTIVES
To gain the knowledge about energy management.
1. To understand the basic concepts in economic analysis in energy management.
2. To understand the basic principles of energy audit.
3. To gain the knowledge about the basic concept of types of Energy Audit
4. To gain and Evaluate the different energy efficient motors
5. Understand the concept of Energy conservation.
6. To study about the behaviour changes of PF requirement in motor currents

COURSE OUTCOMES
At the end of this course, students will demonstrate the ability to
1. Understand the concept of Energy Management.
2. Analyze the different methods for economic analysis
3. Knowledge about the basic concept of Energy Audit and types.
4. Evaluate the different energy efficient motors
5. Understand the concept of Energy conservation.
6. Investigate the different methods to improve power factor.

UNIT I  ENERGY MANAGEMENT  9
Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting –Energy Auditor and Energy Manager – Eligibility, Qualification and functions - Questionnaire and check list for top management.

UNIT II  ECONOMIC ASPECTS AND ANALYSIS  9
Economics analysis – Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Calculation of simple payback method, net present worth method.

UNIT III  BASIC PRINCIPLES OF ENERGY AUDIT  9
Energy audit – definition, concept, type of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes – Energy audit of industries – energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT IV  ENERGY EFFICIENT MOTORS  9
Electric Motors: Factors affecting efficiency - Energy efficient motors - constructional details, characteristics - voltage variation –over motoring – motor energy audit-

UNIT V  POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS  9

TOTAL  45

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<td>John.C.Andreas</td>
<td>Energy Efficient Electric Motors</td>
<td>Marcel Dekker Inc Ltd – 3rd edition</td>
<td>2005</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES
1. To understand the basic principles of PLC systems.
2. To gain the knowledge about data handling functions.
3. To gain the knowledge of storage techniques in PLC
4. To acquire the knowledge about how to handle the data and functions
5. To study about flow charts of ladder and spray process system
6. To understand the principles of PID.

COURSE OUTCOMES
1. At the end of the course the student will be able to understand the registers and functions in PLC and they are able to do the program.
2. To acquire the knowledge of storage techniques in PLC
3. Students know how to handle the data and functions
4. Students known about advanced controller in PLC applications
5. Students gather real time industrial application of PLC
6. Students gathered and evaluate the flow charts of ladder and spray process system

UNIT I INTRODUCTION
PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment. Programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT II PLC PROGRAMMING
PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples. Ladder diagrams for process control. Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT III REGISTERS AND PLC FUNCTIONS
PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT IV DATA HANDLING FUNCTIONS
Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT V PID PRINCIPLES
Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing, analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

TOTAL 45

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<td>1</td>
<td>John Webb and Ronald A Reiss</td>
<td>Programmable Logic Controllers – Principle and Applications</td>
<td>Fifth edition, PHI</td>
<td>2004</td>
</tr>
</tbody>
</table>

WEB REFERENCE

1. http://www.mikroe.com/old/books/plcbook/chapter1/chapter1.htm, - Introduction to programmable Logic controller
COURSE OBJECTIVES
1. To gain the knowledge about environmental aspects of energy utilization.
2. To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion.
3. To study about solar energy collectors and its storages
4. To study about the inter connected system in wind power
5. To understand the basic principles fuel cell, Geothermal power plants.
6. To gain the knowledge about hydro energy.

COURSE OUTCOMES
At the end of this course, students will demonstrate the ability to
1. Analyze the Energy Scenario in India
2. Understand the concept of Solar Energy
3. Understand the concept of Wind Energy
4. Understand the concept of Hydro Energy
5. Analyze the different energy sources
6. Students gathered the real time inter connected system modelling in wind power

UNIT I INTRODUCTION

UNIT II SOLARENERGY

UNIT III WINDENERGY

UNIT IV HYDROENERGY
Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes, Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

UNIT V OTHERSOURCES
Bio energy and types – Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

TOTAL 45

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<td>Rai.G.D</td>
<td>Non-conventional resources of energy</td>
<td>Khanna publishers, Fourth edition</td>
<td>2011</td>
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<td>3</td>
<td>John W Twidell and Anthony D Weir</td>
<td>Renewable Energy Resources</td>
<td>Taylor and Francis</td>
<td>2015</td>
</tr>
</tbody>
</table>

## WEB REFERENCE

1. www.energycentral.com
2. www.catelectricpowerinfo.com
COURSE OBJECTIVES
1. To introduce students to the embedded systems, its hardware and software.
2. To introduce devices and buses used for embedded networking.
3. To study about task management
4. To learn about semaphore management and message passing
5. To study about memory management
6. To imparts knowledge on

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand overview of embedded systems architecture
2. Acquire knowledge on embedded system, its hardware and software.
3. Gain knowledge on overview of Operating system
4. Discuss about task Management
5. Gain knowledge about semaphore management and message passing.
6. Gain knowledge about memory management.

UNITI INTRODUCTION TO EMBEDDED SYSTEM
Introduction - Embedded systems description, definition, design considerations & requirements - Overview of Embedded system Architecture (CISC and RISC) - Categories of Embedded Systems - embedded processor selection & tradeoffs - Embedded design life cycle - Product specifications - hardware/software partitioning - iterations and implementation - hardware software integration - product testing techniques – ARM 7

UNITII OPERATING SYSTEM OVERVIEW

UNITIII TASK MANAGEMENT

UNITIV SEMAPHORE MANAGEMENT AND MESSAGE PASSING

UNITV MEMORY MANAGEMENT
Memory Management: Memory Control Blocks – Creating Partition- Obtaining a Memory Block – Returning a Memory Block .Getting Started with µ C/OS-II – Installing µ C/OS-II – Porting µ C/OS-II: Development Tools – Directories and Files – Testing a Port - IAR Workbench with µ C/OS-II - µ C/OS-II Porting on a 8051 CPU – Implementation of Multitasking - Implementation of Scheduling and Rescheduling – Analyze the Multichannel ADC with help of µ C/OS-II

TOTAL 45
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<td>Jean J. Labrosse</td>
<td>MicroC/OS – II The Real Time Kernel</td>
<td>CMP BOOKS</td>
<td>2009</td>
</tr>
<tr>
<td>3</td>
<td>Steve Furbe,</td>
<td>ARM System-on-Chip Architecture, California</td>
<td>Addison-Wesley Professional, California</td>
<td>2000</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES
1. To study about various speakers and microphone
2. To learn the fundamental of television systems and standards
3. To learn the process of audio recording and reproduction
4. To study various telephone networks
5. To discuss about the working of home appliances
6. To familiarize with TV services like ISDN.

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand working of various type of loud speakers
2. Acquire knowledge on various types of picture tubes
3. Demonstrate the working of various optical recording systems
4. Distinguish various standards for color TV system
5. Acquire knowledge on various telecommunication networks
6. Demonstrate the working of various home appliances

UNIT I  LOUDSPEAKERS AND MICROPHONES
Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones

UNIT II  TELEVISION STANDARDS AND SYSTEMS

UNIT III  OPTICAL RECORDING AND REPRODUCTION
Audio Disc – Processing of the Audio signal – readout from the Disc – Reconstruction of the audio signal – Video Disc – Video disc formats - recording systems – Playback Systems

UNIT IV  TELECOMMUNICATION SYSTEMS
Telephone services - telephone networks – switching system principles – PAPX switching – Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellular modems

UNIT V  HOME APPLIANCES
Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems.

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<td>S.P. Bali</td>
<td>Consumer Electronics</td>
<td>Pearson Education</td>
<td>2005</td>
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</tbody>
</table>
COURSE OBJECTIVES
1. To introduce the basic concepts of neural networks and its applications in various domain
2. To educate how to use Soft Computing to solve real-world problems
3. To have a solid understanding of Basic Neural Network.
4. To provide students with a sound and comprehensive understanding of artificial neural networks and machine learning.
5. To gain exposure in the field of neural networks and relate the human neural system into the digital world
6. To provide knowledge of computation and dynamical systems using neural networks

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand the basic concepts of neural networks and its applications in various domains
2. Gain knowledge about learning process in Neural Networks
3. Apply perception concept in design
4. Design using ART phenomena
5. Gain knowledge on SOM concepts
6. Ability to develop the use of Soft Computing to solve real-world problems

UNIT I INTRODUCTION TO NEURAL NETWORKS
Introduction - biological neurons and their artificial models - learning, adaptation and neural network's learning rules - types of neural networks- single layer, multiple layer- feed forward, feedback networks

UNIT II LEARNING PROCESS

UNIT III PERCEPTION
Single layer perception-Adaptive filtering-unconstrained optimization-Least-mean square algorithm-Leaning curve-Annealing Technique-perception convergence theorem-Relationship between perception and Baye’s classifier-Back propagation algorithm

UNIT IV ATTRACTOR NEURAL NETWORK AND ART

UNIT V SELF ORGANIZATION

TOTAL 45

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<td>1</td>
<td>Simon Haykin</td>
<td>Neural Networks and Learning Machines</td>
<td>Pearson/ Prentice Hall</td>
<td>2009</td>
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<tr>
<td>2</td>
<td>Satish Kumar</td>
<td>Neural Networks - A Classroom Approach</td>
<td>TMH</td>
<td>2008</td>
</tr>
<tr>
<td>3</td>
<td>Freeman J.A., Skapura D.M</td>
<td>Neural networks, algorithms, applications, and programming techniques</td>
<td>Addition Wesley</td>
<td>2005</td>
</tr>
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102
COURSE OBJECTIVES
1. To introduce the basic concepts of Fuzzy logic and its applications in various domains.
2. To educate how to use Fuzzy computation to solve real-world problems.
3. To have a solid understanding of Basic fuzzy models.
4. To provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
5. To learn about applications on Fuzzy based systems.
6. To familiarize with fuzzy fiction and defuzzy fiction procedures.

COURSE OUTCOMES
At the end of the course the students will be able to:
1. Understand the basic concepts of Fuzzy logic and its applications in various domains.
2. Develop fuzzy controllers.
3. Understand concepts of adaptive fuzzy control.
4. Ability to develop how to use Fuzzy computation to solve real-world problems.
5. Design fuzzy based model for any application.

UNIT I   BASICS OF FUZZY LOGIC
Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle

UNIT II   THEORY OF APPROXIMATE REASONING
Linguistic variables, Fuzzy proportions, Fuzzy if-then statements, inference rules, compositional rule of inference-fuzzy models

UNIT III   FUZZY KNOWLEDGE BASED CONTROLLERS (FKBC)
Basic concept structure of FKBC, choice of membership functions, scaling factors, rules, fuzzyfication and defuzzyfication procedures – Design of Fuzzy Logic Controller

UNIT IV   ADAPTIVE FUZZY CONTROL
Process performance monitoring, adaption mechanisms, membership functions, tuning using gradient descent and performance criteria. Set organizing controller model based controller.

UNIT V   FUZZY BASED SYSTEMS
Simple applications of FKBC - washing machines - traffic regulations - lift control-fuzzy in medical applications - Introduction to ANFIS

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<td>1</td>
<td>D. Diankar, H. Hellendoorn</td>
<td>An Introduction to Fuzzy Control</td>
<td>Narosa Publishers India</td>
<td>1996</td>
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<td>2</td>
<td>G.J. Klir and T.A. Folger</td>
<td>Fuzzy Sets Uncertainty and Information</td>
<td>PHI IEEE</td>
<td>1995</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES
1. To impart basic knowledge in bioprocess Engineering
2. To design the bioreactors for various operations.
3. To understand the principle and working of heat transfer equipments.
4. To extend the knowledge in principle of heat transfer inside bioreactor.
5. To construct the equipments used in mass transfer operations.
6. To learn the equipments used in separation process.

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Summarize the basic concepts in bioprocess Engineering.
2. Design the bioreactors for various operations.
3. Understand the principle and working of heat transfer equipments.
4. Develop the heat transfer equipments for Bioprocess Engineering.
5. Construct the equipments used in mass transfer operations.
6. Categorize the equipments used in separation process.

UNIT I ENGINEERING PROPERTIES AND STORAGETANK
Introduction to various mechanical properties of material to be used material of construction, design of cylindrical storage tank.

UNIT II REACTORDESIGN
Design of Airlift fermentor, Bubble column reactor and Continuous stirred tank reactor.

UNIT III HEAT TRANSFER EQUIPMENTS
Design of Shell and tube Heat exchanger, Double pipe heat exchanger, long tube vertical evaporator and forced circulation evaporator.

UNIT IV MASS TRANSFER EQUIPMENTS
Design of Bollmann extractor, fractionating column, packed tower and spray tray absorber.

UNIT V SEPARATION EQUIPMENTS
Design of plate and frame filter press, leaf filter, rotary drum filter, disc bowl centrifuge, rotart drum drier and Swenson – walker crystallizer.

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<td>Don W. Green, Robert H. Perry</td>
<td>Chemical Engineer Hand book</td>
<td>The McGraw- Hill Companies, Inc.</td>
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COURSE OBJECTIVES
1. To learn the scope and importance of food processing.
2. To impart basic knowledge in different food processing methods carried out in the food tech companies.
3. To extend the brief knowledge in food conservation operations.
4. To study the methods of food preservation by cooling.
5. To familiarize the students on the concepts of preservation methods for fruits.
6. To create deeper understanding on preservation methods for vegetables.

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Describe the scope and importance of food processing.
2. Outline the various processing methods for foods.
3. Extend the knowledge in food conservation operations.
4. Describe the methods of food preservation by cooling.
5. Summarize the preservation methods for fruits.
6. Demonstrate the preservation methods for vegetables.

UNIT I   SCOPE AND IMPORTANCE OF FOOD PROCESSING
Properties of food - Physical, thermal, mechanical, sensory. Raw material Preparation - Cleaning, sorting, grading, peeling.

UNIT II   PROCESSING METHODS
Heating- Blanching and Pasteurization. Freezing- Dehydration- canning- additives fermentation- extrusion cooking- hydrostatic pressure cooking- dielectric heating- micro wave processing and aseptic processing – Infra red radiation processing- Concepts and equipment used.

UNIT III   FOOD CONVERSION OPERATIONS
Size reduction- Fibrous foods, dry foods and liquid foods- Theory and equipments - membrane separation- filtration- equipment and application.

UNIT IV   FOOD PRESERVATION BY COOLING
Refrigeration, Freezing-Theory, freezing time calculation, methods of freezing, freezing equipments, freeze drying, freeze concentration, thawing, effect of low temperature on food. Water activity, methods to control water activity.

UNIT V   PRESERVATION METHODS FOR FRUITS AND VEGETABLES
Pre processing operations - preservation by reduction of water content: drying / dehydration and concentration – chemical preservation – preservation of vegetables by acidification, preservation with sugar - Heat preservation- Food irradiation- Combined preservation techniques.

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<td>Fruit and Vegetable Processing</td>
<td>FAO agricultural services bulletin no.119</td>
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<td>CRC Press</td>
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<td>2</td>
<td>B. Sivasankar</td>
<td>Food processing and preservation</td>
<td>PHI Learning Pvt. Ltd</td>
<td>2002</td>
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COURSE OBJECTIVES
1. To understand the available tools and databases for performing research in bioinformatics.
2. To expose students to sequence alignment tool in bioinformatics.
3. To construct the phylogenetic trees for evolution.
4. To get familiar with the 3D structure of protein and classification.
5. To acquire basic knowledge in protein secondary structure prediction.
6. To extend the brief knowledge in Microarray data analysis.

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Summarize the basic concepts and importance of Bioinformatics in various sectors.
2. Demonstrate the sequence alignment tool in bioinformatics.
3. Construct the phylogenetic trees for evolution.
4. Analyze the three-dimensional protein structure and classification using various tools.
5. Illustrate the protein secondary structure prediction by comparative modeling.
6. Extend the knowledge in microarray technology and applications of bioinformatics in various sectors.

UNITI OVERVIEW OF BIOINFORMATICS
The scope of bioinformatics; bioinformatics & the internet; useful bioinformatics sites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & protein expression data; protein interaction data. Databases – contents, structure & annotation: file formats; annotated sequence databases; miscellaneous databases.

UNITII RETRIEVAL OF BIOLOGICAL DATA
Data retrieval with Entrez & DBGET/LinkDB; data retrieval with SRS (sequence retrieval system). Searching sequence databases by sequence similarity criteria: sequence similarity searches; amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST. Multiple-sequence alignment, gene & protein families: multiple-sequence alignment & family relationships; protein families & pattern databases; protein domain families.

UNITIII PHYLOGENETICS
Phylogenetics, cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences. Sequence annotation: principles of genome annotation; annotation tools & resources.

UNITIV STRUCTURAL BIOINFORMATICS
Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing & analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure: CATH & SCOP; introduction to protein structure prediction; structure prediction by comparative modeling; secondary structure prediction; advanced protein structure prediction & prediction strategies.

UNITV MICROARRAY DATA ANALYSIS
Microarray data, analysis methods; microarray data, tools & resources; sequence sampling & SAGE. Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharma informatics resources. Basic principles of computing in bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

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<td>Dan E. Krane, Michael L. Rayme</td>
<td>Fundamental Concepts of Bioinformatics</td>
<td>Pearson education</td>
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<td>Microarray Data Analysis: Methods and Applications</td>
<td>Springer Science &amp; Business Media</td>
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<td>3</td>
<td>David W. Mount</td>
<td>Sequence and Genome Analysis</td>
<td>Cold Spring Harbor Laboratory</td>
<td>2004</td>
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<td>4</td>
<td>Jonathan Pevsner</td>
<td>Bioinformatics and Functional Genomics</td>
<td>Wiley-Liss</td>
<td>2003</td>
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</table>
COURSE OBJECTIVES
1. To impart the skills in the field of nano biotechnology and its applications.
2. To acquire knowledge in the nano particles and its significance in various fields.
3. To extend the knowledge in types and application of nano particles in sensors.
4. To define the concepts of biomaterials through molecular selfassembly.
5. To equip students with clinical applications of nanodevices.
6. To describe deeper understanding of the socio-economic issues in nanobiotechnology.

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Develop skills in the field of nano biotechnology and its applications.
2. Summarize the nanoparticles and its significance in various fields.
3. Extend the knowledge in types and application of nano particles in sensors.
4. Define the concepts of biomaterials through molecular selfassembly.
5. Outline the clinical applications of nanodevices.
6. Describe the socio-economic issues in nanobiotechnology.

UNIT I INTRODUCTION

UNIT II NANOPARTICLES

UNIT III APPLICATIONS

UNIT IV NANOBIO TECHNOLOGY

UNIT V ETHICAL ISSUES IN NANOTECHNOLOGY

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<tbody>
<tr>
<td>1</td>
<td>Niemeyer, C.M. and Mirkin, C.A</td>
<td>Nanobiotechnology: Concepts, Applications and Perspectives</td>
<td>Wiley- VCH</td>
<td>2004</td>
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<td>2</td>
<td>Goodsell, D.S.</td>
<td>Bionanotechnology</td>
<td>John Wiley and Sons, Inc</td>
<td>2004</td>
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<td>2</td>
<td>Bhushan. B.</td>
<td>Springer Handbook of Nanotechnology</td>
<td>Springer- Verlag Berlin Heidelberg</td>
<td>2004</td>
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<tr>
<td>3</td>
<td>FreitasJr.R.A</td>
<td>Nanomedicine</td>
<td>Landes Biosciences</td>
<td>2004</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

1. To impart knowledge on the constructional details and principle of operation of various automobile components.
2. To learn the function and working of various components in transmission and drive lines.
3. To study the concept and working of steering and suspension systems in an automobile.
4. To give knowledge on the wheels, tyres and brakes of automobiles.
5. To provide information on the current and future trends in automobiles.
6. Identify and explain the types of steering system.

COURSE OUTCOMES

Upon successful completion of the course, the students should be able to:

1. Demonstrate the operating principles and constructional details of various automobile components.
2. Explain the function and working of components in transmission and drive lines.
3. Identify and explain the types of steering system.
4. Identify and explain the types of suspension system.
5. Classify and describe the types of wheels, tyres and brakes of automobiles.
6. Discuss the current and future trends in the automobiles.

UNIT I ENGINE AND FUEL FEED SYSTEMS
Classification of Engine, construction and working of four stroke petrol and diesel engine, firing order and its significance. Carburettor working principle, requirements of an automotive carburettor, Petrol injection Systems (MPFI, TBI), Diesel fuel injection systems (CRDI)

UNIT II TRANSMISSION SYSTEMS

UNIT III SUSPENSION SYSTEM

UNIT IV BRAKES

UNIT V ELECTRICAL SYSTEM
Principle and construction of lead acid battery. Lighting system: details of head light and side light, LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator. Starting System and charging system.

TOTAL 45
### TEXT BOOKS

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<tr>
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<tr>
<td>1</td>
<td>Young U.P and Griffiths L</td>
<td>Automotive Electrical Equipment</td>
<td>ELBS &amp; New Press</td>
<td>1999</td>
</tr>
<tr>
<td>3</td>
<td>Dr. Kirpal Singh</td>
<td>Automobile Engineering</td>
<td>Standard Publishes</td>
<td>2011</td>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Heldt .P.M</td>
<td>The Automotive Chassis</td>
<td>Literary Licensing, LLC</td>
<td>2012</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

1. The objective of this course is to make the students to know and understand the constructional details, operating characteristics and design aspects of Two and Three wheelers.

2. Construct the frames of two and three wheelers of different layouts.

3. Demonstrate the constructional details and principle of operation of various engine components.

4. Identify and explain the types of transmission systems.

5. Identify and explain the types of steering and suspension systems.

6. Classify and describe the types of wheels, tyres and brakes for two and three wheelers.

COURSE OUTCOMES

Upon successful completion of the course, the students should be able to:

1. Construct the frames of two and three wheelers of different layouts.

2. Demonstrate the constructional details and principle of operation of various engine components.

3. Identify and explain the types of transmission systems.

4. Identify and explain the types of steering and suspension systems.

5. Classify and describe the types of wheels, tyres and brakes for two and three wheelers.

6. Explain the servicing of two and three wheelers.

UNIT I  INTRODUCTION  9
Classifications- design considerations –weight and dimension limitations – requirements stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

UNIT II  POWER UNITS, IGNITION SYSTEMS AND OTHER ELECTRICAL SYSTEMS  9
2 stoke and 4 stoke SI engines and CI engines design criteria– design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburettor types and design. Battery coil ignition, magneto ignition and electronic ignition. Lighting and other electrical system.

UNIT III  CLutches AND TRANSMISSION  9
Types of clutches for 2 and 3 wheelers. Design of clutch system. Gears for two and three wheelers. Design of gear box and gear change mechanism. Belt, chain and shaft drive. Freewheeling devices, starting systems.

UNIT IV  FRAMES, SUSPENSION, WHEELS AND TYRES  9
Types of frames used for two wheelers and three wheelers. Wheel frames- construction design of frames for fatigue strength torsional stiffness and lateral stability. Front and rear forks. Springs for suspension, Dampers, constructional details of wheel and tyres.

UNIT V  THREE WHEELERS  9
Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission for 3 wheelers wheel types, wheel attachment tyre types. Brakes and their operating mechanism.

TOTAL  45

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<td>2</td>
<td>Bruce A. Johns and</td>
<td>Motorcycles: Fundamentals, Service, Repair</td>
<td>Goodheart-Willcox</td>
<td>1999</td>
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<tr>
<td></td>
<td>Robert Scharff</td>
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</tbody>
</table>
COURSE OBJECTIVES
1. The objective of this course is to make the students to know and understand the maintenance and fault diagnosis of basic systems in Automobile.
2. Describe and differentiate the types of maintenance.
3. List the procedure for dismantling, servicing and assembling of engine components.
4. Demonstrate the servicing of transmission and driveline components.
5. Discuss the procedure for steering and suspension.
6. Discuss the procedure for wheel and brake maintenance.

COURSE OUTCOMES
Upon successful completion of the course, the students should be able to:
1. Describe and differentiate the types of maintenance.
2. List the procedure for dismantling, servicing and assembling of engine components.
3. Demonstrate the servicing of transmission and driveline components.
4. Discuss the procedure for steering and suspension.
5. Discuss the procedure for wheel and brake maintenance.
6. Explain the fault diagnosis in the electrical and air conditioner systems.

UNIT I MAINTENANCE OF RECORDS AND SCHEDULES 9
Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance.

UNIT II ENGINE MAINTENANCE 9
Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

UNIT III CHASSIS MAINTENANCE 9
Mechanical and automobile clutch and gear box, servicing and maintenance, maintenance servicing of propeller shaft and differential system, Maintenance servicing of suspension systems, Brake systems, types and servicing techniques, Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheelbalancing.

UNIT IV ELECTRICAL SYSTEM MAINTENANCE 9
Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems, Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

UNIT V MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VEHICLE BODY
Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply, Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives, Lubrication maintenance, lubricating oil changing, greasing of parts, Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance.

TOTAL 45

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<td>1</td>
<td>John Doke</td>
<td>Fleet Management</td>
<td>McGraw Hill Co</td>
<td>1984</td>
</tr>
<tr>
<td>2</td>
<td>James D Halderman</td>
<td>Advanced Engine Performance Diagnosis</td>
<td>Prentice Hall Publications</td>
<td>2011</td>
</tr>
</tbody>
</table>

REFERENCE
1. Service Manuals from Different Vehicle Manufacturers
COURSE OBJECTIVES
1. To impart knowledge on trends in the vehicle power plants.
2. To learn the various advanced driver assistance systems.
3. To study the working of advanced suspension and braking systems in an automobile.
4. To give information about motor vehicle emission and noise pollution control.
5. To provide knowledge of the vehicle telematics.
6. To give information about the noise control techniques

COURSE OUTCOMES
Upon successful completion of the course, the students should be able to:
1. Distinguish and describe the various modern vehicle power plant systems.
2. List and explain the various driver assistant mechanisms.
3. Identify and describe the working of advanced suspension and braking systems.
4. Apply the knowledge of motor vehicle emission and noise pollution control.
5. Describe the noise control techniques
6. Describe the vehicle telematics and its applications.

UNIT I TRENDS IN POWER PLANTS

UNIT II DRIVER ASSISTANCE SYSTEMS
Collision Avoidance Systems, Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems, cylinder cut-off technology, ABS, Driver Drowsiness Detection system

UNIT III SUSPENSION BRAKES AND SAFETY
Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.

UNIT IV NOISE & POLLUTION
Reduction of noise - Internal & external pollution control through alternate fuels/power plants – Catalytic converters and filters for particulate emission.

UNIT V TELEMATICS
Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition

TOTAL 45

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<td>“Understanding Automotive Electronics”</td>
<td>SAE</td>
<td>1998</td>
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<tr>
<td>3</td>
<td>Robert Bosch,</td>
<td>“Automotive HandBook”</td>
<td>SAE</td>
<td>2000</td>
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</tbody>
</table>
COURSE OBJECTIVES
1. To examine the role and tasks of basic housing policies and building bye laws
2. Understand the process of integrated service delivery in the context of economic, social, environmental and institutional factors
3. Analyze the Innovative construction methods and Materials
4. Analyze city management strategies and strengthen the urban governance through a problem solving approach
5. To know the Importance of basic housing policies and building bye laws
6. To use Housing Programmes and Schemes

COURSE OUTCOMES
The students will be able to
1. Know the Importance of basic housing policies and building bye laws.
2. Use Housing Programmes and Schemes.
3. Plan and Design of Housing projects.
5. Know Housing finance and loan approval procedures.
6. Understand Construction as well as managing techniques.

UNIT I INTRODUCTION TO HOUSING
Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

UNIT II HOUSING PROGRAMMES
Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organisations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS
Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS
New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL

TOTAL 45

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<td>1</td>
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<td>Sage Publications Pvt. Ltd., New Delhi</td>
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<td>2</td>
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<td>1</td>
<td>CMA</td>
<td>Development Control Rules for Chennai Metropolitan Area</td>
<td>CMA, Chennai</td>
<td>2002</td>
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<td>2</td>
<td>UNCHS</td>
<td>National Experiences with Shelter Delivery for the Poorest Groups</td>
<td>UNCHS (Habitat), Nairobi</td>
<td>2000</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES
1. Defining and identifying of engineering services systems in buildings.
2. The role of engineering services systems in providing comfort and facilitating life of users of the building.
3. The basic principles of asset management in a building & facilities maintenance environment
4. Importance of Fire safety and its installation techniques
5. To Know the principle of Refrigeration and application
6. To Understand Electrical system and its selection criteria

COURSE OUTCOMES
The students will be able to
1. Machineries involved in building construction
2. Understand Electrical system and its selection criteria
3. Use the Principles of illumination & design
4. Know the principle of Refrigeration and application
5. Importance of Fire safety and its installation techniques
6. Know the principle behind the installation of building services and to ensure safety in buildings

UNIT I MACHINERIES 9
Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS 9

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN 9

UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS 9

UNIT V FIRESAFETY INSTALLATION 9

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<td>Handbook for Building Engineers in Metric systems</td>
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<td>3</td>
<td>National Building Code</td>
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118
COURSE OBJECTIVES
1. To enable the students for a successful career as water management professionals.
2. To create a potential among students in the area of irrigation management with specific enrichment to synthesis of data and their analysis.
3. To expose the students the need for an interdisciplinary approach in irrigation water management
4. To providing a platform to work in an interdisciplinary team.
5. To provide students an ability to understand the applications of mathematical and scientific concepts to analyse intricate technical, social and environmental problems in irrigation water management and finding solutions for them.
6. To promote student awareness for a life-long learning process and inculcate professional ethics and codes of professional practice in water management.

COURSE OUTCOMES
At the end of this the students will be in a capacity to
1. Understand the concepts of soil-water-plant relationship as well as to expose them to the principles and practices of crop production.
2. Exposure to ground water, hydraulics of ground water related to drainage, drainage concepts, planning, design and management of drainage related irrigation system management
3. Understand the various principles of irrigation management and to analyse the different types of irrigation systems and their performances based on service oriented approach.
4. Gain insight on local and global perceptions and approaches to participatory water resource management
5. Learn from successes and failures in the context of both rural and urban communities of water management.
6. Exposure on the use of economic concepts in irrigation development and to impart knowledge on economic planning so as to enable viable allocation of resources in the irrigation sector.

UNIT I IRRIGATION SYSTEM REQUIREMENTS

UNIT II IRRIGATION SCHEDULING
Time of irrigation – Critical stages of water need of crops – Criteria for scheduling irrigation – Frequency and interval of irrigation

UNIT III MANAGEMENT
Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water.

UNIT IV OPERATION
Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Performance indicators – Case study

UNIT V INVOLVEMENT OF STAKEHOLDERS
Farmer’s participation in System operation – Water user’s associations – Farmer councils – Changing paradigms on irrigation management – Participatory irrigation management

TOTAL 45

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<td>1</td>
<td>Dilip Kumar Majumdar</td>
<td>Irrigation Water Management – Principles and Practice</td>
<td>Prentice Hall of India Pvt. Ltd., New Delhi</td>
<td>2000</td>
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<td>2</td>
<td>R.T. Gandhi</td>
<td>Hand book on Irrigation Water Requirement</td>
<td>Water Management Division, Department of Agriculture</td>
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<td>Maloney, C. and Raju, K.V</td>
<td>Managing Irrigation Together - Practice and Policy in India</td>
<td>Stage Publication, New Delhi, India</td>
<td>2000</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES

1. To give an experience in the implementation of new technology concepts which are applied in field of Advanced construction.
2. To study different methods of construction to successfully achieve the structural design with recommended specifications.
3. To involve the application of scientific and technological principles of planning, analysis, design and management to construction technology.
4. To study of construction equipment’s, and temporary works required to facilitate the construction process
5. To provide a coherent development to the students for the courses in sector of Advanced construction technology.
6. To present the new technology of civil Engineering and concepts related Advanced construction technology.

COURSE OUTCOMES

1. Implementation of new technology concepts which are applied in field of Advanced construction.
2. Different methods of construction to successfully achieve the structural design with recommended specifications.
3. Application of scientific and technological principles of planning, analysis, design and management to construction technology.
4. Will gain the Knowledge of construction equipment’s, and temporary works required to facilitate the construction process
5. Development to the students for the courses in sector of Advanced construction technology.
6. The new technology of civil Engineering and concepts related Advanced construction technology.

UNIT I MODERN CONSTRUCTION METHODS

Open Excavation, Shafts and Tunnels- Preparation of foundation, Cofferdams, Caisson, Piled Foundation, Prestressed Concrete Construction, Pre-cast Concrete Construction.

UNIT II CONSTRUCTION METHODS FOR SPECIAL STRUCTURES


UNIT III MODERN CONSTRUCTION EQUIPEMENTS-I

Construction Equipment used for Earth Moving, Excavating, Drilling, Blasting, Tunneling and hoisting

UNIT IV MODERN CONSTRUCTION EQUIPEMENTS-II

Construction Equipment used for Conveying, Hoisting, Dredging, Dewatering Systems, Paving and concreting Plant

UNIT V PRINCIPLES AND PRACTICES OF TEMPORARY STRUCTURES

Principles and Practices of Temporary structures, Shoring, and Strutting, Underpinning, Principles and Design of Formwork, Scaffolding, Operation and maintenance of construction equipments

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<td>Varma, M</td>
<td>Construction Equipment and its Planning &amp; Applications</td>
<td>Metropolitan Book Co</td>
<td>2000</td>
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<td>2</td>
<td>Nunnaly, S.W</td>
<td>Construction Methods and Management</td>
<td>Prentice – Hall</td>
<td>2000</td>
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<tr>
<td>3</td>
<td>Ataev, S.S</td>
<td>Construction Technology</td>
<td>MIR, Pub</td>
<td>2000</td>
</tr>
</tbody>
</table>
OPEN ELECTIVES
(COURSES OFFERED TO OTHER DEPARTMENTS)

17BEMEOE01  COMPUTERAIDED DESIGN  3 0 0 3100

COURSE OBJECTIVES
1. To apply basic concepts to develop construction (drawing) techniques.
2. To ability to manipulate drawings through editing and plotting techniques.
3. To understand geometric construction and Produce template drawings.
4. To understand and demonstrate dimensioning concepts and techniques.
5. To understand Section and Auxiliary Views.
6. To become familiar with Solid Modelling concepts and techniques.

COURSE OUTCOMES
Upon completion of the course, the students will be able to
1. Apply basic concepts to develop construction (drawing) techniques.
2. Ability to manipulate drawings through editing and plotting techniques.
3. Understand geometric construction and Produce template drawings.
4. Understand and demonstrate dimensioning concepts and techniques.
5. Understand Section and Auxiliary Views.

UNITI  OVERVIEW OF CAD SYSTEMS  9
Conventional and computer aided design processes-advantages and disadvantages. Subsystems of CAD-CAD hardware and software, analytical and graphics packages, CAD workstations. Networking of CAD systems.

UNITII  INTERACTIVE COMPUTER GRAPHICS AND GRAPHICSTRA N S F O R M A T I O N S  9

UNITIII  GEOMETRIC MODELING  9

UNITIV  PARAMETRIC DESIGN AND OBJECT REPRESENTATION  9

UNITV  PRODUCT DESIGN AND DEVELOPMENT  9

TOTAL  45

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<tr>
<td>2</td>
<td>Radhakrishnan P and Subramanyan S</td>
<td>CAD/CAM/CIM</td>
<td>New Age International Pvt. Ltd</td>
<td>2004</td>
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</table>
COURSE OBJECTIVES
1. To recognize and evaluate occupational safety and health hazards in the workplace.
2. To determine appropriate hazard controls following the hierarchy of controls.
3. To analyse the effects of workplace exposures, injuries and illnesses, fatalities.
4. To prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
5. To teach student the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
6. To prevent or mitigate harm or damage to people, property, or the environment.

COURSE OUTCOMES
At the end of the course, student will be able to
1. Recognize and evaluate occupational safety and health hazards in the workplace.
2. Determine appropriate hazard controls following the hierarchy of controls.
3. Analyse the effects of workplace exposures, injuries and illnesses, fatalities.
4. Prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
5. Understand the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
6. Prevent or mitigate harm or damage to people, property, or the environment.

UNIT I  INTRODUCTION TO LOGISTICS
Logistics - concepts, definitions and approaches, factors influencing logistics - Supply chain: basic tasks, definitions and approaches, influencing supply chain - a new corporate model.

UNIT II  PHASES OF SUPPLY CHAIN
The new paradigm shift - The modular company - The network relations - Supply processes - Procurement processes - Distribution management.

UNIT III  EVOLUTION OF SUPPLY CHAIN MODELS

UNIT IV  SUPPLY CHAIN ACTIVITIES
Structuring the SC, SC and new products, functional roles in SC - SC design frame- work - Collaborative product commerce (CPC).

UNIT V  SCM ORGANISATION AND INFORMATION SYSTEM
The management task - Logistics organization - The logistics information systems - Topology of SC application - Product Data Management - Warehouse management system MRP- I, MRP - II, ERP., - Case study, ERPSoftware's

TOTAL 45

TEXTBOOKS

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<tr>
<th>S. No.</th>
<th>Author(s) Name</th>
<th>Title of the book</th>
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<td>2</td>
<td>Steudel H.J and Desruelle P</td>
<td>Manufacturing in the nineteen - How to become a mean, lean and world class competitor</td>
<td>Van Nostrand Reinhold, New York</td>
<td>1992</td>
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</tbody>
</table>
COURSE OBJECTIVES
1. To generalized equations for mass, momentum and heat.
2. To understand the concepts of Reynolds and Gauss theorems.
3. To learn combined diffusive and convective transport.
4. To apply Film- and penetration models for mass and heat transfer.
5. To apply Stefan-Maxwells equations for multi-component diffusion.
6. To Solve the given set of equations either analytically or numerically.

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3. Learn combined diffusive and convective transport.
4. Apply Film- and penetration models for mass and heat transfer.
5. Apply Stefan-Maxwells equations for multi-component diffusion.
6. Solve the given set of equations either analytically or numerically.

UNIT I INTRODUCTION AND BASIC CONCEPTS
General overview of transport phenomena including various applications, Transport of momentum, heat and mass, Transport mechanism, Level of transport, Driving forces, Molecular transport (diffusion), convective transport (microscopic)

UNIT II PROPERTIES, UNITS AND OTHER PHYSICAL PARAMETERS
Unit systems, temperature, mole, concentration, pressure, Gas laws, laws of conservation, energy and heat units

UNIT III MOMENTUM TRANSPORT
Basic concepts in fluid mechanics, Force, unit and dimensions, pressure in fluid, head of fluid, Molecular transport for momentum, heat and mass transfer, Viscosity of fluids, Newton's law, Momentum transfer, Newtonian and non-Newtonian fluids, Fluid flow and Reynolds number, Overall mass balance, Control volume and Continuity equation, Overall energy balance, Bernoulli's equation, Overall momentum balance, Drag coefficient, Stokes law, Flow in packed beds, Flow in fluidized bed

UNIT IV ENERGY TRANSPORT
Basic concepts in heat transfer, Heat transfer mechanisms, Fourier's law of heat conduction, thermal conductivity, convective heat transfer coefficient, Conduction heat transfer - through flat slab/wall and through hollow cylinder, Conduction through solids in series, Forced convection heat transfer inside pipes, Heat transfer outside various geometrics in forced convection, General discussion on natural convection heat transfer, Heat exchangers, General discussion on radiation heat transfer

UNIT V MASS TRANSPORT
Basic concepts in mass transport, Some application examples, Modes of mass transfer, Molecular diffusion-Fick's law, Analogy between mass, heat and momentum transfer, Dispersion, Hydraulic or Darcy's flow in porous media, Chemical kinetics and activation energy, Film theory, Convective mass transfer, Liquid-solid mass transfer, Liquid-liquid mass transport, Gas-liquid mass transfer, Aeration and oxygen transport, Air stripping

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<tr>
<td>1</td>
<td>Geankoplis, C. J</td>
<td>Transport Processes and Separation</td>
<td>Prentice Hall</td>
<td>2003</td>
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<td></td>
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<td>Processes Principles</td>
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WEB REFERENCE
1. https://laulima.hawaii.edu/portal
COURSE OBJECTIVES
1. To describe the principles of the study of human movement.
2. To describe the range of factors that influence the initiation, production and control of human movement.
3. To identify the body's lever systems and their relationship to basic joint movement and classification.
4. To distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
5. To explain joint and muscle function and the forces acting upon the human body during various sporting activities.
6. To relate the different body systems necessary for human movement to occur.

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6. Relate the different body systems necessary for human movement to occur.

UNIT I INTRODUCTION
Biomechanics - Improving Performance – Applications - Preventing And Treating Injury - Qualitative And Quantitative Analysis - Scholarly Societies - Computer Searches – Biomechanical Knowledge versus Information - Kinds of Sources - Evaluating Sources

UNIT II KEY MECHANICAL CONCEPTS
Mechanics - Basic Units - Nine Fundamentals of Biomechanics - Principles and Laws - Nine Principles for Application of Biomechanics

UNIT III HUMAN ANATOMY AND SOME BASIC TERMINOLOGY

UNIT IV ANATOMICAL DESCRIPTION
Key Anatomical Concepts - Directional Terms - Joint Motions - Muscle Actions - Active and Passive Tension of Muscle - Limitations of Functional Anatomical Analysis - Mechanical Method of Muscle Action Analysis - The Need for Biomechanics to Understand Muscle Actions - Sports Medicine and Rehabilitation Applications

UNIT V MECHANICS OF THE MUSCULOSKELETAL SYSTEM

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<td>1</td>
<td>Duane Knudson</td>
<td>Fundamentals of Biomechanics</td>
<td>Springer Science+ Business Media, LLC</td>
<td>2007</td>
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<tr>
<td>2</td>
<td>C. Ross Ethier Craig A. Simmons</td>
<td>Introductory Biomechanics</td>
<td>Cambridge University Press</td>
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