With effect from the academic year 2018-2019

DEPARTMENT OF MECHANICAL ENGINEERING

Scheme of Instructions

and

Syllabi of

B.E VII and VIII SEMESTER

2018-2019

UNIVERSITY COLLEGE OF ENGINEERING
(AUTONOMOUS)

OSMANIA UNIVERSITY

HYDERABAD-500 007, TELANGANA
# SCHEME OF INSTRUCTION & EXAMINATION
## B.E VII Semester (Mechanical Engineering)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Scheme of Instruction</th>
<th>Scheme of Examination</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L  T  P</td>
<td>Contact Hrs/wk</td>
<td>CIE  SEE</td>
</tr>
<tr>
<td>1</td>
<td>PC701ME</td>
<td>Thermal Turbo Machines</td>
<td>3  -  -</td>
<td>3</td>
<td>30  70  3</td>
</tr>
<tr>
<td>2</td>
<td>PC702ME</td>
<td>CAD/CAM</td>
<td>3  -  -</td>
<td>3</td>
<td>30  70  3</td>
</tr>
<tr>
<td>3</td>
<td>PC703ME</td>
<td>Management and Information system</td>
<td>3  -  -</td>
<td>3</td>
<td>30  70  3</td>
</tr>
<tr>
<td>4</td>
<td>HS901MB</td>
<td>Managerial Economics &amp; Accountancy</td>
<td>3  -  -</td>
<td>3</td>
<td>30  70  3</td>
</tr>
<tr>
<td>5</td>
<td>PC704ME</td>
<td>Finite Element Analysis</td>
<td>3  -  -</td>
<td>3</td>
<td>30  70  3</td>
</tr>
<tr>
<td>6</td>
<td>PE **</td>
<td>Professional Elective - III</td>
<td>3  -  -</td>
<td>3</td>
<td>30  70  3</td>
</tr>
<tr>
<td>7</td>
<td>OE **</td>
<td>Open Elective-II</td>
<td>3  -  -</td>
<td>3</td>
<td>30  70  3</td>
</tr>
</tbody>
</table>

## PRACTICALS

<table>
<thead>
<tr>
<th></th>
<th>Course Code</th>
<th>Course Title</th>
<th>L  T  P</th>
<th>Contact Hrs/wk</th>
<th>CIE  SEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>PC751ME</td>
<td>Thermal Engineering Lab</td>
<td>-  -  2</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>9</td>
<td>PC752ME</td>
<td>CAD/CAM Lab</td>
<td>-  -  2</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>10</td>
<td>PW761ME</td>
<td>Summer Internship</td>
<td>-  -  -</td>
<td>-</td>
<td>50</td>
</tr>
<tr>
<td>11</td>
<td>PW762ME</td>
<td>Project Work-I</td>
<td>-  -  2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>21 00 06</td>
<td>27</td>
<td>410</td>
</tr>
</tbody>
</table>

## *PROFESSIONAL ELECTIVE-III*

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE701ME</td>
<td>Design of Solar Energy Systems</td>
</tr>
<tr>
<td>PE702ME</td>
<td>Non-conventional Methods of Machining &amp; Forming</td>
</tr>
<tr>
<td>PE703ME</td>
<td>Additive Manufacturing Technologies</td>
</tr>
<tr>
<td>PE704ME</td>
<td>Aerodynamic Design of Thermal Turbines</td>
</tr>
<tr>
<td>PE707ME</td>
<td>Entrepreunership</td>
</tr>
</tbody>
</table>

## **OPEN ELECTIVE-II**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>OE701BM</td>
<td>Human Factor Engineering</td>
</tr>
<tr>
<td>OE702BM</td>
<td>Basic Medical Engineering</td>
</tr>
<tr>
<td>OE701CE</td>
<td>Optimization Techniques</td>
</tr>
<tr>
<td>OE701CS</td>
<td>Data Base Management Systems</td>
</tr>
<tr>
<td>OE702CS</td>
<td>Information Security</td>
</tr>
<tr>
<td>OE701EC</td>
<td>Principles of electronic communication</td>
</tr>
<tr>
<td>OE702EC</td>
<td>Fundamentals of IOT</td>
</tr>
<tr>
<td>OE701EE</td>
<td>Non-conventional Energy Sources</td>
</tr>
<tr>
<td>OE701ME</td>
<td>Startup Entrepreunership</td>
</tr>
<tr>
<td>#OE702ME</td>
<td>Finite Element Methods</td>
</tr>
</tbody>
</table>

# OE702ME not applicable for Mechanical and Civil Engineering students.
With effect from the academic year 2018-2019

Department of Mechanical Engineering
University College of Engineering (A), Osmania University, Hyderabad-500 007

List of NPTL course approved for the academic year 2018-19

Professional Elective-IV

<table>
<thead>
<tr>
<th>S. No</th>
<th>Name of Course</th>
<th>Registration Last Date</th>
<th>Start Date</th>
<th>End Date</th>
<th>Exam Date</th>
<th>Course Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Design for Quality, Manufacturing and Assembly</td>
<td>August 06, 2018 till 5:00pm</td>
<td>August 06, 2018</td>
<td>September 28, 2018</td>
<td>October 07, 2018</td>
<td>8 weeks</td>
</tr>
<tr>
<td>2.</td>
<td>Processing of Polymers and Polymer Composites</td>
<td>August 06, 2018 till 5:00pm</td>
<td>August 06, 2018</td>
<td>September 28, 2018</td>
<td>October 07, 2018</td>
<td>8 weeks</td>
</tr>
<tr>
<td>3.</td>
<td>Engineering Fracture Mechanics</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>4.</td>
<td>Energy Conservation and Waste heat recovery</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>5.</td>
<td>Mechanics of Human Movement</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
</tbody>
</table>

Professional Elective-V

<table>
<thead>
<tr>
<th>S. No</th>
<th>Name of Course</th>
<th>Registration Last Date</th>
<th>Start Date</th>
<th>End Date</th>
<th>Exam Date</th>
<th>Course Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction to Abrasive Machining and Finishing Process</td>
<td>August 06, 2018 till 5:00pm</td>
<td>August 06, 2018</td>
<td>September 28, 2018</td>
<td>October 07, 2018</td>
<td>8 weeks</td>
</tr>
<tr>
<td>2.</td>
<td>Heat Exchangers: Fundamentals and Design Analysis</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>3.</td>
<td>Work System Design</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>4.</td>
<td>Noise Management and Control</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>5.</td>
<td>Advanced Composites</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
</tbody>
</table>
### Open Elective-III

<table>
<thead>
<tr>
<th>S. No</th>
<th>Name of Course</th>
<th>Registration Last Date</th>
<th>Start Date</th>
<th>End Date</th>
<th>Exam Date</th>
<th>Course Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Integrated Waste Management for Smart City</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>2.</td>
<td>Waste water Treatment and Recycling</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>3.</td>
<td>Introduction to Internet of Things</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>4.</td>
<td>Introduction to R software</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>5.</td>
<td>Fabrication Techniques for MEMS based sensors: Clinical Perspective</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>6.</td>
<td>Digital Image Processing</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>7.</td>
<td>Controls Engineering</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>8.</td>
<td>Ecology and Environment</td>
<td>August 06, 2018 till 5:00pm</td>
<td>August 06, 2018</td>
<td>September 28, 2018</td>
<td>October 07, 2018</td>
<td>8 weeks</td>
</tr>
<tr>
<td>9.</td>
<td>Total Quality Management-I</td>
<td>August 06, 2018 till 5:00pm</td>
<td>August 06, 2018</td>
<td>September 28, 2018</td>
<td>October 07, 2018</td>
<td>8 weeks</td>
</tr>
<tr>
<td>10.</td>
<td>Ethics in Engineering Practice</td>
<td>August 06, 2018 till 5:00pm</td>
<td>August 06, 2018</td>
<td>September 28, 2018</td>
<td>October 07, 2018</td>
<td>8 weeks</td>
</tr>
<tr>
<td>11.</td>
<td>Structural Health Monitoring</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>12.</td>
<td>Transform Techniques for Engineers</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
<tr>
<td>13.</td>
<td>System Design for Sustainability</td>
<td>July 30, 2018 till 5:00pm</td>
<td>July 30, 2018</td>
<td>October 19, 2018</td>
<td>October 28, 2018</td>
<td>12 weeks</td>
</tr>
</tbody>
</table>
PC701ME

THERMAL TURBO MACHINES

Credits: 3

Instruction: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To learn about formulation of governing equations for compressible fluid flows
- To understand the design concepts of mechanical devices handling compressible fluids
- To learn about the functioning of turbomachines and related performance parameters.

Course Outcomes:
The Students will be able to
- Formulate the problems related to fluid flow
- Explain the working principle of mechanical devices handling compressible fluids
- Analyze the turbomachines for its performance parameters

Unit-I
Introduction to compressible flows: bulk modulus and coefficient of compressibility, acoustic velocity, mach number, pressure field created by a point disturbance, mach cone and mach angle.
Isentropic flow through variable area devices: Energy equation for flow through nozzles and diffusers, Relations connecting stagnation and static properties-enthalpy, temperature, pressure and density. Various regimes of flow-adiabatic steady flow. Effect of back pressure on nozzle performance.

Unit-II
Flow through constant area ducts with friction (Fanno flow): Governing equation, Fanno line, Fanno relations for perfect gas, maximum length of a duct.
Flow through constant area ducts with heat transfer (Rayleigh flow): Governing equation, Rayleigh line, Rayleigh relations for perfect gas, choking due to heat transfer.
Types of shocks-normal, oblique and expansion.
Normal shock waves: Governing equations, Prandtl-Meyer equation, Rankine-Hugoniot relations.
Oblique shock waves: Relation between deflection angle and wave angle.

Unit-III
Definition and classification of turbo machines, Euler's equation for energy transfer.
Rotodynamic compressors: General classification, comparison with positive displacement compressors. Concept of shape number-selection of impeller.
Axial flow compressors: Stage velocity triangles, enthalpy-entropy diagram, Euler's work input, flow coefficient, blade loading coefficient, relations for static pressure rise in rotor, stator and stage. Stage and polytropic efficiency. Factors affecting stage pressure ratio. Degree of reaction. Surging, stalling and choking.
Centrifugal compressors: Elements of a centrifugal stage, stage velocity triangles, performance of different types of impellers- forward, radial and backward swept blades. Enthalpy-entropy diagram, degree of reaction. Slip factor, actual work and stage and polytropic efficiency.

Unit-IV
Steam Turbines: Classification, flow over blades, impulse and reaction turbines, Pressure and velocity compounding of steam turbines.
Parson's reaction turbine: Reaction stage analysis, degree of reaction, maximum blade efficiency, representation on enthalpy-entropy diagram. Height of turbine blades.

Unit-V
Gas turbines: Classification and comparison of open and closed cycles. Thermodynamic Analysis
Jet Propulsion: Aircraft propulsion turbo engines: Turbo jet, turboprop, turbofan, ramjet and pulse jet engines. Propulsion performance parameters: Thrust force, thrust power and thrust specific fuel consumption. Thrust, propulsion, transmission and overall efficiencies
Types of Rocket engines: Solid propellant and liquid propellant engines.

Suggested Reading:
PC702ME

CAD/CAM

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks

Duration of SEE: 3hours
SEE: 70 Marks

**Course Objectives:**

- To introduce the concepts of CAD and advanced modeling techniques
- To help the students in understanding the functioning of computer numerical control machine tools and also in writing programs for operating this machines.
- To help the student in understanding advanced manufacturing concepts like Group technology, flexible manufacturing systems, Computer aided Process Planning, Computer aided quality control, Artificial Intelligence etc

**Course Outcomes:**

The Students will be able to

- Model complicated profiled objects using the advanced modeling techniques
- Use the CNC codes to write the program for simple operations
- Integrate the CNC machine, robot and conveyors to develop a FMS

**Unit-I**

CAD Fundamentals, Product life cycle in conventional and computer based manufacturing system, Hardware integration and networking. CAD Software: Definitions of system software and application software. Graphic Standards and Exchange Formats. CAD database and structure. Automatic 2-D facilities such as Fillets, Chamfers, Hatching, Dimensioning, Editing, Windowing & Zooming. 2-D & 3-D Geometric Transformations.

**Unit-II**

Geometric modeling: 3-D wire frame modeling: wire frame entities and their definitions, Interpolation and approximation of curves, synthetic curves and curve fitting. Definitions of cubic, Bezier, and B-spline curves.
Surface modeling: Definitions of basic surfaces, surface of revolution, blends, intersection, and Cubic, Bezier, B-spline surfaces.
Finite element modeling: Introduction, modeling, Meshing, Characteristics of different elements, different solvers and post processing.

**Unit-III**


**Unit-IV**

Computer Control in NC and Robots: Machining centers, CMC, DNC and adaptive control systems. Their types, typical configurations and relative features. Industrial Robots: Classification based on manipulator configurations, relative characteristics, Online and offline programming methods, controls and drives, applications.

**Unit-V**

With effect from the academic year 2018-2019

quality control, Contact and non contact inspection, optical and non optical computer aided testing. Basic concepts of FMS, Experts systems. Artificial intelligence, CAD/CAM integration, Introduction to 3D Printing: Process chain, Classification , description about SLA, SLS and FDM processes.

Suggested Reading:
PC703ME

MANAGEMENT AND INFORMATION SYSTEM

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To understand the concept of method study, ergonomics, forecasting and their role in Management.
- To know the important components of management like marketing, financial and maintenance management.
- To understand the role of information system in implementing modern management concepts.

Course Outcomes: The Students will be able to
- Utilize the concepts of method study and optimize the process
- Realize the importance of marketing, finance and maintenance management
- Appropriately use information systems in implementing management systems

Unit-I

Method Study: Introduction and Definition, Objectives of Method Study, Steps involved in method study, Selection of the job for method study, Recording Techniques, Micro-Motion Study, Memo Motion Study, Cycle Graph and Chronocycle Graph, Principles of Motion Economy.


Unit-II

Forecasting: Introduction, Need for forecasting, Long-term and Short-term forecasts, Classification of Forecasting Methods, Judgment Techniques, Time-Series Analysis: Least Square Method of Forecasting (Regression Analysis), Moving Average Forecasting, Exponential Smoothing Method, Casual Forecasting Method, Forecast Error, Costs and Accuracy of Forecasts.

Unit-III


Unit-IV


Unit-V

Information System: Definition of Information System (IS), Organizational Need for Information System, Impact of IT on Organization Structure, Operating Elements of an IS, Main Functions of IS, Information Flows in organization, Information users and their information needs, Characteristics of the information systems, Information System at operational, tactical and
strategic levels, Model of an information system, strategic uses of information technology. Categories of computers, input/ output devices, primary and secondary storage, introduction to operating system.

**Suggested Reading:**

HS901MB

MANAGERIAL ECONOMICS & ACCOUNTANCY

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks

Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To understand responsibilities of a manager of a business undertaking.
- To analyze various factors influencing demand elasticity
- To forecast and compute the future sales level.
- To determine break even point (BEP) of an enterprise
- To understand the features, steps, merits, uses & limitations of Pay Back, ARR, NPV, PI & IRR methods of Capital Budgeting

Course Outcomes:
- Determine the responsibilities of a manager of a business undertaking.
- Assess various factors influencing demand elasticity
- Able to forecast and compute the future sales level.
- Determine break even point (BEP) of an enterprise
- Outline the features, steps, merits, uses & limitations of Pay Back, ARR, NPV, PI & IRR methods of Capital Budgeting

UNIT-I
Introduction to economics and its evolution: Managerial Economics its scope, importance and relation to other sciences, its usefulness to engineers-Basic concepts of Managerial Economics.

UNIT-II
Demands: Analysis-concept of demand, determinants, law of demand, its assumptions, elasticity of demand, price, income and cross elasticity, demand forecasting-markets competitive structure, price-output determination under perfect competition and Monopoly. (Theory questions and small numerical problems can be asked).

UNIT-III

UNIT-IV
Capital management: Significance, determinants and estimation of fixed and working capital requirements, sources of capital. Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems. (Theory questions and numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked)

UNIT V
Book-keeping: Principles and significance of double entry book keeping, journal, subsidiary books, ledger accounts, trial balance concepts and preparation of final accounts with simple adjustments-analysis and interpretation of financial statements through ratios.
(Theory questions and numerical problems on preparation of final accounts, cash book, petty cash book, bank reconciliation statement, calculation of some ratios)
**Suggested Readings:**

1. Varshney RL and KI Maheswari, Managerial Economics, Sultan Chand.
2. JC Pappas and EF Grigham, Managerial Economics.
PC704ME

FINITE ELEMENT ANALYSIS

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:
- To understand the theory and application of the finite element method for analyzing structural systems.
- To learn Approximation theory for structural problems as the basis for finite element methods
- To learn formulations for a variety of elements in one, two, and three dimensions. Implementations of element formulations will be examined using Matlab.
- To understand modeling and analysis of structures using planar, solid, and plate elements

Course Outcomes:
- Understands the concept of Finite Element Method and realize its limitations.
- Able to formulate 1D, 2D and 3D element and distinguish between linear and higher order elements.
- Applying 1D, 2D and 3D elements to solve different static and dynamic problems.

Unit-I
Introduction to Finite Element Method, solution method using FEM, descretisation, Boundary conditions, load application, types of elements comparison, Stress and Equilibrium, Boundary conditions. Strain-Displacement relations. Stress-strain relations.

One Dimensional problems: Finite element modeling, coordinates and shape functions.


Unit-II
Analysis of trusses and frames: Element stiffness matrix for a truss member. Analysis of plane truss with number of unknowns not exceeding two at each node. Analysis of frames with two translations and a rotational degree of freedom at each node.

Analysis of Beams: Element stiffness matrix for two nodded, two degrees of freedom per node beam element.

Unit-III
Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions.

Finite element modeling of Axisymmetric solids subjected to Axisymmetric loading with triangular elements.

Unit-IV
Two dimensional four nodded isoparametric elements and numerical integration.

Steady state heat transfer analysis: One dimensional analysis of a fin and two dimensional analysis of thin plate. Analysis of uniform shaft subjected to torsion.

Unit-V
Dynamic Analysis: Formulation of finite element mode, element matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and a beam.

Time dependent field problems: Application to one dimensional heat flow in a rod. Finite element formation to three dimensional problems in stress analysis. Types of elements used.

Convergence requirements and geometric isotropy. Local, natural and global coordinates.

Introduction to Finite Element Analysis Software.

Suggested Reading:
PC751ME

THERMAL ENGINEERING LABORATORY

Credits: 1

Instructions: (2P) hrs per week

CIE: 25 Marks

Duration of SEE: 3 hours

SEE: 50 Marks

Objectives:

- To understand working principles of heat transfer equipment
- To understand the flow phenomena on cascade blades.

A representative list of experiments to be conducted is as follows:

1. Determination of static pressure distribution on a turbine blade surface at midspan on low speed wind tunnel.

2. Study on downstream wake profile of a turbine cascade at midspan on low speed wind tunnel.

3. Study on downstream wake profile of a compressor cascade at midspan on low speed wind tunnel.


5. Study of Finned Tube Heat Exchanger: Determination of Overall heat transfer coefficient in Parallel and counter flow modes of operation.


8. Study on Thermal conductivity of metal rod.


10. Study on Thermal conductivity of insulating powder

11. Study on performance of Centrifugal blower with forward swept blades.


15. Critical Heat flux apparatus (Boiling Heat Transfer)


17. Study on heat pipe demonstrator

18. Study on Stefan Boltzmann apparatus

19. Pressure distribution in convergent air nozzle
PC752ME

CAD/CAM LAB

Credits: 1

Instructions: (2P) hrs per week

CIE: 25 Marks

Duration of SEE: 3 hours

SEE: 50 Marks

Objectives:

• To understand the various features of geometric modeling packages like Creo (Pro-E) / CATIA / Solid Works like 2d-Sketching, Part Modeling and Assembly
• To understand the application of Finite Element Analysis packages like ANSYS / NASTRAN / ADINA in solving structural and thermal problems
• To develop NC part program, simulate and manufacture components on CNC machine

Computer Aided Design:

1. Introduction to various features of geometric modeling packages like: Creo (Pro-E) / CATIA / Solid Works.

2. Practicing problems on 2D-Sketching.

3. Practicing problems on Part Modeling

4. Practicing problems on Assembly Modeling.

5. Static Structural Analysis using 2D truss/beam/etc. for different types of loads using ANSYS/NASTRAN/ADINA etc.

6. Steady state heat transfer and transient heat transfer analysis.

Computer Aided Manufacturing:

7. Development of CNC part program for turning, facing, step turning, taper turning etc with and without canned or fixed cycle.

8. Tool path simulation using any CAM software

9. Demonstration of manufacturing of simple parts on CNC machine

10. Programming for simulation of integrating various machines, robots and material handling equipment using plant layout simulation software like FlexSim/Arena/Promodel etc.
PW761ME

SUMMER INTERNSHIP

Credits: 2

CIE: 50 Marks

Instructions: NIL

Course Objectives:

• To give an experience to the students in solving real life practical problems with all its constraints.
• To give an opportunity to integrate different aspects of learning with reference to real life problems.
• To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.

Course Outcomes: Student will be

• Able to design/develop a small and simple product in hardware or software.
• Able to complete the task or realize a prespecified target, with limited scope, rather than taking up a complex task and leave it.
• Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to prespecified criteria.
• Able to implement the selected solution and document the same.

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Industry / R & D Organization / National Laboratory for a period of 8 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide. After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of sessional marks are based on the performance of the student at the work place and awarded by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.

*Students after undergoing summer internship of 6 Weeks duration at the end of semester VI the credits will be awarded after evaluation in VII semester.
PW762ME

PROJECT WORK-I

Instructions: 2 Hrs per week

Credits: 4

CIE: 50 Marks

Objective:
The project seminar is to actively involve the students in preparation of the final year project with regard to following components:

* Problem definition and specification
* Literature survey, familiarity with research journals
* Broad knowledge of available techniques to solve a particular problem.
* Planning of the work, preparation of graphs, bar (activity) charts and analyzing the results.
* Presentation - oral and written.

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.

First 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R & D institutions. The objective of these preliminary talks will be to expose the students to real life practical problems and methodology to solve the technical problems.

Seminar schedule will be prepared by the co-ordinator for all the students from 5th week to the last week of the semester which should be strictly adhered to.

Each student will be required to:
1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 20 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.
PE701ME

DESIGN OF SOLAR ENERGY SYSTEMS
(Professional Elective-III)
Credits: 3

Instructions: (3L) hrs per week          Duration of SEE: 3hours
CIE: 30 Marks                            SEE: 70 Marks

Course Objectives:
- To learn concepts of solar energy conversion
- To understand the design principles of solar energy systems, their utilization and performance evaluation
- To understand the applications of solar photovoltaic systems

Course Outcomes:
- Student will be able to understand working of solar energy measuring equipment for different types of radiation.
- Student will be able to apply principles of solar energy utilization.
- Students able to understand the design of solar energy appliance to collect solar energy.
- To gain the knowledge of various applications of solar photovoltaic systems.

Unit-I

Unit-II
Principles of Solar Energy Utilization:

Unit-III
Design of Solar Energy Systems:

Unit-IV
Performance Testing of Solar Collectors:

Unit-V
Design and Application of Solar Photovoltaic Systems:
Solar photovoltaics - Photovoltaic conversion, Photon energy, p-n junction, Solar cells, efficiency of solar cells, Silicone crystal cells, Photovoltaic applications for refrigeration, street lights, water pumps and power generation.

Suggested Reading:
PE702ME

NON-CONVENTIONAL METHODS OF MACHINING & FORMING
(Professional Elective-III)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks

Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications.
- To understand the basics of various forming operations and machining techniques.

Course Outcomes: The student will be able to
- understand the importance of various unconventional machining process and its principles.
- distinguish the process parameters influencing the performance.
- explain the various forming operations a machining techniques.

Unit-I
Water Jet Machining (WJM): Schematic diagram, equipment used, advantages and applications.

Unit-II
Electro Discharge Machining (EDM): Process description with schematic diagram, process parameters, functions and characteristics of dielectric medium, dielectric fluids, over cut and side taper. Flushing, Mechanism of metal removal, crater volume, types of power supply circuits, mathematical analysis of metal removal rate (MRR), characteristics of spark eroded surfaces, advantages, disadvantages and applications, wire electro-discharge machining principles and description.
Electro-Chemical Machining (ECM): Schematic of the process, process parameters, function and characteristics of electrolyte, chemistry of the process. Equation for specific MRR and electrode feed rate, advantages, limitations and applications.
Rotary Machining, Hot machining, high speed machining, description of each process, process parameters, advantages and applications.

Unit-III
LASER Beam Machining (LBM): Principle of LASER Beam production, materials used, thermal analysis of the process, process parameters, equations for power density and machining rate, advantages, limitations and applications.
Plasma Arc Machining (RAM): Equipment used, process description and parameters, types of plasma arc: Transferred arc and non-transferred arc and process applications.
Electron Beam Machining (EBM): Schematic of the process, process parameters, principle of production of Electron beam, equipment used, Advantages, disadvantages and applications. ION Etching: Process description and applications.
Hybrid Machining Processes: Principle and applications of Electro chemical discharge machining, electro chemical abrasive finishing, electro discharge abrasive grinding.

Unit-IV
Rubber Pad Forming: Principle of the process, process details, process variants - Guerin, wheelon, Marforming and Hydro forming processes and applications.
High Energy Rate Forming (HERF): Advantages of high energy rate forming, Explosive forming: Explosive materials, standoff operation and contact operation, advantages and applications.
Forming (EMF): Process details and parameters, materials used and applications. HERF hammers.

**Unit-V**
Stretch Forming: Introduction, types of stretch forming: stretch draw forming, rotary stretch forming or stretch wrapping, compression forming, radial draw forming. Stretch forming equipment and accessories, accuracy and surface finish, process variables and limitations.
Tube spinning: Introduction, methods of tube spinning, Backward spinning. Forward spinning, machines and tools used. Machine variables, speeds and feeds, effect of tube spinning on work metal properties and applications.
Hydrostatic Forming: Process principle description and applications.
Water Hammer Forming (WHF): Schematic diagram of the process, principle of operation, process variable, work materials, process limitations and applications.

**Suggested Reading:**
3. Davies and Austin, "Developments in High Speed Metal Forming". The Machinery Publishing Co. Ltd., 1985
ADDITIVE MANUFACTURING TECHNOLOGIES
(Professional Elective-III)
Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks

Course Objectives:
- To learn the fundamental concepts of Additive Manufacturing (i.e. Rapid Prototyping) and 3-D printing, its advantages and limitations.
- To classify various types of Additive Manufacturing Processes and know their working principle, advantages, limitations etc.
- To have a holistic view of various applications of these technologies in relevant fields such as mechanical, Bio-medical, Aerospace, electronics etc.

Course Outcomes: The student will be able to
- Realize the importance of additive manufacturing process and the criteria of its classification.
- understand the principles of additive manufacturing and its limitations
- visualize the wide applications of additive manufacturing.

Unit-I

Unit-II

Unit-III

Unit-IV
Unit-V


Suggested Reading:
PE704ME

AERODYNAMICS DESIGN OF THERMAL TURBINES
(Professional Elective-III)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:
- To learn design concepts of thermal turbines
- To understand the analysis of flow past a turbine cascade
- To understand turbine blade design methods

Course Outcomes: The student will be able to
- explain the concepts of thermal turbines
- analyze the flow past a turbine cascade
- design the turbine blade

Unit-I
Introduction: Definition of a turbine stage. Enthalpy - Entropy diagram for a Turbine stage. Definition of Euler work, specific work and isentropic work. Euler's turbine equation and Energy transfer equation. Definitions of shape No, stage efficiency, stage reaction, work done factor, utilization factor and coupling power.


Unit-II


Unit-III
1 D and 2D Blade Design Methods:
2 D methods: Concepts of singularities, simple relations. Schlichting Method - equations for induced velocity, Camber line and thickness distribution for an arbitrary aerofoil shape - Direct and indirect design problems. Channel flow approach - Stanitz I and I approximation methods.

Unit-IV
3D Blading Design Methods:
Radial Equilibrium theory: Fundamental equation and approaches for the vortex design of axial turbine cascades; Simple problems on Radial equilibrium theory.
Actuator Disc theory: Concept and application to simple design problems on axial flow turbine cascades.

Unit-V
Performance Evaluation:
Dimensionless groups and performance maps for axial turbines. Distribution of static pressure over a blade profile losses in turbine cascades. Profile, Annulus, Secondary, Tip clearance and over all loss estimation - Soderberg and Ainley - Malhieson methods. Loss model for a turbine
cascade.

**Suggested Reading:**
PE707ME

ENTREPRENEURSHIP
(Professional Elective-III)
Credits:3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To motivate students to take up entrepreneurship in future
- To learn nuances of starting an enterprise & project management
- To understand the design principles of solar energy systems, their utilization and performance evaluation
- To understand the behavioral aspects of entrepreneurs and time management

Course Outcomes:
Student will be able to

Unit I:
Indian Industrial Environment – Competence; Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries. Types of enterprises.

Unit II:
Identification and characteristics of entrepreneurs, Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas, their sources and decision making. Choice of Technology – Collaborative interaction for Technology development.

Unit III:
Project formulation, analysis of marked demand, demand supply gap, financial and profitability analysis, technical analysis and risk analysis. Project financing in India.

Unit IV:
Project Management during construction phase, project organization, project planning and control using CPM-PERT techniques. Humana aspects of project management. Assessment of tax burden.

Unit V:

Suggested Readings:
OE701BM

HUMAN FACTOR ENGINEERING
(Open Elective-II)

Credits:3

Instructions: (3L) hrs per week
CIE: 30 Marks
SEE: 70 Marks

Duration of SEE: 3 hours

Course Objectives:
- Provide a broad based introduction to ergonomic principles and their application in the design of work, equipment and the workplace.
- Consideration is given to musculo-skeletal disorders, manual handling, ergonomic aspects of the environment as well as to the social and legal aspects.

Course Outcomes:
- apply ergonomic principles to the creation of safer, healthier and more efficient and effective activities in the workplace
- conduct ergonomic risk assessments
- develop appropriate control measures for ergonomic risk factors
- describe work-related causes of musculo-skeletal disorders
- design a workplace according to good ergonomic principles
- Assess ergonomic aspects of the working environment and work organization.

Unit-I Overview of Ergonomics (20%)

General Principles - Aims, objectives and benefits of ergonomics, Definition and scope of ergonomics and systems of work, The role of the ergonomist, Fitting the job to the person and the person to the job, Human characteristics, capabilities and limitations, Human error, Teamwork and ageing, Interfaces between job, person and environment, Human computer interaction.

Biological Ergonomics - Body systems - musculo-skeletal and nervous, Anatomy, static and dynamic anthropometry. Biomechanics. Applying work physiology - body metabolism, work capacity and fatigue, Static and dynamic postures. Psychology - Perception of risk, Motivation and behaviour, Memory, Signal Detection Theory and vigilance, 'Work 'Stress' - causes, preventative and protective measures, Work organisation - shift working and overtime. Developing an Ergonomics Strategy at Work - Culture of an organisation - commitment and decision-making, 'Macro-ergonomics' and participatory ergonomic teams, Ergonomics at the design stage, Developing ergonomics, professional ergonomists and competence

Unit-II

Ergonomics Methods and Techniques (20%)

Work Design - Task analysis and allocation of functions, User trials, Problem solving - scientific method. Ergonomics Risk Assessment - Definitions of hazard and risk, Priorities, Risk evaluation quantity and quality of risk, Assessment systems, Overall ergonomics approach, Control measures monitoring and feedback. Measurements and Information Gathering - Ergonomics standards, Observational techniques, Rating scales, questionnaires and check lists, Use of models and simulation

Unit-III Musculo-Skeletal Disorder (20%)

Manual Handling - The nature and causes of manual handling disorders, Risk assessment, Job design and training, Principles of handling and preventative and protective measures

Work Related Upper Limb Disorders (WRULD) - The nature and causes of WRULD/ 'Repetitive Strain Injuries'/Cumulative Disorders, Risk assessment, Principles of control, preventive and protective measures

Unit-IV Workplace, Job and Product Design (20%)

Workplace Layout and Equipment Design - Principles of workstation and system design, Space and workstation design principles, Risks to health: Musculoskeletal problems, Visual fatigue, Mental stress, Requirements for eye tests, Design considerations for Visual Display Unit (VDU)
Stations: Ergonomic factors, Work stations, Design of work and practice, Carrying out assessments of risk at VDU workstations

Controls, Displays and Information - Visual, auditory and other displays, Quantitative and qualitative information, Compatibility and population stereotypes, Warnings, signs and labels, Sources and selection of data, Principles of software ergonomics

Unit-V Relevant Physical Factors of the Work Environment (10%) & Standards and Social Aspects (10%). Lighting - Visual acuity and colour vision, Lighting levels, contrast and glare, Reflections and flicker fusion. Noise - Noise induced hearing loss, Distraction, annoyance and emergency signals. Thermal Environment - Body temperature regulation and acclimatisation, Subjective assessments - thermal comfort and discomfort. Other Considerations - Smell, taste and tactile senses, Vibration - effects and subjective assessment

Clothing and Protective Equipment - Objective and subjective effects, Risk perception, and wearability, Design, style and fit. Standards - ISO standards, Sources of other standards

Selection and Training - Training Needs Analysis, Testing and interview techniques

Instruction and Supervision - Health information, legal requirements, Supervision and records, Measuring health and illness

Suggested Reading:

6. R.S.Bridger 2003 Introduction to Ergonomics Taylor & Francis
OE702BM

BASIC MEDICAL ENGINEERING
(Open Elective-II)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:
- State the Physiological reasons for using a particular piece of Biomedical Equipment.
- Describe the operating principles of a wide range of biomedical equipment.
- To familiarize the latest technologies of modern medicine
- To make learners able to use new and updated diagnostic methodologies
- To make learners capable enough of adopting the methods of recovery and improving health with a service approach

Course Outcomes: At the end of the course the student will be able to
- Perform tests to assess the performance and safety of various Equipments.
- Learn the maintenance of biomedical equipment.

Unit-I Medical Monitoring and recording:

Unit-II Physiotherapy and Electrotherapy Equipment:
Diathermy machines: Short wave diathermy, Microwave diathermy and ultrasonic diathermy Electro diagnostic/Therapeutic apparatus: Nerve muscle stimulator, Functional electrical stimulator etc.

Unit-III Medical Imaging Equipment:

Unit-IV Critical care Equipment:

Unit-V Therapeutic Equipment:

Suggested Reading:
OE701CE

OPTIMIZATION TECHNIQUES
(Open Elective-II)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks

Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To understand the basic concepts of operations research.
- To study about the linear programming and non linear programming.
- To gain knowledge on various gradient search methods.

Course Outcomes: Student will acquire the
- Ability to solve problems of L.P. by graphical and Simplex methods
- Ability to formulate Operation Research formulation
- Ability to solve problems of Integer Programming

Unit I:

Unit II:
Linear Programming: Definitions and Formulation of the LPP, Graphical methods, numerical problems by graphical method, Simplex algorithm, Numerical problems using Simplex method.

Unit III:

Unit IV:
Non-Linear Programming:
Introduction, local and global optima, concave and convex functions, Kuhn-Tucker conditions, graphical solutions. Direct search method, Gradient method, Quadratic programming problems.

Unit V:
Integer Linear Programming
Importance of Integer Linear Programming, Necessity, Definitions, Gomory’s cutting plane method, Branch and bound method, zero-one programming, numerical problems.

Suggested Readings:
OE701CS

DATA BASE MANAGEMENT SYSTEMS
(Open Elective-II)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:

- To introduce three schema architecture and DBMS functional components
- To learn formal and commercial query languages of RDBMS
- To understand the principles of ER modeling and theory of normalization
- To study different file organization and indexing techniques
- To familiarize theory of serializability and implementation of concurrency control, and recovery

Course Outcomes: Student will be able to:

- Understand the mathematical foundations on which RDBMS are built
- Model a set of requirements using the Extended Entity Relationship Model (EER), transform an EER model into a relational model, and refine the relational model using theory of Normalization
- Develop Database application using SQL and Embedded SQL
- Use the knowledge of file organization and indexing to improve database application performance
- Understand the working of concurrency control and recovery mechanisms in RDBMS

UNIT – I


UNIT – II

Structured Query Language: Data Definition, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null

UNIT – III

UNIT – IV
Indexing and Hashing: Basic Concepts, Ordered Indices, B+-tree Index Files, B-tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

UNIT – V


Suggested Readings:
OE702CS

INFORMATION SECURITY
(Open Elective-II)

Credits:3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:

- To learn legal and technical issues in building secure information systems
- To provide an understanding of network security
- To expose the students to security standards and practices

Course Outcomes: On completion of this course student should be able to:

- Describe the steps in Security Systems development life cycle (SecSDLC)
- Understand the common threats and attack to information systems
- Understand the legal and ethical issues of information technology
- Identify security needs using risk management and choose the appropriate risk control strategy based on business needs
- Use the basic knowledge of security frameworks in preparing security blueprint for the organization
- Usage of reactive solutions, network perimeter solution tools such as firewalls, host solutions such as antivirus software and Intrusion Detection techniques and knowledge of ethical hacking tools
- Use ethical hacking tools to study attack patterns and cryptography and secure communication protocols
- Understand the technical and non-technical aspects of security project implementation and accreditation

UNIT-I

UNIT-II

UNIT-III

UNIT-IV

UNIT-V
Suggested Reading:
OE701EC

Principles of Electronic Communications

Credits: 3

Instruction: (3L) hrs per week

CIE: 30 Marks

SEE: 70 Marks

Duration of SEE: 3 hours

Course Objectives:

• Provide an introduction to fundamental concepts in the understanding of communications systems.
• Provide an introduction to network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
• Provide an introduction to the evolution of wireless systems and current wireless technologies.

Course Outcomes: Student will be able to

• Understand the working of analog and digital communication systems
• Understand the OSI network model and the working of data transmission
• Understand the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.

UNIT- I


UNIT- II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes - ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT- III


UNIT- IV

Telecommunication Systems: Telephones, Telephone system, Paging systems, Internet Telephony.

Optical Communications: Optical Principles, Optical Communication Systems, Fiber - Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT- V


Suggested Readings:

PE 702 EC

Fundamentals of IOT

Credits: 3

Instruction: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:
- Discuss fundamentals of IoT and its applications and requisite infrastructure
- Describe Internet principles and communication technologies relevant to IoT
- Discuss hardware and software aspects of designing an IoT system
- Describe concepts of cloud computing and Data Analytics
- Discuss business models and manufacturing strategies of IoT products

Course Outcomes: Student will be able to
- Understand the various applications of IoT and other enabling technologies.
- Comprehend various protocols and communication technologies used in IoT
- Design simple IoT systems with requisite hardware and C programming software
- Understand the relevance of cloud computing and data analytics to IoT
- Comprehend the business model of IoT from developing a prototype to launching a product.

Unit- I
Introduction to Internet of Things
IOT vision, Strategic research and innovation directions, Iot Applications, Related future technologies, Infrastructure, Networks and communications, Processes, Data Management, Security, Device level energy issues.

Unit- II
Internet Principles and communication technology

Unit- III
Prototyping and programming for IoT

Unit- IV
Cloud computing and Data analytics
Introduction to Cloud storage models -SAAS, PAAS, IAAS. Communication APIs, Amazon webservises for IoT, Skynet IoT Messaging Platform. Introduction to Data Analytics for IoT - Apache hadoop- Map reduce job execution workflow.

Unit- V
IoT Product Manufacturing - From prototype to reality
Business model for IoT product manufacturing, Business models canvas, Funding an IoT Startup, Mass manufacturing - designing kits, designing PCB, 3D printing, certification, Scaling up software, Ethical issues in IoT- Privacy, Control, Environment, solutions to ethical issues.
Suggested Readings:

1. Internet of Things - Converging Technologies for smart environments and Integrated ecosystems, River Publishers.
2. Designing the Internet of Things, Adrian McEwen, Hakim Cassimally. Wiley India Publishers
OE701EE

NON CONVENTIONAL ENERGY SOURCES
(Open Elective-II)

Credits:3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To learn the importance of various non-conventional energy sources and its principles
- To learn solar energy applications and its concepts
- To learn the basics of wind energy, ocean thermal electric conversion and tidal energy
- To learn the biomass process and generation of energy through biomass

Course Outcomes: The student will be able to
- Understand clearly the various non-conventional energy sources and applications
- Distinguish between different non-conventional energy sources and principle of energy extraction.

Unit I:

Unit II:

Unit III:
Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind - Basic components of WECS - Classification of WECS - Site selection considerations - Advantages and disadvantages of WECS - Wind energy collectors - Wind electric generating and control systems - Applications of Wind energy - Environmental aspects.

Unit IV:

Unit V:
Energy from Biomass - Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation - Thermal gasification of biomass - Biomass gasifies.

Suggested Reading:
OE701ME

STARTUP ENTREPRENEURSHIP
(Open Elective-II)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To motivate students to take up entrepreneurship in future
- To learn nuances of starting an enterprise & project management
- To understand the behavioral aspects of entrepreneurs and time management

Course Outcomes: Student will
- Think creatively and transform ideas into reality.
- be prepared to take-up entrepreneurship as career and clearly understand the requirements of starting new enterprise
- realize the importance of innovation in new business opportunities
- Differentiate market transforming strategy.
- Create a complete business plan and workout the budget plan.
- be able to write a project proposal with budget statement

Unit I: Creativity & Discovery
Definition of Creativity, self test creativity, discovery and delivery skills, The imagination threshold, Building creativity ladder, Collection of wild ideas, Bench marking the ideas, Innovative to borrow or adopt, choosing the best of many ideas, management of tradeoff between discovery and delivery, Sharpening observation skills, reinventing self, Inspire and aspire through success stories

Unit II: From Idea to Startup
Introduction to think ahead backward, Validation of ideas using cost and strategy, visualizing the business through value profile, activity mapping, Risks as opportunities, building your own road map

Unit III: Innovation career lessons
Growing & Sharing Knowledge, The Role of Failure In Achieving Success, Creating vision, Strategy, Action & Resistance: Differentiated Market Transforming Strategy; Dare to Take Action; Fighting Resistance; All About the startup Ecosystem; Building a Team; Keeping it Simple and Working Hard.

Unit IV: Action driven business plan
Creating a completed non-business plan (a series of actions each of which moves your idea toward implementation), including a list of the activities to be undertaken, with degrees of importance (scale of 1 to 3, where 1 is ‘most important’). A revision of the original product or service idea, in light of information gathered in the process, beginning to design the business or organization that will successfully implement your creative idea. Preparing an activity map.

Unit V: Startup financing cycle
Preparing an initial cash flow statement, showing money flowing out (operations; capital) and flowing in. Estimate your capital needs realistically. Prepare a bootstrapping option (self financing). Prepare a risk map. Prepare a business plan comprising five sections: The Need; The Product; Unique Features; The Market; Future Developments. Include a Gantt chart (project plan – detailed activities and starting and ending dates); and a project budget.

Suggested Readings:
OE702ME

FINITE ELEMENT METHODS
(Open Elective-II)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:
- To understand the theory and application of the finite element method for analyzing structural systems.
- To learn Approximation theory for structural problems as the basis for finite element methods.
- To learn formulations for a variety of elements in one, two, and three dimensions. Implementations of 
  element formulations will be examined using Matlab.
- To understand modeling and analysis of structures using planar, solid, and plate elements.

Course Outcomes: Student will be able to
- Understand the concept of Finite Element Method and realize its limitations.
- Be able to formulate 1D, 2D and 3D element and distinguish between linear and higher order elements.
- Applying 1D, 2D and 3D elements to solve different static and dynamic problems.

Unit I:
Introduction to Finite Element Method, solution method using FEM, discretisation, Boundary 
conditions, load application, types of elements comparison, Stress and Equilibrium, Boundary  
conditions. Strain-Displacement relations. Stress-strain relations.
One Dimension: problems: Finite element modeling, coordinates and shape functions.
Potential Energy approach: Assembly of Global stiffness matrix and load vector. Finite 
element equations, Treatment of boundary conditions. Quadratic shape functions.

Unit II:
Analysis of trusses and frames: Element stiffness matrix for a truss member. Analysis of 
plane truss with number of unknowns not exceeding two at each node. Analysis of frames with  
two translations and a rotational degree of freedom at each node.
Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node
beam element.

Unit III:
Finite element modeling of two dimensional stress analysis with constant strain triangles and
 treatment of boundary conditions.
Finite element modeling of Axisymmetric solids subjected to Axisymmetric loading with triangular
 elements.

Unit IV:
Two dimensional four noded isoparametric elements and numerical integration.
Steady state heat transfer analysis: Onedimensional analysis of a find and two dimensional
analysis of thin plate. Analysis of uniform shaft subjected to torsion.

Unit V:
Dynamic Analysis: Formulation of finite element mode, element matrices, evaluation of Eigen
values and Eigen vectors for a stepped bar and a beam.
Time dependent field problems: Application to one dimensional heat flow in a rod. Finite element
formation to three dimensional problems in stress analysis. Types of elements used.
Convergence requirements and geometric isotropy. Local, natural and global coordinates.
Introduction to Finite Element Analysis Software.

Suggested Readings:


**SCHEME OF INSTRUCTION & EXAMINATION**  
B.E VIII Semester (Mechanical Engineering)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Scheme of Instruction</th>
<th>Scheme of Examination</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L  T  P</td>
<td>Contact Hrs/wk</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CIE</td>
<td>SEE</td>
</tr>
<tr>
<td>1.</td>
<td>PE *</td>
<td>Professional Elective-IV</td>
<td>3  -  -</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>2.</td>
<td>PE **</td>
<td>Professional Elective-V</td>
<td>3  -  -</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>3.</td>
<td>OE ***</td>
<td>Open Elective-III</td>
<td>3  -  -</td>
<td>30</td>
<td>70</td>
</tr>
</tbody>
</table>

**PRACTICALS**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Title</th>
<th>Scheme of Instruction</th>
<th>Scheme of Examination</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>PW861ME Project Work-II/Internship</td>
<td>-  -  4</td>
<td>40  100</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>130</td>
<td>17</td>
</tr>
</tbody>
</table>

*PROFESSIONAL ELECTIVE-IV*

- **PE801ME** Waste Heat Recovery & Co-Generation
- **PE802ME** Mechanics of Composite Materials
- **PE803ME** Machine Tool Engineering & Design
- **PE804ME** Advanced Propulsion & Space Science

**PROFESSIONAL ELECTIVE-V**

- **PE807ME** Energy Conservation & Management
- **PE808ME** Tool Design
- **PE809ME** Non-Destructive Testing

**OPEN ELECTIVE-III**

- **OE801MT** Statistical Applications in Engineering
- **OE801BM** Human Machine Interface
- **OE802BM** Instrumentation Engineering
- **OE801CE** Road Safety Engineering
- **OE802CE** Green Building Technology
- **OE801CS** Data Science using R
- **OE801EC** Global and Regional Satellite Navigation System
- **OE801EE** Illumination and Electric Traction System
- **OE801ME** Composite Materials
- **OE802 ME** Industrial Administration and Financial Management
- **OE803ME** 3D Printing Technology
PE801ME

WASTE HEAT RECOVERY & CO-GENERATION
(Professional Elective-IV)

Course Objectives:

- To learn concepts of waste heat recovery
- To learn the applications of heat exchangers & recuperators in heat recovery
- To understand cogeneration methods

Course Outcomes: Student will be

- Understand the concept of waste heat recovery
- Distinguish heat exchangers and recuperators
- Acquire knowledge about various cogeneration methods

Unit I:
Definition, Sources, Quantity and quality of waste heat. Technologies for waste heat recovery and utilization.

Need of storage systems for waste heat.


Unit II:

Unit III:
First and Second law of thermodynamics, and it’s effect on design of recuperators.

Recuperators - Ceramic, metallic and radiant recuperators, high temperature recuperators.

Concept of porosity, Peclet number superficial velocity, pressure drop, and selection of material for heat storage and recovery.

Unit IV:
Cogeneration - Definition, Two basic cogeneration concepts, thermodynamic advantage, Cogeneration efficiency, potential benefits and costs of cogeneration. Cogeneration - Overview, Industrial application of cogeneration.

Unit V:

Suggested Readings:
PE802ME

MECHANICS OF COMPOSITE MATERIALS
(Professional Elective-IV)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:
- To know the properties of fiber and matrix materials used in composites, as well as some common manufacturing techniques.
- To know how to analyze a laminated plate in bending, including finding laminate properties from lamina properties.
- To understand the strength of an orthotropic lamina and measurement of basic composite properties.

Course Outcomes: The students will be able to
- Understand the concept of composites its advantages and applications
- Estimate the properties of composites using micromechanics and macromechanics
- Estimate the strength of laminate using various failure criteria

Unit I:
Introduction: Fibres, Matrix materials, interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon fibre composites.

Unit II:
Micromechanics of Composites:
Mechanical properties: Production of Elastic constant, micromechanical approach, Halpin-Tsal equations, Transverse stresses.
Thermal properties: Hygrothermal stresses, mechanics of load transfer from matrix to fibre.

Unit III:
Macromechanics of Composites:
Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation.

Unit IV:

Unit V:

Suggested Reading:
Unit I:

Unit II:

Unit III:

Unit IV:

Unit V:

Suggested Reading:
PE804ME

ADVANCED PROPULSION & SPACE SCIENCE
(Professional Elective-IV)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:
- To learn about gas dynamic concepts of rocket propulsion system
- To learn rocket engine system.
- To learn celestial sphere and its parameters
- To learn about Satellites & Remote Sensing

Course Outcomes: Student will be able to
- Classify different rocket propulsion systems and understand the concept of gas dynamics
- understand the working principle of rocket engine system
- understand celestial sphere and its parameters

Unit I:
Advanced Gas Dynamics: Normal shock waves, pitot tubes, moving shock waves, oblique shock waves, reflected shock waves, conical shock waves, hypersonic flow, Newtonian theory, high temperature flows, low density flows.

Unit II:
Advanced Propulsion: Rocket engines - Operation and performance of rocket engines, design and operating parameters - total impulse, thrust, energy and efficiencies, Typical performance values, overview of monopropellant, bipropellant liquid, solid and hybrid rocket propulsion systems, combined cycle propulsion, Electric / Ion propulsion.

Unit III:

Unit IV:
Two Body Problem: Formulation, relative motion and solution, Kepler's equation, motions of rockets and artificial satellites, transfer orbits, minimum energy interplanetary transfer orbits, use of parking orbits, Perturbations of artificial satellites due to atmospheric drag and flattening of earth.

Unit V:
Nuclear Processes in the Sun, Solar wind, interaction of solar Wind and Earth's magnetic field, Van Allen radiation belts.

Suggested Reading:
PE805ME

ENERGY CONSERVATION AND MANAGEMENT
(Professional Elective-V)

Credits:3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To learn about energy conservation
- To understand sources of loss of power in energy conversion
- To understand Procedure for Comprehensive Energy Conservation Planning
- To understand Industrial energy conservation methods

Course Outcomes: Student will be
- Student will able to understand different forms of energy
- Student will be able to calculate the amount of heat energy available
- Students able to understand the industry energy conservation modeling
- Students able to understand methodology for forecasting industrial energy supply and demand.

Unit I:

Unit II:
Heat energy and storage - Media of transport of heat energy - steam, oil and flue gases. Calculation of steam quality. Calculation of amount of heat energy available. Recuperators. Constructional details, Selection of materials to store heat energy. Concept of power. Modes of mechanical energy transport - Gears, pulleys, belts, shafts etc., Calculation of power. Sources of loss of power in energy conversion into electricity, potential energy (i.e., pumps).

Unit III:

Unit IV:

Unit V:

Suggested Reading:
PE806ME

TOOL DESIGN
(Professional Elective-V)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To understand the basic knowledge of select appropriate materials for tooling applications
- To grasp the Design, develop, and evaluate cutting tools and work holders for a manufactured product
- To comprehend the basic knowledge of press tools for sheet metal working.

Course Outcomes:
- Understand ASA and ORS systems of tool geometry .
- Design a single point or multi point cutting tool to machine a required job.
- Design a die and punch for blanking, piercing, drawing and bending operations.
- Discriminate the knowledge of Jigs and Fixtures design
- Apply the concepts and design a GO and NO GO gauge.

Unit I:
Cutting tool materials and single point cutting tools:
Cutting tool materials, desired properties. Types, major Constituent, relative characteristics, latest development: ISO; classification and coding of carbides.
Geometry of single point cutting tool. Influence of each geometrical parameters on the cutting tool performance. Factors involved in their selection. Tool signature and geometry in MRS, ORS, NRS. Cutting forces and design features of HSS and carbide tipped tools.
Feature of high production cutting tools. Chipbreakers and their types.

Unit II:
Form tools and multi point cutting tools:
Form tools: Radial and tangential: flat and circular. Form correction and tool holding methods.
Drills Geometry: Variation of rake and clearance angles along tips, effect of geometrical parameters on thrust and torque effect of feed rate on rake and clearance, web thinning. Types of drill points, Grinding of drills. Milling Cutters: Major types, geometry of peripheral, end and face milling cutters. Profile sharpened and form relieved expression for minimum number of teeth.
Design features, forces and power estimation, Grinding of milling cutters.
Reamers: Types, geometry, Reaming allowance, design features tolerance disposition.

Unit III:
Press tools for sheet metal working:
Bending dies: Spring back and bending allowance estimation of punch load.
Drawing Dies: Punch load, blank size, number of draws, methods of retaining metal in draw dies. Metal flow during drawing.
Metal spinning: Configuration and design features of metal spinning, shear forming and flow forming.

Unit IV:
Unit V:


**Plastic Tools:** Application of plastic as a tooling material viz, for Gauges, Surface plates, jigs and fixtures. Forming dies.

**Suggested Readings:**

PE807ME

NON-DESTRUCTIVE TESTING
(Professional Elective-V)

Credits:3

Instructions: (3L) hrs per week
CIE: 30 Marks

Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To learn the basic principles, techniques, equipment, applications and limitations of basic NDT methods.
- To learn the selection of appropriate NDT methods.
- To grasp the standards and specifications related to NDT technology.
- To know the developments and future trends in NDT.

Course Outcomes:
After study of the course, the learner should be able to:
- Understand the importance of non-destructive testing and its applications
- Explain the basic principles, techniques and limitations of NDT.

Unit I:
Liquid Penetrant Inspection: Principles of penetrant inspection, characteristics of a penetrant, water-washable system, post-emulsification system, solvent-removable system, surface preparation and cleaning, Penetrant application, Development, Advantages limitations, and applications.
Magnetic Particle Inspection: Principle, Magnetisation methods, continuous and residual methods, sensitivities, Demagnetisation, Magnetic particles, Applications, Advantages and limitations.

Unit II:
Eddy Current Testing: Principle, Lift-off factor, and edge effects, Skin effect, Inspection frequency, coil arrangements, inspection probes, types of circuit, reference pieces, phase analysis, display methods and applications.

Unit III:

Unit IV:
Radiography: Principle and uses of Radiography, limitations, Principle, Radiation sources, Production of X-rays, x-ray spectra, Attenuation of radiation, Radiographic equivalence, Shadow formation, enlargement and distortion, Radiographic film and paper, Xeroradiography, fluoroscopy, Exposure factors, Radiographic screens, identification markers and image quality indicators, Inspection of simple shapes, inspection of complex shapes, viewing and interpretation of radiographs, Radiation hazard, Protection against radiation, measurement of radiation received by personnel.

Unit V:
Acoustic Emission: Physical Principles, Sources of emission, instrumentation and applications.
Other NDT Techniques: Neutron radiography, Laser induced Ultrasound, Surface analysis, Thermography.

Suggested References:
With effect from the academic year 2018-2019

OE801MT

STATISTICAL APPLICATIONS IN ENGINEERING
(Open Elective-III)

Credits:3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:
- Introduce the basics of Probability
- To provide the knowledge of various distributions like Normal Weibull, Log normal etc
- To provide the knowledge of tests of significance like F-test, t-test and Chi-square test

Course Outcomes: At the end of this course student is expected reach the following outcomes
- Explain what is meant by a statistic and its sampling distribution
- Apply various probability distributions to solve practical problems
- Estimate unknown parameters of populations and apply the tests of hypothesis
- Judge the independence of attributes of given data.

Random Variables-One dimensional Random Variable, Discrete Random Variable, Continuous Random Variable.

Unit II: Basic Statistics: Measures of Central tendency (Mean, Median, Mode), Moments, Skewness, Kurtosis.
Probability distributions, Binomial, Poisson-Evaluation of statistical parameters for these two distributions.

Unit III: Continuous Distributions: Exponential, Gamma, Normal distribution, Weibull distribution, \( \chi^2 \)-distribution, t-distribution, F-distribution, Lognormal distribution, Evaluation of statistical parameters for these distributions.


Unit V: Test of Significance for Small samples: Tests of Significance for small samples Test for single mean, Difference of means, Test for ratio of variances (F-test, t-test), Chi-square test for goodness of fit and independence of attributes.

Suggested Reading:
OE801BM

HUMAN MACHINE INTERFACE
(Open Elective-III)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks

Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To stress the importance of a good interface design.
- To understand the importance of human psychology in designing good interfaces.
- To motivate students to apply HMI in their day-to-day activities.
- To bring out the creativity in each student – build innovative applications that are user friendly.
- To encourage students to indulge into research in Machine Interface Design.

Course Outcomes: At the end of this course student is expected reach the following outcomes.
- To design user centric interfaces.
- To design innovative and user friendly interfaces.
- To apply HMI in their day-to-day activities.
- To criticise existing interface designs, and improve them.
- To Design application for social and technical task.

UNIT-I:
Introduction - Introduction to Human Machine Interface, Hardware, software and operating environment to use HMI in various fields.
The psychopathology of everyday things – complexity of modern devices; human-centered design; fundamental principles of interaction; Psychology of everyday actions - how people do things; the seven stages of action and three levels of processing; human error

UNIT-II:
Understanding goal directed design - Goal directed design; Implementation models and mental models; Beginners, experts and intermediates – designing for different experience levels; Understanding users; Modeling users – personas and goals.

UNIT-III:
GUI - benefits of a good UI; popularity of graphics; concept of direct manipulation; advantages and disadvantages; characteristics of GUI; characteristics of Web UI; General design principles.

UNIT-IV:
Design guidelines - perception, Gesalt principles, visual structure, reading is unnatural, color, vision, memory, six behavioral patterns, recognition and recall, learning, factors affecting learning, time.

UNIT-V:
Interaction styles - menus; windows; device based controls, screen based controls.
Communication - text messages; feedback and guidance; graphics, icons and images; colours.

Suggested Reading:
OE802BM

INSTRUMENTATION ENGINEERING
(Open Elective-III)

Credits:3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- to understand the need of instrument
- understand the principle of operation of different sensors
- to design signal conditioning circuits for different industrial sensors
- to design the instruments.

Course Outcomes: At the end of this course student is expected reach the following outcomes.

UNIT I
Instrument, block diagram of an instrument, Principles of transduction and measurement, Sensor Classification, Functional specifications of sensors; static and dynamic characteristics of measurement systems. Primary sensors, bimetals, Bellows, Bourdon tube, capsule, diaphragm, applications.

UNIT – II

UNIT-III
Reaction variation and electromagnetic sensors. Capacitive sensors, inductive sensors, LVDT, electromagnetic sensors. Signal conditioning, AC bridges, AC amplifiers, electrostatic shields, carrier amplifiers, phase-sensitive detectors, Applications.

UNIT-IV

UNIT-V
Other sensors: Accelerometer transducers, Gyroscopes, Ph sensors, measurement of Conductivity, viscosity, conductivity, flow meters, Humidity, signal conditioning and Applications.

Suggested Reading:
2. Principles of measurements by J P Bentely
3. Electronic measurements and instrumentation by A K Sawhany
OE801CE

ROAD SAFETY ENGINEERING
(Open Elective-III)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks
SEE: 70 Marks
Duration of SEE: 3hours

Course Objectives:
- Introduction to various factors considered for road safety and management
- Explain the road safety appurtenances and design elements
- Discuss the various traffic management techniques

Course Outcomes: At the end of this course student is expected reach the following outcomes.
- Prepare accident investigation reports and database
- Apply design principles for roadway geometrics improvement with various types of traffic safety appurtenances/tools
- Manage traffic including incident management.

UNIT - I
Road accidents: Causes, scientific investigations and data collection, Analysis of individual accidents to arrive at real causes, statistical methods of analysis of accident data, Basic concepts of Road accident statistics, Safety performance function: The empirical Bayes method Identification of Hazards road location. Application of computer analysis of accident data.

UNIT-II
Safety in Road Design: Operating the road network for safety, highway operation and counter measures, road safety audit, principles-procedures and practice, code of good practice and checklists, vehicle design factors & Driver characteristics influencing road safety.

UNIT - III
Road Signs and Traffic Signals: Classification, Location of Signs, measures of sign effectiveness, Types of visual perception, sign regulations, sign visibility, sign variables, Text versus symbols. Road Marking: Role of Road markings, Classification, visibility. Traffic Signals: Need, Signal face. Illumination and location of Signals, Factors affecting signal design, pedestrians’ safety, fixed and vehicle actuated signals. Design of signals, Area Traffic control. Delineators, Traffic Impact Attenuators, Road side rest areas, Safety Barriers, Traffic Aid Posts.

UNIT-IV
Traffic Management Techniques: Integrated safety improvement and Traffic Calming Schemes, Speed and load limit, Traffic lights, Safety cameras, Tests on driver and vehicles, pedestrian safety issues, Parking, Parking enforcement and its influence on Accidents. Travel Demand Management; Methods of Traffic management measures: Restriction of Turning Movements, One-way streets, Tidal Flow Operation Methods, Exclusive Bus Lanes and Closing Side-streets; Latest tools and techniques used for Road safety and traffic management. Road safety issues and various measures for road safety; Legislation, Enforcement, Education and Propaganda, Air quality, Noise and Energy Impacts; Cost of Road Accidents.

UNIT-V
Incident Management: Introduction, Characteristics of Traffic Incidents, Types of Incidents, Impacts, Incident management process, Incident traffic management; Applications of ITS: Motorist information, Equipment used; Planning effective Incident management program, Best practice in Incident management programs. National importance of survival of Transportation systems during and after all natural disasters especially cyclones, earthquakes, floods etc and manmade disasters like sabotage, terrorism etc.

Suggested Reading
OE801CE

GREEN BUILDING TECHNOLOGY
(Open Elective-III)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:

- Exposure to the green building technologies and their significance.
- Understand the judicial use of energy and its management.
- Educate about the Sun-earth relationship and its effect on climate.
- Enhance awareness of end-use energy requirements in the society.
- Develop suitable technologies for energy management.

Course Outcomes:

- Understand the fundamentals of energy use and energy processes in building.
- Identify the energy requirement and its management.
- Know the Sun-earth relationship vis-a-vis its effect on climate.
- Be acquainted with the end-use energy requirements.
- Be familiar with the audit procedures of energy.

UNIT I
Overview of the significance of energy use and energy processes in building: Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT II

UNIT III
Climate, solar radiation and their influences: Sun-earth relationship and the energy balance on the earth’s surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT IV
End-use, energy utilization and requirements: Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building - Heat gain and thermal performance of building envelope - Steady and non steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer

UNIT V
Energy management options: Energy audit and energy targeting - Technological options for energy management.

Suggested Reading:
OE801CS

DATA SCIENCE USING R
(Open Elective-III)

Credits:3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To learn basics of R Programming environment: R language, R-studio and R packages
- To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting
- To learn Decision tree induction, association rule mining and text mining

Course Outcomes: At the end of this course student is expected reach the following outcomes.
- Use various data structures and packages in R for data visualization and summarization
- Use linear, non-linear regression models, and classification techniques for data analysis
- Use clustering methods including K-means and CURE algorithm

UNIT-I
Introduction To R: Introduction, Downloading and Installing R, IDE and Text Editors, Handling Packages in R.
Loading and Handling Data In R: Introduction, Challenges of Analytical Data Processing, Expression, Variables, Functions, Missing Values Treatment In R, Using ’As’ Operator To Change The Structure Of The Data, Victors, Matrices, Factors, List, Few Common Analytical Tasks, Aggregation And Group Processing Of A Variable, Simple Analysis Using R, Methods For Reading Data, Comparison Of R GUI’s For Data Input, Using R With Databases And Business Intelligence Systems.

UNIT-II

UNIT- III
Linear Regression Using R: Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption.

UNIT IV
Decision Tree: Introduction, What Is A Decision Tree?, Decision Tree Representation In R, Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search In Decision Tree Learning, Inductive Bias In Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning.

UNIT-V
Association Rules: Introduction, Frequent Itemset, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association.

Text Mining: Introduction, Definition of Text Mining, A Few Challenges in Text Mining, Text Mining Verses Data Mining, Text Mining In R, General Architectures of Text Mining Systems, Pre-Processing of Documents In R, Core Text Mining Operations, Using Background Knowledge for Text Mining, Text Mining Query Languages.

Mining Frequent Patterns, Associations and Correlations: Basic Concepts and Methods.

Frequent Itemset, Closed Itemset And Association Rules.

Suggested Reading:
2. Practical Data Science with R, Nina Zumel and John Mount, Manning Shelter Island.
3. The R book, Crawley, Michael J. John Wiley & Sons, Ltd
OE801EC

GLOBAL AND REGIONAL SATELLITE NAVIGATION SYSTEM
(Open Elective-III)

Credits:3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To explain the basic principle of GPS and its operation.
- To make the students to understand signal structure.
- To make the students understand the GPS errors.
- Highlight the importance of integrating GPS with other systems.
- To make the students understand about various GRNSS.

Course Outcomes: Student will be
- Able to understand the principle and operation of GPS.
- Able to understand the GPS Signal structure and services.
- Able to understand about various errors.
- Able to use GPS in various fields such as navigation, GIS etc.
- Able to understand principle of Operation of various GRNSS.

Unit I:

Unit II:
GPS Signal structure: C/A and P-Codes, SPS and PPS services, GPS Coordinate Systems: Significance, Types of GPS receivers, Selective Availability, Spoofing and Anti-spoofing.

Unit III:
GPS Errors: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Multipath; Dilution of Precision (DOP).

Unit IV:

Unit V:

Suggested Reading:
With effect from the academic year 2018-2019

OE801EE

ILLUMINATION AND ELECTRIC TRACTION SYSTEM
(Open Elective-III)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
• To introduce the students and understand Utilization of electrical energy for various applications like industrial heating, welding etc.,
• To understand the concept of illumination, and know the applications of various lamps to factory lighting, street lighting etc.
• To understand the concept of electrification of traction system.

Course Outcomes: At the end of this course student is expected to reach the following outcomes.
• Understand the advantages and disadvantages of different methods of electric heating
• Understand different control techniques used in the operation of three phase induction motors.
• Decide the type and ratings of lights used for different purposes like residential, street lighting, factories etc.
• Understand the electric traction system, type of motors and their speed control.

Unit I:

Unit II:
Schematic Utilization and Connection Diagrams for Motor Control:

Unit III:

Unit IV:

Unit V:

Suggested Reading:
OE801ME

COMPOSITE MATERIALS
(Open Elective-III)

Credits:3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3hours
SEE: 70 Marks

Course Objectives:
- To know the properties of fiber and matrix materials used in composites, as well as some common manufacturing techniques.
- To know the various moulding process and architecture of composite laminates
- To know how to estimate the laminate properties from lamina properties.
- To understand the strength of an orthotropic lamina and measurement of basic composite properties.

Course Outcomes: At the end of this course student is expected reach the following outcomes.
- Understand the concept of composites its advantages and applications
- Understand the manufacturing methods of composites
- Estimate the properties of composites using micromechanics and macromechanics
- Estimate the strength of laminate using various failure criteria

Unit I: Introduction to composite materials, general characteristics, Fibres, Matrix materials, interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon fibre composites

Unit II: Molding Processes: hand layup, vacuum molding, compression molding, pultrusion molding, centrifugal molding, filament winding, prepegs and molding compounds and architecture of composite materials: laminates, sandwich composites and other architectures.

Unit III: Micromechanics of Composites: Mechanical properties: Production of Elastic constant, micromechanical approach, Halpin-Tsal equations, Transverse stresses. Thermal properties: Hygrothermal stresses, mechanics of load transfer from matrix to fibre.

Unit IV: Macromechanics of Composites: Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation.


Suggested Reading:
OE802ME
INDUSTRIAL ADMINISTRATION AND FINANCIAL MANAGEMENT
(Open Elective-III)
Credits:3

Instructions: (3L) hrs per week
CIE: 30 Marks

Course Objectives:
- To understand various types of organizational structures, manufacturing processes and importance of plant layout and the role of scheduling function in optimizing the utilization of resources
- To understand the importance of quality, inventory control and concepts like MRP I and MRP II
- To understand the nature of financial management and concepts like breakeven analysis, depreciation and replacement analysis

Course Outcomes: At the end of this course student is expected reach the following outcomes.
- Understand the different phases of product life cycle, types of manufacturing systems, plant layout optimization problems and role of scheduling function in better utilization of resources
- Understand the Fundamental concepts of quality control, process control, material control and appreciate the importance of MRP-I and MRP –II.
- Know the different terminology used in financial management and understand the different techniques of capital budgeting and various types of costs involved in running an industrial organisation.

Unit-I

Unit-II
Locating production and services facilities, effects of location and costs and revenues, factor rating, simple median model (linear programming) Layout planning; process layout; product layout — Assembly lines; line balancing manufacturing cellular layout. Scheduling systems and aggregate planning for production and services; loading assignment algorithm; priority sequencing and other criteria.

Unit-III


Unit-IV
Inventory control: determinstic and stochastic inventory models; variable demand; lead time, specific service level, perishable products and service.
Inventory control in application; concepts for the practioners; saving money in inventory systems; ABC classifications. Inventory control procedures; Quantity - reorders versus periodic inventory systems; material requirement planning (MRP); MRP as a scheduling and ordering system; MRP system components; MRP computational procedure; Detailed capacity planning; MRP - limitation and advantages; Manufacturing Resources Planning (MRP-II).

Unit-V
Elements of cost, overheads, breakeven analysis, depreciation, replacement analysis. Nature of financial management-time value of money, techniques of capital budgeting and method, cost of capital, financial leverage.
Suggested Reading
With effect from the academic year 2018-2019

OE803ME

3D PRINTING TECHNOLOGY
(Open Elective-III)

Credits: 3

Instructions: (3L) hrs per week
CIE: 30 Marks
Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:
- To understand the fundamental concepts of 3D Printing, its advantages and limitations.
- To classify various types of 3D Printing Processes and know their working principle, advantages, limitations etc.
- To have a holistic view of various applications of these technologies in relevant fields such as Mechanical, Bio-medical, Aerospace, electronics etc.

Course Outcomes: Upon completion of this course the student will be able to:
- Understand the significance of 3D Printing and compare it with conventional manufacturing process.
- Classify various types of 3D PRINTING processes, rapid tooling and understand the working principle and applications of them with case studies.
- Know the various types of errors that creep up while saving the .STL file format and also will be able to appreciate the features of various types of software’s used in 3D Printing.
- Appreciate the diversified applications of 3D PRINTING in various fields like biomedical, aerospace, automobile, defence, architecture etc.

UNIT-I


UNIT-II


UNIT-III


UNIT-IV


UNIT-V


Suggested Reading: