Solapur University, Solapur
Choice Based Credit System Syllabus (w.e.f. June 2015-16)
M.E. Mechanical (Thermal Engineering)

(Part-I)

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Name of the Subject</th>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
<th>Total Marks</th>
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<tr>
<td></td>
<td></td>
<td>L</td>
<td>T/P</td>
<td>T/W</td>
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<tr>
<td>1</td>
<td>Advanced Fluid Mechanics &amp; CFD</td>
<td>3</td>
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<tr>
<td>2</td>
<td>Measurement in Thermal Systems</td>
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<tr>
<td>3</td>
<td>Advanced Heat &amp; Mass Transfer</td>
<td>3</td>
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<tr>
<td>4</td>
<td>Design of Experiments &amp; Research Methodology</td>
<td>3</td>
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<tr>
<td>5</td>
<td>Elective-I</td>
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Elective-I:
1. Advanced Thermodynamics
2. Turbomachines
3. Combustion
4. Steam & Gas Turbines

(Part-II)

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<tr>
<td>1</td>
<td>Design of Thermal Systems</td>
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<td>2</td>
<td>Computational Techniques in Thermal Engineering</td>
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<td>3</td>
<td>Theory &amp; Design of I.C. Engines</td>
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<td>4</td>
<td>Design of Refrigeration &amp; Air Conditioning System</td>
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Elective-II:

1. Power Plant Engineering
2. Energy Analysis & Management
3. Rocket Technology
4. Cryogenics & Vacuum Technology

(Part-III)

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<td>L</td>
<td>T/P</td>
<td>T/W</td>
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Note:-

1. L=Lecture, T/P = Tutorial/Practical, T/W = Term Work, TP=Theory Paper.
2. In-plant training report for the training for at least two weeks undertake in the vacation after part-II is to be submitted in part-III.
3. In-plant Training should be in the industries related to thermal engineering.
4. The Contact Hours for the calculation of load of teacher.

   Seminar- 1 Hr/Week/Student &
   Project- 2 Hr/Week/Student
M. E. MECHANICAL (Thermal Engineering) Part -I

1. ADVANCE FLUID MECHANICS & CFD

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<tr>
<td>Teaching: 3 Periods (60 min.) per week</td>
<td>Uni.Exam: 100 marks</td>
</tr>
<tr>
<td>Practical: 2 Period (120 min.) per week</td>
<td>Term Work: 25 marks</td>
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</table>

1. **Fluid Motions with friction**: Hagen Poiseulli equation, Navier-Stokes equations (2Hrs)

2. **Boundary Layer Theory**: Reynolds principle of similarity, laminar and turbulent boundary layer, flow along a flat plate. Exact and integral methods of solutions flowin a straight conduit, flow separation and control, hydrodynamic theory of lubrication. (8Hrs)


4. **Compressible Fluid Flow**: Fundamental equations of Gas-dynamics propagation of shock waves, oblique shock waves (elementary treatment). (4Hrs)

5. **Philosophy of computational fluid mechanics**: Introduction, impact of CFD, application areas. (2Hrs)

6. **Governing equations of fluid dynamics**: Introduction, Models of the flow, substantial derivative of moving fluid element, Divergence of the velocity, Continuity equation, momentum equation, energy equation, physical boundary conditions. (5Hrs)

7. **Mathematical Behaviour of PDE, the impact of CFD**: Suitable forms of Governing equations, Hyperbolic, parabolic, Elliptic equations, Well- posed problems. (3Hrs)

8. **Some Simple CFD Techniques**:  
   1. Introduction, Lax-wendroff Technique, Mac Cormackls Techniques, Relaxation Technique, Numerical dissipation and dispersion, Alternating direction-implicit technique, pressure correction formula, boundary condition for pressure correction method, introduction to different plots of computer graphics.
2. Numerical solution for quasi one dimensional nozzle flows: subsonic – supersonic, isentropic flow and its CFD solution, stock capturing

(6Hrs)

Term Work:

1. Four to five assignment on Chapter 1 to 4
2. Four to five assignment on Chapter 5 to 8

References Books:

1. “Computational Fluid Dynamics, The basics with application”, John D. Anderson,
4. “Fluids Mechanics”, W. Kanzman
2. MEASUREMENT IN THERMAL SYSTEMS

Teaching Scheme:
Teaching: 3 Periods (60 min.) per week
Practical: 1 Period (60 min.) per week

Examination Scheme:
Uni.Exam: 100 marks
Term Work: 25 marks

1. Error Analysis in Experimental Investigations-Curve Fitting of Experimental Data. (5 Hrs)


3. Measurement of Unsteady Temperature-Optical Methods Shadow graph, Schilieren and Interferometer, Spectroscopic Temperature Determination. (8 Hrs)

4. Measurement of Pressure, Vacuum, Level etc. (5 Hrs)


7. Measurement of Turbulence, Pollutants-Gas Chromatography. (4 Hrs)

Term Work:
Eight to ten Practical/Tutorial based on above syllabus.

Reference Books:
3. T.P. Holeman, Experimental Methods for Engineers.
M. E. MECHANICAL (Thermal Engineering) Part -I

3. ADVANCED HEAT & MASS TRANSFER

Teaching Scheme:
Teaching: 3 Periods (60 min.) per week
Practical: 2 Period (120 min.) per week

Examination Scheme:
Uni.Exam:100 marks
Term Work: 25 marks

1. Conduction

2. Convection

3. Radiation

4. Condensation and Boiling:
Film and drop condensation. Film condensation on vertical plate and horizontal tube. Condensation number. Film condensation inside horizontal tube. Drop condensation promoters. Boiling heat transfer. Simplified relation for boiling heat transfer with water.
**Heat transfer by natural convection:** Natural conventional flow patterns, natural convection from vertical flat plate. Correlations for cylinders and plates. Correlation for enclosed spaces (6Hrs)

**5. Heat Exchangers**

**6. Mass Transfer**

**Term Work:**

1. Determination of Thermal conductivity of liquids and gases.
2. Determination of Thermal conductivity of insulating materials, glass wool, PUFF etc.
3. Determination of heat transfer in boiling and condensation.
4. Determination of correlations between Nusselt, Prandtl and Reynold's numbers in Forced convection heat transfer.
5. Determination of effectiveness in Parallel and Counter flow heat exchanger.
6. Plotting of Schmidt plot: by a computer program
7. Two assignment involving computer programmes based on above syllabus.
8. One problem on Thermal analysis using FEM software packages.

**References Books:**

1. “Heat Transfer”, J. P. Holman
5. “Engineering Heat Transfer”, Simonson
1. **Research concept**: concept, meaning, objectives, motivation, types of research approaches. research (Descriptive research, conceptual, theoretical. Applied experimental) 

(4 Hrs)

2. **Formulation of research task**: literature review: importance and methods, source quantification of cause effect relations, discussions, field study, labours experiments. Critical analysis of already generated facts. Hypothetical proposal future development and testing. Selection of research task. Prioritization research. 

(4 Hrs)


(6 Hrs)

4. **Experimental Modeling**:  
   a) Definition of experimental design, examples, single factor experiment blocking and nuisance factors, guidelines for designing experiments.  
   b) General model of process; input factors/variables, o/p parameters variables, controllable /uncontrollable variables, dependent/independent variables. Compounding variables, extraneous variables. Experiment validity.  
   c) Process optimization and designed experiments: methods for study response surface, 1 order design. Determining optimum combination of factors, method of steepest ascent. Taguchi approach parameter design.  

(8 Hrs)

5. **Analysis of results**: (parametric and non-parametric. Descriptive and infinite.data): types of data, collection of data (normal distribution, calculation correlation coefficient) processing, analysis, error analysis, meaning, different methods analysis of variance, significance of variance, analysis of co variance multiple regression, testing linearity/ non linearity of model, testing adequate model, testing model/ hypothesis. 

(6 Hrs)
6. **Report writing:** Types of report, layout of research report, interpretation of new style manuals, layout and format, style of writing, typing, references, paging, tables, figures, conclusions, appendices. *(6Hrs)*

7. **Landscape of creativity:** Convergent v/s divergent thinking, creativity, creativity v/s intelligence, creativity abilities, creativity and madness, determination of creativity, increasing creativity, creative achievement, techniques of creativity, collective creativity. *(6Hrs)*

**Term Work:**

At least ten assignments based on above syllabus.

**Reference Books:**

4. “Research Methodology- A step by step guide for beginners”, RanjitKumar, Pearson Education
8. “Introduction to SQC”, John Willy and Sons.
M. E. MECHANICAL (Thermal Engineering) Part -I

5. ADVANCED THERMODYNAMICS (Elective-I)

Teaching Scheme:  
Teaching: 3 Periods (60 min.) per week  
Practical: 1 Period (60 min.) per week

Examination Scheme:  
Uni.Exam: 100 marks  
Term Work: 25 marks

1. Thermodynamic Relations
Maxwell relations, thermodynamic relations involving enthalpy, internal energy and entropy. Thermodynamic relations involving specific heat. Developing tables of thermodynamic properties from experimental data (4 Hrs)

2. Entropy
Principle of increase of entropy, thermal death of universe, fluctuation hypothesis, entropy and disorder, entropy production. Limitations of second law of thermodynamics. Third law of thermodynamics and its corollaries. (8 Hrs)

3. Real Gases
Deviation from ideal gas behavior, equations of state for real gases. Reduced coordinates, generalized equation of state. Law of corresponding states, generalized compressibility charts, enthalpy, deviation and entropy deviation charts and their applications. P-V-T surfaces of real substances. Fugacity and activity (8 Hrs)

4. Mixtures of Ideal Gases
Gravimetric analysis and volumetric analysis, Amagat's model, Dalton's model, Gas constant and molecular weight of the mixtures, Energy changes and entropy changes of the mixtures, Reversible and irreversible mixing of the ideal gases. Elementary analysis of mixture of real gases. (6 Hrs)

5. Energy, Entropy and Exergy
Exergy calculations. Exergetic efficiency and exergy charts. Exergy balance and analysis of exergy losses

Relative Systems: Combustion with excess, deficient and stoichiometric air. Heats of reaction, heating values of fuel. Enthalpy of formation. Adiabatic flame temperature. Gibb's function of formation, entropy changes during ideal gas reactions. Dissociation, condition for chemical equilibrium, equilibrium constant. (8 Hrs)
6. Kinetic Theory of Gases

Statistical Thermodynamics: Quantum considerations, degeneracy, microstates, microstates and thermodynamic probability. The equilibrium distribution, microscopic interpretation of heat and work. Partition function and its use. (6 Hrs)

Term Work:
Eight to Ten Practicals / Tutorials based on above syllabus.

References Books:
7. “Engineering Thermodynamics”, Lee-Sears
M. E. MECHANICAL (Thermal Engineering) Part -I

5. TURBOMACHINES (Elective-I)

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<tr>
<td>Practical: 1 Period (60 min.) per week</td>
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</tr>
</tbody>
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1. Dimensional analysis and principle of similitude, Energy transfer between fluid and rotor, Potential flow through cascades of blades. 3-dimensional viscous and compressibility effects. *(15 Hrs)*

2. Principles of design and performance of different types of turbomachines. *(15 Hrs)*

3. Equilibrium running diagrams, Principles of Mechanical design of different components of turbomachines and its auxiliary equipment, Regulation of turbomachines. *(10 Hrs)*

**Term Work:**

Eight to Ten Assignments based on above syllabus.

**References Books:**

2. S.M. Yahya, Turbomachines, IIT, New Delhi.
M. E. MECHANICAL (Thermal Engineering) Part -I
5. COMBUSTION  (Elective-I)

Teaching Scheme:
Teaching: 3 Periods (60 min.) per week
Practical: 1 Period (60 min.) per week

Examination Scheme:
Uni.Exam: 100 marks
Term Work: 25 marks

1. Fuels and their properties, Review of basic thermodynamics and gaseous mixtures, combustion thermodynamics, stoichiometry. (7Hrs)

2. The First and Second Laws of Thermodynamics applied to combustion, composition of products in equilibrium, fundamentals of combustion kinetics. (6Hrs)

3. Theory of thermal ignition, self ignition temperature, ignition delay. (3 Hrs)

4. Flame phenomena, deflagration and detonation, laminar flame propagation, flammability limits, flame quenching and minimum ignition energy. (7 Hrs)

5. Laminar burning velocity measurements, turbulent flame propagation, flame stabilization, diffusion flames. (7 Hrs)

6. Gaseous jet flames, burning of condensed phase, vaporization and combustion of liquid fuel droplet. (5 Hrs)

7. Spray combustion, combustion of solid fuels, Rocket motor systems. (5Hrs)

Term Work:
Eight to Ten Assignments based on above syllabus.

References Books:

5. STEAM & GAS TURBINES (Elective-I)

Teaching Scheme:
Teaching: 3 Periods (60 min.) per week
Practical: 1 Period (60 min.) per week

Examination Scheme:
Uni.Exam: 100 marks
Term Work: 25 marks

1. Steam Turbines: power plant cycles, Cycle analysis and design, losses in steam turbine.  
   (7 Hrs)

2. Design of a stage, Design of multistage axial flow turbines, Vortex flow and lower pressure stage design.  
   (8 Hrs)

3. Performance at varying loads governing, Calculation of design point efficiency using cascade data.  
   (8 Hrs)

   (7 Hrs)

   (10 Hrs)

Term Work:
Eight to Ten Assignments based on above syllabus.

References Books:
1. W.J. Kearton, Steam Turbine Theory and Practice.
2. Lee, Theory and design of Steam and Gas Turbine, McGraw Hill.
4. Jennings and Rogers, Gas turbine analysis and Practice, McGraw Hill. /NITK-
Teaching Scheme:
Tutorial/Practical: 2 Hr./Week/Student  Term Work: 25 Marks

Seminar I shall be delivered on one of the advanced topics chosen in consultation with the guide after compiling the information from the latest literature and also internet. The concepts must be clearly understood and presented by the student. All modern methods of presentation should be used by the student. A hard copy of the report (25 to 30 pages A4 size, 12 fonts, Times New Roman, single spacing both side printed, preferably in IEEE format) should be submitted to the Department before delivering the seminar. A PDF copy of the report in soft form must be submitted to the guide along with other details if any.
M. E. MECHANICAL (Thermal Engineering) Part -II

1. DESIGN OF THERMAL SYSTEMS

Teaching Scheme:                                                                                        Examination Scheme:
Teaching: 3 Periods (60 min.) per week                                                                 Uni.Exam: 100 marks
Practical: 1 Period (60 min.) per week                                                                   Term Work: 25 marks

    Designing a Workable System: Workable and optimum systems. Steps involved in arriving at a workable system (5 Hrs)

2. Economics of Engineering Decision: Variable factor involved.
    Mathematical Modeling: Equation fitting, Modeling a thermal equipment – counter-flow heat exchanger, evaporators and condensers (8 Hrs)

3. System Simulation
    Uses of simulation, Method of simulation (6 Hrs)

    Mathematical Modeling of Thermodynamic Properties: Need, Form of the equation, Criteria for fidelity of representation. Linear and nonlinear regression analysis. Thermodynamic properties. Internal energy and enthalpy. Clapeyron equation, Pressure-temperature relationship at saturated conditions. Maxwell relations, p-v-t equations, Building a full set of data (8 Hrs)

5 Steady-State Simulation of Large Systems

6 Introduction to Dynamic Behavior of Thermal Systems (5 Hrs)

Term Work:

1. Any two assignments on above syllabus.
2. Development of Computer Programs for simulation of thermal system.
Reference Books:

M. E. MECHANICAL (Thermal Engineering) Part -II

2. COMPUTATIONAL TECHNIQUES IN THERMAL ENGINEERING

Teaching Scheme:                                                                 Examination Scheme:
Teaching: 3 Periods (60 min.) per week                                          Uni.Exam: 100 marks
Practical: 2 Period (120 min.) per week                                          Term Work: 25 marks
____________________________________________________________________________

1. Solution Of Linear Simultaneous Equations: Gauss elimination, Gauss-Jordan, Matrix
   method, Newton-Raphson method, Methods for simultaneous non-linear equations Algebraic
   and Transcendental equations, Lin-Bairstows method (8 Hrs)

2. Numerical Integration:
   Area and Volume Integration: Trapezoidal rule, Simson’s rules, Gaussian Quadrature,
   Newton-Cotes Quadrature formulae. Numerical Solutions Of Ordinary Differential Equations: Taylor’s method, Eular’s method,
   Modified Eular’s method Runge-Kutta method, Methods for simultaneous and higher order
   equations. (8 Hrs)

3. Curve Fitting
   Principal of least squares, fitting a straight line, fitting a parabola, fitting an exponential curve,
   fitting a curve of the form $y = ax^b$ (4 Hrs)

4. Finite Difference and Solution of Partial Differential Equations
   Forward difference, backward difference, Central difference expression for first and second
   derivative terms. (6 Hrs)

5. Applications of Finite Difference Technique
   In conduction and convection heat transfer (1D & 2D Problems) (8 Hrs)

6. Introduction to Finite Element Method
   Solutions of boundary value problems, Integral formulations for numerical solutions, One
   dimensional linear element, Application of FEM in 1D and 2D conduction and convection heat
   transfer problems. (5 Hrs)

Term Work:

Numerical problems and computer programs based on above syllabus.
Reference Books:

M. E. MECHANICAL (Thermal Engineering) Part -II

3. THEORY & DESIGN OF I.C.ENGINES

Teaching Scheme:       Examination Scheme:
Teaching: 3 Periods (60 min.) per week  Uni. Exam: 100 marks
Practical: 2 Period (120 min.) per week  Term Work: 25 marks

1. Constructional features of different engines. (5 Hrs)
2. Combustion phenomena in SI engine, Combustion knock, Combustion chamber designs for SI engine. (8 Hrs)
3. Combustion phenomenon in the CI engine, Combustion chamber design for the CI engine, Delay period, and diesel knock, IC engine design principles. (8 Hrs)
4. Design of engine components, Piston, connecting rod, crankcase, crankshaft, manifolds, valves. (10 Hrs)
5. Design of cooling system, lubricating oil system and radiator fans, computer aided design of engine components, Engine balancing, recent advances. (9 Hrs)

Term Works:
Six to Eight practical / Assignments based on above syllabus.

References Books:
The MIT Press Massachusetts Institute of Technology, USA, 1996
## M. E. MECHANICAL (Thermal Engineering) Part -II
### 4. DESIGN OF REFRIGERATION & AIR CONDITIONING SYSTEM

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1. Principles of vapour compression refrigeration system, cascade cycles, working fluids (4 Hrs)

2. Compressors: reciprocating, rotary, scroll compressors, screw and centrifugal compressors. Heat exchangers, condensers, evaporators, dynamics of capillary and valve expansion devices (5 Hrs)

3. Design criteria for pipelines, absorption and adsorption refrigeration cycles, choice of working fluids, Thermoelectric refrigeration and Hybrid cycles (7 Hrs)


5. Cooling load and heating load calculations. Solar space heating and cooling. Passive cooling systems. Dehumidification and humidification equipment (7 Hrs)

6. Design of cooling towers, spray washers, air washers, cooling and dehumidifying coils. Design of air duct system. Room air distribution. Various types of air conditioning systems (6 Hrs)


### Term Works:

Six to Eight Practicals / Assignments based on above syllabus.

### References Books:

1. Arora C. P., Refrigeration and Air Conditioning, Tata McGraw Hill
4. Jones,“Air Conditioning”.
5. Stockers ,“Refrigeration and Air Conditioning”
M. E. MECHANICAL (Thermal Engineering) Part -II

5. POWER PLANT ENGINEERING (Elective-II)

Teaching Scheme:                                                                 Examination Scheme:
Teaching: 3 Periods (60 min.) per week                                            Uni.Exam: 100 marks
Practical: 1 Period (60 min.) per week                                             Term Work: 25 marks

1. Resources and Development of Power India:
Source of energy, energy consumption as a measure of prosperity. Availability of commercial or conventional energy sources in India. (3 Hrs)

2. Hydro-Electric Power Plant:
Introduction, site selection, elements of hydroelectric power plant, classification of hydroelectric power plants, types of hydraulic machines, selection of turbines, hydro plant auxiliaries, hydro plant controls, electrical and nonelectrical equipments in hydro-plant, hydro power development in India. (4 Hrs)

3. Thermal Power Plant:
Introduction, classification, layout of modern steam power plant, site selection, fuel handling equipments, combustion equipment, spreader stoker, conveyor stoker, underfeed stoker, pulverised fuel firing, pulverised fuel handling, pulverising mills, coal burners, gas & oil burners, ash handling equipments, dust collection.
Steam Generators:-Components, design criteria, boiler types, high pressure boiler, water boiler, boiler accessories. (5 Hrs)

4. Diesel Engine Power Plant:

5. Nuclear Power Plant:
Nuclear reactors classification, essential components of a nuclear reactor, power of a nuclear reactor, main components of nuclear power plant, description of various types of reactors, selection of materials for reactor components, advantages & disadvantages of Nuclear power plant. Application of nuclear power plants. Safety measures for nuclear power plants, nuclear power plants in India. (4 Hrs)

5. Variable Loads on Power Plant:
Industrial production and power generation comparison, Ideal and Load curves, Effect of variable loads on power plant design and operation, method of meeting the load. (4 Hrs)
7. Power Plant Economics:
Economics in plant selection, factors affecting economics of generation & distribution of power, economics of hydro-electrics, combined hydro & steam power plants, performance & operating characteristics of power plants, economic load shearing, tariff for electrical energy.

(4 Hrs)

8. Peak Load Plant:
Introduction, requirement, various types of peak load plants.

(2 Hrs)

9. Combined Operation of Different Power Plant:
Advantages of combined operations of plants, load division between power stations. Hydraulic plant in combined with steam plant, hydro-electric and gas turbine combination, co-ordination of different types of plants.

(3 Hrs)

10. Instrumentation & Controls:
Classification of instruments ,Pressure, temp., Liquid level, Flow. PIL Speed, Humidity instruments, Gas Analyzers.

(2 Hrs)

11. Major Electrical Equipments in Power Plants:
Generator, Transformers, Cooling of Generators & Transformers, Switch Gears, Protection systems, Control room, Transmission of electrical power.

(3 Hrs)

12. Pollution and Its Control:
Air and Water pollution by thermal power plants & its control, Pollution due to Nuclear power plant its control, Standardization for environmental protection.

(2 Hrs)

Term Works:
Six to Eight Assignments based on above syllabus.

References Books:
3. “Power plant Engineering”, Arora S. Domkundwar, Dhanpatrai and sons, Delhi,
1. Energy Scenario: - World’s production and reserves of commercial energy sources. India’s production and reserves energy alternatives. (4 Hrs)

(b) Other methods for solar energy/ wind energy utilization: - Applications, geothermal resources, geothermal electrical power plant, classification and types, vapour dominated, liquid dominated geothermal power plant, scope for geothermal system in India. (10 Hrs)

3. Economical and environmental aspect of alternatives: - Initial and annual costs, definitions of annual solar savings, lifecycle savings, present worth calculations, repayment of loan in equal annual instalments, annual solar savings, cumulative solar savings and lifecycle savings, pay-back period, environmental problem related with utilization of geothermal and wind energy. (8 Hrs)

4. Energy auditing: - Introduction, types, preliminary audit, intermediate and compressive audit, procedure of auditing, case study and recommendation. (5 Hrs)

5. Energy conservation: - Importance, principles, planning for energy conversion- electrical energy, thermal energy, human and animal muscle energy, waste recovery revelling, cogeneration. (8 Hrs)


Term Work:
Six Assignments based on above syllabus.
References:

M. E. MECHANICAL (Thermal Engineering) Part -II

5. ROCKET TECHNOLOGY (Elective-II)

Teaching Scheme:
Teaching: 3 Periods (60 min.) per week
Practical: 1 Period (60 min.) per week

Examination Scheme:
Uni.Exam: 100 marks
Term Work: 25 marks

1. Reaction Principles, Essential factors of propulsive devices. Momentum theory. (7 Hrs)

2. Ramjet engine, Design of propulsion and turbo jet engines. (10 Hrs)

3. Performance of rocket vehicles. Design parameters, Solid propellant rocket motors, liquid propellant rockets. (10 Hrs)

4. Combustion mechanism, testing of rockets. (6 Hrs)

5. Introduction to nuclear and electrical rocket system. (7 Hrs)

Term Works:
Six to Eight assignments based on above syllabus.

References Books:
2. Mathur and Sharma, Gas Turbines and Jet Propulsion.
M. E. MECHANICAL (Thermal Engineering) Part -II

5. CRYOGENICS & VACUUM TECHNOLOGY (Elective-II)

Teaching Scheme:  
Teaching: 3 Periods (60 min.) per week  
Practical: 1 Period (60 min.) per week  

Examination Scheme:  
Uni.Exam: 100 marks  
Term Work: 25 marks

1. Liquefaction of permanent gases, Methods of Air liquefaction, separation, storage and transport, Applications.  
   (5 Hrs)

2. Properties of solids and liquids at Cryogenic temperatures, cryogenic insulations vacuum technology.  
   (7 Hrs)

   (8 Hrs)

4. Kinetic Theory of Gases, fluid flow in vacuum lines, transitional and molecular flows; Conductors of pipelines, fitting, pumps down line - Constructional materials for vacuum equipments and their out gassing and their out gassing characteristics - Vacuum production techniques.  
   (8 Hrs)

5. Principles of operation of rotary, diffusion, turbo molecular, cryo vacuum production techniques - Principles of operation of rotary, diffusion, turbo molecular, cryo vacuum pumps - Mechanical and thermal design considerations - Selection of vacuum pump .  
   (6 Hrs)

6. Measurement of vacuum : Mcleod, thermal seals, valves, flanges and pipelines Applications of vacuum technology for space, food preservation, manufacturing and cryogenic applications.  
   (6 Hrs)

Term Works:

Six to Eight assignments based on above syllabus.

References Books:

1. R.B. Scott Cryogenics Engineering - Van Nostrand  
4. Refrigeration / Thermodynamics/ Heat transfer / Air conditioning Data Hand book  
Seminar II shall be delivered preferably on the topic of dissertation or at least the area of dissertation. The concepts must be clearly understood and presented by the student. All modern methods of presentation should be used by the student. A hard copy of the report (25 to 30 pages A4 size, 12 fonts, Times New Roman, single spacing both side printed, well formatted preferably in IEEE format) should be submitted to the Department before delivering the seminar. A PDF copy of the report in soft form must be submitted to the guide along with other details if any.
M. E. MECHANICAL (Thermal Engineering) Part -III

1. IN-PLANT TRAINING

Term Work: 50

The student has to prepare the report of training undergone in the industry during vacation after part-II. It shall include the brief details of assignment completed by the candidate and general observation and analysis. The identified areas for undertaking the dissertation works shall form part of report. The term work marks be based on report and departmental oral exam.

2. SEMINAR-III

T/P-1 Hrs/Week
Ext. Exam-50 Marks

Seminar III shall be based on the work carried out for dissertation. This may cover the points right from various areas considered and analyzed: the relevance feasibility and scope for finally selected topic, alternative solution and appropriate solution.
Each student has to prepare a write up of 25 pages of A4 size sheets and submit in duplicate as term work.
The student has to deliver a seminar talk in front of the teachers of the department and his classmates. The external examiner appointed by the university and examiner shall do an assessment. Based on the quality of work and preparation and understanding of the candidate. Some marks should be reserved for the attendance of a student of a student in the seminars of other students.

3. PROJECT PHASE-I

Term Work: 50

The term work under this submitted by the student shall include.
1. Work diary maintained by the student and countersigned by his guide.
2. The contents of works diary shall reflect the efforts taken by the candidate for
(a) Searching the suitable project work
(b) Visit to different factories or organizations
(c) Brief report on journals and various papers referred

(d) Brief report on websites seen for project work

(e) The brief report of feasibility studies carried to come to final conclusion

(f) Rough sketches

(g) Design calculation etc. carried by the student.

The student has to make a presentation in front of panel of experts in addition to guide as decided by department head.
M. E. MECHANICAL (Thermal Engineering) Part -IV

1. PROJECT PHASE-II

Tut/Pract  5hrs per week
Exam Scheme.
Term Work-200 marks.
Oral Exam -100 marks.

The dissertation submitted by the student on topic already approved by university authorised on basis of initial synopsis submitted by the candidate shall be according to following guidelines.

**Format of Dissertation report:**

The dissertation work report shall be typed with double space on A4 size bond paper. The total number of pages shall not be more than 150 and not less than 60, figure, graphs, annexure etc. be added as per requirement.

The report should be written in the following format.

1. Title sheet
2. Certificate
3. Acknowledgement
4. List of figure, photographs, graphs, tables.
5. Abbreviations.
7. Contents.
8. Text with usual scheme of chapters.
9. Discussion of the result and conclusions.
10. Bibliography [The source of illustrative matter be acknowledged clearly at appropriate place.]
The Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan offers scholarships to international students who wish to study at Japanese universities as undergraduate or research (masters / PhD) students under the Japanese Government (MEXT) Scholarships Program. Normally the Application cycle of the MEXT Japanese Government Scholarship is announced in April.


Akash. A. In this paper an algorithm for one-way hash function construction based on a two layer feed forward neural network along with the piece-wise linear (pwl) chaotic map is proposed. Based on chaotic neural networks, a Hash function is more. In this paper an algorithm for one-way hash function construction based on a two layer feed forward neural network along with the piece-wise linear (pwl) chaotic map is proposed. Based on chaotic neural networks, a Hash function is constructed, which makes use of neural networks' diffusion property and chaos' confusion property. B.E. (E&TC) Solapur University, Solapur B. E. (Electronics & Telecommunication Engg.) â€“ Part I & II w.e.f. Academic Year 2010-2011 B. E. (Electronics & Telecommunication Engg.) â€“ Part I Sr. No. 1 2 3 4 5 6 7 Subject Teaching Scheme T P Total L Computer Communication Network VLSI Design Mobile & Satellite Communication Random Signal Theory & Coding Elective â€“ I Seminar & Project Vocational Training Total Th.Â No. 1 2 3 4 5 Subject Broad Band Communication Audio Video Engineering Embedded Systems Elective â€“ II Project Total L Teaching Scheme T P Total Th. Examination Scheme TW POE OE Total 3 1 -. 4 100 25