

**Nirma University
Institute of Technology
School of Engineering
Mechanical Engineering Department**

M.Tech. Mechanical Engineering (Thermal Engineering)

3ME2111 Advanced Thermodynamics [3 0 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. analyze various thermodynamic systems based on first law, second law, entropy and exergy concepts
2. utilize the principles of real gas behavior and multicomponent system for industrial problems
3. assess the combustion phenomenon using thermo chemistry principles
4. evaluate thermodynamic system applying fundamentals of statistical thermodynamics.

3ME2112 Advanced Fluid Mechanics [3 0 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. apply the fundamentals of kinematics and conservation laws to fluid flow systems,
2. apply the principles of potential and creeping flows to fluid flow systems,
3. analyse the concepts of boundary layer flow,
4. analyse and apply the fundamentals of turbulent flow.

3ME2113 Heat Transfer Processes [3 0 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. analyze steady state and transient heat conduction in thermal systems,
2. analyze extended surface heat transfer, phase change heat transfer and radiation heat transfer principles,
3. appreciate the basic concepts of micro-scale heat transfer

3ME2114 Modelling and Optimization of Thermal Systems [2 1 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. explain the basic concepts of optimization and its use as a tool for decision making,
2. apply various optimization methods to thermal engineering problems based on linear programming, non-linear programming and stochastic programming,
3. simulate engineering problems which are interdisciplinary in nature using unconventional optimization techniques.

3ME2118 Energy Conservation and Management [2 1 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. understand the overall energy scenario of country and the world
2. prepare energy planning
3. comprehend and apply various models for resource availability predictions
4. demonstrate various energy conservation techniques for effective energy utilization
5. evaluate the viability of energy conservation options through various energy economic indices.

3ME2116 Thermo-Fluid Engineering Laboratory [0 0 4 2]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. apply the principles of uncertainty analysis to experiments conducted.
2. evaluate the fundamental concepts of thermo-fluid systems through experimentation.
3. identify the effect of relevant parameters on various thermo-fluid systems and able to correlate the same.

3ME2117 Computational Laboratory [0 0 4 2]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. apply the principles of programming skills for engineering problem solving
2. make use of software skills to solve problems related to thermo-fluid engineering.

3ME2209 **Computational Fluid Dynamics and Heat Transfer** **[3 0 2 4]**

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. develop an understanding of major theories, approaches and methodologies used in CFD,
2. apply CFD concepts for solution of diffusion type problems,
3. make use of CFD concepts for solution of convection diffusion problems,
4. apply the concepts of turbulence and multiphase modelling for thermo-fluid systems.

3ME2211 **Minor Project** **[0 0 10 5]**

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. practice acquired knowledge within the chosen area of technology for project development,
2. identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach,
3. reproduce, improve and refine technical aspects for engineering projects,
4. work as an individual or in a team in development of technical projects,
5. report project related activities effectively to peers and mentors.

3ME2301 **Major Project-Part-I** **[0 0 0 14]**

Course Learning Outcomes (CLOs):

1. identify the issues related to the recent trends in the field of engineering and its applications,
2. formulate the problem definition, analyze and propose the solutions,
3. design, verify, test, and implement the solution,
4. compile and conclude the work carried out.

3ME2402 **Major Project-Part-II** **[0 0 0 14]**

Course Learning Outcomes (CLOs):

1. identify the issues related to the recent trends in the field of engineering and its applications,
2. formulate the problem definition, analyze and propose the solutions,
3. design, verify, test, and implement the solution,
4. compile and conclude the work carried out.

Department Elective Courses

3ME22D101 Design of Heat Exchangers [3 0 2 4]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. develop an understanding of the basic thermal design principles for heat exchangers,
2. apply principles of thermo-hydraulic design for double-pipe and shell and tube heat exchangers,
3. design compact heat exchanger for various thermal applications,
4. make use of computerized methods for the design and analysis of heat exchangers.

**3ME22D102 Experimental Techniques in Thermal [3 0 2 4]
Engineering**

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. analyse the experimental data and apply statistical tools,
2. apply the concepts of error and uncertainty analysis,
3. make use of various experimentation techniques for thermo-fluid applications,
4. utilize data acquisition system for experimentation.

3ME22D103 Thermal Insulation Design [3 0 2 4]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. apply the fundamentals of heat transfer to thermal insulation,
2. develop an understanding of various properties and features of thermal insulations,
3. make use of testing methods and conduct audit of thermal insulations,
4. select, design and optimize thermal insulation for various applications.

**3ME22D104 Modelling of Internal Combustion Engine [3 0 2 4]
Processes**

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. apply equilibrium charts to determine mixture properties and carry out combustion analysis,
2. analyze Internal Combustion Engine processes using various combustion and heat transfer models,
3. analyze performance of SI and CI Engines including fuel supply, gas exchange and emission models,

4. measure the emissions and devise strategies to control emissions.

3ME22D201 Refrigeration and Cryogenics [3 0 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. analyze vapour compression systems and related components,
2. appraise vapour absorption systems, air cycle and non-conventional refrigeration systems,
3. apply principles of refrigeration for food preservation, transport and cold storages,
4. analyze properties at cryogenic temperatures and various gas liquefaction systems.

3ME22D202 Principles of Compressible Flow [3 0 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. apply the fundamentals of one dimensional isentropic flow,
2. analyse the principles of normal and oblique shock formation and their effects,
3. apply the principles of compressible flow to constant area duct subjected to friction and heat transfer,
4. evaluate the forces acting on submerged bodies.

3ME22D203

Microfluidics

[3 0 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. develop understanding of kinetic theory, continuum hypothesis and scaling laws,
2. assess micro scale gas and liquid flows,
3. apply nanofluidics fundamentals to nanoscale components,
4. evaluate performance of microfluidics components.

3ME22D204

Analytical Combustion

[3 0 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. apply chemical equilibrium and chemical kinetics fundamentals to reacting flow,
2. design of combustion reactors,
3. appraise importance of different types of combustion flames,
4. explain solid and liquid combustion processes,
5. elaborate various emissions and choose control technique.

3ME22D301

Air-conditioning System Design

[3 0 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. utilize the principles of applied psychrometry and thermal comfort for air conditioning system design,
2. estimate the cooling load for air conditioning applications,
3. design the air distribution and air handling systems,
4. analyse the performance of various air conditioning systems, cooling towers and evaporative coolers,
5. analyse noise in air conditioning systems and its control methods.

3ME22D302

Turbomachines

[3 0 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. apply the thermal design principles to steam turbines,
2. evaluate the performance of gas turbines,
3. analyze the performance of hydro turbines,
4. assess the parameters affecting the performance of different compressors.

3ME22D303 Alternate Fuels and Systems for [3 0 0 3]
Transportation

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. develop understanding of various alternate fuels for transportation system,
2. assess combustion characteristics of alternate fuels and related engine modifications,
3. identify the importance of emissions and apply control methodologies,
4. appraise modern systems of transportation.

3ME22D304 Principles of Aerodynamics [3 0 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. design and analyse flow over airfoils,
2. analyse the fluid flow around cylinder,
3. evaluate the aerodynamic concepts for design of wings,
4. develop understanding of wind tunnels for aerodynamic testing.

3ME22D305 Energy Storage Technology [3 0 0 3]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. analyse the various types of energy storage systems,
2. develop understanding of electrical energy storage devices,
3. appraise the technology of thermal energy storage systems,
4. build up an understanding related to fuel cell and alternate technology for energy storage.

3SS1201 Research Methodology and IPR [2 0 0 2]

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1. formulate a research problem for a given engineering domain,
2. analyze the available literature for given research problem,
3. develop technical writing and presentation skills,
4. comprehend concepts related to patents, trademark and copyright.