

 सयोजिरावसुन्दरम्	Mechanical Engineering Department Faculty of Technology & Engineering The M. S. University of Baroda, Vadodara, Gujarat, India-390 001 Website: http://www.msubaroda.ac.in		
Subject: Advanced Gas Dynamics (MEC 2243)			
Specialization: Thermal Science			
Teaching Scheme: Lectures: 4 Hours per Week Practicals/Termwork: 2 Hours per Week	Examination Scheme: Theory Paper : 100 Marks PR/TW/Viva : 50 Marks Total : 150 Marks	Page : 1 of 1	
		Academic Year : 2003-04	
		M. E. Part - I	

Syllabus

1. Review of Fundamentals:

Types of flows, concepts of continuum and control volume, Generalized continuity, momentum and energy equations, velocity of sound and its importance, physical difference between incompressible, subsonic and supersonic flows, three reference speeds, dimensionless velocity M^* , concepts of static and stagnation parameters.

2. One Dimensional Isentropic Flow:

General features, working equations, choking in isentropic flow, operation of nozzles and diffusers under varying pressure ratios, performance of real nozzles, applications of isentropic flow.

3. Normal Shocks:

Introductory remarks, governing equations, Rankine – Huguenot, Prandtl and other relations, weak shocks, thickness of shocks, normal shocks in ducts, performance of convergent-divergent nozzle with shocks, moving shock waves, shock problems in one dimensional supersonic diffuser, supersonic pitot tube.

4. Flow in Constant Area Duct with Friction:

Governing equations, working formulas and tables, choking due to friction, performance of long ducts, Isothermal flow in long ducts.

5. Flow in Constant Area Duct with Heating and Cooling:

Governing equations, working formula and tables, choice of end states, choking effects, shock waves with changes in stagnation temperature.

6. Generalized One-Dimensional Flow:

Working equations, general method of solution, example of combined friction and area change, Example of combined friction and heat transfer.

7. Study of various flow visualization techniques.

8. Study of different types of wind tunnels, their design criteria.

 THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA सयोजिरावसुन्दरम्	Mechanical Engineering Department Faculty of Technology & Engineering The M. S. University of Baroda, Vadodara, Gujarat, India-390 001 Website: http://www.msubaroda.ac.in		
Subject: Advanced Thermodynamics (MEC 2246)			
Specialization: Thermal Science			
Teaching Scheme: Lectures: 4 Hours per Week Practicals/Termwork: Nil	Examination Scheme: Theory Paper : 100 Marks PR/TW/Viva : Nil Total : 100 Marks	Page : 1 of 1	
		Academic Year : 2003-04	
		M. E. Part - I	

Syllabus

1. Review of Basic Concepts:

System and surroundings, state parameters, thermal equilibrium and Zeroth law of thermodynamics, Thermodynamic equilibrium, Forms of energy and concept of work and heat, First law of thermodynamics – its applications and limitations.

2. Thermodynamic State Equations:

Perfect and real gases, state equation of perfect gas, Amagat's isothermals, Detailed study of Van der Waal, Dieterio, Berthelot, Redlich and Kwong and other state equations for real gases, compressibility factor and compressibility chart, generalized chart.

3. Second Law of Thermodynamic and Entropy:

Reversibility and irreversibility, statements of second law and their discussion Equivalence of Kelvin-Planck and Clausius statements, Carnot engine and Carnot refrigeration, Thermodynamic temperature scale and absolute zero temperature, Clausius theorem and Clausius inequality, concept and characteristics of entropy Principle of increase of entropy and entropy of universe.

4. Availability and Irreversibility:

Available energy lost work and degradation of energy, Maximum work, Availability – in a closed system and in a steady flow system, Gibbs function, Helmholtz function, Irreversibility and its measurement.

5. General Thermodynamic Relations:

General relations from energy equations, specific heat relations, relations for internal energy, enthalpy and entropy, Joule-Thomson coefficient, Applications of general thermodynamic relations to ideal gas, Van der Waal and other state equations.

6. Variable Specific heat:

Factors affecting specific heat, classical analysis, Plank's quantum hypothesis, methods for considering variation in specific heats, use of temperature-internal energy-entropy (t-u-s) chart for air.

7. Statistical Thermodynamics and Kinetic Theory of Gases:

Macrostate and microstate thermodynamic probability, Entropy and probability, entropy and lack of information, classical versus quantum statistics.

Kinetic theory of gases - Microscopic view of an ideal gas, mean and rms velocity, pressure exerted by a gas, kinetic interpretation of temperature, gas laws, Atomacy of gases and degrees of freedom, law of equipartition of energy, Distribution of velocity among the molecules and most probable velocity, Mean free path, Transport phenomena and associated properties.



Mechanical Engineering Department
Faculty of Technology & Engineering
The M. S. University of Baroda, Vadodara, Gujarat, India-390 001
Website: <http://www.msubaroda.ac.in>

Subject: Engineering Experimentation (MEC 2244)

Specialization: Thermal Science

Teaching Scheme:

Lectures: 4 Hours per Week

Practicals/Termwork:

2 Hours per Week

Examination Scheme:

Theory Paper : 100 Marks

PR/TW/Viva : 50 Marks

Total : 150 Marks

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M. E. Part - I

Syllabus

1. Generalized measurement system.
Basic detector transducer elements, intermediate modifying systems, terminating devices & methods.
2. Analysis of Experimental data, uncertainty analysis by various methods, statistical analysis, Probability distribution, Gaussian error distribution, method of rejecting a reading, chi-square test of goodness of fits, methods of least squares, graphical analysis and curve fitting.
3. Measurement of displacement, force and torque and strain measurements.
4. Measurement of pressure, measurement of high & low pressures, dynamic characteristics of pressure measuring devices.
5. Measurement of temperature, temperature measurements by mechanical effects, electrical effects and by radiation, transient response of thermal systems, temperature measurement in high speed flow.
6. General-purpose electronic instruments.
7. Recording techniques and Automatic control systems.
8. Motion and vibration measurements, principles of seismic instruments, practical considerations of seismic instruments.

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Subject: Numerical Methods and Computer Programming (MEC 2245)			
Specialization: Thermal Science			
Teaching Scheme: Lectures: 4 Hours per Week Practicals/Termwork: 2 Hours per Week	Examination Scheme: Theory Paper : 100 Marks PR/TW/Viva : 50 Marks Total : 150 Marks	Page : 1 of 1	
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Syllabus

NUMERICAL METHODS:

1. Algorithms, types, classification, complexity of Algorithms, efficiency of algorithms.
2. Gauss elimination algorithm, Cholesky method of matrix decomposition, Gauss Siedel method, Eigen Value, problem Vienne-Stodola or power method, Jacobi method, Giben's method for Eigen values and vectors
3. Finite differences – forward, backward and central, ordinary and partial differential equations, extrapolation, Richardson's extrapolation.
4. Numerical differentiation, Euler's and Rungakutta methods.
5. Numerical Integration, Gauss quadratic, Newton Cotes formula, Webber rule.
6. Finite element methods -1D, 2D problems, element types, interpolating polynomials, optimal fit and direct method, variational approach, weight residual approach.
7. Applications in Heat Exchangers, Vibration of reciprocating & rotary systems, Heat transfer.

COMPUTER PROGRAMMING:

1. Fortran -77 Syntax and control structures.
2. Subroutines and 1D, 2D and 3D arrays.
3. File input outputs, Random, Sequential.
4. Programming for Gauss Elimination, Cholesky, Jacobi algorithms.



Mechanical Engineering Department
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The M. S. University of Baroda, Vadodara, Gujarat, India-390 001
Website: <http://www.msubaroda.ac.in>

Subject: Stress Analysis and Vibration (MEC 2232)

Specialization: Thermal Science

Teaching Scheme:

Lectures: 4 Hours per Week

Practicals/Termwork:

2 Hours per Week

Examination Scheme:

Theory Paper : 100 Marks

PR/TW/Viva : 50 Marks

Total : 150 Marks

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Academic Year : 2003-04

M. E. Part - I

Syllabus

A) Stress Analysis:

Stress strain relationship in elasticity, stress strain analysis by analytical methods, experimental techniques of stress analysis, Resistance strain gauges, Brittle coating, Photo elasticity, Moire Fringes, Relative merits and demerits of experimental techniques, Selection of appropriate experimental technique of stress analysis - some illustrative practical problems.

B) Vibrations:

Vibrations of single and multi degree freedom system, Torsional vibrations : two and three rotor systems, geared systems. Vibrations in multi-cylinder engines, analysis and remedial measures. Vibrations in rotating machinery, analysis and remedial measures - Experimental methods in vibration measurements, Equipments – their principle of operation, construction and working.

Case Studies: On vibration problems in industry.

	Mechanical Engineering Department Faculty of Technology & Engineering The M. S. University of Baroda, Vadodara, Gujarat, India-390 001 Website: http://www.msubaroda.ac.in		
Subject: Advanced Heat and Mass Transfer (MEC 2206)			
Specialization: Thermal Science			
Teaching Scheme: Lectures: 4 Hours per Week Practicals/Termwork: 2 Hours per Week	Examination Scheme: Theory Paper : 100 Marks PR/TW/Viva : 50 Marks Total : 150 Marks	Page : 1 of 1	
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		M. E. Part - II	

Syllabus

1. Review of Basic Equations and Steady State

Conduction:

General three-dimensional heat conduction equation, Boundary conditions. Steady one dimensional heat conduction through simple & composite, plane, cylindrical and spherical walls without heat generation, Effect of variable thermal conductivity, Critical thickness of insulation for cylindrical and spherical systems. Steady one dimensional heat conduction through plane wall, hollow cylinder, solid cylinder and solid sphere with uniform heat generation, heat flow through piston crown, buried cables, various heat sources. Heat transfer from finned surfaces, General equation, efficiency and effectiveness of fins, conduction in cooling of turbine blade, optimum dimensions, comparison of materials. Two dimensional steady state heat conduction, numerical and graphical methods, Analogical solution.

2. Unsteady State Heat Conduction:

Heating and cooling with negligible internal resistance, temperature-time response of thermocouple, heating and cooling with negligible surface resistance, transient heat conduction in semi-infinite solids, heating and cooling of infinite plate with finite internal and surface resistance, numerical and graphical analysis.

3. Convection:

Laminar and turbulent flow, Velocity (hydrodynamic) and thermal boundary layer. Dimensional analysis and dimensionless numbers for free and forced convection. Empirical relations and practical solution of free and forced convection in pipes, over plates and across cylinders and spheres, combined free and forced convection, combined free convection and radiation heat transfer.

4. Heat Exchangers:

Classification, overall heat transfer coefficient, LMTD correction factors for use with cross flow and multi-pass heat exchangers, effectiveness NTU method, Design considerations and performance of heat exchangers, compact heat exchangers.

5. Radiation:

Laws of thermal radiation, intensity of radiation, Lambert's cosine law, Radiant heat exchange between non-black bodies separated by a non-absorbing medium, radiation shape factor, radiation heat exchange through an absorbing medium, radiation from gases, radiation shields, solar radiation, correction for radiation effects in temperature measurement.

6. Boiling and Condensation:

Film condensation on tubes and tube banks, film condensation in horizontal tubes, influence of the presence of non-condensable gases, drop wise condensation, pool boiling regimes, pool boiling correlation, forced convection boiling inside tubes.

7. Mass Transfer:

Modes of mass transfer, Diffusion (molecular or eddy) and convective mass transfer, Fick's laws and molecular diffusivity, diffusion of gases and liquids through solids, diffusion in liquids, equimolar counter between diffusion in gases, mass transfer coefficient, mass transfer in laminar and turbulent flows, combined heat and mass transfer – wet and dry bulb thermometer.

	Mechanical Engineering Department Faculty of Technology & Engineering The M. S. University of Baroda, Vadodara, Gujarat, India-390 001 Website: http://www.msubaroda.ac.in		
Subject: Economics of Power Plant (MEC 2210)			
Specialization: Thermal Science – Thermal Power Plants			
Teaching Scheme: Lectures: 4 Hours per Week Practicals/Termwork: Nil	Examination Scheme: Theory Paper : 100 Marks PR/TW/Viva : Nil Total : 100 Marks	Page : 1 of 1	
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		M. E. Part - II	

Syllabus

1. Role of Power in the Development of a Society with Emphasis on Indian Scene:

Both rural and urban as well as agriculture and Industrial development, general economic considerations leading to the choice of a power plant.

2. Fluctuating Loads on Power Plants:

Introduction, load curves, different terms and definitions, effect of variable load on power plant design and operation, method to meet variable loads.

3. Peak Load Plants:

Requirements, pump storage power plants, economical justification of pump storage plant, their advantages and disadvantages compressed air storage plants, their advantages and limitation.

4. Economic Analysis of Power Plants:

The cost of electrical energy, selection of the type of generation, selection of generating equipment, performance and operating characteristics of power plants, load division among generators, tariff methods for electrical energy, economics of various types of power plants.

5. Combined Operation of Power Plant:

Their advantages, load division between power stations storage type hydro electric plant on combination with steam power plant, run-off river plant in combination with steam power plant, coordination hydroelectric and gas turbine plants, coordination of hydroelectric and nuclear power plants.

6. Role of fuels in power plant economics.

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Subject: Gas Turbine and Diesel Power Plants (MEC 2208)			
Specialization: Thermal Science			
Teaching Scheme: Lectures: 4 Hours per Week Practicals/Termwork: 2 Hours per Week	Examination Scheme: Theory Paper : 100 Marks PR/TW/Viva : 50 Marks Total : 150 Marks	Page : 1 of 1	
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		M. E. Part - II	

Syllabus

GAS TURBINE PLANTS:

1. Classification and comparison of different types of gas turbine power plants, thermodynamic cycles, analysis of closed cycle and open cycle gas turbine plants, methods of improving the thermal efficiency and power output of gas turbine plants.
2. Different components of gas turbine plants and different arrangements of gas turbine components.
3. Types of compressors and turbines used in gas turbine plants, their operational characteristics and design criteria.
4. Types of combustion chambers used, fuels and fuel handling equipments, governing of gas turbines.
5. Combined steam and gas turbine plants.
6. Advantages of gas turbine plants over other power plants, maintenance of gas turbine plants.
7. Recent developments of gas turbine power plants.

DIESEL POWER PLANTS:

1. Introduction, field of use, outline of Diesel power plants.
2. Thermodynamic cycle and cycle analysis, performance and rating of diesel engines, methods of improving the performance.
3. General design considerations of Diesel power plants.
4. Different systems of diesel power plants.
5. Parallel operation of Diesel power plants.
6. Common faults and their rectification, maintenance of diesel plants.
7. Recent developments in diesel power plants.

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Subject: Modern Steam Power Plants (MEC 2207)			
Specialization: Thermal Science			
Teaching Scheme: Lectures: 4 Hours per Week Practicals/Termwork: 2 Hours per Week	Examination Scheme: Theory Paper : 100 Marks PR/TW/Viva : 50 Marks Total : 150 Marks	Page : 1 of 1	
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		M. E. Part - II	

Syllabus

- General layout of modern thermal power plants, site selection for thermal power plants.
- Fuels:**
Their storage, preparation, handling, feeding and burning. Ash handling and dust collection, air preheaters.
- High Pressure Boilers:**
Their advantages, study of different high-pressure boilers, waste heat boilers, feed water system, feed water treatment plants, boiler draught system and their design heat criteria balance sheet for boilers.
- Condensing Systems:**
Types and main elements of condensing plants, performance of condensers, thermodynamic analysis of condensers, design criteria for condensers, spray ponds, cooling towers, performance of cooling towers, cooling tower environmental effects, analysis of cooling towers.
- Steam Turbines:**
Classification of turbines and their working, compounding of steam turbines, governing of turbines, cycles for steam power plants, Rankine cycle, Reheat cycle and its analysis, Reheat-regenerative cycle, Binary cycle and its analysis, methods to improve performance.
- Steam Piping Systems:**
Steam piping fittings, expansion joints, piping support, piping design, insulation of steam piping.
- Power plant layout, arrangement of units.
- Design aspects, operation and maintenance of thermal power plants.

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Subject: Nuclear Power Plants (MEC 2209)			
Specialization: Thermal Science			
Teaching Scheme: Lectures: 4 Hours per Week Practicals/Termwork: 2 Hours per Week	Examination Scheme: Theory Paper : 100 Marks PR/TW/Viva : 50 Marks Total : 150 Marks	Page : 1 of 1	
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Syllabus

1. Induction, why nuclear power, review of nuclear theory, fusion and fission processes of release of nuclear energy, properties and reactions of nuclear fuels, fuel handling.
 2. Main elements of a nuclear power plant and their arrangement, types of nuclear furnaces and moderator, heat exchangers, turbines.
 3. Nuclear reactors, general components of nuclear reactors, types of nuclear reactors, their applications and their relative merits and demerits, special problems with fast reactors, general design consideration, heat transfer problems in nuclear reactors, principles of control and operation.
 4. Location of nuclear power plants, nuclear power development, operation and maintenance of nuclear plants.
 5. Safety precautions during the operation of nuclear power plants.
 6. Nuclear materials, moderating and reflecting materials, control rod materials shielding materials, effects of nuclear radiating.
 7. Disposal of nuclear waste.
- Comparison of nuclear power plants