SCHOOL OF ENGINEERING & IT, MATS UNIVERSITY
MECHANICAL DEPARTMENT

Programme Outcome

Undergraduate engineering programmes are designed to prepare graduates to attain the following program outcomes:

1. An ability to apply knowledge of mathematics, science and Mechanical engineering to solve practical complex problems.
2. An ability to identify, critically analyze, formulate and solve engineering problems using principles of mathematics, sciences, and engineering sciences.
3. An ability to select appropriate engineering tools and techniques and use them with skill and proficiency.
4. An ability to use the modern tools, resources and IT tools for complex engineering problems.
5. An ability to design a system and process to meet desired needs of society within realistic limitations such as health, safety, security and environmental considerations.
6. An ability to create and conduct experiments, interpret data, design of experiments and provide well informed conclusions.
7. An ability to understand the impact of engineering solutions within purview of laws, in a contemporary, global, economical, environmental, and social context for sustainable development of society.
8. An Ability to develop ability to work individually and in a team as a member or a leader to develop professional ethics and leadership qualities.
9. An ability to function professionally with ethical response ability as an individual as well as in multidisciplinary teams with positive attitude for engineering practice.
10. An ability to communicate effectively on complex engineering activities and effective documentation.
11. An ability to appreciate the importance of goal setting and to recognize the need for life-long learning for technological change
12. To produce well informed socially responsible global citizen with sharp critical thinking skills having sound awareness about finance management, engineering laws and human rights, ethics and values. They will have entrepreneurial spirit.

Programme Specific Outcomes

P.G –M.Tech in Turbo Engineering

Programme Specific Outcomes

1. Analyze, design and evaluate mechanical components and systems.
2. Plan the manufacturing of given mechanical components and systems (methods design, process plan, process automation and manufacturing methods)
3. Apply modern management methods to manufacturing of components and systems
4. Analyze and design quality assurance systems

Mapping with PSOs with Pos:

Programme Specific	Programme Outcome			
Outcomes	PO1	PO2	PO3	PO4
1.				
2.				
3.				
4.				

			PO1	PO2	PO3	PO4
YEAR-I	**SEM 1**	Finite Element methods	**Y**	**Y**		
		Advance Heat Transfer			**Y**	
		Experimental Techniques				
		Advance Fluid Dynamics		**Y**		**Y**
		Gas Turbine Cycle & Jet Propulsion	**Y**	**Y**	**Y**	
		CAD /CAE Lab	**Y**		**Y**	
		Advance Heat Transfer Lab	**Y**		**Y**	**Y**

		Finite Element methods	**Y**		**Y**	**Y**
		Advance Heat Transfer				
		Gas Turbine & Jet Propulsion Lab				**Y**
	SEM 2	Gas Dynamics and Flow Through Turbo Machine Passages	**Y**	**Y**		
		Thermal Turbo Machines	**Y**	**Y**	**Y**	**Y**
		Hydro Turbo Machines			**Y**	
		Computational Fluid Dynamics				
		Energy & Exergy Analysis	**Y**	**Y**		
		Advanced Fluid Machinery Lab				
		Gas Dynamics Lab	**Y**		**Y**	**Y**
		Turbo Machine Design Lab	**Y**		**Y**	
YEAR-2	**SEM 3**	Fatigue and Fracture Mechanics	**Y**	**Y**		
		High Temperature Materials				**Y**
		Design of Heat Exchanger	**Y**	**Y**		
		CFD Lab	**Y**	**Y**		
		Project Work Phase – I		**Y**		
	SEM 4	Project Work Phase – I I	**Y**	**Y**	**Y**	**Y**

SEMESTER-I

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester : 1st M.Tech
Branch : Turbomachinery
Subject Finite Element methods
Code : ME 111

Course objective:
Understand the fundamental concepts of FEM.
Understanding the use and knowledge of fundamental stiffness matrix.
Know the behaviour and usage of each type of elements covered in this course.
Be able to prepare a suitable FE model for structural mechanical analysis problems.
Can interpret and evaluate the quality of the results
Be aware of the limitations of the FEM.

UNIT-I INTRODUCTION : Review of various approximate methods – Raleigh Ritz's, Galerkin and finite difference methods- Governing equation and convergence criteria of finite element method.

UNIT-II DISCRETE ELEMENTS : Bar elements, uniform sections, mechanical and thermal loading, varying section, truss analysis. Beam element - problems for various loadings and boundary conditions - longitudinal and lateral vibration. Use of local and natural coordinates.

UNIT-III CONTINUUM ELEMENTS : Plane stress, Plane strain and axisymmetric problems, constant and linear strain, triangular elements, stiffness matrix, axisymmetric load vector.

UNIT-IV ISOPARAMETRIC ELEMENTS : Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, Stiffness matrix and consistent load vector, Gaussian integration

UNIT-V FIELD PROBLEM : Heat transfer problems, Steady state fin problems, Derivation of element matrices for two dimensional problems, Torsion problems.

TEXT BOOK

1. Tirupathi.R. Chandrapatha and Ashok D. Belegundu – Introduction to Finite Elements in Engineering – Printice Hall India, Third Edition, 2003.
2. Rao. S.S., Finite Element Methods in Engineering, Butterworth and Heinemann, 2001.

REFERENCES

1. Reddy J.N.–An Introduction to Finite Element Method – McGraw Hill – 2000.
2. Krishnamurthy, C.S., Finite Element Analysis, Tata McGraw Hill, 2000.
3. Bathe, K.J. and Wilson, E.L., Numerical Methods in Finite Elements Analysis, Prentice Hall of India, 1985.
4. Robert D Cook, David S Malkus, Michael E Plesha, 'Concepts and Applications of Finite Element Analysis', 4th edition, John Wiley and Sons, Inc., 2003.
5. Larry J Segerlind, 'Applied Finite Element Analysis', Second Edition, John Wiley and Sons, Inc. 1984.

Course Outcome:
Apply knowledge of finite element method for understanding, formulating and solving engineering problems.
Analysis of structural and thermal systems.
Demonstrate creativeness in designing new systems components and processes in the field of engineering
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary problems

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester : 1st M.Tech
Branch : Turbomachinery
Subject : Advance Heat Transfer

Code : ME 112

Course Objectives:
To provide a fundamental understanding of the principles of heat transfer due to conduction, convection and radiation.
To achieve an understanding of the basic concepts of phase change processes.
To understand the principles of mass transfer.
To learn about the design of heat exchangers.

UNIT-I FUNDAMENTALS: Modes of heat transfer: Conduction – Convection – Radiation.

UNIT II HEAT CONDUCTION: Factors affecting thermal conductivity of solids, liquids & gases, General three-dimensional heat conduction equation in Cartesian, cylindrical & spherical coordinates, Initial condition and various boundary conditions. Heat source systems, Critical thickness of insulation. Different types of fins & their analysis, Two-dimensional steady state conduction. Electrical analogy, graphical & numerical methods. Transient heat conduction with & without temperature gradients within the system, Heat flow in Semi -infinite solids. Application of heisler charts.

UNIT-III FREE AND FORCED CONVECTION: Convection fundamentals: Basic equations, Boundary layer concept, Dimensional analysis.**Free & Forced convection**: Similarity & Simulation of convection heat transfer, Boundary layer theory. Turbulent flow heat transfer. Analogy between momentum & heat transfer. Heat transfer with liquid metals. Heat transfer in high velocity flow. Recent development in theory of turbulent heat transfer. Natural convection under different situations. Empirical relations in convection heat transfer.

UNIT-IV BOILING AND CONDENSATION: Boiling & Condensation, Regimes of boiling heat transfer, Heat transfer in condensation, Drop wise & film condensation, Empirical equations.

UNIT-V RADIATIVE HEAT TRANSFER : Radiation heat transfer properties. Laws of thermal radiation. Shape factors. Radiation heat transfer between black, diffuse & gray surface. Electric network method of solving radiation problems. Radiosity approach. Gas emission & absorption, Bulk Radiations.

REFERENCES:

1. S. P. Sukhatme, "Heat Transfer", University Press (India), 1996.

2. J. P. Holman, "Heat Transfer", McGraw Hill Book. Co, 2002.

3. Eckert and Drake, "Heat and Mass Transfer", McGraw Hill, 1960.

4. Oziski, M. N. “Heat Transfer – A Basic Approach”, McGraw Hill, book comp., N. Y., 1985.

5. Roshenow, W., Hartnett, J., Ganic, P., “Hand Book of Heat Transfer, Vol -1 & Vol- 2, McGraw Hill N. Y. 1980.

6. Incropera & Dewitt, “Fundamentals of Heat and Mass Transfer”, John Wiley 1996.

Course Outcome:
Apply knowledge of heat transfer for understanding, formulating and solving engineering problems.
Acquire knowledge and hands-on competence in applying the concepts of heat and mass transfer in the design and development of mechanical systems.
Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs.

MATS UNIVERSITY, RAIPUR (C.G.)
SCHOOL OF ENGINEERING & I.T.

Semester : 1st M.Tech
Branch : Turbomachinery
Subject : Experimental Techniques
Code : ME113

Course Objectives:

This course aims to introduce students to use advanced quantitative methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems.

UNIT-I

Basic concepts of Measurement, Statistical Analysis of Experimental Data Method of Least Squares, Uncertainty Analysis.

UNIT-II

Response characteristics of Instruments – 1st & 2nd order instrument. Transducers, Vibration & Noise measurements

UNIT-III

Theory of strain gauges, Advance & Specific measurements –Stress & Strain Measurement by Photo Elastic Bench, Hotwire & Laser Doppler Anemometry.

UNIT-IV

Thermal & Transport property measurement, Thermo gravimetry, Gas Chromatography, Air Pollution & Nuclear radiation measurement.

UNIT-V

NDT, Radiography, Ultrasonography, Wind Tunnel Testing, Data Acquisition System.

REFERENCES:

1. Holman, J.P, "Experimental Methods for Engineers" 5th Ed. McGraw hill International Edition, 1989.

2. Doeblin, E.O., "Measurement System – Application and Design – McGraw Hill International Ed., 1990.

3. Eckman, D.P. "Industrial Instrumentation", Wiley Eastern Ltd., New Delhi, 1990.

4. Hale, J. and Kocak, H., "Dynamics and Bifurcations", Springer-Verlag, N.Y. 1991.

5. Strogatz, S.H., "Nonlinear Dynamics and Chaos", Addison Wesley, Massachusetts, 1995.

6. Helfrack, A.D. and Cooper, W.D., "Modern Electronic Instrumentation & Measurement Techniques", Prentice Hall of India Pvt. Ltd., New Delhi -2001.

Course Objectives:
Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively.
Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry.
Skills in the use of Operations Research approaches and computer tools in solving real problems in industry.

MATS UNIVERSITY, RAIPUR

Semester: 1st M. Tech Course
Branch :Turbo-Machinery
Subject: Advance Fluid Dynamics
Code: ME 114

Course Objectives:
Obtaining a solid understanding of the fundamentals of Fluid dynamics
The ability to formulate basic equations for Fluid Engineering problems

.The ability to use tables and figures to determine the friction energy loss for various pipes/ducts geometries and fluid engineering applications
The ability to perform dimensional analysis and identify important parameters

UNIT-I

Cartesian Tensors, Basic Concepts: Types of fluids and basic equations of flow, basic concepts in laminar and turbulent flows. Equations Governing Fluid Motion: Navier stokes equations, Boundary layer equations, Exact solutions of N -S equations, Flow between concentric rotating Cylinders, Parallel flow of a powder–law fluid.

UNIT-II

Potential Theory: Kelvin's theorem, source, sink, vortex and doublet, development of complex potentials by super position, Singularities – plane flow past bodies – Dirchlet theorem - Conformal transformation and thin aerofoil theory.

UNIT-III

Laminar Boundary Layers: Blasius solution, Boundary Layers with non -zero pressure gradient, separation and vortex shedding. Turbulent Flow: Mechanism of turbulence, derivation of governing equations for turbulent flow, K-E model of turbulence, Universal velocity distribution law and friction factor, Kinetic energy of the mean flow and fluctuations, Relaminarization.

UNIT-IV

Experimental Techniques: Pressure tubes, Thermal anemometers, Laser – Doppler anemometers, P-I velocimeter.

UNIT-V

Computational Fluid Dynamics: Philosophy of CFD, Governing equations, thin derivation and physical meaning, mathematical behaviour of P.D.E. and its impact on CFD, Finite difference scheme, Grid generation and transformation, Application to FEM and finite volume method for CFD Problems.

REFERENCES:

1. H. Schlichting, "Boundary layer Theory", McGraw Hill, 1987.

2. Jo. Hinze, "Turbulence", McGraw Hill, 1975.

3. P. Bradshaw, "Turbulence", Springer-Verleg, 1976.

4. Anderson D. A., Tannhill, I.C., and Pletcher, R.H., "Computational Fluid Mechanics and Heat Transfer," Hemisphere Publ. Co., N.Y. 1984.

5. K. Murlishar and T. Sunderajan, "Computational Fluid Flow and Heat Transfer," Narosa Pub. House, New Delhi, 1997.

6. Anderson, John, D., "Computational Fluid Dynamics," McGraw Hill, N.Y., 1995.

7. Fox, R. W. and McDonald, A. T., "Introduction to fluid Mechanics," John, Wiley & Sons, N. Y., 1985.

8. Shapiro, A.H., "The Dynamics and Thermodynamics of Compressible Fluid Flow," The Ronald Press Company, N.Y., 1954.

9. Tennekes, H. and Lumley, J. L., "A First Course in Turbulence," M.I.T., Press, Cambridge, M.A. 1972.

10. Streeter, V.L. and Wylie, E.B., "Fluid Mechanics," McGraw Hill Int. Student Edition, 1979.

11. Zucrow, M. "Gas Dynamics," John Wiley & Sons, 1976.

Course Outcomes:
.Apply knowledge of Fluid dynamics formulating and solving engineering problems.
.Acquire knowledge of fluid dynamics for the design and development of mechanical systems.
.Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
Identify, analysis, and solve mechanical engineering problems useful to the society.
.Work effectively with engineering and science teams as well as with multidisciplinary designs.
Skill fully use modern engineering tools and techniques for mechanical engineering design, analysis and application.
.Develop fundamentals to continue the study of the advance subject fluid machinery, Heat and mass transfer etc.

MATS UNIVERSITY, RAIPUR

Semester	:	1st M. Tech Course
Branch	:	Turbo-Machinery
Subject	:	Gas Turbine Cycles and Jet Propulsion
Total Theory Periods	:	45
Total Tutorial Periods	:	15
Code	:	ME 115

Course Objectives
To study classifications of gas turbine cycle

To study construction and working of different jet propulsion
To acquire the knowledge and skill of analyzing Gas Turbine Cycles and Jet Propulsion

UNIT-I

Open cycle, Twin Shaft Arrangement, Multi Spool Arrangement of Gas Turbines, Closed Cycles, Air Craft Propulsion, and Environmental Issues.

UNIT-II

Ideal Cycles, Combustion and Combustion Chambers, Component Losses, performance calculations Comparison with practical Cycles.

UNIT-III

Criteria for performance, Intake & Propelling Nozzle efficiency, Simple Turbo –Jet Cycles, Turbo Fan Engine, Turbo -prop engines, Turbo Shaft engines, Thrust augmentation.

UNIT-IV

Prediction of Performance of Simple Gas Turbine, Methods for Improving Part–load Performance, Matching Procedure for Turbo -fan Engines Transient behaviour of Gas Turbines, Performance Deterioration and principle of control system.

UNIT-V

Rocket Propulsion-Classification, Operation, Performance, Ramjet Engines.

REFERENCES:

1. Saravanamootoo, H.I.H., & Rogers, G.F.C., "Gas Turbine Theory" Person Education (Singapore) Pvt. Ltd.., Indian Branch, New Delhi 2001.

2. Somasundaram S.L., "Gas Dynamics & Jet Propulsion", New Age International (P) Ltd., New Delhi, 1996

3. Barlit V., "Lecture Notes Delivered at Bharat Heavy Electricals Ltd.", Vol.I & Vol.II, 1966.

4. Canady G., "Theory of Turbomachines" McGraw Hill Book Co., N.Y. 1964

5. Jain J.K., "Gas Turbine Theory & Jet Propulsion" Khanna Publisher, Delhi 1995.

6. Yahya S.M., "Gas Turbine Theory" Ganeshan, V., "Gas Turbine", Tata McGraw Hill, 1999.

Course Outcomes:
Apply knowledge of turbo machinery for understanding, formulating and solving engineering problems.
Acquire knowledge and hands-on competence in the design and development of mechanical systems.
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs.

MATS UNIVERSITY, RAIPUR

Semester : 1st M. Tech Course
Branch : Turbo-Machinery
Subject : CAD/CAE Laboratory
Code : ME 116

Course Objective:
To introduce the student to be familiar with CAD/ CAE terminology & its capabilities.
To become familiar with CAD/ CAE software, Graphical user interface & basic tools.
To recognize geometric and graphical elements of engineering design problems

To apply a "hands-on" understanding of the basic concepts of computer-aided manufacturing and prototyping through group and individual projects
To study Basic features of CAE so as to be capable of accepting professional responsibilities and to understand the associatively between design and manufacturing.
Integrate the CAD system and the CAE system by using the CAD system for modeling design information and converting the CAD model into a CAE model for modeling the manufacturing information.

LIST OF EXPERIMENTS

1. Scaling, rotation, translation, editing, dimensioning –Typical CAD command structure.
2. Wire frame modeling –surface modeling
3. Solid Modeling
4. Advanced modeling
5. CFD/FEM Fundamentals
6. Flow Simulation over a Symmetrical Airfoil using CFD
7. Flow Simulation over a Cambered Airfoil using CFD
8. Flow Simulation over a Turbine Blade (static analysis) using CFD
9. Stress Analysis of a Turbine Blade (Rotation only and no pressure loads)
10. Stress Analysis of any Turbine Component

LIST OF EQUIPMENTS

1. Computers with minimum 1 GB RAM, Pentium-IV Processor,
2. Pro-E-Wildfire,
3. AutoCAD(latest),
4. CATIA,
5. SOLIDWORKS
6. ANSYS- 12 with Fluent and CFX
7. NASTRAN
8. UPS 10 KVa 3-Phase

Course Outcome:
Understand the various CAD/ CAE and CNC processes.
Generate and verify the tool path and NC programs for milling and drilling manufacturing processes.
Recognize various types of Curves, surface and Solid and their application as used in geometric modeling.
Appreciate the concept of parametric modeling which is the mainstay of most of the 3D modeling system.

Write and prove sample part programs for CNC machining centres in planar milling operations using the word address format.
Understand the needs of master production schedule and methods to develop it.
Plan and execute the production activity control, which actually deals with operations in the shop floor.
Skill fully uses modern engineering tools and techniques for mechanical engineering design, analysis and application.

MATS UNIVERSITY, RAIPUR

Semester : 1st M. Tech Course
Branch : Turbo-Machinery
Subject : Advance Heat Transfer Laboratory
Code : ME 117

Course Objectives:
To provide a fundamental understanding of the principles of heat transfer due to conduction, convection and radiation.
To achieve an understanding of the basic concepts of phase change processes.

To understand the principles of mass transfer.
To learn about the design of heat exchangers.

LIST OF EXPERIMENTS

1. To find out the thermal conductivity of a given metallic rod.
2. To study the counter flow and parallel flow heat exchangers and derive the expression for log mean temperature difference and effectiveness.
3. To find out the thermal conductivity of given insulating powder.
4. To find out the thermal emissivity of a given grey body.
5. To study two phase heat transfer unit to observe the boiling phenomenon and to find out critical heat flux for a given wire.
6. To find out the value of Stephen Boltzmann constant and compare the same with the theoretical value.
7. To find out the thermal conductivity of two slab guarded by hot plate method.
8. To find out heat transfer coefficients under different flow conditions and compare with the theoretical value.
9. To find out the efficiency of pin fin in natural convection conditions.
10. To find out the thermal conductivity of metal by the method of heat transfer in extended surface.

LIST OF EQUIPMENTS

1. Voltmeter,
2. Ammeter,
3. Digital temperature indicator,
4. Voltage regulator,
5. Heating element,
6. Parallel flow and Counter flow Heat Exchanger,
7. Glass beaker,
8. Immersion Heater,
9. Thermocouple,
10. IS: 3346- 1966 Apparatus,
11. Thermometers,
12. Brass fin

Course Outcome:

Apply knowledge of heat transfer for understanding, formulating and solving engineering problems.
Acquire knowledge and hands-on competence in applying the concepts of heat and mass transfer in the design and development of mechanical systems.
Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs

MATS UNIVERSITY, RAIPUR

Semester : 1st M. Tech Course
Branch : Turbo-Machinery
Subject : Gas Turbine and Jet Propulsion Laboratory
Code : ME 118

LIST OF EXPERIMENTS

1. To study about the operation of Open cycle and Closed cycle Gas Turbine Engines.

2. To estimate the performance of Gas Turbine Engine.

3. To study about the construction and operation of Turbojet Engine.

4. To study about the construction and operation of Turbofan Engine.

5. To study about the construction and operation of Ramjet Engine.

7. To estimate the performance of Combustion Chamber of Gas Turbine Engine.

8. To estimate the performance of De-Laval Nozzle.

9. To study about the construction and operation of Rocket Engines.

10. To study about the matching procedure of Turbofan Engines.

11. Part-load Performance estimation of Gas Turbine.

LIST OF EQUIPMENTS

1. Gas Turbine Performance Test Setup
2. Combustion Chamber Test Setup
3. De-Laval Nozzle Test Setup.
4. Gas Turbine Part-load Performance Test Setup

Course Outcomes:
Apply knowledge of turbo machinery for understanding, formulating and solving engineering problems.
Acquire knowledge and hands-on competence in the design and development of mechanical systems.
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs.

MATS UNIVERSITY, RAIPUR

Semester	:	2nd M. Tech Course
Branch	:	Turbo-Machinery
Subject	:	Gas Dynamics and Flow through Turbo Machine Passages
Total Theory Periods	:	45
Total Tutorial Periods	:	15
Code	:	ME 211

Course Objectives
To study classifications of Gas Dynamics and Flow through Turbo Machine Passages
To study construction and working of different Gas Dynamics and Flow through Turbo Machine Passages
To acquire the knowledge and skill of analyzing different Gas Dynamics and Flow through Turbo Machine Passages

UNIT-I INTRODUCTION

Review of fundamentals - Isentropic, adiabatic, Fanno line and Rayleigh line flows. Beltrami flows-Cylindrical stream surfaces-Axisymmetric Beltramic flows -free vortex type-forced vortex type and with constant flow angle-Mass flow rate through annulus - Chocking of flow through annulus. Potential flows -Absolute potential flows - flow equations.

UNIT-II NORMAL AND OBLIQUE SHOCKS

Normal shock-Governing equations-strength of shock waves-shocks in nozzles.

Oblique shocks- Theoretical analysis-governing equation-Rankine-Hugonoit relations-Prandtl's relation- Strong and weak shocks-oblique shock tables-Mach angles-Mach waves-Prandtl- Meyer expansion-Shock polar diagram- Flow around a corner-Hodograph method for the solution of two-dimensional flows.

UNIT-III SUPERSONIC FLOWS

Supersonic flows-Method of characteristics one and two dimensional isentropic flows-two dimensional, irrotational, isentropic, supersonic flow-Design of curved passages-supersonic nozzles-Supersonic cascades

UNIT-IV AXI-SYMMETRIC FLOWS

Axi-symmetric flows in rotating and stationary passage - Geometry of blade surfaces - Equilibrium conditions of flow - Influence of conditions at leading edge of blades - Flow conditions at rotor inlet and at rotor outlet - Flow in rotors with arbitrary blades - Methods of solution - correction for finite spacing and thickness of blades - Experimental results.

UNIT-V FLOW TYPES

Quasi two-dimensional flows in Turbo machines-Quasi two dimensional flows on surface of revolution-Irrotational flows on cylindrical stream surfaces-Blade force and circulation - systems of vortex lines as replacement for cascades - Axial cascades replaced by vortex sheet -Biot-Savart's law applied to vortex system for cascade with non -radial blades.

TEXT BOOK

6. Aerothermodynamics and flow in Turbo machines, Vavra, M.H., John Wiley, 1960.

7. The dynamics and thermodynamics of compressible fluids, Vol. I & II, Shapiro A.H., Ronald Press, 1965.

REFERENCES

3. Axial flow compressors - Horlock J.H., Butter worth London, 1973.
4. Axial flow turbines - Horlock J.H., Butter worth, London, 1973.
5. Mathematical theory of compressible fluid flow - Richard Von Mosses -Academia Press. N.Y., 1958.

Course Outcomes:
Apply knowledge of turbo machinery for understanding, formulating and solving engineering problems.
Acquire knowledge and hands-on competence in the design and development of mechanical systems.
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs

MATS UNIVERSITY, RAIPUR

Semester : 2nd M. Tech Course
Branch : Turbo-Machinery
Subject : Thermal Turbo Machines
Total Theory Periods : 45
Total Tutorial Periods : 15
Code : ME 212

Course Objectives:
To provide a mature approach to the basic principle of classical thermodynamics and to apply it to system surroundings interactions; involving work and heat transfer with associated property changes.
To Use classical thermodynamics principles to develop algebraic relationships among key physical parameters and variable based on analysis of a specified system
Use references that provide tabulated physical data that are useful to mechanical engineers.

UNIT-I RADIAL FLOW COMPRESSORS

Radial flow compressors- Energy transfer-Slip-Pressure coefficient- Isentropic efficiency-Effect of compressibility and pre-whirl-Diffuser-Non- dimensional parameters- surging- choking- performance characteristics.

UNIT II AXIAL FLOW COMPRESSORS

Axial flow compressors-Velocity triangles-Blading-number and type of stagings - Air and blade angles- Degree of reaction- Losses-Radial equilibrium and actuator disc theory performance characteristics.

UNIT-III STEAM TURBINES AND GAS TURBINES

Steam turbines - Types- Classification - constructional details of different types of steam turbines.

Gas turbines -Types - Classification- Gas turbines engine and its components –constructional details of components - working principles of different components. Axial flow turbines (Impulse and Reaction) - Velocity triangles.

UNIT-IV TURBINE POWER CYCLES AND PERFORMACE

Power Cycles -Basic steam and gas turbine power cycles -Analysis-Efficiencies -Thermodynamic methods of improving the cycle efficiencies -Heat rate and steam rate calculations. Turbine speed - Number of stages and stage work - Gas angles and blade angles. Losses in turbines - Reheat factor and condition curve - constant stage efficiency - forms of actual condition curve - Turbine total wheel speed. Partial admission turbines - losses - Applications – performance estimation.

UNIT-V COMBUSTION CHAMBERS

Gas turbine combustion chambers - Requirements - Flame stabilization-combustion efficiency - fuel injection and atomization - Different types of combustors. Gas turbine power plant matching characteristics.

TEXT BOOKS:

1. Steam & Gas Turbines - Lee J.F. - McGraw Hill, 1962.
2. Theory of gas turbines - Cohen and Rogers Longman, 1974.

REFERENCES:

1. Steam turbines - Theory and Design - Shlyakhin. P., Peace Publishers, Moscow, (Translated from Russian by A. Jagamohan), 1965.
2. Fans - Eck B., Pergaman, 1972.
3. Axial flow turbines - Horlack, H.H., Butter worth, London, 1973.

Course outcomes:
Apply knowledge of classical thermodynamics for formulating and solving engineering problems.
Acquire knowledge and hands-on competence in applying the concepts of thermal sciences in the design and development of mechanical systems.
Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs.
Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.
To continue the study of the applied thermodynamics.

MATS UNIVERSITY, RAIPUR

Semester	:	2nd M. Tech Course
Branch	:	Turbo-Machinery
Subject	:	Hydro Turbo machines
Total Theory Periods	:	45
Total Tutorial Periods	:	15
Code	:	ME 213

Course Objectives:

To understand boundary layer theory
To formulate basic equations for impact of free jets
To understand construction and working and performance of various Turbines
To understand construction and working & performance of various Pumps
To solve and analyze a variety of fluid mechanics and fluid machinery related problems.

UNIT-I ROTODYNAMIC PUMPS AND AXIAL FLOW PUMPS

Rotodynamic pumps - pump parameters - similar pumps - non-dimensional Parameters - Specific speed - pump classification - different types - Ranges of operation.

Axial flow pumps-Constructional details-pump casing-guide system-Impeller -blade adjusting mechanism-diffuser-bearings-blade profiles-Aerofoil theory- estimation of blade lift and pump head losses–Performance Characteristics - cavitation.

UNIT-II CENTRIFUGAL PUMPS

Centrifugal pumps-radial and mixed flow-constructional details–Inlet passage -Suction spiral-impeller-Recuperator-Vaned diffuser-multistage pumps-return passage-internal leakage-Wearing ring-axial thrust- Balancing devices-Self priming arrangements-bearings and seals–Basic theory-number and shape of blades-blade loading-Head slip–Correction factors-pre-rotation-off-design performance-flow in the volute-flow in the diffuser and return passage-losses -hydraulic losses-volumetric losses- disc friction-mechanical losses-estimation of axial thrust–pump characteristics-stable operation-parallel operation of pumps-pumps in pipe systems-cavitations- NPSH.

UNIT-III BASICS OF HYDRAULIC TURBINES

Hydraulic turbines-basic parameters-principles of similarity–model turbines-Unit quantities and specific speed classification range of utilization- Constructional details of water turbines-Reaction turbines-propeller-Kaplan, bulb and Francis turbines-Inlet passage-Spiral casing-speed ring guide apparatus–casing draft tube-pelton wheel-distributor-nozzle-needle regulator –deflector bucket-braking jet.

UNIT-IV REACTION TURBINE AND PELTON WHEEL

Basic theory of reaction turbine-Velocity triangles and their correction-aerofoil theory-flow through different flow passages-volute, guide apparatus, runner and draft tube-hydraulic, volumetric and mechanical losses-energy balance- regulation of discharge-off-design performance-Forces and moments of guide vanes and adjustable blades of runner–axial thrust-cavitation in turbines- Thoma's coefficient-Location of turbine above the tail race. Theory of pelton wheel-action of jet on the buckets-flow on bucket surfaces-Hydrodynamic forces and torque on the runner-losses–energy balance.

UNIT-V TESTING OF PUMPS AND TURBINES

Testing of pump-test rig-standard instrumentation-operational characteristics. Testing of model turbines - test rigs- universal characteristics- separation of losses- Cavitation characteristics.

TEXT BOOKS:

1. Hydraulic Turbines - Nechlepa, M., Constable and Co., 1957.
2. Centrifugal and axial flow pumps - Stepanoff A.J., John Wiley 1962.

REFERENCES:

1. Impeller pumps - Lazarkieniz and Torskolanski, Pergamon Press, 1965.
2. Hydroelectric engineering practice - Vol. II, Editor Brown JG. 1958.
3. A treatise on applied hydraulics - Addison, H., Chapman and Hall, 1954.

Course Outcomes:
Apply knowledge of fluid mechanics and fluid machinery for understanding, formulating and solving engineering problems.
Acquire knowledge and hands-on competence in applying the concepts of fluid mechanics and fluid machinery in the design and development of mechanical systems.
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs.
Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.

MATS UNIVERSITY, RAIPUR

Semester : 2nd M. Tech Course
Branch : Turbo-Machinery
Subject : Computational Fluid Dynamics
Total Theory Periods : 45
Total Tutorial Periods : 15
Code : ME 214

Course Objectives:
Obtaining a solid understanding of the fundamentals of Fluid dynamics
The ability to formulate basic equations for Fluid Engineering problems

.The ability to use tables and figures to determine the friction energy loss for various pipes/ducts geometries and fluid engineering applications
The ability to perform dimensional analysis and identify important parameters

UNIT-I REVIEW OF GOVERNING EQUATIONS FLUID FLOW & HEAT TRANSFER

Conservation of Mass, Newton's Second Law of Motion, Expanded Forms of Navier stokes equations, Conservation of Energy Principle; Special Forms of the Navier Stokes Equations, Classification of Second order Partial Differential Equations, Initial and Boundary Conditions, Governing Equations in Generalized Coordinates.

UNIT-II FINITE DIFFERENCE, DISCRETIZATION, CONSISTENCY, STABILITY AND FUNDAMENTAL OF FLUID FLOW MODELING

Elementary Finite Difference Quotients, Basic Aspects of Finite Difference Equations, Errors and Stability Analysis, Some Nontrivial Problems with Discretized Equations, Applications to Heat Conduction and Convection.

UNIT-III SOLUTION OF VISCOUS INCOMPRESSIBLE FLOWS BY STREAM FUNCTION –VORTICITY FORMULATION

Two Dimensional Incompressible Viscous Flow, Incorporation of Upwind Scheme, Estimation of Discretization Error, Application to Curvilinear Geometries, Derivation of Surface Pressure and Drag.

UNIT-IV SOLUTION OF NAVIER -STOKES EQUATIONS FOR INCOMPRESSIBLE FLOWS USING MAC AND SIMPLE ALGORITHMS

Staggered Grid, Solution of the Unsteady Navier -Stokes Equations, Solutions of Energy Equation, Formulation of the Flow Problems, Simple Algorithm.

UNIT-V INTRODUCTION TO FVM

Introduction to FVM: Integral Approach, Discretization & Higher order scheme

TEXT BOOKS:

1. Anderson D.A., Tannehill J.C., Pletcher R.H., Computational Fluid Mechanics and Heat Transfer, Hemisphere Publishing Corporation, New York, U.S.A. 1984.
2. Anderson J.D., Jr., Computational Fluid Dynamics McGraw Hill, Inc New York, 1996.

3. H. K.Versteag and W. Malalsekara, “An Introduction to Computational Fluid Dynamics”, Longman, 1995

REFERENCES:

1. Murlidhar K. Sunderarajan T., Computational Fluid Flow and Heat Transfer, Narosa Publishing House, New Delhi, 2003.
2. Ankar S.V., “Numerical Heat Transfer and Flow” Hemisphere Publ., Corporation, 1985.
3. Sturt P.A., “Introduction to Numerical Methods”, the Macmillan Company, London, 1985.
4. Pratap R., “Getting Started with MATLAB”, Sounders College Publ. 1995.
5. Carnahan B., “Applied Numerical Methods”, John Wiley & Sons 1969.

Course Outcomes:
.Apply knowledge of Fluid dynamics formulating and solving engineering problems.
.Acquire knowledge of fluid dynamics for the design and development of mechanical systems.
.Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
Identify, analysis, and solve mechanical engineering problems useful to the society.
.Work effectively with engineering and science teams as well as with multidisciplinary designs.
Skill fully use modern engineering tools and techniques for mechanical engineering design, analysis and application.
.Develop fundamentals to continue the study of the advance subject fluid machinery, Heat and mass transfer etc.

MATS UNIVERSITY, RAIPUR

Semester	:	2nd M. Tech Course
Branch	:	Turbo-Machinery
Subject	:	Energy & Exergy Analysis
Total Theory Periods	:	45
Total Tutorial Periods	:	15
Code	:	ME 2153

Course Objectives:
To provide a mature approach to the basic principle of classical thermodynamics and to apply it to system surroundings interactions; involving work and heat transfer with associated property changes.
To Use classical thermodynamics principles to develop algebraic relationships among key physical parameters and variable based on analysis of a specified system
Use references that provide tabulated physical data that are useful to mechanical engineers.

UNIT-I BASIC CONCEPTS OF ENERGY

Basic concepts of energy analysis of thermal systems.

UNIT-II BASIC EXERGY CONCEPTS

Classification of forms of exergy, concepts of exergy, exergy concepts for a control region, physical exergy, chemical exergy, exergy concepts for closed system analysis, Non-flow exergy.

UNIT-III ELEMENTS OF PLANT ANALYSIS

Control mass analysis, control region analysis, criteria of performance, pictorial representation of exergy balance, exergy based property diagram.

UNIT-IV EXERGY ANALYSIS OF PROCESSES

Expansions process, compression processes, heat transfer process, Mixing & separation process, Chemical process including combustion etc.

UNIT-V ENERGY ANALYSIS OF THERMAL SYSTEMS

Gas turbine plant -Thermal Power Plant -Cogeneration Plant -Captive power plant -Combined cycle Power plant-Refrigeration Plant-Chemical Plant-Lunde air liquification plant, Heat Exchanger etc.

TEXT BOOKS:

1. Ahrendts J., "The Exergy Methods & Energy System Analysis" John Wiley & Sons., N.Y., 1980.
2. Winternore, D.E. "Advance Thermodynamics for Engineers", Arnold Publ. Corp., 1997.
3. Kotas J.J. "The Exergy Methods of Thermal Plant Analysis," 2nd Ed., Krieger Publ. Corp. U.S.A., 1995.

REFERENCES:

1. Zemanskey M W and Diffman "Heat and Thermodynamics", McGraw Hill, N.Y. 1997.
2. Turner, W.C., (Ed.), "Energy Management Handbook", John Wiley & Sons, N.Y., 1982.
3. Dryden, I.G.C., "The Efficient use of Energy", Butterworths, London, 1982.

4. Saravanamootoo, H. I. H., & Rogers, G.F.C., "Gas Turbine Theory "Person Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi 2001.
5. Seikan, Ishigai, "Steam Power Engineering -Thermal and Hydraulic Design Principles", Cambridge Univ., Press, 1999.

Course outcomes:
Apply knowledge of classical thermodynamics for formulating and solving engineering problems.
Acquire knowledge and hands-on competence in applying the concepts of thermal sciences in the design and development of mechanical systems.
Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs.
Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.
To continue the study of the applied thermodynamics.

MATS UNIVERSITY, RAIPUR

Semester : 2nd M. Tech Course
Branch : Turbo-Machinery
Subject : Advanced Fluid Machinery Lab
Code : ME 216

Course Objectives:
To understand boundary layer theory

To formulate basic equations for impact of free jets
To understand construction and working and performance of various Turbines
To understand construction and working & performance of various Pumps
To solve and analyze a variety of fluid mechanics and fluid machinery related problems.

LIST OF EXPERIMENTS

1. To study Navier Stokes equation and its applications in engineering.
2. To study the transition from laminar to turbulent flow and to determine the lower critical Reynold's number.
3. To calculate the velocity of the flow through pipe and determine the shear stress distribution.
4. To study about the Conformal Transformation.
5. To study Thin Aerofoil Theory.
6. To study flow separation and vortex shedding over an Aerofoil.
7. To study the functioning of Laser Doppler Anemometer.
8. To study the construction and working of Thermal anemometers.
9. To study the functioning of P-I velocimeter.
10. To study grid generation techniques in CFD.

LIST OF EQUIPMENTS

1. Laser Doppler Anemometer.
2. Thermal anemometers.
3. P-I velocimeter.

Course Outcomes:
Apply knowledge of fluid mechanics and fluid machinery for understanding, formulating and solving engineering problems.
Acquire knowledge and hands-on competence in applying the concepts of fluid mechanics and fluid machinery in the design and development of mechanical systems.
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs.
Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.

MATS UNIVERSITY, RAIPUR

Semester : 2nd M. Tech Course

Branch : Turbo-Machinery

Subject : Gas Dynamics Lab

Code : ME 217

Course Objectives

To study classifications of Gas Dynamics and Flow through Turbo Machine Passages
To study construction and working of different Gas Dynamics and Flow through Turbo Machine Passages
To acquire the knowledge and skill of analyzing different Gas Dynamics and Flow through Turbo Machine Passages

LIST OF EXPERIMENTS

1. To study about the isentropic flow through the C-D nozzle.
2. To study about Beltrami flow.
3. To study about the formation of Normal shock waves.
4. To study about the formation of Oblique shock waves.
5. To study about Prandtl's Mayer Expansion process.
6. To study about the Axi-symmetric flows in rotating and stationary passages.
7. To study about performance of various types of supersonic nozzles and Supersonic cascades.
8. To study about the Shock polar diagram and Hodograph.

Course Outcomes:
Apply knowledge of turbo machinery for understanding, formulating and solving engineering problems.
Acquire knowledge and hands-on competence in the design and development of mechanical systems.
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs.

MATS UNIVERSITY, RAIPUR

Semester : 2nd M. Tech Course

Branch : Turbo-Machinery

Subject : Turbo machine Design Lab

Code : ME 217

Course Objectives

To study classifications of gas turbine cycle
To study construction and working of different jet propulsion
To acquire the knowledge and skill of analyzing Gas Turbine Cycles and Jet Propulsion

LIST OF EXPERIMENTS

1. To study about the construction and operation of Centrifugal flow compressors.
2. To study about the construction and operation of Axial flow compressors.
3. To study about the construction and operation of Axial flow Turbine.
4. To study about the construction and operation of Radial flow Turbine.
5. To study the Designing procedure of Gas Turbine Blades.
6. To study about the various problems associated with the operation of Radial flow Turbine.

Course Objectives
To study classifications of Gas Dynamics and Flow through Turbo Machine Passages
To study construction and working of different Gas Dynamics and Flow through Turbo Machine Passages
To acquire the knowledge and skill of analyzing different Gas Dynamics and Flow through Turbo Machine Passages

MATS UNIVERSITY, RAIPUR

Semester	:	3rd M. Tech Course
Branch	:	Turbo-Machinery
Subject	:	Optimization Techniques
Total Theory Periods	:	45
Total Tutorial Periods	:	15
Code	:	ME 311

Course Objectives:
This course aims to introduce students to use advanced quantitative methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems.

UNIT I

Single and Multivariable optimization methods, constrained optimization methods, Kuhn-Tucker conditions-Necessary & Sufficiency theorems.

UNIT II

Linear programming - Traveling salesman problem and Transshipment problems-post optimization analysis. Integer programming all integers, mixed integer and zero-one programming

UNIT III

Geometric programming – concept – degree of difficulty –solution of unconstrained & constrained non linear problems by geometric programming. Dynamic programming.

UNIT IV

Energy System Simulation & optimization/Objectives/constraints, Problems formulation, Unconstrained problems, Constrained Variations, Kuhn-Tucker Conditions.

UNIT V

Probabilistic Technique – Tradeoffs between capital & energy using Pinch Analysis. Energy-Economy models –Scenario Generation.

TEXT BOOKS

1. Rao S.S., "Optimization Theory & Applications", Wiley Eastern 1990.
2. K. Deb, "Optimization for Engineering Design", Prentice Hall of India, 1995.
3. Reklaitis G.V., Ravindram A., Ragsdell K.M., "Engineering Optimization methods & Application", Wiley 1983.

REFERENCES

1. New Fville R. "Applied System Analysis", McGraw Hill, Int. Edition 1990.
2. Stocker, W.I. "Design of Thermal System", McGraw Hll, 1987.

Course Objectives:
Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively.
Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry.
Skills in the use of Operations Research approaches and computer tools in solving real problems in industry.

MATS UNIVERSITY, RAIPUR

Semester	:	3rd M. Tech Course
Branch	:	Turbo-Machinery
Subject	:	High Temperature Materials
Total Theory Periods	:	45
Total Tutorial Periods	:	15

Code : ME 312

Course Objectives :
To provide a fundamental understanding of the principles of heat transfer due to conduction, convection and radiation.
To achieve an understanding of the basic concepts of phase change processes.
To understand the principles of mass transfer.

UNIT-I CREEP

Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate.

UNIT-II DESIGN FOR CREEP RESISTANCE

Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile & brittle materials, Monkman- Grant relationship.

UNIT-III FRACTURE

Various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture, ductile fracture due to micro void coalescence-diffusion controlled void growth; fracture maps for different alloys and oxides.

UNIT-IV OXIDATION AND HOT CORROSION

Oxidation, Pilling, Bedworth ratio, kinetic laws of oxidation- defect structure and control of oxidation by alloy additions, hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, interaction of hot corrosion and creep, methods of combat hot corrosion.

UNIT-V SUPER ALLOYS AND OTHER MATERIALS

Iron base, Nickel base and Cobalt base super alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase, embrittlement, solidification of single crystals, Intermetallics, high temperature ceramics.

TEXT BOOKS

1. Raj. R., "Flow and Fracture at Elevated Temperatures", American Society for Metals, USA, 1985.

2. Hertzberg R. W., "Deformation and Fracture Mechanics of Engineering materials", 4th Edition, John Wiley, USA, 1996.
3. Courtney T.H, "Mechanical Behavior of Materials", McGraw-Hill, USA, 1990.

REFERENCES

1. Boyle J.T, Spencer J, "Stress Analysis for Creep", Butterworths, UK, 1983.
2. Bressers. J., "Creep and Fatigue in High Temperature Alloys", Applied Science, 1981.
3. McLean D., "Directionally Solidified Materials for High Temperature Service", The Metals Society, USA, 1985.

Course Outcome:
Apply knowledge of heat transfer for understanding, formulating and solving engineering problems.
Acquire knowledge and hands-on competence in applying the concepts of heat and mass transfer in the design and development of mechanical systems.
Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs.

MATS UNIVERSITY, RAIPUR

Semester	:	3rd M. Tech Course
Branch	:	Turbo-Machinery
Subject	:	Design of Heat Exchanger
Total Theory Periods	:	45
Total Tutorial Periods	:	15
Code	:	ME 3131

Course Objectives :
To provide a fundamental understanding of the principles of heat transfer due to conduction, convection and radiation.
To achieve an understanding of the basic concepts of phase change processes.
To understand the principles of mass transfer.

UNIT-I

Review of Heat Transfer Principles & Convection Correlation. Introduction to Heat Exchangers and classification.

UNIT-II

Basic Design Methodologies, -NTU Method AND LMTD method, Design of Double Pipe Heat Exchangers, Shell & Tube Type Heat Exchangers, TEMA, Nomenclature, j –Factors.

UNIT-III

Conventional Design Methods, Bell-Delware Method, Compact Heat Exchangers, j -Factors, Design Method, Condensers Classification and Design, Methods for Surface Condensers.

UNIT-IV

Evaporators – classification and Design Methods, Plate Type – Heat Exchangers, Regenerators.

UNIT-V

Basic Concepts of Mechanical Design of Heat Exchanger, Fixed and Floating Tube Sheet Design, Design of Expansion Bellows.

TEXT BOOKS

1. Holger Martin, “Heat Exchangers” Hemisphere Publ. Corp. Washington, 1992.
2. Kuppan, T., “Heat Exchanger Design Handbook”, Macel Dekker, Inc., N.Y. 2000.
3. Saunders, E.A.D., “Heat Exchangers – Selection Design and Con struction”, Longmann Scientific and Technical, N.Y., 1988.

REFERENCES

1. Kern, D.O., "Process Heat Transfer", McGraw Hill, 1965.
2. Shah R.K., Subbarao, E.C., Mashelkar, R.A., "Heat Transfer Equipment Design", Hemisphere Publ. Corp., 1988.
3. Seikan Ishigai, "Steam Power Engineering -Thermal and Hydraulic Design Principles", Cambridge Univ. Press 1999.

Course Outcome:
Apply knowledge of heat transfer for understanding, formulating and solving engineering problems.
Acquire knowledge and hands-on competence in applying the concepts of heat and mass transfer in the design and development of mechanical systems.
Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs.

MATS UNIVERSITY, RAIPUR

Semester : 3rd M. Tech Course

Branch : Turbo-Machinery

Subject : CFD Lab

Code : ME 314

Course Objectives:
To understand boundary layer theory
To formulate basic equations for impact of free jets
To understand construction and working and performance of various Turbines
To understand construction and working & performance of various Pumps
To solve and analyze a variety of fluid mechanics and fluid machinery related problems.

LIST OF EXPERIMENTS

1. To carry out flow simulation for the supersonic flow over a flat plate.
2. To carry out flow simulation for turbulent flow in a pipe.
3. Flow Simulation over a circular cylinder with circulation effect.
4. Generation velocity profile for laminar flow
5. Generation of velocity profile for turbulent flow
6. Nussent number determination for a flow with constant it edition
7. Nussent number determination for a flow with heat edition at constant temperature
8. Simulation of flow over a car body.
9. Simulation of supersonic flow over an aircraft.
10. Determination of drag for a flow over a body
11. Analysis of 2-D transient heat flow over a plate
12. To study about different K-E models.
13. Friction factor for laminar flow
14. Friction factor for turbulent flow
15. Shear stress distribution for a flow in horizontal duct
16. To study about Navier-Stoke's Equation and various methods for its solution.
17. To study about various Grid-less techniques used in CFD.
18. To study about Moving Mesh and Auto-Mesh techniques.
19. To study about species transport and energy transport equation for combustion analysis.

LIST OF EQUIPMENTS

9. Computers with minimum 1 GB RAM, Pentium-IV Processor,
10. Ansys Fluent and Gambit packages,
11. ANSYS- 12 with Fluent and CFX,
12. UPS 10 KVa 3-Phase.

Course Outcomes:
Apply knowledge of fluid mechanics and fluid machinery for understanding, formulating and solving engineering problems.
Acquire knowledge and hands-on competence in applying the concepts of fluid mechanics and fluid machinery in the design and development of mechanical systems.
Identify, analysis, and solve mechanical engineering problems useful to the society.
Work effectively with engineering and science teams as well as with multidisciplinary designs.
Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.

MATS UNIVERSITY, RAIPUR

Semester : 3rd M. Tech Course
Branch : Turbo-Machinery
Subject : Project Work Phase – I
Code : ME 315

The objective of the phase – I of the students project work is to prepare themselves to undertake lively project which will found end application to the industry /society. Preparation for the project work involve

- ✓ The project for M. Tech should be carried by individual student.
- ✓ Make a preliminary survey and data collection or literature review of the project proposed in the next semester.
- ✓ Conduct a thorough literature survey and publish or present a paper of the proposed work in any one of the forthcoming International seminars/ conferences/journals.
- ✓ Plan for necessary supports, facilities, analytical tools and fixation of faculties /supervisors for the final semester project work.
- ✓ Partial work of the project is to be carried out in Phase-I and remaining in Phase-II which leads to the Thesis submission at the end of the project work.
- ✓ Project should be research oriented and at least two papers should be presented/accepted in the International Journals for the Thesis submission.

MATS UNIVERSITY, RAIPUR

Semester : 4th M. Tech Course

Branch : Turbo-Machinery

Subject : Project Work Phase – II

Code : ME 411

The objective of the project work is to enable the students to work individually on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Students can opt for the co-guide from industries/ other colleges to get the necessary supervision. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student shall finally produce a comprehensive report in the form of Thesis covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines. It is mandatory that the project selected should be research oriented and at least two papers/articles related to the project work should be published/ accepted for publication in the international journals for Thesis submission.

The continuous assessment shall be made as prescribed by the regulation.