SEMESTER III

MATS UNIVERSITY, RAIPUR

SCHOOL OF ENGINEERING & I.T.

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

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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

SCHOOL OF ENGINEERING & I.T.

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

SCHOOL OF ENGINEERING & I.T.

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

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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.