B.E. Mechanical Engineering
2012 Course

(402041) Refrigeration and Air Conditioning

Prerequisite:

Basic Thermodynamics- Laws of thermodynamics, Ideal gas processes, Thermodynamic cycles, Properties of pure substance, Mollier Charts, Fluid properties, Fluid dynamics, Modes of heattransfer, Governing Equations in Heat Transfer, Extended Surfaces, Condensation and Boiling, Heat Exchangers.

Course Objectives

- Learning the fundamental principles and different methods of refrigeration and air conditioning.
- Study of various refrigeration cycles and evaluate performance using Mollier charts and/ orrefrigerant property tables.
- Comparative study of different refrigerants with respect to properties, applications and environmental issues.
- Understand the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.
- Study of the various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems

Course Outcomes:

At the end of this course the students should be able to

- Illustrate the fundamental principles and applications of refrigeration and air conditioning system
- Obtain cooling capacity and coefficient of performance by conducting test on vapor compression refrigeration systems
- Present the properties, applications and environmental issues of different refrigerants
- Calculate cooling load for air conditioning systems used for various applications
- Operate and analyze the refrigeration and air conditioning systems.

(402042) CAD/CAM and Automation

Pre-requisite:
Engineering Graphics, Machine drawing, Manufacturing processes, SOM.

Course Objectives: To teach students

- Basics of modeling.
- Discuss various geometries.
- Discretization of the solid model.
- Apply Boundary Conditions similar to real world.
- Generate solution to ensure design can sustain the applied load conditions.
- Discuss latest manufacturing methods.

Course Outcomes: After completion of the course students would be able to,

- Analyze and design real world components
- Suggest whether the given solid is safe for the load applied.
- Select suitable manufacturing method for complex components.

(402043) Dynamics of Machinery

Prerequisites: Engg. Mechanics, TOM- I and TOM-II

Course Objectives:

- To conversant with balancing problems of machines.
- To make the student conversant with fundamentals of vibration and noise.
- To develop competency in understanding of vibration and noise in Industry.
- To develop analytical competency in solving vibration problems.
- To make the student conversant with natural frequencies, Eigen values & Eigen vectors.
- To understand the various techniques of measurement and control of vibration and noise.
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Course Outcomes:

- Solutions to balancing problems of machines.
- Ability to understand the fundamentals of vibration and Noise.
- Ability to develop analytical competency in solving vibration problems.
- Ability to understand measurement and control of vibration and noise.
- Ability to calculate natural frequencies, Eigen values & Eigen vectors.
- Ability to measure vibrations, vibration characteristics and understand various methods for vibration control for real life problem.

(402044A) Energy Audit and Management (Elective I)

Pre-Requisites: Economics, Basic Thermodynamics.

Course Objectives: Following concepts to be taught to the students,

- Importance of Energy Management.
- How to carry out Energy Audit.
- Methods to reduce consumption of energy and save cost.
- How to improve energy efficiency of overall system.
- Significance of Waste heat recovery and Cogeneration.

Course Outcomes: After successful completion of the course student would be able to,

- Carry out Energy Audit of the residence / society / college where they are studying.
- Carry out electrical tariff calculation and accurately predict the electricity bill required for the installation.
- Suggest various methods to reduce energy consumption of the equipment / office / premises.

(402044B) Tribology (Elective I)

Pre-Requisites: TOM-I, TOM-II and Machine design.

Course Objectives: After successful completion of this course, students will be able-

- To know about properties of lubricants, modes of lubrication, additives etc.
- To Select suitable/proper grade lubricant for specific application.
- To select suitable material combination for tribological contact.
- To Apply the basic theories of friction, wear and lubrications about frictional behavior commonly encountered sliding surfaces.
- To suggest an explanation to the cause of tribological failures.
- To design bearing, friction, wear test rig for laboratory purposes.

Course Outcomes:

- For these simplified course contents, student develops confidence in him/her to fulfill course objectives.
- Term work includes simple case study/assignment/seminar/visit and in-semester theory examination as a part of learning process encourages students.
- He/she proves himself/herself to be excellent practical engineer in any tribological industry.

(402044C) Reliability Engineering (Elective I)

Pre-Requisites: Engineering Mathematics, Probability, Statistics.

Course Objectives: To teach students,

- Understanding of basic principles of Reliability for ensuring sustainable product design.
- Application to system requirements, design, manufacturing and testing, with real-world examples.
- Understand in detail Asset Management, Maintenance, Quality and Productiveness,
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Course Outcomes: After completion of the course students would be able to,

- Understand and analyze different methods of failure.
- Calculate MTTF, MTBF, failure rate and hazard rate.
- Different probability methods applied to Reliability.
- Optimize Cost & reliability.
- Perform FEMA, FMECA, DOE, Taguchi method.
- Different methods to test reliability.

(402044D) Machine Tool Design (Elective I)

Pre-requisite: Manufacturing Processes, TOM, Machine Design.
Course Objectives: It expected to teach following concepts to the students,

- Selection of suitable drive to run the system.
- Design of machine tools structures, guide-ways.
- Design of Spindle, power screws.
- Dynamics of machine tools.
- Special features of machine tool design.
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Course Outcome: After completion of the course student will be able to,

- Design gear box.
- Design different machine tools considering static and dynamic loads.
- Understand effect of vibrations on life of machine tools.
- Understand design considerations for Special features in Machine tools.

(402045A) Gas Turbine and Propulsion (Elective II)

Pre-requisites: Basic Thermodynamics, Fluid Mechanics, Turbo Machinery

Course Objectives:

- Understand the thermodynamics of each component of a turbine engine which include inlets,fans, compressors, burners, turbines, afterburners and nozzles
- Know what the design variables are for each component
- Understand the linked system performance of all components in the engine and performance trends for each component
- Understand the basis for off-design performance

Course Outcome: At the end of this course the students should be able to

- Demonstrate the gas turbine power plant
- Illustrate the jet propulsion system
- Analyze the performance of gas turbine engine
- Present the technical details of compressors used in gas power systems

(402045B) Product Design and Development (Elective II)

Pre-Requisites: Nil

Course Objectives: To explain students significance of,

- Product design and development.
- Hurdles in commercialization of product.
- Importance of reverse engineering.
- Focus of designing a product.
- Design validation plan.
- PLM and PDM
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Course Outcome: After successful completion of the course students would be able to

- Design a sustainable product.
- Develop commercial Product
- Master in new techniques PLM and PDM

402045C Operation Research (ELECTIVE II)

Pre-Requisites: Engineering Mathematics, Theory of probability, Statistics.

Course Objectives:

- To familiarize the students with the use of practice oriented mathematical applications for optimization functions in an organization.
- To familiarize the students with various tools of optimization, probability, statistics and simulation, as applicable in particular scenarios in industry for better management of various resources.

Course Outcomes: Learner will be able to.....

- Illustrate the need to optimally utilize the resources in various types of industries.
- Apply and analyze mathematical optimization functions to various applications.
- Demonstrate cost effective strategies in various applications in industry.

(402045D) Advanced Manufacturing Processes (Elective II)

Prerequisite: Fluid Mechanics, Heat transfer

Course Objectives:

1. To Introduce the students with Advanced Manufacturing Processes
2. To Introduce the student with Measurement techniques for micro machining
3. To Introduce the student

Course Outcomes:

1. Selection of appropriate manufacturing process for advance components
2. Characterization of work pieces

(402046) PROJECT STAGE I*

No course objective /outcome are given

SEMESTER II

(402047) Power Plant Engineering

Prerequisites:
Thermodynamics, Basic Mechanical Engineering, Turbo Machine, and Internal Combustion Engine

Course Objectives:

- To develop an ability to apply knowledge of mathematics, science, and engineering.
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
- To develop an ability to identify, formulate, and solve engineering problems.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcomes:

- Ability to have adequacy with Design, erection and development of energy conversion plants.
- Optimization of Energy Conversion plant with respect to the available resources.
- Scope of alternative erection of optimized, suitable plant at the location depending upon geographical conditions.

(402048) Mechanical System Design

Pre-requisite: Manufacturing Process, Machine design, Engineering Mathematics, TOM, IC Engines.

Course Objectives:

- To develop competency for system visualization and design.
- To enable student to design cylinders and pressure vessels and to use IS code.
- To enable student select materials and to design internal engine components.
- To introduce student to optimum design and use optimization methods to design mechanical components.
- To enable student to design machine tool gearbox.
- To enable student to design material handling systems.
- Ability to apply the statistical considerations in design and analyze the defects and failure modes in components.

Course Outcomes:

- The student will understand the difference between component level design and system level design.
- Ability to design various mechanical systems like pressure vessels, machine tool gear boxes, material handling systems, etc. for the specifications stated/formulated.
- Ability to learn optimum design principles and apply it to mechanical components.
- Ability to to handle system level projects from concept to product.

(402049A) Refrigeration and Air Conditioning Equipment Design

Pre-requisite:
Refrigeration and Air Conditioning, Engineering Thermodynamics,
Course Objectives:

- Study of refrigeration cycles i.e. trans-critical cycle, cascade cycle, etc.
- Understanding of materials and designs of refrigeration and air conditioning equipment like controls, evaporators, condensers, cooling towers
- Learning of low temperature systems and heat pipe

Course Outcomes: At the end of this course the students should be able to
- Select the different components of refrigeration system i.e. condensers, evaporators, controls etc. for given applications

- Demonstrate the concepts of design of evaporators and condensers for unitary systems
- Analyses the performance of cooling tower and heap pipe.
- Illustrate the methods for production of ultralow temperature

(402049B) Robotics (Elective III)

Pre-Requisite: Engineering Mechanics, TOM, Mechatronics, Basics of Electrical Engineering, Control
system.

Course Objective: To teach students,

1. Basics of robotics (Links, Actuators, Sensors etc).
2. Statistics & Kinematics of robots.
3. Desired motion of robot.
4. Control system necessary for accurate operation of the robot.

Course Outcomes: After completion of the course student would be able to,

1. Understand the complete design procedure of the robot.
2. Select correct mechanism for operation of the robot.
3. Select necessary actuators, sensors, control for satisfactory performance of the robot.

(402049C) Industrial Engineering (Elective III)
Code Subject Teaching Scheme

Pre-requisite: Manufacturing Process, Engineering Mathematics.
Course Objectives:

- To introduce the concepts, principles and framework of contents of Industrial Engineering
- To acquaint the students with various productivity enhancement techniques.
- To acquaint the students with different aspects of Production Planning and Control and Facility Design.
- To introduce the concepts of various cost accounting and financial management practices as applied in industries.
- To acquaint the students with different aspects of Human Resource activities and Industrial Safety rules
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Course Outcomes: Learner will be able to.....

- Apply the Industrial Engineering concept in the industrial environment.
- Manage and implement different concepts involved in methods study and understanding of work content in different situations.
- Undertake project work based on the course content.
- Describe different aspects of work system design and facilities design pertinent to manufacturing industries.
- Identify various cost accounting and financial management practices widely applied in industries.
- Develop capability in integrating knowledge of design along with other aspects of value addition in the conceptualization and manufacturing stage of various products.

(402050 A) Computational Fluid Dynamics (Elective IV)

Pre-Requisites:
Fluid Mechanics, Heat transfer, Numerical methods, Programming Languages.

Course Objectives:

- Students should be able to model fluid / heat transfer problems and apply fundamental conservation principles.
- Students should be able to discretize the governing differential equations and domain by Finite Difference Method.
- Students should be able to solve basic convection and diffusion equations and understands the role in fluid flow and heat transfer.
- To prepare the students for career in industry in CAE through use of software tools.
- To prepare the students for research leading to higher studies.
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Course Outcomes:

- Ability to analyze and model fluid flow and heat transfer problems.
- Ability to generate high quality grids and interprete the correctness of numerical results with physics.
- Ability to use a CFD tool effectively for practical problems and research.
- Ability to conceptualize the programming skills.

(402050B) Finite Element Analysis (Elective IV)

Pre-Requisites:

- Mechanics of materials
- DME I and DME II (Static and dynamic failure theories)
- Engineering Graphics
- Fundamentals of Programming Language

Course Objectives:

- To familiarize students with the displacement-based finite element method for displacement and stress analysis and to introduce related analytical and computer tools.
- It provides a bridge between hand calculations based on mechanics of materials and machine design and numerical solutions for more complex geometries and loading states.
- To study approximate nature of the finite element method and convergence of results are examined.
- It provides some experience with a commercial FEM code and some practical modeling exercises.

Course Outcomes:

Upon completion of this course, the student will be able to:

- Derive and use 1-D and 2-D element stiffness matrices and load vectors from various methods to solve for displacements and stresses.
- Apply mechanics of materials and machine design topics to provide preliminary results used for testing the reasonableness of finite element results.
- Explain the inner workings of a finite element code for linear stress, displacement, temperature and modal analysis.
- Interpret the results of finite element analyses and make an assessment of the results in terms of modeling (physics assumptions) errors, discretization (mesh density and refinement toward convergence) errors, and numerical (round-off) errors.

(402050C) Design of Pumps, Blowers and Compressors
(Elective IV)

Pre-Requisite: Turbo Machines, Engineering Thermodynamics,

Course Objectives: To teach students.

- Different applications of Pumps, Fans, blowers & Compressors.
- Different types of Pumps, Fans, blowers & Compressors.
- How to design Pumps, Pumps, Fans, blowers & Compressors..
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Course Outcomes: After completion of the course students would be able to

- Select suitable Pump, Blower, fan or compressor for a given application.
- Design Pump, Blower, fan or compressor for a given application

(402051) PROJECT STAGE II

No course objective /outcome are given