Mechanical Engineering

CO of All Semesters

Program Outcomes (POs)

At the end of successul completion of program, the graduates will be able to—

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge andresearch methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assesssocietal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

2.Program Specific Outcomes (PSOs) :

1. Possess comprehensive knowledge of engineering material and their mechanical and physical Properties.

2.Possess adequate knowledge of manufacturing, metrology and quality control (processes, Tools, Equipment & accessories etc.) And skill to apply them appropriately.

SEMESTER 3

Sr. No	Code No.	Subject	Credits
1.	BSC-ME201	Engineering Mathematics - III	4
2.	PCC-ME202	*Electrical Technology	4
3.	PCC-ME203	Applied Thermodynamics	4
4.	PCC-ME204	Metallurgy	4
5.	PCC-ME205	Fluid Mechanics	4
6.	PCC-ME206	Machine Drawing	1
7.	PCC-ME207	*Computer Programming Using C++	1
8.	PCC-ME208	Workshop Practice – III	1
9.	MC-ME209	Environmental studies	3
		Total	26

Course Outcome Details:

1.Course(Subject) Code: BSC-ME201& Course(Subject): Engineering Mathematics – III

2.COs

1. Solve Linear Differential Equations with constant coefficients.

2. Describe the statistical data numerically by using Lines of regression and Curve fittings.

3. Find Laplace transforms of given functions and use it to solve linear differential equations.

4. Apply knowledge of vector differentiation to find directional derivatives, curl and divergence of vector fields.

5. Develop Fourier series expansion of a function over the given interval.

6. Make use of Partial Differential Equation to solve the Mechanical Engineering problems.

1.Course (Subject) Code:PCC-ME202 &

Course (Subject):Electrical Technology

2.Cos

1.Deals the principles of Electrical engineering

2.Understands the theoretical and practical's concepts of Electric motors.

3.Apply electrical heating methods

4.Identify and select suitable types of motors and drives

5.Decide complete electrical drive system for Industrial applications

6.Design various speed control techniques for Electric motors

1.Course (Subject) Code: PCC-ME203& Course (Subject): Applied Thermodynamics

2. COs

At the end of this course, student will be able to

1. Remember the fundamental laws of thermodynamics

2. Understand and solve the introductory problems on Rankine cycle.

3. Classify steam generators and condensers and Steam turbines.

4. Design the steam nozzle.

5. Understand and Solve problems on Steam turbines.

6. Understand the property of lubricants and selection of lubricants.

1.Course (Subject) Code: PCC-204&Course(Subject): Metallurgy.

2.Cos

1. Classify metallic and non metallic materials according to their properties and phase diagrams.

2. Demonstrate destructive and non destructive testing methods of materials.

3. Selection of various heat treatment processes for different metals and alloys.

4. Explain the process powder metallurgy and its applications.

1.Course(Subject) Code: PCC-ME205 & Course(Subject):Fluid Mechanics.

2.Cos

1. Understand properties of fluids, classification of fluid flows and theoretical concepts of fluid statics,Fluid kinematics and fluid dynamics.

2. Apply fundamental equation of fluid mechanics and also apply theory of boundary layer, Drag and lift forces in proper cases.

3. Analysis of laminar flow to calculate resistance to it through circular pipe and Parallel plates.

4. Calculate different losses in fluid flow through different arrangements of pipes.

1.Course Code: - PCC-ME206 Course: -Machine Drawing

2.Course Outcomes

1. Use BIS conventions in machine drawings.

2. Find line/curve of intersection between two solids.

3. Sketch the various machine components.

4. Read and interpret the given production drawings.

5. Understand significance of assembly and detail drawings.

1.Course (Subject) Code: PCC- ME207& Course (Subject): Computer Programming Using C++

2. COs

1. Write, compile and debug programs in C++ language.
2. Design programs involving decision control statements, loop control statements and case
control structures.
3. Develop algorithms for solving problems using object oriented language.
4. Apply their knowledge and programming skills to solve various computing problems
in the field of Mechanical Engineering.

1.Course Code: - PCC ME 208   Course: - Workshop Practice III

2.Course Outcomes

1.Understand types of Patterns, Core boxes and Preparation of Pattern for solid casting.

2.Understand properties of sand by permeability test, moisture percentage test, and greenstrength.

3.Understand gating system for metal casting with casting defects

1.Course(Subject)Code:PCC-ME209   Course(Subject):Environmental studies

2.Cos

1. To study about environment and ecosystems.

2. To study about different types of natural resource.

3. Knowledge and concept of biodiversity and its conservation.

4. Basic knowledge and concept of causes, effect and control of different type of environmental pollution.

5. To study population growth and its impact on environment.

SEMESTER 4

Sr. No	Code No.	Subject	Credits
1.	BSC-ME210	Applied Numerical Methods	4
2.	PCC-ME211	Analysis of Mechanical Elements	4
3.	PCC-ME212	Fluid and Turbo Machinery	4
4.	PCC-ME213	Theory of Machines – I @	4
5.	PCC-ME214	Machine Tools and Processes	4
6.	PCC-ME215	Testing and Measurement	1
7.	PCC-ME216	Computer Aided Drafting	1
8.	PCC-ME217	Computer Graphics	1
9.	PCC-ME218	Workshop Practice – IV	1
		Total	24

Course Outcome Details:

1. Course(Subject)   Code: PCC-ME-210& Course(Subject): Applied Numerical Methods

2. COs

1. Understand and apply various methods to find roots of equations.

2. Learn and Implement different methods to solve simultaneous equations.

3. Understand and apply the methods of Regression and interpolation.

4. Implement various numerical methods for differentiation and Integration.

5. Apply various methods to solve engineering problems with Ordinary differential equations.

6. Understand the methods to solve Partial differential equations involved in Engineering Problems.

1. Course(Subject) Code: PCC-ME211 &

Course(Subject):Analysis of Mechanical Element

2.Cos

1. Apply the concept of analysis of mechanical elements & Determine the stresses in Components, Principal Stresses, maximum shear stress & their orientations using analytical method and Graphical Method.

2. Draw shear force and bending moment diagrams for simple beams subjected to various loads and support conditions.

3. Compute and analyze bending stresses and shear stresses & the effect of deflection in   beams.

4. Evaluate buckling and strain energy in beams subject to various types of loading.

1.Course(Subject) Code: : PCC-ME212&

Course (Subject): Fluid and Turbo Machinery

2. COs

At the end of this course, student should be to

1.understand and remember Euler's equation of rotodynamic machines.

2.understand and explain classification, working principle and construction of rotodynamic machines and reciprocating compressor.

3.apply Euler's equation to rotodynamic machine and theoretical knowledge to solve numerical.

4.evaluate the performance of turbomachines and select the machines for particular application.

1.Course (Subject) Code: PCC-ME-213 &

Course(Subject): Theory of Machines-I

2.Cos

1.Understand different types of mechanisms and their applications.

2.Analyze kinematic theories of mechanism.

3.Design cam with follower for different applications.

4.Select different power transmitting elements and governing mechanisms according to application.

1.Course Code: - PCCME214 Course: -Machine Tool Process

2.Course Outcomes

1. Understand Importance of casting as manufacturing Process.

2. Understand different types of forming and Plastic Shaping processes.

3. Understand Basic working principle, Configuration, Specification and classification of machine tools.

4. Understand Working Principle and Applications of nontraditional machining.

1.Course Code: - PCCME215 Course: -Testing and Measurement

2.Course Outcomes

1. Understand basic constriction of working of various instruments

2. Select the various of types of instruments for the measurement system

1.Course (Subject) Code: PCC- ME216& Course (Subject): Computer Aided Drafting

2. COs
1. Draw 2D drawings and 3D models of simple components.

2. Analyze and interpret production Drawing

3. Use modern engineering techniques, tools and skills for engineering practice.

4. Develop the skills for drafting using CAD software and get the knowledge to enhance the CAD utilities.

1. Course(Subject) Code: PCC-ME217 & Course(Subject): Computer Graphics

2. COs

1) To acquire the knowledge of basics of computer graphics.

2) To Apply basic programming in C for line, rectangle, circle etc for different shapes.

3) To recognize the importance of using three dimensional transformations like translation,

scaling and rotating.

4) To Analyzing the hidden unwanted parts in graphics and do the program on animation

5) To choose the different of curves and surfaces

1.Course Code: - PCC ME 218 Course: - Workshop Practice IV

2.Course Outcomes

1. Understand Machine layout, method of Machine Tool installation, selection of Tools for various machining operation.
2. Understand Construction, Mechanism and Application of Lathe Machine, Drilling Machine, and Milling Machine.
3. Understand machining operations and prepare Job with plain turning, taper turning, external threading and knurling operation along with its process sheet
4. Understand basics of CNC and VMC Machine

SEMESTER 5

Sr. No	Code No.	Subject	Credits
1.	PCC-ME 301	Control Engineering	4
2.	PCC-ME 302	Theory of Machines – II	4
3.	PCC-ME 303	Heat and Mass Transfer	4
4.	PCC-ME 304	Machine Design – I	4
5.	PCC-ME 305	Manufacturing Engineering @	4
6.	OEC-ME 306	Open Elective-I	3
7.	PCC-ME 307	CAD/CAM Laboratory	1
8.	PCC-ME308	Workshop Practice – V	1
		Total	25

Course Outcome Details:

1. Course(Subject) Code: PCC-ME 301 & Course(Subject): Control Engineering

2. Cos

1. Understand control system , its type application, & representation of system.

2. Determine system stability and system response.

3. Analyze the frequency response & state space.

4. Use of MATLAB software to analyze control system.

1.Course(Subject) Code: PCC-ME 302 & Course(Subject): Theory of Machines - II

2.Cos

1. Differentiate between types of gears and to analyze the characteristics of meshing gears.

2. Explain the effects of gyroscopic couple in aero-plane, ship, two wheelers and four wheelers.

3. Use balancing concept while designing machine components to reduce vibration.

4. Understand turning moment diagram for flywheel.

1. Course(Subject) Code: PCC-ME303 & Course(Subject): Heat and Mass Transfer

2. COs

1. To identify the modes of heat transfer and calculate the conduction in various solids.

2. Calculate unsteady state heat conduction problems applied to different geometries.

3. To solve the heat convection in various medium.

4. To learn about the radiation and its use in real life

5. To evaluate the heat transfer in phase change process, design heat exchange equipment based on the need that fit to application.

1.Course Code: - PCC-ME304   Course: - Machine Design-I

2.Course Outcomes
At the end of this course, student will be able to
1.Apply basic principles of Machine Design.
2.Design machine elements on the basis of strength concept.
3.Use design data book and standard practices.
4.Select machine elements from manufacturer's catalogue

1.CourseCode: -PCC-ME304 Course: -Manufacturing Engineering
2.Course Outcomes.

M305.1.Understand various metal cutting technology including the process and measurement etc.

M305.2. Design and Draw Jig and Fixture.

M305.3. Select and design dies for press working operations.

M305.4. Understand and apply CNC Technology.

1.CourseCode: -PCC-ME306 Course: - Enterprise Resource Planning

2.Course Outcomes.

M306.1. Understand the structure of an ERP system and its implementation by customizing appropriate modeling methods.

M306.2. Implement ERP modules using software.

M306.3. Compile the different ERP implementation life cycle.

M306.4. Identify ERP Market and case studies for various areas in manufacturing, marketing and other business systems etc.

1. Course (Subject) Code: PCC-ME307 & Course (Subject): CAD CAM Laboratory

2. COs

1. Understand and read engineering Drawings..
2. Prepare solid and surface models from 2D drawings.
3. Prepare assemblies and BOM.
4. Conversion of 3D Models into orthographic views.
5. Know the process of CAD data exchange between the software.
6. Understand the basics of Computer Aided Manufacturing.

1. Course(Subject) Code: PCC-ME308 & Course(Subject): WORKSHOP PRACTICE – V

2. COs

1. Select the suitable machining operations and prepare process sheet to manufacture a

Component and implement the same.

2. Control key dimensions on a component using principles of metrology and assembly To make any one assembly / sub – assembly comprising of minimum three components in Workshop Practice V and Workshop Practice VI

SEMESTER 6

Sr. No	Code No.	Subject	Credits
1.	PCC-ME 311	Industrial Management and Operations Research	4
2.	PCC-ME 312	Industrial Fluid Power	4
3.	PCC-ME 313	Metrology and Quality Control	4
4.	PCC-ME 314	Machine Design – II	4
5.	PCC-ME 315	Internal Combustion Engines	4
6.	OEC-ME 316	Open Elective-II	3
7.	PCC-ME 317	Computer Integrated Manufacturing Lab	1
8.	PCC-ME318	Workshop Practice –VI	1
9.	**PCC- ME319**** **(Audit Course)**	**Professional Skill Development****	**--**
		Total	**25**

Course Outcome Details:

1. Course(Subject) Code: PCC-ME311 & Course(Subject): Industrial Management & Operation Research

2. COs

1. Apply the concepts of Industrial management and operations research approaches. Know various functional areas of management.

2. They will analyses issues in Managing operations and projects and various approaches to resolve those issues..

3. Formulate and solve a wide variety of applications and problems that can be addressed using Operations Research techniques as Linear programming problems.

4. Formulate and solve a wide variety of applications and problems that can be addressed using Operations Research techniques as Transportation and Assignment problems.

5. Apply the various techniques of Project Management such as Network Model and Sequencing Model.

1. Course(Subject) Code: PCC-ME 312 &

Course (Subject): Industrial Fluid Power

2. COs

1. Analyze the performance of hydraulic & pneumatic system.
2. Apply Hydraulic and pneumatic system fundamentals to industrial applications.
3. Demonstrate knowledge about the fundamentals of Hydraulic and pneumatic system.

1. Course(Subject) Code: PCC-ME 313 & Course(Subject): Metrology and Quality Control

2. COs

1. Identify and use various measuring instruments and select appropriate instrument for particular feature measurement.
2. Distinguish and understand quality assurance and quality control. They can use control charts and sampling plans to manufacturing and service sector problems.
3. Learn advanced techniques of metrology in various industrial applications.
4. Prepare and understand drawings with general dimensions, tolerances and surface finish.

1.Course(Subject) Code: PCC-ME 314 &

Course(Subject): Machine Design – II

2.COs

1. Design machine elements subjected to fluctuating loading

2. Understand effect of tribological considerations on design

3. Select rolling contact bearings from manufacturer's catalogue.

4. Design sliding contact bearings used in various mechanical systems

1.Course Code:- PCC-ME315 Course:-Internal Combustion Engines

2.Course Outcomes

At the end of this course, student will be able to
1.Demonstrate engine construction, function of various parts of the engine and classify I.C Engines
2.Demonstrate Combustion Mechanism
3.Demonstrate Importance and functions of various systems on the engine
4.Demonstrate need and methods of engine testing.
5.Understand the impact of Vehicular Pollution and ways to reduce or control the Pollution

1.CourseCode:-OCE-ME316 Course:-Electrical Vehicle

2.Course Outcomes

1.To Understand the basic knowledge of electric vehicle technology.

2. To Select power sources for electric vehicles

3. To Choose various configurations of an electric vehicle.

4. To Configure power transmission system in electric vehicle

1.Course(Subject) Code: PCC-ME 317&Course(Subject): Computer Integrated Manufacturing

2.Cos

1.Locate modern techniques for integrating CAD/CIM in CIM

2.Obtain an overview of computer technology in Production Planning and Control including Computers

3.Apply classification and coding in Group Technology.

4.Elaborate Computer Aided Production Planning and Control.

1.Course Code: - PCC-ME318   Course: - Workshop Practice–VI

2.Course Outcomes

1.Select the suitable machining operations and prepare process sheet to manufacture a Components and implement the same.

2.Control key dimensions on a component using principles of metrology and assembly

1.Course(Subject)Code:PCC-ME319&Course(Subject): Professional Skill Development**

2.Cos

1. Effectively use techniques for self-awareness and self-development to increase

2. confidence in abilities

3. Strengthen soft skills to achieve success in professional career

4. Smoothly transit from student life to professional life

SEMESTER 7

Sr. No	Code No.	Subject	Credits
1.	PCC ME 401	Refrigeration and Air Conditioning	4
2.	PCC ME 402	Mechanical System Design	4
3.	PCC ME 403	Finite Element Analysis	4
4.	PCE ME 404	Elective I	4
5.	PCE ME 405	Elective II	4
6.	PCC ME 406	Seminar	1
7.	SI ME 407	Summer Internship @	1
8.	PW ME 408	Project Phase -I	3
		Total	25

Course Outcome Details:

1.Course(Subject) Code: PCC-ME401 & Course(Subject): Refrigeration and Air –Conditioning

2. COs

1. Explain the working and need of different Refrigeration systems.

2. Classify refrigerants and refrigeration equipments.

3. Illustrate psychometrics and its application in HVAC engineering and human comfort conditions with respect to temperature and humidity.

4. Demonstrate heat transfer in buildings with a given architectural design and its application to heating and cooling load estimation

1.Course(Subject) Code: PCC ME402 &Course(Subject): Mechanical System Design

2.COs

1. Study the concept of aesthetics, ergonomics and creativity considerations in product design.

2. Study design of various mechanical systems such as pressure vessel, brakes, clutches, machine tool gear box.

3. Study design of machine tool gear box.& various I.C. Engine components.

4. To enable student to design material handling systems.

1.Course Code:- PCC ME 403 Course:- Finite Element Analysis

2.Course Outcomes:

At the end of this course, student will be able to

1.Elaborate the basic finite element formulation techniques

2.Apply the Finite element equations for 1D,2D Elements

3.Formulate and solve basic problems in Solid Mechanics & Heat Transfer

4.Apply commercial software to solve Basic Engineering problems in Solid Mechanics & Heat Transfer.

1.Course Code :- PCE ME 404   Course:- Automobile Engineering

2.Course Outcomes

1.Classify the Automobile Layouts and identify its components with materials.

2.Demonstrate construction of different systems of Automobile and compare, select the automobile power Plant for different applications.

3.Analyze the performance of Automobiles

4.Identify and explain the various systems of Automobiles like transmission, steering, braking, Electric suspension.

1.Course(Subject)   Code: PCC-ME405 & Course(Subject): Total Quality Management

2. COs

1. Understand the concepts of total quality and quality assurance approaches using various TQM tools and techniques,

2. Interpret various quality attributes and discuss the various quality approaches.

3.Identify and solve issues in industries using the various techniques of TQM such as 5S, JIT, TPM, Reliability Engineering, Quality Circle etc. 4. Demonstrate heat transfer in buildings with a given architectural design and its application to heating and cooling load estimation

1.Course(Subject) Code: PCC-ME406 & Course(Subject): Seminar

2.Course Outcomes:- Upon successful completion of this course, the student will be able to

1. Have and develop presentation skills.

2. Impart knowledge in different aspects of knowledge domains.

3. Make them aware of knowledge in industry perspective and new industry trends. 4. Build confidence and improve communication skills.

5. Collect ideas through literature survey about new innovations, analyze and present them.

6. Sharpen their personality and intelligence.

1. Course(Subject) Code: SI-ME407 &

Course(Subject): Summer Internship

2. Course Outcomes:

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

1. Comprehend the knowledge gained in the coursework

2. Create, select, learn and apply appropriate techniques, resources, and modern engineering tools.

1. Course(Subject) Code: PW ME408 &

Course(Subject): PROJECT PHASE–I

2. Course Outcomes:

1. Improve the professional competency and research aptitude in relevant area.

2. Develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research

SEMESTER 8

Sr. No	Code No.	Subject	Credits
1.	PCC ME 409	Mechatronics	4
2.	PCC ME 410	Energy and Power Engineering	4
3.	PCC ME 411	Noise and Vibration	4
4.	PCE ME 412	Elective III	4
5.	PCE ME 413	Elective IV	4
6.	**PCE ME414*****	**Online Certificate Course**	**2**
7.	PW ME 415	Project Phase –II	3
		Total	25

Course Outcome Details:

1. **Course(Subject) Code: PCC-ME409 & Course(Subject): Mechatronics**

2. **COs**

1. Develop a simulation model for simple physical systems and explain Mechatronics design process.

2. Outline appropriate sensors and actuators for an engineering application

3. Write simple PLC programs

4. Explain various applications of design of Mechatronic systems

Course Code:- PCC ME410 Course:- Energy and Power Engineering

Course Outcomes: -

At the end of this course, student will be able to

1. Analyze the utilization of Solar, Wind energies

2. Demonstrate need of different energy sources and their performance

3. Illustrate Power Plant economics.

4. Comprehend various Equipment's/Systems utilized in Power Plants

1. Course Code: PCC ME 411 & Subject: Noise and Vibration

Course Outcomes

1.Understand relevance of noise in mechanical systems.

2.Carry out measurement of various vibration parameters.

3.Analyse vibratory response of mechanical element/system.

4.Estimate natural frequency of mechanical element/system.

5.Develop mathematical model to represent dynamic system

Course Code:- PCE ME412 Course:- Industrial Engineering
Course Outcomes

At the end of this course, students are able to

1. Manage and implement different concepts involved in methods study and understanding of work content in different situations.

2. Measure and estimate standard time for job.

3. Understand different types of plant layouts.

4. Interpret job evaluation and merit rating

1.Course Code:- PCE ME413 Course:- Cryogenics
Course Outcomes

At the end of this course, student will be able to

1.Learn the concept of Low Temperature and its Application

2.Explain Liquefaction System and Cryogenic Heat Exchangers

3.Apply knowledge of Mathematics, Science and Engineering for the need in Cryogenic.

4.Do the analysis of Cryocooler

5.Design and analysis separation and distillation column

6.Define and understand the cryogenic insulation and storage Vessel

1.Course Code:- PCE ME414** Course:- Online Certification Course

2.Course outcome –

On successful completion of the course Student should be able to Students will be able to choose course of their choice from Moodle/Swayam/MOOC/NPTEL. etc. and to be acquaintance with recent advance developments in Mechanical Engineering beyond syllabus

1.Course Code:- PW ME415 Course:- PROJECT PHASE–II
2.Course Outcome:

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

1. Improve the professional competency and research aptitude in relevant area.

 2. Develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.