Mahatma Education Society's
Pillai HOC College of Engineering and Technology, Rasayani
Department of Mechanical Engineering

Mechanical Engineering Program Course outcomes:

Quality improvement in education encompasses the all-round development of learners. This requires a multi-pronged approach aiming at quality curriculum and its effective transaction in an enabling environment. Learning outcomes specify what learners' new behaviors will be after a learning experience. They state the knowledge, skills, and attitudes that the students will gain through your course. Since we are affiliated with University of Mumbai, in addition to university curriculum, course outcomes for Mechanical graduate program were finalized in a brain storming sessions by senior faculty. The course outcomes for the graduate program in Mechanical Engineering are listed below;

Course outcomes: Semester III

Course Name: MEC301 Engineering Mathematics-III	
MEC 301.1	Understand the concept of Laplace transform and its application to solve the real integrals in engineering problems.
MEC 301.2	Understand the concept of inverse Laplace transform of various functions and its applications in engineering problems.
MEC 301.3	Expand the periodic function by using Fourier series for real life problems and complex engineering problems.
MEC 301.4	Understand complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic function
MEC 301.5	Apply Matrix algebra to solve the engineering problems
MEC 301.6	Solve Partial differential equations by applying numerical methods.

Course Name: MEC302 Strength of Materials

MEC302.1	To understand the concept of stress and strain for homogeneous, isotropic material
MEC302.2	To use concept of physics to solve variety of applied real world problems using the appropriate tools backed by mathematical to solve structural problem involving strength.
MEC302.3	To determine the stress and strain in members subjected to combined loading and apply the theories of failure and static loading.
MEC302.4	To determine and analyse principal stress, maximum shearing and the stress acting on structural member.
MEC302.5	To determine the deflection and rotation produced by axial, torsion and flexural load.
MEC302.6	To design simple bars, beams and circular shafts for allowable stresses and loads.

Course Name: MEC303   Production Process

MEC303.1	Understand the Casting Process
MEC303.2	Understand the Principles of forming such as Rolling, Extrusion etc.
MEC303.3	Understand the Applications of various types of welding processes such as TIG, MIG, Soldering & Brazing etc.
MEC303.4	Differentiate the chip forming process such as turning, milling, drilling etc.
MEC303.5	Illustrate the concept of producing polymer components & ceramic components.
MEC303.6	Understand the Principles and working of Non-traditional Manufacturing.
MEC303.7	Understand the manufacturing technologies enabling Industry 4.0.

Course Name: MEC304 Materials and Metallurgy

MEC 304.1	Identify the various classes of materials and comprehend their properties
MEC 304.2	Apply phase diagram concepts to engineering applications
MEC 304.3	Apply particular heat treatment for required property development
MEC 304.4	Identify the probable mode of failure in materials and suggest measures to prevent them
MEC 304.5	Choose or develop new materials for better performance
MEC 304.6	Decide an appropriate method to evaluate different components in service

Course Name: MEC305 Thermodynamics

MEC305.1	Demonstrate application of the laws of thermodynamics to a wide range of systems.
MEC305.2	Compute heat and work interactions in thermodynamic systems
MEC305.3	Demonstrate the interrelations between thermodynamic functions to solve practical problems.
MEC305.4	Compute thermodynamic interactions using the steam table and Mollier chart
MEC305.5	Compute efficiencies of heat engines, power cycles.
MEC305.6	Apply the fundamentals of compressible fluid flow to the relevant systems

Course Name: MEL301 Materials Testing

MEL301.1	Prepare metallic samples for studying its microstructure following the appropriate procedure.
MEL301.2	Identify effects of heat treatment on microstructure of medium carbon steel and hardenability of steel using Jominy end quench test
MEL301.3	Perform Fatigue Test and draw S-N curve
MEL301.4	Perform Tension test to Analyse the stress - strain behaviour of materials
MEL301.5	Measure torsional strength, hardness and impact resistance of the material
MEL301.6	Perform flexural test with central and three point loading conditions

Course Name: MEL302: Machine Shop Practice

MEL 302.1	Know the specifications, controls and safety measures related to machines and machining operations.
MEL 302.2	Use the machines for making various engineering jobs
MEL 302.3	Perform various machining operations
MEL 302.4	Perform Tool Grinding
MEL 302.5	Perform welding operations.

Course Name: MESBL301   CAD Modelling

MESBL301.1	Understand the types of CAD Model creations.
MESBL301.2	Visualize and prepare 2D modelling of a given object using modelling software.
MESBL301.3	Understand to build solid model of a given object using 3D modelling software.
MESBL301.4	Visualize and develop the surface model of a given object using modelling software.
MESBL301.5	Generate assembly models of given objects using assembly tools of a modelling software.
MESBL301.6	Understand to perform product data exchange among CAD Systems.

Course outcomes: Semester IV

Course Name: MEC401 Engineering Mathematics-IV	
MEC 401.1	Apply the concept of Vector calculus to evaluate line integrals, surface integrals using Green's theorem, stokes theorem & Gauss Divergence theorem.
MEC 401.2	Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
MEC 401.3	Apply the concept of Correlation, Regression and curve fitting to the engineering problems in data science.
MEC 401.4	Understand the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
MEC 401.5	Apply the concept of probability distribution to engineering problems & Testing hypothesis of small samples using sampling theory
MEC 401.6	Apply the concepts of parametric and nonparametric tests for analysing practical problems.

Course Name: MEC402 Fluid Mechanics	
MEC402.1	Study Fluid Statics and Fluid Dynamics.
MEC402.2	Acquaint with dimensional analysis of Thermal and Fluid systems.
MEC402.3	Familiarize with application of mass, momentum and energy equations in fluid flow.
MEC402.4	Study various flow measurement techniques.
MEC402.5	Familiarize with the dynamics of fluid flows and the governing non dimensional parameters.

Course Name: MEC403 Kinematics of Machinery

MEC 403.1	To Understand and explain various components of mechanisms.
MEC 403.2	To Understand and explain various components of mechanisms.
MEC 403.3	To Draw using various methods velocity and acceleration diagrams of mechanisms.
MEC 403.4	To Construct CAM profile illustrating displacement, velocity, acceleration and jerk for the specific follower motion.
MEC 403.5	To Define and apply different Flexible connectors and Concept of Brakes
MEC 403.6	To Define different Terms used in gears and application of different Gears in power Transmission.

Course Name: MEC 404 CAD CAM

MEC 404.1	Use techniques of computer graphics for 3 D geometric modelling and write equations for line, curves also solve problems based upon it.
MEC 404.2	Develop mathematical representation and object oriented programs for 2D and 3D transformations and apply the concept for 3 D animation.
MEC 404.3	Learning medical scan data formats and applying technique for 3- D model development.
MEC 404.4	Understand and apply the computer aided manufacturing technique.
MEC 404.5	Understand the additive manufacturing technique and applying the concept for 3 D model development using rapid prototyping process.
MEC 404.6	Understand the concept of augmented reality and virtual reality to explore the cost effective methods for manufacturing

Course Name: MEC405 Industrial Electronics

MEC405.1	Illustrate construction, working principles and applications of power electronic switches
MEC405.2	Identity rectifiers and inverters for dc and ac motor speed control
MEC405.3	Develop circuits using OPAMP and timer IC555
MEC405.4	Identify digital circuits for industrial applications
MEC405.5	Demonstrate the knowledge of basic functioning of microcontrollers
MEC405.6	Analyse speed-torque characteristics of electrical machines for speed control

Course Name: MEL401 Industrial Electronics

MEL401.1	Demonstrate characteristics of various electrical and electronics components
MEL401.2	Develop simple applications built around these component
MEL401.3	Identify use of different basic gates
MEL401.4	Identify and use digital circuits for industrial applications
MEL401.5	Built and demonstrate basic parameter measurement using microcontroller
MEL401.6	Test and Analyse speed-torque characteristics of electrical machines for speed control

Course Name: MEL402 Kinematics of Machinery Lab

MEL402.1	Draw velocity diagram using instantaneous Centre method
MEL402.2	Find velocity and acceleration of 4 point on a four-bar mechanism by using Relative method.
MEL402.3	Analyse velocity and acceleration of a specific link of a slider crank mechanism using graphical approach by Relative method.
MEL402.4	Plot displacement-time, velocity-time, and acceleration-time diagrams of follower motion.
MEL402.5	Draw cam profile for the specific follower motion.
MEL402.6	Develop and build mechanisms to provide specific motion.

Course Name: MEL 403 Python Programming	
MEL403.1	Demonstrate understand of basic concepts of python programming.
MEL403.2	Identify, install and utilize python packages
MEL403.3	Develop and execute python programs for specific applications.
MEL403.4	Develop and build python program to solve real-world engineering problems
MEL403.5	Prepare a report on case studies selected.

Course Name: MESBL401 Skill based Lab: CNC and 3-D Printing	
MESBL 401.1	Develop and execute part programming for any given specific operation.
MESBL 401.2	Build any given object using various CNC operations.
MESBL 401.3	Demonstrate CAM Tool path and prepare NC- G code.
MESBL 401.4	Develop 3D model using available biomedical data
MESBL 401.5	Build any given real life object using 3D printing process.
MESBL 401.6	Convert 2D images into 3D model.

Course outcomes: Semester V

Course Name: MEC501: Mechanical Measurement and Control

MEC 501.1	To study the principles of precision measuring instruments & their significance.
MEC 501.2	To familiarize with the handling & use of precision measuring instruments/ equipment's.
MEC 501.3	To impart knowledge of architecture of the measurement system.
MEC 501.4	To deliver working principle of mechanical measurement system.
MEC 501.5	To study concept of mathematical modelling of the control system.
MEC 501.6	To acquaint with control system under different time domain.

Course Name: MEC502 Thermal Engineering

MEC 502.1	Analyse the three modes of heat transfer in engineering application.
MEC 502.2	Develop mathematical models for different modes of heat transfer.
MEC 502.3	Analyse performance parameters of different types of heat exchangers.
MEC 502.4	Identify and analyse the Transient heat Transfer in engineering applications.
MEC 502.5	Explain construction and working of different components of internal combustion engines.
MEC 502.6	Evaluate engine performance and emission characteristics.

Course Name: MEC503 Dynamics of Machinery

MEC503.1	To demonstrate working Principles of different types of governors and Gyroscopic effects on the mechanical systems
MEC503.2	To illustrate basic of static and dynamic forces
MEC503.3	To determine natural frequency of element/system
MEC503.4	To determine vibration response of mechanical elements / systems

MEC503.5	To design vibration isolation system for a specific application
MEC503.6	To demonstrate basic concepts of balancing of forces and couples

Course Name: MEC504 Finite Element Analysis	
MEC 504.1	Solve differential equations using weighted residual methods.
MEC 504.2	Develop the finite element equations to model engineering problems governed by second order differential equations.
MEC 504.3	Apply the basic finite element formulation techniques to solve engineering problems by using one dimensional elements.
MEC 504.4	Apply the basic finite element formulation techniques to solve engineering problems by using two dimensional elements.
MEC 504.5	Apply the basic finite element formulation techniques to find natural frequency of single degree of vibration system.
MEC 504.6	Use commercial FEA software, to solve problems related to mechanical engineering.

Course Name: Computational Method	
MEDLO5013.1	To understand and develop mathematical models of physical systems
MEDLO5013.2	To identify an appropriate mathematical formulation to linear algebraic equations
MEDLO5013.3	To build an appropriate mathematical formulation to non-linear algebraic equations
MEDLO5013.4	To evaluate and interpret the data regression, curve fitting and statistics
MEDLO5013.5	To apply the numerical techniques and numerical schemes
MEDLO5013.6	To Formulate the concept of numerical methods in realistic applications

Course Name: Design of Experiment

MEDLO5012.1	To obtain clear understanding of use of statistics in experimentation
MEDLO5012.2	To obtain clear understanding of scheme of experimentation and its effect on accuracy of experimentation
MEDLO5012.3	To obtain knowledge of how to analyze results from such investigations to obtain conclusions
MEDLO5012.4	To become familiar with methodologies that can be used in conjunction with experimental designs for robustness and optimization
MEDLO5012.5	To become familiar with Statistical distributions and Analysis
MEDLO5012.6	To apply DoE Concepts in Mechanical Engineering application

Course Name: MEL501 Thermal Engineering

MEL 501.1	Estimate thermal conductivity of engineering materials.
MEL 501.2	Evaluate performance parameters of extended surfaces.
MEL 501.3	Analyse heat transfer parameters in various engineering applications.
MEL 501.4	Analyse engine performance and emission parameters at different operating conditions.

Course Name: MEL502 Dynamics of Machinery Lab

MEL502.1	To plot and analyze governor characteristics
MEL502.2	To analyze gyroscopic effect on laboratory model
MEL502.3	To estimate natural frequency of mechanical systems
MEL502.4	To analyze vibration response of mechanical systems
MEL502.5	To determine damping coefficient of a system
MEL502.6	To balance rotating mass

Course Name: MEL503 Finite Element Analysis	
MEL 503.1	Select appropriate element for given problem
MEL 503.2	Select suitable meshing and perform convergence test
MEL 503.3	Select appropriate solver for given problem
MEL 503.4	Interpret the result
MEL 503.5	Apply basic aspects of FEA to solve engineering problems
MEL 503.6	Validate FEA solution

Course Name: MEPBL501 Mini Project - 2A	
MEPBL501.1	Identify problems based on societal /research needs and apply Knowledge and skill to solve societal problems in a group.
MEPBL501.2	Develop interpersonal skills to work as member of a group or leader.
MEPBL501.3	Draw the proper inferences from available results through theoretical/ experimental/simulations.
MEPBL501.4	Analyse the impact of solutions in societal and environmental context for sustainable development.
MEPBL501.5	Use standard norms of engineering practices and Excel in written and oral communication.
MEPBL501.6	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning and project management principles during project work.

Course outcomes: Semester VI

Course Name: MEC 601 Machine Design	
MEC 601.1	Student should be able to use design data books and various standard codes to standardise dimensions.
MEC 601.2	Student should be able to design components like cotter joint, knuckle joint and screw jack on the basis of strength and economic criteria.
MEC 601.3	Student should be able to design shaft and couplings under various operating conditions.
MEC 601.4	Student should be able to select suitable bearing for given application from manufacturer's catalogue.
MEC 601.5	Student should be able to design belts and flywheel for given applications.
MEC 601.6	Student should be able to design spring, clutch and brakes.

Course Name: MEC602: Turbo Machinery	
MEC 602.1	To define various parameters associated with steam generators and turbo machines.
MEC 602.2	To identify various components and mountings of steam generators with their significance.
MEC 602.3	To identify various turbo machines and explain their significance.
MEC 602.4	To apply principles of thermodynamics and fluid mechanics to estimate various parameters like mass flow rate power, torque, efficiency, temperature, etc.
MEC 602.5	To evaluate performance of SG and Turbo machines and apply various techniques to enhance performance.
MEC 602.6	To evaluate various phenomena related to performance like cavitation, choking, surging.

Course Name: MEC603 Heating, Ventilation, Air Conditioning and Refrigeration	
MEC 603.1	Illustrate the fundamental principles and applications of refrigeration and air conditioning systems.
MEC 603.2	Identify various HVAC&R components

MEC 603.3	Evaluate performance of various refrigeration system
MEC 603.4	Estimate cooling and heating loads for an air conditioning system.
MEC 603.5	Select air handling unit & design air distribution system
MEC 603.6	Apply the knowledge of HVAC for the sustainable development of refrigeration and Air conditioning systems.

Course Name: MEC604 Automation and Artificial Intelligence

MEC 604.1	Demonstrate understanding of fundamentals of industrial automation and AI.
MEC 604.2	Design & develop pneumatic / hydraulic circuits.
MEC 604.3	Design and develop electro pneumatic circuits and PLC ladder logics.
MEC 604.4	Demonstrate understanding of robotic control systems and their applications.
MEC 604.5	Demonstrate understanding of various AI end machine learning technologies.

Course Name: MEDLO6023 Metal Forming Technology

MEDLO6023.1	Understand the concept of different metal forming process.
MEDLO6023.2	Approach metal forming processes both analytically and numerically
MEDLO6023.3	Design metal forming processes
MEDLO6023.4	Develop approaches and solutions to analyse metal forming processes and the associated problems and flaws.
MEDLO6023.5	To understand sheet metal forming process in the industry application
MEDLO6023.6	To conversant forming metal process like Rolling ,forging, Extrusion, Drowning etc.

Course Name: MEL 601 Machine Design

MEL 601.1	Student should be able to design shaft under various operating conditions.
MEL 601.2	Student should be able to design components like cotter joint and knuckle joint.
MEL 601.3	Student should be able to design screw jack.
MEL 601.4	Student should be able to design flexible flange coupling and leaf springs.
MEL 601.5	Student should be able to convert design dimensions into drawing.
MEL 601.6	Student Should be able to use design data books and various standard codes to standardise dimensions.

Course Name: MEL602: Turbo Machinery

MEL602.1	Differentiate boiler, boiler mountings and accessories
MEL602.2	Conduct a trial on reciprocating compressor / centrifugal compressor.
MEL602.3	Conduct a trial on impulse turbine and analyse its performance
MEL602.4	Conduct a trail on reaction turbine and analyse its performance
MEL602.5	Conduct a trial on Centrifugal pump and Reciprocating pump and analyse its performance
MEL602.6	Conduct a trial on gear pump

Course Name: MEL603 Heating, Ventilation, Air Conditioning and Refrigeration

MEL603.1	Demonstrate fundamental principles of refrigeration and air conditioning
MEL603.2	Identify and locate various important components of refrigeration and air conditioning system.
MEC603.3	Represent various refrigeration and air conditioning processes using psychometric chart.
MEC603.4	Operate and maintain refrigeration system.

MEC603.5	Operate and maintain air conditioning system.
MEC603.6	Simulate VCRS

Course Name: MESBL601 Measurements and Automation	
MESBL601.1	Apply inspection gauge to check or measure surface parameters.
MESBL601.2	Measure surface parameters using precision measurement tools and equipment.
MESBL601.3	Measure different mechanical parameters by using sensors.
MESBL601.4	Analyse the response of a control systems.
MESBL601.5	Demonstrate use of automated controls using pneumatic and hydraulic systems.
MESBL601.6	Implement program on PLC system and demonstrate its application.

Course Name: MEPBL601 Mini Project – 2B	
MEPBL601.1	Identify problems based on societal /research needs and apply Knowledge and skill to solve societal problems in a group.
MEPBL601.2	Develop interpersonal skills to work as member of a group or leader.
MEPBL601.3	Draw the proper inferences from available results through theoretical/ experimental/simulations.
MEPBL601.4	Analyse the impact of solutions in societal and environmental context for sustainable development.
MEPBL601.5	Use standard norms of engineering practices and Excel in written and oral communication.
MEPBL601.6	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning and project management principles during project work.

Course outcomes: Semester VII

Course Name: MEC 701 Design of Mechanical System	
MEC701.1	Students should be able to understand and apply the concept of system design.
MEC701.2	Students should be able to Select appropriate gears for power transmission on the basis of given load and speed
MEC701.3	Students should be able to design material handling systems such as hoisting mechanism of EOT crane.
MEC701.4	Students should be able to design belt conveyor systems
MEC701.5	Student should be able to design engine components such as cylinder, piston, connecting rod and crankshaft
MEC701.6	Student should be able to design pumps for the given applications

Course Name: MEC702 Logistics and Supply Chain Management	
MEC 702.1	To understand the fundamentals of supply chain management and Logistics
MEC 702.2	To develop an understanding related to Supply Chain Performance and related aspects
MEC 702.3	To understand Inventory management in supply chain
MEC 702.4	To learn tools and techniques used in logistics, transportation, warehousing and outsourcing decisions.
MEC 702.5	To develop critical understanding towards digitization in supply chain management and sustainability
MEC 702.6	To develop analytical and critical understanding for planning and designing supply chain network.

Course Name: MEDLO7032 Renewable Energy Sources

MEDLO7032.1	Describe the need for renewable energy and its potential for the development of a sustainable environment.
MEDLO7032.2	Analyse different solar collectors using geometrical parameters and photovoltaics for generation of solar energy
MEDLO7032.3	Identify and analyse various wind turbine energy harnessing techniques.
MEDLO7032.4	Design biogas plant for harnessing energy from organic waste.
MEDLO7032.5	Describe significance of hydrogen energy to fulfil present and future energy needs.
MEDLO7032.6	Describe the operating principle of geothermal energy and ocean energy and their role in sustainable development.

Course Name: MEDLO7041 Machinery Diagnostics

MEDLO7041.1	Student should be able to understand and relate basic concepts of Machinery Diagnostic to the practical machine setup.
MEDLO7041.2	Student should be able to describe the working of Vibration Measuring Instruments.
MEDLO7041.3	Student should be able to apply different Signal Processing Techniques in Vibration Measurement.
MEDLO7041.4	Student should be able to identify common faults in Machinery using Vibration Spectrum.
MEDLO7041.5	Student should be able to interpret the Vibration Signals for Monitoring and Prognosis.
MEDLO7041.6	Student should perform the case study on vibration response of Rotor dynamic system

Course Name: ILO 7017 Disaster Management and Mitigation Measures

ILO7017.1	To understand definition of disaster ,hazard and terms related to Disaster Management
ILO7017.2	Get to know natural as well as manmade disaster and their extent and possible effects on the economy.
ILO7017.3	Get to know role of various agencies linked with Disaster management including government, NGO.
ILO7017.4	Plan of national importance structures based upon the previous history.
ILO7017.5	Get acquainted with government policies, acts and various organizational structure associated with an emergency.
ILO7017.6	Get to know the simple do's and don'ts in such extreme events and act accordingly.

Course Name: MEL 701 Design of Mechanical System

ME L 701.1	Students should be able to formulate the system design process for any mechanical system.
MEL 701.2	Students should be able to design of Gear box for any engineering application.
MEL 701.3	Students should be able to design the hoisting mechanism like EOT crane.
MEL 701.4	Students should be able to design belt conveyor systems.
MEL 701.5	Students should be able to design the engine for any suitable application.
MEL 701.6	Students should be able to design pumps for the given applications

Course Name: MEL702 Maintenance Engineering Lab

MEL 702.1	Identify different tools used for maintenance.
MEL 702.2	Apply different maintenance strategies.

MEL 702.3	Demonstrate the process of servicing a machine.
MEL 702.4	Identify common faults in Machinery using Vibration Spectrum.
MEL 702.5	Interpret the Vibration Signals for Monitoring and Prognosis.

Course Name: MEL703 Industrial Skills

MEL 703.1	To familiarize students with basic computer / IT skills required in the industry.
MEL 703.2	To familiarize students with soft skills and communication skills to make them ready for Industry.
MEL 703.3	To inculcate critical thinking and problem-solving abilities for team work and project outcomes
MEL 703.4	To prepare students to face interviews by practicing aptitude, Logical reasoning, group discussions and personal Interviews
MEL 703.5	To work in MS Office Software including Word and functions in excel.
MEL 703.6	To hone team building and leadership qualities of the students

Course Name: MEP701 Major Project-I

MEP701.1	Students will be able to develop the understanding of the problem domain through extensive review of literature.
MEP701.2	Students will be able to identify and analyze the problem in detail to define its scope with problem specific data.
MEP701.3	Students will be able to identify various techniques to be implemented for the selected problem and related technical skills through feasibility analysis.

MEP701.4	Students will be able to design solutions for real-time problems that will positively impact society and environment.
MEP701.5	Students will be able to develop clarity of presentation based on communication, teamwork and leadership skills.
MEP701.6	Students will be able to inculcate professional and ethical behaviour.