Vidyavardhini's College Of Engineering & Technology
Department of Mechanical Engineering
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Program Outcomes

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**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.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**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.
PO11	**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.
PO12	**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.

Program Specific Outcomes

PSO1	**The graduate will be able to identify, analyze, and develop a solution for the complex engineering problems in the Mechanical Engineering domain.**
PSO2	**The graduate will be able to integrate technical and interpersonal skills with the ethical and professional standards in their career.**

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Course Outcomes (FE to BE)

At the end of the semester student will able to

FEC101	**Applied Mathematics-I**
FEC101.1	Illustrate the basic principles of partial differentiation.
FEC101.2	Illustrate the knowledge of maxima, minima and successive differentiation.
FEC101.3	Illustrate the basic concepts of Complex numbers.
FEC101.4	Apply the knowledge of complex numbers to solve problems in hyperbolic functions and logarithmic function.
FEC101.5	Apply principles of basic operations of matrices, rank and echelon form of matrices to solve simultaneous equations.
FEC101.6	Illustrate Scilab programming techniques to the solution of linear and simultaneous algebraic equations.

FEC102	**Engineering Physics-I**
FEC102.1	Describe the concept of superconductors and super capacitors
FEC102.2	List the properties of crystal structure and describe x-ray diffraction.
FEC102.3	Describe concepts of semiconductor physics and select its application
FEC102.4	Describe the concept of interference in thin films and select it application

FEC103	**Engineering Chemistry -I**
FEC103.1	Analyze the quality of water and suggest upto four methods of treatment.
FEC103.2	Illustrate the knowledge of polymers, fabrication methods, conducting polymers in industrial fields & calculate molecular weight of polymer.
FEC103.3	Explain the concept of microscopic chemistry in terms of atomic and molecular orbital theory and relate it to diatomic molecule.
FEC103.4	Describe the concept of aromaticity & interpret with relation to specific aromatic system.
FEC103.5	Interpret upto two phase transformations using thermodynamics.
FEC103.6	Illustrate the knowledge of upto four types of intermolecular forces & relate it real gases.

FEC104	**Engineering Mechanics**
FEC104.1	Illustrate the concept of force, moment and apply the same along with the concept of equilibrium in two and three dimensional systems with the help of FBD.
FEC104.2	Demonstrate the understanding of Centroid and its significance and locate the same
FEC104.3	Estimate required force to overcome friction and correlate real life application to specific type of friction.
FEC104.4	Establish relation between velocity and acceleration of a particle and analyse the motion by plotting the relation
FEC104.5	Illustrate different types of motions and establish Kinematic relations for a rigid body
FEC104.6	Analyse body in motion using force and acceleration, work-energy, impulse-momentum principles

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FEC105	Basic Electrical Engineering
FEC105.1	Apply various network theorems to determine the circuit response / behavior
FEC105.2	Evaluate and analyse 1-Φ AC circuits.
FEC105.3	Evaluate and analyse 3-Φ AC circuits.
FEC105.4	Understand the constructional features and operation of 1-Φ transformer.
FEC105.5	Illustrate the working principle of 3-Φ machines and 1-Φ machines.

FEL101	Engineering Physics-I
FEL101.1	Draw miller indices
FEL101.2	Calculate energy band gap of semiconductor and studied about Hall effect.
FEL101.3	Calculate radius of curvature of a lens using Newton's ring set up and thickness of paper using Wedge shape film

FEL102	Engineering Chemistry -I
FEL102.1	Analyse water for its hardness.
FEL102.2	Estimate viscosity of lubricant using Redwood viscometer.
FEL102.3	Estimate chloride content of water uing Mohr's method.
FEL102.4	Estimate PH of water using PH meter.
FEL102.5	Synthesize phenol-formaldehyde.

FEL103	Engineering Mechanics
FEL103.1	Verify the law of polygon, varignon's theorem and find the resultant of given force system
FEL103.2	Verify the conditions of equilibrium and find the beam reactions
FEL103.3	Analyse the friction between two different surfaces.
FEL103.4	Demonstrate the understanding of Centroid and its significance and locate the same
FEL103.5	Illustrate different types of motions and establish Kinematic relations for particles and rigid body.
FEL103.6	Verify the law of conservation of momentum and find the coefficient of restitution.

FEL104	Basic Electrical Engineering
FEL104.1	Implement DC circuits and analyze their behavior using network theorems
FEL104.2	Analyze frequency behavior of RLC circuit and calculate resonance frequency, Bandwidth and Q- factor.
FEL104.3	Determine relationship between voltage/current/power in three phase star/delta circuits.
FEL104.4	Perform OC/SC test on transformer and determine its equivalent circuit and efficiency.
FEL104.5	Illustrate the working of Single & Three Phase Induction Motor

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FEL105	Basic Workshop Practice-I
FEL105.1	Model different prototypes in the carpentry trade such as Cross cut lap joint, Tee lap joint, Dovetel lap joint.
FEL105.2	Model various basic prototypes in the trade of fitting such as Square, Hexagonal and V Male Female joint.
FEL105.3	Perform various basic House Wiring techniques such as connecting one lamp with one switch, connecting two lamps with one switch, connecting a fluorescent tube, Series wiring, Go down wiring while taking care of electrical safety.
FEL105.4	Perform various basic domestic plumbing operations such as pipe cutting, threading, fitting etc.
FEL105.5	Read various basic Layout drawing; make positive and negative film, and perform PCB etching and drilling, Tinning and soldering operations.
FEL105.6	Dismantle and Assemble a Personal Computer, perform Basic troubleshooting and maintenance, identify network components and perform Basic networking and crimping.

FEC201	Engineering Mathematics-II
FEC201.1	Understand and apply the basic concepts of ODE , LDE & Higher order Differential equations
FEC201.2	Illustrate the knowledge of beta & gamma function ,DUIS & Rectification.
FEC201.3	Apply the concepts of multiple integral.
FEC201.4	Apply Numerical methods to solve ODE of first order & first degree &Numerical integration Analytically & using scilab

FEC202	Engineering Physics-II
FEC202.1	Describe diffraction through single slit and grating and select its application
FEC202.2	Discuss the concept of LASER and Fiber-optics and list characteristics of LASER & Fiber-optics
FEC202.3	Describe basics of electrodynamics.
FEC202.4	Classify sensors based on their sensing technique.

FEC203	Engineering Chemistry -II
FEC203.1	Illustrate upto six types of corrosion & suggest control measures in industries
FEC203.2	Analyze the quality of fuel & calculate the oxygen required for combustion of fuel.
FEC203.3	Distinguish the ranges of EMS used for molecular transitions in spectroscopic techniques.
FEC203.4	Illustrate the phenomenon of fluorescence & Phosphorescence.
FEC203.5	Explain the concept of electrode potential &calculate EMF of cell.
FEC203.6	Illustrate the principles of green chemistry, synthesis and calculate % atom economy of chemical reaction.

FEC204	Engineering Graphics
FEC204.1	Apply the basic principles of projections in Projection of Lines and Planes
FEC204.2	Apply the basic principles of projections in Projection of Solids & Section of solids
FEC204.3	Apply the basic principles of projections in converting 3D view to 2D drawing.
FEC204.4	Visualize an object from the given two views.

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FEC205	C Programming
FEC205.1	Formulate the simple algorithm for arithmetic, logical problems and translate them to programs in C language.
FEC205.2	Implement, test and execute programs consisting of control structures and demonstrate the use of arrays
FEC205.3	Implement solutions to the problem using the concept of strings and functions
FEC205.4	Understand the concept of pointers and structure-union

FEC206	Professional Communication and Ethics-I
FEC206.1	Write effective business/ technical documents.
FEC206.2	Relate and apply strategies for personal and professional skills to meet the demands of the industry
FEC206.3	Apply various techniques to be successful in group discussions, technical presentation and meetings
FEC206.4	Deliver successful professional presentations.
FEC206.5	Develop creative thinking and interpersonal skills.
FEC206.6	Apply codes of ethical conduct & organizational behaviour.

FEL201	Engineering Physics-II
FEL201.1	Determine wavelength of given colour using diffraction grating
FEL201.2	Determine number of lines on the grating using Laser source and numerical aperture of an optical fibre
FEL201.3	Studied I-V charactristics of Photodiode and ultrasonic distance meter

FEL202	Engineering Chemistry -II
FEL202.1	Analyse fuel for moisture content.
FEL202.2	Estimate Na,k & Ca in the given sample using flame photometer.
FEL202.3	Estimate flash point of diesel oil using Abel's apparatus.
FEL202.4	Estimate saponification value of vegetable oil.
FEL202.5	Estimate acid value of vegetable oil.

FEL203	Engineering Graphics
FEL203.1	Apply the basic principles of projections in Projection of Lines and Planes and Curves.
FEL203.2	Apply the basic principles of projections in Projection of Solids & Section of solids
FEL203.3	Apply basic AutoCAD skills to draw different views of a 3D object.
FEL203.4	Apply basic AutoCAD skills to draw the isometric view from the given two views.

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FEL204	C programming
FEL204.1	Translate given algorithms to a program.
FEL204.2	Correct syntax and logical errors
FEL204.3	Write iterative as well as recursive programs
FEL204.4	Represent data in arrays, strings and structures and manipulate them through a program
FEL204.5	Declare pointers and demonstrate call by reference concept.

FEL205	Professional Communication and Ethics-I
FEL205	Listen and comprehend all types of spoken discourse successfully
FEL205	Speak fluently and make effective professional presentations.
FEL205	Read large quantities of text in a short time to comprehend, summarise and evaluate content
FEL205	Draft precise business letters, academic essays and technical guidelines.
FEL205	Dress finely and conduct themselves with confidence in social, academic and professional situation.
FEL205	Demonstrate principles of ethics in professional environment

FEL206	Basic Workshop Practice-II
FEL206.1	Model different prototypes in the carpentry trade such as Cross cut lap joint, Tee lap joint, Dovetel lap joint.
FEL206.2	Model various basic prototypes in the trade of fitting such as Square, Hexagonal and V Male Female joint.
FEL206.3	Perform various basic House Wiring techniques such as connecting one lamp with one switch, connecting two lamps with one switch, connecting a fluorescent tube, Series wiring, Go down wiring while taking care of electrical safety.
FEL206.4	Perform various basic domestic plumbing operations such as pipe cutting, threading, fitting etc.
FEL206.5	Read various basic Layout drawing; make positive and negative film, and perform PCB etching and drilling, Tinning and soldering operations.
FEL206.6	Dismantle and Assemble a Personal Computer, perform Basic troubleshooting and maintenance, identify network components and perform Basic networking and crimping.

MEC 301	Engineering Mathematics-III
MEC 301.1	Apply the concept of Laplace transform to solve the real integrals in engineering problems
MEC 301.2	Apply the concept of inverse Laplace transform of various functions in engineering problems.
MEC 301.3	Apply the concept of Fourier series to expand periodic functions.
MEC 301.4	Find orthogonal trajectories and analytic function by using basic concepts of complex variable theory.
MEC 301.5	Apply matrix theory to solve the system of linear equations and eigen values and eigen vectors and their applications.
MEC 301.6	Solve Partial differential equations by applying numerical solution for one dimensional heat and wave equations.

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MEC 302	Strength of Materials
MEC 302.1	Exhibit the concepts of direct stresses and strain in simple and compound bars.
MEC 302.2	Analyse the principal planes and stresses induced in thin shell subjected to internal and external pressure
MEC 302.3	Evaluate Shear force, Bending moment and plot variation for the different types of loads and support conditions
MEC 302.4	Analyse the stresses induced in engineering components due to shearing force, bending moment, twisting moment
MEC 302.5	Estimate the strain energy in Mechanical Elements subjected to different types of loading.
MEC 302.6	Estimate buckling and deflection phenomenon in columns, struts and beams by using different methods.

MEC 303	Production Processes
MEC 303.1	Demonstrate principles and process pertaining to casting.
MEC 303.2	Demonstrate understanding of joining processes and its applications.
MEC 303.3	Illustrate principles and calculate parameters relating to forming processes.
MEC 303.4	Illustrate chip generating machine tools and machining processes
MEC 303.5	Demonstrate and choose conventional and non traditional machine tools.
MEC 303.6	Illustrate the concept of producing polymer, ceramic compound for moulding processes and manufacturing technology enabling industry 4.0.

MEC304	Material and Metallurgy
MEC304.1	Identify the various classes of materials and comprehend their properties w.r.t. their crystal structures , atomic bonding and defects.
MEC304.2	Apply phase diagram concepts to engineering applications
MEC304.3	Apply particular heat treatment for required property development
MEC304.4	Identify the probable mode of failure in materials and suggest measures to prevent them
MEC304.5	Choose or develop new materials for better performance
MEC304.6	Decide an appropriate method for processing and evaluating different components in service

MEC 305	Thermodynamics
MEC 305.1	Appy first law of thermodynamics for various flow and non-flow systems and compute heat and work interactions.
MEC 305.2	Compute quantification and grade of energy using second law, entropy and availability.
MEC 305.3	Use steam table and Mollier chart to compute properties of steam and Rankine cycle parameters.
MEC 305.4	Analyse gas power cycles like Otto, Diesel, Dual and Brayton cycles.
MEC 305.5	Apply the fundamentals of compressible fluid flow to the nozzle and diffuser.
MEC 305.6	Demonstrate the interrelations between thermodynamic functions.

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MEL 301	Materials Testing
MEL 301.1	Prepare metallic samples for studying its microstructure following the appropriate procedure.
MEL 301.2	Measure the hardness and distinguish the effect of heat treatment on microstructure and hardness
MEL 301.3	Perform the fatigue test and draw the S-N curve
MEL 301.4	Analyse the stress strain behaviour of materials.
MEL 301.5	Conduct the flexural test and measure the modulus of rupture, deflection and bending stresses
MEL 301.6	Measure the torsional and impact strength of the materials

MEL 302	Machine Shop Practice
MEL 302.1	Perform plain turning, taper turning, screw cutting, drilling and boring operations on lathe machine
MEL 302.2	Perform plane and inclined shaping on shaper machine
MEL 302.3	Perform rough and smooth grinding on pedestal grinder and precision grinding on surface grinder
MEL 302.4	Perform basic milling operations and gear cutting on universal milling machine
MEL 302.5	Perform forging and heat treatment operations to prepare forging tool
MEL 302.6	Prepare composite welded job using arc welding machine

MESBL301	CAD-Modeling
MESBL301.1	Visualize and prepare 2D modeling of a given object using Solidworks/AUTOCAD/Inventor.
MESBL301.2	Create 3D model of a given object using Solidworks/Inventor.
MESBL301.3	Visualize and develop the surface model of a given object using Solidworks/Inventor.
MESBL301.4	Generate assembly models of given objects using assembly tools of Solidworks/Inventor
MESBL301.5	Create manufacturing drawing using drafting tools.
MESBL301.6	Perform product data exchange among CAD systems.

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MEPBL 301	Mini Project -IA
MEPBL 301.1	Identify societal needs, industrial, research problems and investigate them through in-depth literature survey for defining the problem statement.
MEPBL 301.2	Implement the appropriate methodology with modern tools.
MEPBL 301.3	Compare theoretical/computational /experimental results to draw the proper inferences.
MEPBL 301.4	To develop interpersonal skills as a member of a group and excel in written and oral communication
MEPBL 301.5	To develop capabilities of self-learning ,ethical values in a group which leads to lifelong learning
MEPBL 301.6	Implement project management principles during project work

MEC 401	Engineering Mathematics-IV
MEC 401.1	Apply the concepts of vector calculus to evaluation of line integrals, surface integrals using Green's theorem, Stoke's theorem & Gauss Divergence.
MEC 401.2	Use the concepts of complex integration for evaluating integrals, computing residues & evaluate various contour integrals.
MEC 401.3	Apply the concepts of correlation, regression and curve fitting to the engineering problems.
MEC 401.4	Apply the concepts of probability and expectation for getting the spread of data and distributions of probabilities
MEC 401.5	Apply the concept of probability distribution to engineering problems & testing hypothesis of small samples using small sampling theory.
MEC 401.6	Apply the concept of parametric and non-parametric tests for analyzing practical problems.

MEC 402	Fluid Mechanics
MEC 402.1	Discuss properties of fluid
MEC 402.2	Evaluate hydrostatic forces on various surfaces/structures and predict stability of floating bodies
MEC 402.3	Differentiate velocity potential function and stream function
MEC 402.4	Formulate and solve equations of control volume for fluid flow systems and apply bernoulli's Equation to various flow measuring devices.
MEC 402.5	Calculate pressure drop in laminar and turbulent flow, evaluate major and minor losses in pipes.
MEC 402.6	Calculate resistance numerically/computationally to flow of fluid over surfaces.

MEC 403	Kinematics of Machinery
MEC 403.1	Illustrate various components of mechanisms.
MEC 403.2	Develop mechanisms to provide specific motion.
MEC 403.3	Draw velocity and acceleration diagrams of various mechanisms using graphical methods.
MEC 403.4	Plot s-t, v-t, a-t and j-t diagram for specific cam and follower motion.
MEC 403.5	Select appropriate power transmission for specific applications from belt, rope and chain drive.
MEC 403.6	Analyze power transmission through spur gears and gear trains.

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MEC404	CAD/CAM
MEC404.1	Illustrate methods of geometric modelling using computer graphics techniques.
MEC404.2	Illustrate transformation of 2D and 3D objects.
MEC404.3	Develop 3D model using various types of available biomedical data.
MEC404.4	Create the CAM Toolpath NC G and M codes for a given operation.
MEC404.5	Demonstrate rapid prototyping & tooling concepts in real life application.
MEC404.6	Illustrate understanding of various cost effective alternatives for manufacturing products.

MEC405	Industrial Electronics
MEC405.1	Compare power diodes, power BJT, power MOSFET, IGBT and SCR on the basis of construction, characteristics, ratings & applications.
MEC405.2	Analyze controlled Rectifiers, inverter circuits for dc and ac motor speed control
MEC405.3	Analyze and demonstrate linear applications of Op-AMP and IC555 timer
MEC405.4	Examine the working of Combinational circuits and describe Sequential circuits
MEC405.5	Distinguish between microprocessor and microcontroller and interpret working of MSP430 microcontroller for applications.
MEC405.6	Compare DC and AC motors based on constructional features, working principle and their characteristics.

MEL 401	Industrial Electronics
MEL 401.1	Sketch and analyze characteristics of Semiconductor devices (SCR & TRIAC)
MEL 401.2	Analyze power electronics circuits for resistive and resistive inductive load.
MEL 401.3	Construct and analyze performance of integrated circuits (Opamp and 555 Timer).
MEL 401.4	Design and develop and analyze combinational circuits
MEL 401.5	Develop MSP430 programs
MEL 401.6	Analyze variation of speed of motor with change of given parameters (varying armature and field resistance)

MEL 402	Kinematics of Machinery
MEL 402.1	Illustrate various components and mechanisms.
MEL 402.2	Design and Develop mechanisms to provide specific motion.
MEL 402.3	Draw velocity up to six bar linkage mechanisms using ICR and relative velocity method.
MEL 402.4	Draw relative velocity and acceleration diagrams up to six bar linkage mechanisms using graphical methods
MEL 402.5	Plot s-t, v-t, a-t and j-t diagram and draw cam profile for specific cam and follower motion
MEL 402.6	Select appropriate power transmission for specific applications from gears, belt, rope and chain drive.

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MEL 403	Python Programming
MEL 403.1	Demonstrate and analyse basic concepts of Python Programming using new programming environment.
MEL 403.2	Develop and execute Python programs by making use of data structures and conditional statements.
MEL 403.3	Develop and execute Python programs with object oriented features.
MEL 403.4	Identify, install and utilize Python packages for plotting graphs.
MEL 403.5	Develop and build Python program to solve machine learning problems.
MEL 403.6	Prepare a case study report identifying appropriate libraries of Python.

MESBL401	CNC and 3-D Printing
MESBL401.1	Develop and execute tool path generation by conversion of part geometry from CAD to CAM.
MESBL401.2	Develop and execute part programming for given object using CNC Machine.
MESBL401.3	Demonstrate CAM Tool path and simulation for unconventional machining process.
MESBL401.4	Develop and analyze 3D model using biomedical data.
MESBL401.5	Develop 3D object using rapid prototyping method: Fused Deposition Modeling.
MESBL401.6	Generate 3D model of a object using 3D slicer image processing software.

MEPBL 401	Mini Project -IB
MEPBL 401.1	Identify societal needs, industrial, research problems and investigate them through in-depth literature survey for defining the problem statement.
MEPBL 401.2	Implement the appropriate methodology with modern tools.
MEPBL 401.3	Compare theoretical/computational /experimental results to draw the proper inferences.
MEPBL 401.4	To develop interpersonal skills as a member of a group and excel in written and oral communication
MEPBL 401.5	To develop capabilities of self-learning ,ethical values in a group which leads to life long learning
MEPBL 401.6	Implement project management principles during project work

MEC501	Mechanical Measurements and Controls
MEC501.1	Demonstrate inspection methods for different gauges.
MEC501.2	Illustrate working principle of measuring instruments to measure dimensional stability & functionality
MEC501.3	Illustrate various types of static characteristics and types of errors occurring in the measuring instruments.
MEC501.4	Demonstrate with the displacement, strain, pressure, flow and temperature measuring instruments for utilized for industrial applications.
MEC501.5	Design mathematical model of various types of control system/process with standard input responses in time domain and frequency domain and analyse for error coefficients.
MEC501.6	Analyse the problems associated with stability

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MEC502	Thermal Engineering
MEC502.1	Analyze the three modes of heat transfer in engineering application.
MEC502.2	Develop mathematical models for different modes of heat transfer.
MEC502.3	Analyze performance parameters of different types of heat exchangers.
MEC502.4	Identify and analyze the Transient heat Transfer in engineering applications.
MEC502.5	Explain construction and working of different components of internal combustion engines.
MEC502.6	Evaluate engine performance and emission characteristics.

MEC503	Dynamics of Machinery
MEC503.1	Apply principles of governors and Gyroscopic effects on the mechanical systems
MEC503.2	Illustrate basic concepts of inertia, static and dynamic forces in mechanical system components.
MEC503.3	Determine natural frequency of element/system
MEC503.4	Determine vibration response of mechanical elements / systems
MEC503.5	Select vibration isolation system for a specific application
MEC503.6	Demonstrate basic concepts of balancing using forces and couples

MEC504	Finite Element Analysis
MEC504.1	Develop the finite element equations to model engineering problems governed by second order differential equations.
MEC504.2	Apply the basic finite element formulation techniques to solve engineering problems by using one dimensional element structural analysis, heat transfer and fluid flow (stepped and taper bars, fluid network, spring-Cart Systems)
MEC504.3	Apply the basic finite element formulation techniques to solve engineering problems by using one dimensional elements for analysis of Plane trusses, Analysis of Beams.
MEC504.4	Apply the basic finite element formulation techniques to solve engineering problems by using two dimensional two Dimensional Vector Variable Problems.
MEC504.5	Apply the basic finite element formulation techniques to find natural frequency of single degree of vibration system
MEC504.6	Apply the basic finite element formulation techniques to find natural frequency of single degree of vibration system.

MEDLO5011	Optimisation Techniques
MEDLO5011.1	Identify the types of optimization problems and apply the calculus method to single variable problems.
MEDLO5011.2	Formulate the problem as Linear Programming problem and analyse the sensitivity of a decision variable.
MEDLO5011.3	Apply various linear and non-linear techniques for problem solving in various domain.
MEDLO5011.4	Apply multi-objective decision making methods for problem in manufacturing environment and other domain.
MEDLO5011.5	Apply multi criterion decision making methods for problem in manufacturing environment and other domain.
MEDLO5011.6	Apply Design of Experiments method for Optimization

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MEDLO5012	Design of Experiments
MEDLO5012.1	Understand basic principles of DOE and apply basic statistical methods.
MEDLO5012.2	Design the experiment with Full factorial design method and intrepret results by ANOVA method.
MEDLO5012.3	Design the experiment with fractional factorial design method
MEDLO5012.4	Apply appropriate method on model to create a robust design.
MEDLO5012.5	Apply first order and second order response surface model to optimize process.
MEDLO5012.6	Identify methods which are alternative to classical designed experiments

MEDLO5013	Computational Methods
MEDLO5013.1	Understand and develop mathematical models of physical systems.
MEDLO5013.2	Identify an appropriate mathematical formulation to linear algebraic equations.
MEDLO5013.3	Build an appropriate mathematical formulation to non-linear algebraic equations.
MEDLO5013.4	Evaluate and interpret the data regression, curve fitting and statistics.
MEDLO5013.5	Apply the numerical techniques and numerical schemes.
MEDLO5013.6	Formulate the concept of numerical methods in realistic applications.

MESBL 501	Professional Communication & Ethics
MESBL 501.1	Write effective business/ technical documents.
MESBL 501.2	Relate and apply strategies for personal and professional skills to meet the demands of the industry.
MESBL 501.3	Apply various techniques to be successful in group discussions, technical presentation and meetings
MESBL 501.4	Deliver successful professional presentations.
MESBL 501.5	Develop creative thinking and interpersonal skills.
MESBL 501.6	Apply codes of ethical conduct & organizational behavior.

MEDLO5012	Statistical Techniques
MEDLO5012.1	Apply the concepts of statistical distributions in engineering applications
MEDLO5012.2	Use sampling theory for a given data set
MEDLO5012.3	Apply the best fitting curve for a given data set
MEDLO5012.4	Determine the Correlation values of regression equation from a given data set.
MEDLO5012.5	Perform analysis of variance from the available experimental data.
MEDLO5012.6	Demonstrate the understanding of Statistical Decision making and Hypothesis testing

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MEL501	Thermal Engineering
MEL501.1	Estimate thermal conductivity of engineering materials.
MEL501.2	Compute heat transfer coefficient in natural and forced convection
MEL501.3	Analyse heat exchanger performance
MEL501.4	Perform load test/speed test on engine setup
MEL501.5	Calculate performance of multi cylinder engine
MEL501.6	Analyse engine performance and draw heat balance sheet

MEL502	Dynamics of Machinery
MEL502.1	Plot and analyse governor characteristics
MEL502.2	Analyse gyroscopic effect on laboratory model
MEL502.3	Estimate natural frequency of mechanical system
MEL502.4	Analyse vibration response of mechanical systems
MEL502.5	Determine damping coefficient of a system
MEL502.6	Analyse the balancing of rotating masses in rotor system

MEL503	Finite Element Analysis
MEL503.1	Analysis of one dimensional Bar element
MEL503.2	Analysis of one dimensional Truss element
MEL503.3	Analysis of one dimensional Beam element
MEL503.4	Analysis of Beam element for Modal and Harmonic conditions
MEL503.5	Analysis of Two dimensional plate
MEL503.6	Analysis of Axisymmetric Element

MESBL501	Professional communication and ethics - II
MESBL501.1	Write effective business/ technical documents.
MESBL501.2	Relate and apply strategies for personal and professional skills to meet the demands of the industry
MESBL501.3	Apply various techniques to be successful in group discussions, technical presentation and meetings
MESBL501.4	Deliver successful professional presentations.
MESBL501.5	Develop creative thinking and interpersonal skills.
MESBL501.6	Apply codes of ethical conduct & organizational behavior.

MEPBL501	Mini Project – 2 A
MEPBL501.1	Identify societal needs, industrial, research problems and investigate them through in-depth literature survey for defining the problem statement.
MEPBL501.2	Implement the appropriate methodology with modern tools.
MEPBL501.3	Compare theoretical/computational /experimental results to draw the proper inferences.
MEPBL501.4	To develop interpersonal skills as a member of a group and excel in written and oral communication.
MEPBL501.5	To develop capabilities of self-learning ,ethical values in a group which leads to lifelong learning.
MEPBL501.6	Implement project management principles during project work

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MEC 601	Machine Design
MEC 601.1	Illustrate the basic principle and procedure of machine design and various parameters involved in machine design
MEC 601.2	Design Knuckle Joint, cotter joint and Screw Jack
MEC 601.3	Design shaft under various conditions and coupling
MEC 601.4	Select bearings for a given applications and Design of hydrodynamically lubricated Bearing
MEC 601.5	Select and/or design belts and flywheel for given applications
MEC 601.6	Design springs, clutches and brakes

MEC 602	Turbo Machinery
MEC 602.1	Identify various steam generators, boiler mountings and accessories, compute boiler performance and define various parameters pertaining to Turbomachines
MEC 602.2	Classify hydraulic turbines and estimate the performance parameters and efficiencies for hydraulic turbines
MEC 602.3	Explain working of pumps and compute performance of reciprocating and centrifugal pumps
MEC 602.4	Identify various air compressors and compute performance of reciprocating and centrifugal compressors
MEC 602.5	Classify steam turbines and estimate the performance parameters and efficiencies for steam turbines
MEC 602.6	Describe Brayton cycle, classify gas turbines and jet propulsion engines and compute performance of gas turbines

MEC603	Heating, Ventilation, Air conditioning and Refrigeration
MEC603.1	Demonstrate fundamental principles of refrigeration & air conditioning and analyse Bell Coleman and aircraft air refrigeration systems.
MEC603.2	Explain vapour absorption refrigeration system, heat pump and analyze vapour compression refrigeration system.
MEC603.3	Illustrate refrigeration and air conditioning processes using psychometric chart and estimate cooling & heating load calculations.
MEC603.4	Design and explain air distribution system and air handling unit.
MEC603.5	Identify and explain HVAC&R components like compressors, condensers, expansion devices, evaporators, insulation.
MEC603.6	Explain applications of refrigeration and air conditioning.

MEC604	Automation and Artificial Intelligence
MEC604.1	Illustrate basics of industrial Automation and AI
MEC604.2	Design and develop pneumatic/ hydraulic circuits
MEC604.3	Design electro-pneumatic circuits and write a program in PLC for process Industry
MEC604.4	Demonstrate basic working of robotic control system
MEC604.5	Demonstrate understanding of Machine learning Algorithms
MEC604.6	Demonstrate understanding of Artificial Neural Network

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MEDLO6021	Press Tool Design
MEDLO6021.1	Demonstrate press working operation for mass production of sheet metal parts
MEDLO6021.2	Design and Select elements pertaining to requirements of progressive tool
MEDLO6021.3	Develop components having bend and draw operation
MEDLO6021.4	Illustrate construction and working of different types of press tools
MEDLO6021.5	Illustrate presses and setting parameters for load and energy consideration
MEDLO6021.6	Illustrate automation and safety aspects in press working

MEDLO6023	Metal Forming Technology
MEDLO6023.1	Demonstrate the concept of different metal forming process
MEDLO6023.2	Illustrate relationships between geometry of rolls with forces
MEDLO6023.3	Illustrate principles and forces analysis in forging process
MEDLO6023.4	Illustrate principles and forces analysis in Extrusion process
MEDLO6023.5	Demonstrate various Drawing process with load analysis
MEDLO6023.6	Demonstrate non-conventional sheet metal forming process.

MEL601	Machine Design
MEL601.1	Design Knuckle Joint / cotter joint
MEL601.2	Design Screw Jack
MEL601.3	Design of Shafts and Flexible flange couplings
MEL601.4	Select bearings for a given applications and Design of hydrodynamically lubricated Bearing
MEL601.5	Select and/or design belts and flywheel for given applications
MEL601.6	Design of Leaf springs , Clutches and Brakes

MEL 602	Turbo Machinery
MEL 602.1	Differentiate boilers, boiler mountings and accessories
MEL 602.2	Compute and analyze the performance of Reciprocating air compressor
MEL 602.3	Compute and analyze the performance of Impulse and Reaction Hydraulic Turbine.
MEL 602.4	Compute and analyze the performance of Reciprocating and Centrifugal pumps.
MEL 602.5	Write technical report of Industrial Visit to a Power Plant.

MEL603	Heating, Ventilation, Air conditioning and Refrigeration
MEL603.1	Identify parts, operate and evaluate performance of HVAC & R systems.
MEL603.2	Plot processes on psychrometric chart.
MEL603.3	Compute performance of cooling tower.
MEL603.4	Present the impact of professional engineering solutions in societal and environmental contexts.
MEL603.5	Communicate effectively through the preparation of report and practical presentation.
MEL603.6	Analyze design aspects of HVAC & R in various applications

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MESBL601	Measurements and Automation
MESBL601.1	Apply inspection gauge to check or measure geometrical dimensions.
MESBL601.2	Measure various parameters of gear tooth profile & Screw threads.
MESBL601.3	Determination of displacement, pressure, strain by using sensors.
MESBL601.4	Analyse the response of a control systems.
MESBL601.5	Design and develop electro pneumatic systems and ladder logic program on PLC.
MESBL601.6	Make use of Roboanalyzer software for visualization of DH (Denavit–Hartenberg) parameters

MEPBL601	Mini Project – 2 B
MEPBL601.1	Identify societal needs, industrial, research problems and investigate them through in-depth literature survey for defining the problem statement.
MEPBL601.2	Implement the appropriate methodology with modern tools.
MEPBL601.3	Compare theoretical/computational /experimental results to draw the proper inferences.
MEPBL601.4	To develop interpersonal skills as a member of a group and excel in written and oral communication
MEPBL601.5	To develop capabilities of self-learning ,ethical values in a group which leads to lifelong learning
MEPBL601.6	Implement project management principles during project work

MEC701	Design of Mechanical System
MEC701.1	Analysis of optimum design for mechanical elements
MEC701.2	Select appropriate gears for power transmission on the basis of given load and speed
MEC701.3	Design material handling systems such as hoisting mechanism of EOT Crane
MEC701.4	Design material handling systems such as belt conveyor
MEC701.5	Design engine components such as cylinder, piston, connecting rod and crankshaft from system design point of view
MEC701.6	Design pumps for given application

MEC702	Logistics and Supply Chain Management
MEC702.1	Understand the concepts of Logistics and Supply Chain Management and their role in today's business environment.
MEC702.2	Identify the drivers of Supply Chain performance and risks in Supply Chain Management.
MEC702.3	Apply various techniques of inventory management and their practical situations.
MEC702.4	Apply optimized transportation mode and techniques to minimize overall logistics cost.
MEC702.5	Comprehend the emerging trends and application of IT in Supply Chain Management leading to sustainability.
MEC702.6	Examine various models to design the Supply Chain network.

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MEDLO7031	Automotive Power Systems
MEDLO7031.1	Demonstrate the working of Fuel supply and ignition system of I.C. engines
MEDLO7031.2	Illustrate the working of lubrication, cooling and supercharging systems
MEDLO7031.3	Comprehend the different technological advances in engines and alternate fuels
MEDLO7031.4	Identify and describe the history and different EV/HEV drivetrain topologies
MEDLO7031.5	Compare and evaluate various energy sources and energy storage components for EV and HEV application
MEDLO7031.6	Comprehend EV and HEV working through Case studies

MEDLO7032	Renewable Energy Systems
MEDLO7032.1	Describe the need for renewable energy and its potential for the development of a sustainable environment
MEDLO7032.2	Calculate and Analyze different solar collectors using geometrical parameters
MEDLO7032.3	Describe the working principle and life cycle of photovoltaics cell by using different parameters.
MEDLO7032.4	Identify and analyze various wind turbine energy harnessment techniques
MEDLO7032.5	Design biogas plant from organic waste and Describe signficance of hydrogen energy for future needs
MEDLO7032.6	Describe the operating principle of geothermal and ocean energy and discuss energy management and economics for sustainable development

MEDLO7033	Vehicle Systems
MEDLO7033.1	Illustrate various systems like clutch, transmission and drive lines in an automobile.
MEDLO7033.2	Illustrate significance and feature of various systems like differential, brake and steering in an automobile.
MEDLO7033.3	Describe the automotive system and components like suspension, wheels and tyres
MEDLO7033.4	Illustrate the working of different Vehicle Electrical systems and subsystems
MEDLO7033.5	Demonsrate different Vehicle Body systems and layouts.
MEDLO7033.6	Comprehend the different technological advances in vehicle systems.

MEDLO7041	Machinery Diagnostics
MEDLO7041.1	Apply the concepts of vibration with condition monitoring of machine
MEDLO7041.2	Illustrate concepts and working of vibration measuring instruments
MEDLO7041.3	Select appropriate data acquisition system and signal processing techniques in machinery diagnosis
MEDLO7041.4	Illustrate common faults in mechanical system using vibration spectrum
MEDLO7041.5	Illustrate faults in machine elements using vibration spectrum
MEDLO7041.6	Analyse the vibration signals of Industrial machines

MEDLO7042	Vibration Controls
MEDLO7042.1	Apply basic concepts of Vibration Isolation and Damping.
MEDLO7042.2	Identify suitable Vibration Absorber
MEDLO7042.3	Identify suitable Vibration Isolator
MEDLO7042.4	Apply suitable method to Control the vibrations to the acceptable level.

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ILO7013	Management Information System
ILO7013.1	Identify the impact of information systems on an organization
ILO7013.2	Use tools and technologies to access database information for improving business performance and decision making
ILO7013.3	Identify the threats to information systems and apply security controls for IS
ILO7013.4	Identify use of social computing for business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce.
ILO7013.5	Use technologies that underlie pervasive computing, providing examples of how businesses can utilize each one.
ILO7013.6	Identify the Transaction Processing, Functional Area Information and ERP system for enterprise-wide knowledge management

ILO7015	Operation Research
ILO7015.1	Solve the LP problems using simplex algoritm and Interepret the optimum solution of it
ILO7015.2	Perform sensitivity analysis on LPP problem and Solve specialized LPP problems like the transportation and assignment problems.
ILO7015.3	Solve network models like the shortest path, minimum spanning tree, and maximum flow problems
ILO7015.4	Compute important performance measures of queuing model
ILO7015.5	Solve simulation problem using Monte Carlo Technique
ILO7015.6	Solve game theory problem and to determine optimal order quantity with price breaks, shortage, and with /without discount.

ILO7016	Cyber Security and Laws
ILO7016.1	Describe the characteristics of cybercrime and concept cyber-frauds, cybercriminal types with their motives and relate legal issues with respect to cybercrime.
ILO7016.2	Identify the security challenges presented by mobile devices and infer measures for protecting the same.
ILO7016.3	Understand the tools and Methods used in Cyber line
ILO7016.4	Interpret and apply IT law in various legal issues
ILO7016.5	Distinguish different aspects of cyber law
ILO7016.6	Apply Information Security Standards compliance during software design and development

ILO7017	Disaster Management and Mitigation Measures
ILO7017.1	Illustrate scenario of disaster and its effects in India
ILO7017.2	Compare Manmade and Natural disasters and their extent and possible effects on the economy
ILO7017.3	Outline the Government Policies, acts and administration
ILO7017.4	Employ the knowledge of Institutional Framework for Disaster Management in India
ILO7017.5	Apply the knowledge of Financing and Relief Measures
ILO7017.6	Utilize the knowledge of preventive and mitigation measures to know the simple do's and don’ts in disasters

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ILO7018	Energy Audit and Management
ILO7018.1	Compare the present state of energy security and its importance to achieve sustainability
ILO7018.2	Explore the basic principles and methodologies adopted in energy audit of an utility
ILO7018.3	Evaluate the energy performance of electrical installations and identify the energy saving opportunities
ILO7018.4	Evaluate the energy performance of some common thermal installations and identify the energy saving opportunities
ILO7018.5	Analyse the data collected during performance evaluation and recommend energy saving measures

MEL701	Design of Mechanical System
MEL701.1	Apply the Concept of system Design
MEL701.2	Design the gears and gear box housing
MEL701.3	Design of EOT Crane
MEL701.4	Design of belt conveyor system
MEL701.5	Design engine components such as cylinder,piston,connecting rod and crankshaft
MEL701.6	Design gear pump and centrifugal pump

MEL702	Maintenance Engineering
MEL702.1	Differentiate maintenance tools based on function and application
MEL702.2	Demonstrate assembly and dismantling of mechanical systems
MEL702.3	Apply different maintenance strategies based on function and mode of failure
MEL702.4	Demonstrate the process of servicing a machine
MEL702.5	Identify common faults in Machinery using Vibration Spectrum.
MEL702.6	Interpret the Vibration Signals for Monitoring and Prognosis.

MEL703	Industrial Skills
MEL703.1	Skillfully prepare and edit documents and slides on MS Word and MS Powerpoint.
MEL703.2	Execute functions on MS Excel.
MEL703.3	Navigate tasks and execute functions in G-Suite.
MEL703.4	Understand and practice metacognitive skills of creativity and problem solving.
MEL703.5	Hone team building and leadership skills.

MEP701	Major Project I
MEP701.1	Identify societal needs, industrial, research problems and investigate them through in-depth literature survey for defining the problem statement.
MEP701.2	implement the appropriate methodology with modern tools.
MEP701.3	Manufacture the product for experimentations and correlate with theoretical/computational results to draw the proper inferences.
MEP701.4	Work as an individual and contribute as a team member with effective management skills to achieve a common objective.
MEP701.5	Write and present their work effectively with ethical values.
MEP701.6	Engage themselves in their area of interest and explore engineering advancements to structure open problem competency.

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MEC801	Operations Planning and Control
MEC801.1	Illustrate operations functions and manage operations in a better way.
MEC801.2	Apply various strategies to develop aggregate production plan based on the demand forecasting.
MEC801.3	Apply various algorithms in scheduling and sequencing of manufacturing and service operations
MEC801.4	Illustrate Material Requirements Plans (MRP) to estimate the planned order releases.
MEC801.5	Design line balancing to optimize the resources and apply various techniques for facility layout planning
MEC801.6	Demonstrate the importance of implementation of JIT, Lean, Agile and Synchronous manufacturing in manufacturing and service organizations.

MEDLO8051	Composite Materials
MEDLO8051.1	Discuss the different manufacturing methods of composite material.
MEDLO8051.2	Develop relationship in stresses and strains through the elastic constants for a given lamina.
MEDLO8051.3	Evaluate elastic properties of a lamina based on the properties of its constituents.
MEDLO8051.4	Design of lamina under the given loading condition and predict failure.
MEDLO8051.5	Analyse the composite lamina for failures using different inspection methods
MEDLO8051.6	Apply the methods to repair the composites using different methods and repair.

MEDLO8052	Smart Materials
MEDLO8052.1	Classify and select different types of smart materials
MEDLO8052.2	Comprehend Important Concepts and principles of Smart Materials
MEDLO8052.3	Understand and classified the synthesis, sensing and actuation of Piezoelectric Materials, Magneto strictive Materials, Shape Memory Alloys, Electroactive Polymers
MEDLO8052.4	Understand and classified the synthesis, sensing and actuation of Ferrofluids and Magneto rheological Fluids, Soft Matter, Carbon Nanotubes and Carbon nanostructures, Thermoelectric Materials
MEDLO8052.5	Classify and select Smart Materials for Energy Applications: Materials used for energy storage
MEDLO8052.6	Classify and select Composite Materials, Nano Composite Materials

MEDLO8053	Micro Electro Mechanical Systems
MEDLO8053.1	Apply laws of scaling for development of a MEMS device
MEDLO8053.2	Understand the materials and their processing to make MEMS
MEDLO8053.3	Select and use microfabrication techniques for microsystems
MEDLO8053.4	Understand the development of micro sensors and actuators
MEDLO8053.5	Analyze microsystems technology for technical feasibility as well as practicality
MEDLO8053.6	Develop useful applications of MEMS.

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MEDLO8061	Product Design and Development
MEDLO8061.1	Apply concepts of product development and outline product planning process.
MEDLO8061.2	Identify concept generation activities and summarize the methodology involved in concept selection and testing.
MEDLO8061.3	Apply and integrate customer needs in establishing product specifications.
MEDLO8061.4	Apply the various techniques for stimulating creativity and innovation thinking.
MEDLO8061.5	Apply the concepts of Industrial design outlining the human, serviceability and environmental factors considered while designing.
MEDLO8061.6	Apply principles of prototyping in product development.

MEDLO8063	Total Quality Management
MEDLO8063.1	Illustrate significance of Quality Management System and principles of Total Quality Management in organizational development process.
MEDLO8063.2	Use the Quality Control & Quality Management tools in process improvement.
MEDLO8063.3	Apply Statistical Quality Control techniques to improve process quality.
MEDLO8063.4	Use Six Sigma project in Total Quality Management Implementation
MEDLO8063.5	Illustrate Quality Management System and Certifications for Quality Accreditation
MEDLO8063.6	Choose and Apply the advanced tools for Quality Sustainability.

ILO8021	Project Management
ILO8021.1	Apply selection criteria and select an appropriate project from different options
ILO8021.2	Write work break down structure for a project and develop a schedule based on it
ILO8021.3	Identify opportunities and threats to the project and decide an approach to deal with them strategically
ILO8021.4	Use Earned value technique and determine & predict status of the project
ILO8021.5	Capture lessons learned during project phases and document them for future reference

ILO8025	Professional Ethics and CSR
ILO8025.1	Understand rights and duties of business.
ILO8025.2	Analyze and explore duties of business and professional ethics in the marketplace.
ILO8025.3	Analyze and Demonstrate professional ethics of consumer protection and job discrimination.
ILO8025.4	Describe and analyze different aspects of corporate social responsibility
ILO8025.5	Analyze interrelatedness of enterprises and corporate social responsibility.
ILO8025.6	Understand legal aspects of corporate social responsibility.

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ILO8029	Environmental Management
ILO8029.1	Illustrate the significance of Environment Management and sustainable development
ILO8029.2	Identify Global Environmental Concerns and Hazards
ILO8029.3	Employ the Concept of Ecology and interdependence between ecosystem and living organisms
ILO8029.4	Utilize the knowledge of Scope of Environment Management and Corporate Environmental Responsibility
ILO8029.5	Outline the EMS Certification and ISO-14000
ILO8029.6	Interpret Environment related legislations and acts

MEL801	Product Design and Development
MEL801.1	Explain the need for developing the products
MEL801.2	Select suitable Product Design and Development Processes
MEL801.3	Apply the creativity and industrial design methods to design and develop the chosen product
MEL801.4	Design and Develop product through collaborative work in a team
MEL801.5	Effectively communicate the result of project and other assignment both in written and oral format
MEL801.6	Demonstrate the result of project and other assignment both in written and oral format.

MEL802	Laboratory based on IoT
MEL802.1	Develop simple applications using microcontroller and Arduino platform.
MEL802.2	Interface simple peripheral devices to a Microcontroller
MEL802.3	Interface sensors to a Microcontroller.
MEL802.4	Interface actuators to a Microcontroller.
MEL802.5	Illustrate wireless peripherals for exchange of data
MEL802.6	Setup cloud platform and log sensor data

MEP801	Major Project II
MEP801.1	Identify societal needs, industrial, research problems and investigate them through in-depth literature survey for defining the problem statement.
MEP801.2	Implement the appropriate methodology with modern tools.
MEP801.3	Manufacture the product for experimentations and corelate with theoretical/computational results to draw the proper inferences.
MEP801.4	Work as an individual and contribute as a team member with effective management skills to achieve a common objective.
MEP801.5	Write and present their work effectively with ethical values.
MEP801.6	Engage themselves in their area of interest and explore engineering advancements to structure open problem competency.

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