



LOYOLA INSTITUTE OF TECHNOLOGY

Palanchur, Chennai – 600 123

Approved by AICTE, New Delhi and Affiliated to Anna University,
Chennai (An ISO Certified Institution)

Department of Mechanical Engineering

2021 Regulations

Course Outcomes (COs)

II YEAR

ODD SEM (6 Theory + 3 Labs)

Si.No	Name of the Subject (In Abbreviation)	Course Outcomes	Statement
1	Transforms and Partial Differential Equations	CO1	Understand how to solve the given standard partial differential equations
		CO2	Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
		CO3	Appreciate the physical significance of Fourier series techniques in solving one- and two-dimensional heat flow problems and one-dimensional wave equations.
		CO4	Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
		CO5	Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems
		CO6	Using Z -transform as the effective mathematical tool to solve the Difference Equations for discrete time system.
2	Engineering Mechanics	CO1	Illustrate the vector and scalar representation of forces and moments
		CO2	Analyze the rigid body in equilibrium
		CO3	Evaluate the properties of distributed forces
		CO4	Determine the friction and the effects by the laws of friction
		CO5	Calculate dynamic forces exerted in rigid body
		CO6	Gain knowledge in basic concepts in general plane

			motion
3	Engineering Thermodynamics	CO1	Apply the zeroth and first law of thermodynamics by formulating temperature scales and calculating the property changes in closed and open engineering systems.
		CO2	Apply the second law of thermodynamics in analyzing the performance of thermal devices through energy and entropy calculations.
		CO3	Apply the second law of thermodynamics in evaluating the various properties of steam through steam tables and Mollier chart
		CO4	Apply the properties of pure substance in computing the macroscopic properties of ideal and real gases using gas laws and appropriate thermodynamic relations.
		CO5	Apply the properties of gas mixtures in calculating the properties of gas mixtures and
		CO6	Apply various thermodynamic relations to calculate property changes
4	Fluid Mechanics and Machinery	CO1	Understand the properties and behavior in static conditions. Also, to understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics
		CO2	Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel. Also, to understand the concept of boundary layer and its thickness on the flat solid surface.
		CO3	Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies
		CO4	Explain the working principles of various turbines and design the various types of turbines
		CO5	Explain the working principles of centrifugal, reciprocating and rotary pumps and design the centrifugal and reciprocating pumps
		CO6	Have knowledge in the applications of dimensionless parameters
5	Engineering Materials and Metallurgy	CO1	Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification.
		CO2	Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
		CO3	Clarify the effect of alloying elements on ferrous and non-ferrous metals.
		CO4	Summarize the properties and applications of non-metallic materials.
		CO5	Explain the testing of mechanical properties.
		CO6	Understand the concepts in mechanism of plastic deformation

6	Manufacturing Processes	CO1	Explain the principle of different metal casting processes.
		CO2	Describe the various metal joining processes.
		CO3	Illustrate the different bulk deformation processes.
		CO4	Apply the various sheet metal forming process.
		CO5	Apply suitable molding technique for manufacturing of plastics components.
		CO6	Understand the concepts in the melting furnace types and its applications
7	Computer Aided Machine Drawing	CO1	Understand drawings of machine components
		CO2	Gain knowledge in Indian standards on drawing practice and its standard components
		CO3	Prepare standard drawing layout for modelled assemblies with BoM.
		CO4	Gain experience in 2D drafting software
		CO5	Model orthogonal views of machine components.
		CO6	Prepare standard drawing layout for modelled parts
8	Manufacturing Technology Laboratory	CO1	Demonstrate the safety precautions exercised in the mechanical workshop.
		CO2	Join two metals using GMAW.
		CO3	Make the workpiece as per given shape and size using Lathe.
		CO4	Make the gears using Gear Making Machine.
		CO5	Use different molding tools, patterns and prepare sand molds.
		CO6	Analyze the defects in the cast and machined components.
9	Professional Development	CO1	Use MS Word to create quality documents, by structuring.
		CO2	Use MS Word to organizing content for their day to day technical and academic requirements.
		CO3	Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements.
		CO4	Use MS EXCEL to perform data operations and visualize data for ease of understanding.
		CO5	Use MS PowerPoint to create high quality academic presentations by including common tables, chart and graphs.
		CO6	Use MS PowerPoint to create high quality academic presentations by interlinking other elements, and using media objects.



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EVEN SEM (6 Theory + 3 Labs)

1.	Theory of Machines	CO1	Discuss the basics of mechanism.
		CO2	Solve problems on gears and gear trains.
		CO3	Examine friction in machine elements.
		CO4	Calculate static and dynamic forces of mechanisms
		CO5	Calculate the balancing masses and their locations of reciprocating and rotating masses.
		CO6	Computing the frequency of free vibration, forced vibration and damping coefficient.
2.	Thermal Engineering	CO1	Apply thermodynamic concepts to different air standard cycles and solve problems.
		CO2	To solve problems in steam nozzle and calculate critical pressure ratio.
		CO3	Explain the flow in steam turbines, draw velocity diagrams, flow in Gas turbines and solve problems.
		CO4	Explain the functioning and features of IC engine .
		CO5	Calculate the various performance parameters of IC engines
		CO6	Explain the IC engines components and auxiliaries
3.	Hydraulics and Pneumatics	CO1	Apply the working principles of fluid power systems and hydraulic pumps.
		CO2	Apply the working principles of hydraulic actuators and control components.
		CO3	Design and develop hydraulic circuits and systems.
		CO4	Apply the working principles of pneumatic circuits and power system and its components.

		CO5	Identify various troubles shooting methods in fluid power systems.
		CO6	Gain knowledge in hydraulic and Pneumatic components of CNC machine tools and power pack
4.	Manufacturing Technology	CO1	Apply the mechanism of metal removal process and to identify the factors involved in improving machinability.
		CO2	Describe the constructional and operational features of centre lathe and other special purpose lathes.
		CO3	Describe the constructional and operational features of reciprocating machine tools.
		CO4	Apply the constructional features and working principles of CNC machine tools.
		CO5	Demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.
		CO6	Use of the CNC programming codes in components manufacturing
5.	Strength of Materials	CO1	Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
		CO2	Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment
		CO3	Apply basic equation of torsion in designing of shafts and helical springs
		CO4	Calculate slope and deflection in beams using different methods
		CO5	Analyze thin shells for applied pressures.
		CO6	Analyze thick shells for applied pressures.
6.	Environmental Sciences and Sustainability	CO1	To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
		CO2	To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
		CO3	To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
		CO4	To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
		CO5	To demonstrate the knowledge of sustainability practices and identify green materials
		CO6	To demonstrate the knowledge of sustainability energy cycles and the role of sustainable urbanization.

7.	Strength of Materials and Fluid Mechanics and Machinery Laboratory	CO1	Determine the tensile and torsion of metals by testing
		CO2	Determine the hardness properties of metals by testing
		CO3	Determine the stiffness properties of helical and carriage spring
		CO4	Apply the conservation laws to determine the coefficient of discharge of a venturimeter and finding the friction factor of given pipe
		CO5	Apply the fluid static and momentum principles to determine the metacentric height and forces due to impact of jet
		CO6	Determine the performance characteristics of turbine, rotodynamic pump and positive displacement pump.
8.	Thermal Engineering Laboratory	CO1	Describe valve timing and port timing diagram
		CO2	Acquire the various p-v diagrams of IC engines
		CO3	Conduct tests to evaluate performance characteristics of IC engines
		CO4	Demonstrate the flash and fire point of various fuels and lubricants
		CO5	Conduct tests to evaluate the performance of refrigeration cycle and reciprocating air compressor.
		CO6	Conduct tests to evaluate Performance and Energy Balance on a Steam Generator.



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III YEAR

ODD SEM (5 Theory + 1 Labs)

1.	Design of Machine Elements	CO1	Explain the design machine members subjected to static and variable loads.
		CO2	Apply the concepts design to shafts, key and couplings.
		CO3	Apply the concepts of design to bolted, Knuckle, Cotter, riveted and welded joints.
		CO4	Apply the concept of design helical, leaf springs, flywheels, connecting rods and crank shafts.
		CO5	Apply the concepts of design and select sliding contact bearings.
		CO6	Apply the concepts of design and select rolling contact bearings, seals and gaskets
2.	Metrology and Measurements	CO1	Discuss the concepts of measurements to apply in various metrological instruments.
		CO2	Apply the principle and applications of linear and angular measuring instruments, assembly and transmission elements.
		CO3	Apply the tolerance symbols and tolerance analysis for industrial applications.
		CO4	Apply the principles and methods of form and surface metrology.
		CO5	Apply the advances in measurements for quality control in manufacturing Industries.
		CO6	Apply the advances in quality control in manufacturing Industries.
3.	Additive Manufacturing	CO1	Recognize the development of AM technology and how AM technology propagated into various businesses and developing opportunities.
		CO2	Acquire knowledge on process of transforming a concept into

			the final product in AM technology.
		CO3	Elaborate the vat polymerization and direct energy deposition processes and its applications.
		CO4	Acquire knowledge on process and applications of powder bed fusion and material extrusion.
		CO5	Evaluate the advantages, limitations, applications of binder jetting and material jetting.
		CO6	Evaluate the advantages, limitations, applications of sheet lamination processes.
4.	Digital Manufacturing and IoT	CO1	Impart knowledge to use various elements in the digital manufacturing.
		CO2	Differentiate the concepts involved in digital product development life cycle process and supply chain management in digital environment
		CO3	Select the proper procedure of validating practical work through digital validation in Factories.
		CO4	Implementation the concepts of IoT and its role in digital manufacturing
		CO5	Apply the basic concepts, features and implementation of practical manufacturing process through digital twin
		CO6	Analyze and optimize various practical manufacturing process through digital twin.
5.	CAD and CAE	CO1	Discuss the fundamental concepts of computer graphics and its tools in a generic framework.
		CO2	Create and manipulate geometric models using curves, surfaces and solids.
		CO3	Discuss concept of 3D modeling , visual realism and standard CAD practices in engineering design.
		CO4	Develop the mathematical models for one dimensional finite element problems and their numerical solutions.
		CO5	Formulate solution techniques to solve non-linear problems.
		CO6	Formulate solution techniques for geometric non-linearity and Introduction to Analysis Software.
6.	Metrology and Dynamics Laboratory	CO1	Calibrate the vernier, micrometer and slip gauges and setting up the comparator for the inspection
		CO2	Measure the gear tooth dimensions, angle using sine bar, thread parameters, form parameters and Surface Finish
		CO3	Examine the working of CMM, Toolmaker's microscope, Profile projector and Video measurement system.
		CO4	Explain gear parameters, kinematics of mechanisms, gyroscopic effect and working of lab equipments.

		CO5	Determine mass moment of inertia of mechanical element, governor effort and range of sensitivity.
		CO6	Determine the natural frequency and damping coefficient, critical speeds of shafts



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III YEAR

EVEN SEM (6 Theory + 2 Labs)

1.	Heat and Mass Transfer	CO1	Apply heat conduction equations to different surface configurations under steady state and transient conditions and solve problems.
		CO2	Apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems.
		CO3	Explain the phenomena of boiling and condensation, apply LMTD and NTU methods of thermal analysis to different types of heat exchanger configurations and solve problems
		CO4	Explain basic laws for Radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems.
		CO5	Apply diffusive and convective mass transfer equations for different applications.
		CO6	Apply Heat and Mass Transfer Analogy and Convective Mass Transfer Correlations.
2.	Automotive Materials, Components, Design and Testing	CO1	Discuss the requirements of engine components and select suitable materials.
		CO2	Apply the concept of design to cylinder and piston components and solve problems.
		CO3	Apply the concept of design to Connecting rod and crank shaft and solve problems.
		CO4	Apply the concept of design to flywheel and valve train and solve problems.
		CO5	Discuss engine test cycles, dynamometer.
		CO6	Discuss emission measurement technologies and instruments.
3.	Modern Robotics	CO1	Discuss the definition, history of robotics and robot anatomy

		CO2	Develop the simulation of robot kinematics
		CO3	Describe the grasping and manipulation of robots.
		CO4	Explain about mobile robot and manipulation.
		CO5	Discuss the applications of industrial, service, domestic robots.
		CO6	Discuss the Role of robots in inspection, assembly, material handling.
4.	Industrial Layout Design and Safety	CO1	Explain the industrial facility layout design principles, process and material flow analysis and product and equipment analysis.
		CO2	Discuss the facilities layout design algorithms and selecting appropriate software.
		CO3	Describe the facilities layout problem modeling tools and algorithms for production, warehouse, and material handling.
		CO4	Explain the safety planning and management principles in industries.
		CO5	Illustrate the various safety management approaches in industries-Safeguarding against Common Potential Hazards
		CO6	Illustrate the various safety management approaches in industries-Safe Handling and Storage
5.	Advanced Internal Combustion Engineering	CO1	Explain the working of Gasoline fuel injection systems and SI combustion.
		CO2	Explain the working of Diesel fuel injection systems and CI combustion
		CO3	Identify the source and measure it; explain the mechanism of emission formation and control methods
		CO4	Select alternative fuel resources and its utilization techniques in IC engines
		CO5	Explain advanced combustion modes
		CO6	Explain future power train systems
6.	Well-Being with traditional practices-Yoga, Ayurveda and Siddha	CO1	Learn the importance of different components of health.
		CO2	Understand the importance of diet.
		CO3	Learn the role of Ayurveda & siddha systems.
		CO4	understand the importance mental wellness.
		CO5	Gain confidence to lead a healthy life.
		CO6	Workouts in maintaining health, Learn new techniques to prevention of health disorders.
7.	C.A.D. / C.A.M. Laboratory	CO1	Design experience in handling 2D drafting and 3D modelling software systems
		CO2	Design 3-Dimensional geometric model of parts, sub-assemblies, assemblies and export it to drawing

		CO3	Demonstrate manual part programming with G and M codes using CAM.
		CO4	Simulate the tool path program by using simulation software with suitable codes.
		CO5	Produce various components using CNC lathe, milling machines by using the suitable codes
		CO6	Demonstrate the modelling software and CNC incorporated manufacturing of various components
8.	Heat Transfer Laboratory	CO1	Conduct experiment on Predict the thermal conductivity of solids and liquids
		CO2	Conduct experiment on Estimate the heat transfer coefficient values of various fluids
		CO3	Conduct experiment on Test the performance of tubes in tube heat exchangers
		CO4	Conduct tests on radiative heat transfer apparatus and evaluate Stefan Boltzmann constant and emissivity.
		CO5	Conduct tests on natural and forced convective heat transfer apparatus and evaluate heat transfer coefficient.
		CO6	Determine the emissivity of a grey surface and Calibration of thermocouples/RTD



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Course Outcomes (COs)

IV YEAR

ODD SEM (7 Theory + 1 Labs)

1.	Mechatronics and IoT	CO1	Explain select suitable sensors and actuators to develop mechatronics systems.
		CO2	Discuss devise proper signal conditioning circuit for mechatronics systems, and also able to implement plc as a controller for an automated system.
		CO3	Elucidate the fundamentals of iot and embedded systems.
		CO4	Discuss control i/o devices through Arduino and raspberry pi.
		CO5	Design and develop an apt mechatronics.
		CO6	Iot based system for the given real-time application.
2.	Computer Integrated Manufacturing	CO1	Discuss the basics of computer aided engineering.
		CO2	Choose appropriate automotive tools and material handling systems.
		CO3	Discuss the overview of group technology, FMS and automation identification methods.
		CO4	Design using computer aided process planning for manufacturing of various components.
		CO5	Acquire knowledge in computer process control.
		CO6	Acquire knowledge in data analysis.
3.	Human Values and Ethics	CO1	Identify the importance of democratic, secular and scientific values in harmonious functioning of social life
		CO2	Practice democratic and secular values in both their personal and professional life.
		CO3	Practice scientific values in both their personal and professional life.
		CO4	Behave in an ethical manner in society

		CO5	Practice critical thinking and the pursuit of truth.
		CO6	Practice scientific ethics and avoiding unfair application of scientific inventions.
4.	Industrial Management	CO1	Discuss basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
		CO2	Discuss the planning; organizing and staffing functions of management in professional organization.
		CO3	Apply the leading; controlling and decision making functions of management in professional organization.
		CO4	Discuss the organizational theory in professional organization.
		CO5	Apply principles of productivity in management in professional organization.
		CO6	Apply principles of modern concepts in management in professional organization.
5.	IoT Concepts and Applications	CO1	Explain the concept of IoT.
		CO2	Understand the communication models and various protocols for IoT.
		CO3	Design portable IoT using Arduino/Raspberry Pi /open platform
		CO4	Apply data analytics and use cloud offerings related to IoT.
		CO5	Analyze applications of iot in real time scenario.
		CO6	Analyze Environment monitoring and surveillance
6.	Introduction to Non-destructive Testing	CO1	Realize the importance of NDT in various engineering fields.
		CO2	Have a basic knowledge of surface NDE techniques which enables to carry out various inspection in accordance with the established procedures
		CO3	Calibrate the instrument and inspect for in-service damage in the components by means of Eddy current testing as well as Thermography testing
		CO4	Differentiate various techniques of UT and AET and select appropriate NDT methods for better evaluation.
		CO5	Interpret the results of Radiography testing .
		CO6	The ability to analyse the influence of various parameters on the testing.
7.	Production Planning and Control	CO1	The students can able to prepare production planning and control activities
		CO2	Acquire knowledge about the work study.
		CO3	The students can able to prepare product planning

		CO4	The students can able to prepare production scheduling
		CO5	The students can able to prepare Inventory Control.
		CO6	They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).
8.	Mechatronics and IoT Laboratory	CO1	Demonstrate the functioning of mechatronics system with various pneumatic, hydraulic and electrical systems.
		CO2	Demonstrate the microcontroller and PLC as controllers in automation systems by executing proper interfacing of I/O devices and programming
		CO3	Gain knowledge of utilizing PLC software and its applications
		CO4	Acquire knowledge of image processing technique
		CO5	Demonstrate the sensing of mechatronics elements using IoT.
		CO6	Demonstrate the actuation of mechatronics elements using IoT.



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IV YEAR

EVEN SEM

1.	Project Work	CO1	Acquire the skill to form and work as a team to complete the project in a time duration
		CO2	Identify and assess the specific problem by performing the literature review
		CO3	Generate different possible solution by formulating proper methodology and select a suitable solution
		CO4	Acquire skills to present the work in a periodic manner over a period of time
		CO5	Compile all the work performed and generate the report for the project
		CO6	Acquire the knowledge of completing and compiling the project along with the importance of team work