SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Approved by AICTE, New Delhi / Affiliated to Anna University, Chennai / Accredited by NAAC)
(Accredited by NBA – ECE, EEE & MECH UG Programs)
Dindigul – Palani Highway, Dindigul 624 002

CRITERIA – 2 TEACHING - LEARNING AND EVALUATION

2.6 Students Performance and Learning Outcome

2.6.2 Attainment of POs and COs are evaluated.

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1. Programme Outcomes (POs) for all Programmes

PO	GRADUATE ATTRIBUTE
1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6	**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.
7	**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.
8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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2. Programme Specific Outcomes (PSOs) of Mechanical Engineering

PROGRAMME SPECIFIC OUTCOMES (PSOs)

On successful completion of the Mechanical Engineering Degree programme, the Graduates shall exhibit the following:

1.Research oriented: Comprehend journal literature, do research on new mechanical engineering problems and publish the results through patents, journals, conferences and symposium.

2. Industry oriented: Realize professional experience through industry-interaction activities, internships, and in-plant training.

3. Start-up & Entrepreneur oriented: Recognize and implement new ideas on new product design and development with the help of modern engineering tools, while ensuring the best manufacturing practices.

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3. Course Outcomes (Cos) of the Mechanical Engineering

Anna University Regulations 2017

First Year Courses (I & II Semester)

Course Outcomes (COs)

C101	HS8151	COMMUNICATIVE ENGLISH

Course Outcomes (Cos)

C101.1	Students will be able to read articles of a general kind in magazines and newspapers.
C101.2	Students will be able to participate effectively in informal conversations; introduce themselves and their friends and express opinions in English
C101.3	Students will be able to comprehend conversations and short talks delivered in English
C101.4	Students will be able to listen to dialogues and conversations and to complete exercises based on them.
C101.5	Students will be able to write short essays of a general kind and personal letters and emails in English.

C102	MA8151	ENGINEERING MATHEMATICS – I

Course Outcomes (Cos)

C102.1	Students will be able to use both the limit definition and rules of differentiation to differentiate functions and Apply differentiation to solve maxima and minima problems.
C102.2	Students will be able to evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus
C102.3	Students will be able to evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts and Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
C102.4	Students will be able to determine convergence/divergence of improper integrals and evaluate convergent improper integrals
C102.5	Students will be able to apply various techniques in solving differential equations.

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C103	PH8151	ENGINEERING PHYSICS

Course Outcomes (Cos)

C103.1	The students will gain knowledge on the basics of properties of matter and its applications,
C103.2	The students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
C103.3	The students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
C103.4	The students will get knowledge on advanced physics concepts of quantum theory and its applications in tunnelling microscopes
C103.5	The students will understand the basics of crystals, their structures and different crystal growth techniques.

C104	CY8151	ENGINEERING CHEMISTRY

Course Outcomes (Cos)

C104.1	To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
C104.2	To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
C104.3	To know the Preparation, properties and applications of engineering materials.
C104.4	To know the types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
C104.5	To apply the Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

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C105	GE8151	PROBLEM SOLVING AND PYTHON PROGRAMMING

Course Outcomes (Cos)

C105.1	Students will be able to develop algorithmic solutions to simple computational problems
C105.2	Students will be able to read, write, execute by hand simple python programs
C105.3	Students will be able to decompose a python program into functions
C105.4	Students will be able to represent compound data using python lists, tuples, dictionaries.
C105.5	Students will be able to read and write data from/to files in python programs.

C106	GE8152	ENGINEERING GRAPHICS

Course Outcomes (Cos)

C106.1	Students will be able to familiarize with the fundamentals and standards of engineering graphics
C106.2	Students will be able to perform freehand sketching of basic geometrical constructions and multiple views of objects.
C106.3	Students will be able to project orthographic projections of lines and plane surfaces.
C106.4	Students will be able to draw projections and solids and development of surfaces.
C106.5	Students will be able to visualize and to project isometric and perspective sections of simple solids.

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C107	GE8161	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

Course Outcomes (Cos)

C107.1	Students will be able to write, test, and debug simple python programs.
C107.2	Students will be able to implement python programs with conditionals and loops.
C107.3	Students will be able to develop python programs stepwise by defining functions and calling them.
C107.4	Students will be able to use python lists, tuples, dictionaries for representing compound data.
C107.5	Students will be able to read and write data from/to files in python.

C108	BS8161	PHYSICS AND CHEMISTRY LABORATORY

Course Outcomes (Cos)

C108.1	Apply principles of elasticity, optics and thermal properties for engineering applications
C108.2	Analyze young's modulus, rigidity modulus, wavelength of different colors and particle size of minute particles
C108.3	Construct the circuits, assemble the apparatus, tabulate the readings and calculate the answers using appropriate formulae.
C108.4	Compare and conclude the calculated values with the standard values and justify their

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C109	HS8251	TECHNICAL ENGLISH

Course Outcomes (Cos)

C109.1	Students will be able to read technical texts and write area- specific texts effortlessly.
C109.2	Students will be able to listen and comprehend lectures and talks in their area of specialisation successfully.
C109.3	Students will be able to speak appropriately and effectively in varied formal and informal contexts.
C109.4	Students will be able to write reports and winning job applications.
C109.5	Students will be able to participate effectively in public speaking and group discussion.

C110	MA8251	ENGINEERING MATHEMATICS – II

Course Outcomes (Cos)

C110.1	Students will have good understanding of eigen values and eigenvectors, diagonalization of a matrix, symmetric matrices, positive definite matrices and similar matrices.
C110.2	Students will have good understanding of gradient, divergence and curl of a vector point function and related identities.
C110.3	Students will have good understanding of evaluation of line, surface and volume integrals using gauss, stokes and green's theorems and their verification.
C110.4	Students will have good understanding of analytic functions, conformal mapping and complex integration.
C110.5	Students will have good understanding of laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients

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C111	PH8251	MATERIALS SCIENCE

Course Outcomes (Cos)

C111.1	The students will have knowledge on the various phase diagrams and their applications
C111.2	The students will acquire knowledge on Fe-Fe3C phase diagram, various microstructures and alloys
C111.3	The students will get knowledge on mechanical properties of materials and their measurement
C111.4	The students will gain knowledge on magnetic, dielectric and superconducting properties of materials
C111.5	The students will understand the basics of ceramics, composites and nanomaterials.

C112	BE8253	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING

Course Outcomes (Cos)

C112.1	Students will be able to understand electric circuits.
C112.2	Students will be able to determine the regulation and efficiency of transformers.
C112.3	Students will be able to describe the construction and working principle of electrical machines.
C112.4	Students will be able to understand the concepts of various electronic devices.
C112.5	Students will be able to choose appropriate instruments for electrical measurement for a specific application

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C113	GE8291	ENVIRONMENTAL SCIENCE AND ENGINEERING

Course Outcomes (Cos)

C113.1	Define Environment, ecosystem and biodiversity, classify types of ecosystems and outline the impacts to biodiversity.
C113.2	Define pollution, classify its types, analyze the causes and suggest control measures for Pollution.
C113.3	Outline various natural resources; explain causes and impacts of destruction of resources.
C113.4	List various social issues related to land, water and energy; summarize the concerning government acts and rules to overcome these problems.
C113.5	Interpret population explosion and variation among nations, show the impacts of over population and illustrate the methods to mitigate the same.

C114	GE8292	ENGINEERING MECHANICS

Course Outcomes (Cos)

C114.1	Students will be able to illustrate the vectorial and scalar representation of forces and moments
C114.2	Students will be able to analyse the rigid body in equilibrium
C114.3	Students will be able to evaluate the properties of surfaces and solids
C114.4	Students will be able to calculate dynamic forces exerted in rigid body
C114.5	Students will be able to determine the friction and the effects by the laws of friction

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C115	GE8261	ENGINEERING PRACTICES LABORATORY

Course Outcomes (Cos)

C115.1	Students will be able to fabricate welding equipment's to join the structures and also carpentry components and pipe connections including plumbing works.
C115.2	Students will be able to carry out the basic machining operations and able to make the models using sheet metal works.
C115.3	Students will be able to illustrate on centrifugal pump, air conditioner, operations of smithy, foundary and fittings.
C115.4	Students will be able to carry out basic home electrical works and appliances and able to measure the electrical quantities.
C115.5	Students will be able to elaborate on the components, gates, soldering practices.

C116	BE8261	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY

Course Outcomes (Cos)

C116.1	Students will be able to determine the speed characteristic of different electrical machines
C116.2	Students will be able to design simple circuits involving diodes and transistors
C116.3	Students will be able to use operational amplifiers

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Department of Mechanical Engineering
Anna University Regulations 2017
Second Year Courses (III & IV Semester)
Course Outcomes (COs)

C201	MA8353	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

Course Outcomes (Cos)

C201.1	Students will be able to understand how to solve the given standard partial differential equations.
C201.2	Students will be able to solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
C201.3	Students will be able to appreciate the physical significance of Fourier series techniques in solving one- and two-dimensional heat flow problems and one-dimensional wave equations.
C201.4	Students will be able to 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.
C201.5	Students will be able to use the effective mathematical tools for the solutions of partial differential equations by using z transform techniques for discrete time systems.

C202	ME8391	ENGINEERING THERMODYNAMICS

Course Outcomes (Cos)

C202.1	Students will be able to apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions.
C202.2	Students will be able to apply second law of thermodynamics to open and closed systems and calculate entropy and availability.
C202.3	Students will be able to apply Rankine cycle to steam power plant and compare few cycle improvement methods.
C202.4	Students will be able to derive simple thermodynamic relations of ideal and real gases.

C202.5	Students will be able to calculate the properties of gas mixtures and moist air and its use in psychometric processes

C203	CE8394	FLUID MECHANICS AND MACHINERY

Course Outcomes (Cos)

C203.1	Students will be able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
C203.2	Students can analyze and calculate major and minor losses associated with pipe flow in piping networks.
C203.3	Students Can mathematically predict the nature of physical quantities.
C203.4	Students Can critically analyze the performance of pumps.
C203.5	Students Can critically analyze the performance of turbines.

C204	ME8351	MANUFACTURING TECHNOLOGY – I

Course Outcomes (Cos)

C204.1	Students will be able to explain different metal casting processes, associated defects, merits and demerits
C204.2	Students will be able to compare different metal joining processes.
C204.3	Students will be able to summarize various hot working and cold working methods of metals.
C204.4	Students will be able to explain various sheet metal making processes.
C204.5	Students will be able to distinguish various methods of manufacturing plastic components.

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C205	EE8353	ELECTRICAL DRIVES AND CONTROLS

Course Outcomes (Cos)

C205.1	Select the appropriate power rating of the motors based on the duty cycle and thermal loading.
C205.2	Choose a motor to match the speed-torque characteristics of the mechanical load system and apply electrical braking.
C205.3	Identify the suitable starter for starting of DC and Induction motors based on the power rating.
C205.4	Compute the parameters for controlling the speed of DC motor by both conventional and solid state methods.
C205.5	Select the suitable speed control technique by conventional and solid state control for three phase induction motors

C206	ME8361	MANUFACTURING TECHNOLOGY LABORATORY – I

Course Outcomes (Cos)

C206.1	Students will be able to demonstrate the safety precautions exercised in the mechanical workshop.
C206.2	Students will be able to make the workpiece as per given shape and size using lathe.
C206.3	Students will be able to join two metals using arc welding.
C206.4	Students will be able to use sheet metal fabrication tools and make simple tray and funnel.
C206.5	Students will be able to use different moulding tools, patterns and prepare sand moulds.

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C207	ME8381	COMPUTER AIDED MACHINE DRAWING

Course Outcomes (Cos)

C207.1	Students will be able to follow the drawing standards, Fits and Tolerances
C207.2	Students will be able to understand and interpret drawings of machine components.
C207.3	Students will be able to Re-create part drawings, sectional views and assembly drawings as per standards.
C207.4	Students will be able to handle 2D drafting and 3D modeling software systems.

C208	EE8361	ELECTRICAL ENGINEERING LABORATORY

Course Outcomes (Cos)

C208.1	Demonstrate the working of electric machines and measure the electrical parameters.
C208.2	Compute the performance parameters of DC motors, AC motors, synchronous motor and transformer at various loading conditions.
C208.3	Infer the internal and external characteristics of shunt and series generator for various loading conditions
C208.4	Analyze the starting and speed control methods for DC and AC motors.

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C209	HS8381	INTERPERSONAL SKILLS/LISTENING & SPEAKING

Course Outcomes (Cos)

C209.1	Students will be able to listen and respond appropriately
C209.2	Students will be able to listen and respond appropriately
C209.3	Students will be able to make effective presentations
C209.4	Students will be able to participate confidently and appropriately in conversations both formal and informal

C210	MA8452	STATISTICS AND NUMERICAL METHODS

Course Outcomes (Cos)

C210.1	Students will be able to apply the concept of testing of hypothesis for small and large samples in real life problems.
C210.2	Students will be able to apply the basic concepts of classifications of design of experiments in the field of agriculture.
C210.3	Students will be able to appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
C210.4	Students will be able to understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
C210.5	Students will be able to solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

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C211	ME8492	KINEMATICS OF MACHINERY

Course Outcomes (Cos)

C211.1	Students will be able to discuss the basics of mechanism
C211.2	Students will be able to calculate velocity and acceleration in simple mechanisms
C211.3	Students will be able to develop cam profiles
C211.4	Students will be able to solve problems on gears and gear trains
C211.5	Students will be able to examine friction in machine elements

C212	ME8451	MANUFACTURING TECHNOLOGY – II

Course Outcomes (Cos)

C212.1	Students will be able to explain the mechanism of material removal processes.
C212.2	Students will be able to describe the constructional and operational features of center lathe and other special purpose lathes.
C212.3	Students will be able to describe the constructional and operational features of shaper, planner, milling, drilling, sawing and broaching machines.
C212.4	Students will be able to explain the types of grinding and other super finishing processes apart from gear manufacturing processes.
C212.5	Students will be able to summarize numerical control of machine tools and write a part program.

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C213	ME8491	ENGINEERING METALLURGY

Course Outcomes (Cos)

C213.1	Students will be able to explain alloys and phase diagram, iron-iron carbon diagram and steel classification.
C213.2	Students will be able to explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
C213.3	Students will be able to clarify the effect of alloying elements on ferrous and non-ferrous metals.
C213.4	Students will be able to summarize the properties and applications of non metallic materials.
C213.5	Students will be able to explain the testing of mechanical properties. .

C214	CE8395	STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS

Course Outcomes (Cos)

C214.1	Students will be able to understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes
C214.2	Students will be able to understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
C214.3	Students will be able to apply basic equation of simple torsion in designing of shafts and helical spring.
C214.4	Students will be able to calculate the slope and deflection in beams using different methods.
C214.5	Students will be able to analyze and design thin and thick shells for the applied internal and external pressures.

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C215	ME8493	THERMAL ENGINEERING - I

Course Outcomes (Cos)

C215.1	Students will be able to apply thermodynamic concepts to different air standard cycles and solve problems.
C215.2	Students will be able to solve problems in single stage and multistage air compressors.
C215.3	Students will be able to explain the functioning and features of IC engines, components and auxiliaries.
C215.4	Students will be able to calculate performance parameters of IC engines.
C215.5	Students will be able to explain the flow in gas turbines and solve problems.

C216	ME8462	MANUFACTURING TECHNOLOGY LABORATORY – II

Course Outcomes (Cos)

C216.1	Students will be able to use different machine tools to manufacturing gears.
C216.2	Students will be able to use different machine tools for finishing operations
C216.3	Students will be able to manufacture tools using cutter grinder
C216.4	Students will be able to measure cutting forces milling and Turning process.
C216.5	Students will be able to develop cnc part programming.

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C217	CE8381	STRENGTH OF MATERIALS AND FLUID MECHANICS AND MACHINERY LABORATORY

Course Outcomes (Cos)

C217.1	Compute the surface hardness and impact strength of the given material.
C217.2	Calculate the stresses induced in material due to tension, torsion and compression experimentally and interpret the values.
C217.3	Estimate the parameters like coefficient of discharge, error percentage in flow meters and compute the friction factor for different types of pipes.
C217.4	Calculate the performance parameters of different types of pumps and hydraulic turbines and plot the characteristic curves.

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C218	HS8461	ADVANCED READING AND WRITING

Course Outcomes (Cos)

C218.1	Students will be able to write different types of essays.
C218.2	Students will be able to write winning job applications.
C218.3	Students will be able to read and evaluate texts critically.
C218.4	Students will be able to display critical thinking in various professional contexts.

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Department of Mechanical Engineering
Anna University Regulations 2017
Third Year Courses (V & VI Semester)
Course Outcomes (COs)

C301	ME8595	THERMAL ENGINEERING – II

Course Outcomes (Cos)

C301.1	Students will be able to solve problems in Steam Nozzle
C301.2	Students will be able to explain the functioning and features of different types of Boilers and auxiliaries and calculate performance parameters.
C301.3	Students will be able to explain the flow in steam turbines, draw velocity diagrams for steam turbines and solve problems.
C301.4	Students will be able to summarize the concept of Cogeneration, Working features of Heat pumps and Heat Exchangers.
C301.5	Students will be able to solve problems using refrigerant table / charts and psychrometric charts

C302	ME8593	DESIGN OF MACHINE ELEMENTS

Course Outcomes (Cos)

C302.1	Students will be able to explain the influence of steady and variable stresses in machine component design.
C302.2	Students will be able to apply the concepts of design to shafts, keys and couplings.
C302.3	Students will be able to apply the concepts of design to temporary and permanent joints.
C302.4	Students will be able to apply the concepts of design to energy absorbing members, connecting rod and crank shaft.
C302.5	Apply the concepts of design to bearings.

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C303	ME8501	METROLOGY AND MEASUREMENTS

Course Outcomes (Cos)

C303.1	Students will be able to describe the concepts of measurements to apply in various metrological instruments.
C303.2	Students will be able to outline the principles of linear and angular measurement tools used for industrial applications.
C303.3	Students will be able to explain the procedure for conducting computer aided inspection.
C303.4	Students will be able to demonstrate the techniques of form measurement used for industrial components.
C303.5	Students will be able to discuss various measuring techniques of mechanical properties in industrial applications.

C304	ME8594	DYNAMICS OF MACHINES

Course Outcomes (Cos)

C304.1	Students will be able to calculate static and dynamic forces of mechanisms. Compute the frequency of free vibration.
C304.2	Students will be able to calculate the balancing masses and their locations of reciprocating and rotating masses.
C304.3	Students will be able to compute the frequency of forced vibration and damping coefficient.
C304.4	Students will be able to demonstrate the techniques of form measurement used for industrial components.
C304.5	Students will be able to calculate the speed and lift of the governor and estimate the gyroscopic effect on automobiles, ships and airplanes.

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C305 (OE I – 11)	OIM552	LEAN MANUFACTURING

Course Outcomes (Cos)

C305.1	Students will be able to gain knowledge about basic elements of lean manufacturing and its tools.
C305.2	Students will be able to gain knowledge on principles of various lean manufacturing tools.
C305.3	Students will be able to gain knowledge on various procedures, approaches and concepts of quality management.
C305.4	Students will be able to demonstrate the techniques of form measurement used for industrial components. understand the concepts of six sigma.
C305.5	Students will be able to analyze and evaluate the implementation of lean manufacturing concepts.

C306	ME8511	KINEMATICS AND DYNAMICS LABORATORY

Course Outcomes (Cos)

C306.1	Explain gear parameters, kinematics of mechanisms, gyroscopic effect and working of lab equipment's.
C306.2	Determine mass moment of inertia of mechanical element, governor effort and range sensitivity, natural frequency and damping coefficient, torsional frequency, critical speeds of shafts, balancing mass of rotating and reciprocating masses, and transmissibility ratio.

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C307	ME8512	THERMAL ENGINEERING LABORATORY

Course Outcomes (Cos)

C307.1	Students will be able to conduct tests on heat conduction apparatus and evaluate thermal conductivity of materials.
C307.2	Students will be able to conduct tests on natural and forced convective heat transfer apparatus and evaluate heat transfer coefficient.
C307.3	Students will be able to conduct tests on radiative heat transfer apparatus and evaluate Stefan Boltzmann constant and emissivity.
C307.4	Students will be able to conduct tests to evaluate the performance of parallel/counter flow heat exchanger apparatus and reciprocating air compressor.
C307.5	Students will be able to conduct tests to evaluate the performance of refrigeration and air conditioning test rigs

C308	ME8513	METROLOGY AND MEASUREMENTS LABORATORY

Course Outcomes (Cos)

C308.1	Measure the gear tooth dimensions, angle using sine bar, straightness and flatness, thread parameters, temperature using thermocouple, force, displacement, torque and vibration.
C308.2	Calibrate the vernier, micrometer and slip gauges and setting up the comparator for the inspection.

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C309	ME8651	DESIGN OF TRANSMISSION SYSTEMS

Course Outcomes (Cos)

C309.1	Students will be able to apply the concepts of design to belts, chains and rope drives.
C309.2	Students will be able to apply the concepts of design to spur, helical gears.
C309.3	Students will be able to apply the concepts of design to worm and bevel gears.
C309.4	Students will be able to calibrate the Vernier, micrometer and slip gauges.
C309.5	Students will be able to apply the concepts of design to cams, brakes and clutches.

C310	ME8691	COMPUTER AIDED DESIGN AND MANUFACTURING

Course Outcomes (Cos)

C310.1	Students will be able to explain the 2D and 3D transformations, clipping algorithm, Manufacturing models and Metrics
C310.2	Students will be able to explain the fundamentals of parametric curves, surfaces and Solids.
C310.3	Students will be able to summarize the different types of Standard systems used in CAD.
C310.4	Students will be able to apply NC & CNC programming concepts to develop part Programme for Lathe & Milling Machines.
C310.5	Students will be able to summarize the different types of techniques used in Cellular Manufacturing and FMS.

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C311	ME8693	HEAT AND MASS TRANSFER

Course Outcomes (Cos)

C311.1	Students will be able to explain Apply heat conduction equations to different surface configurations under steady state and transient conditions and solve problem.
C311.2	Students will be able to apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems.
C311.3	Students will be able to 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.
C311.4	Students will be able to Explain basic laws for radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems.
C311.5	Students will be able to Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications.

C312	ME8692	FINITE ELEMENT ANALYSIS

Course Outcomes (Cos)

C312.1	Students will be able to summarize the basics of finite element formulation.
C312.2	Students will be able to apply finite element formulations to solve one dimensional Problems.
C312.3	Students will be able to apply finite element formulations to solve two dimensional scalar Problems.
C312.4	Students will be able to apply finite element method to solve two-dimensional Vector problems.
C312.5	Students will be able to apply finite element method to solve problems on iso parametric element and dynamic Problems.

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C313	ME8694	HYDRAULICS AND PNEUMATICS

Course Outcomes (Cos)

C313.1	Students will be able to explain the fluid power and operation of different types of pumps.
C313.2	Students will be able to summarize the features and functions of hydraulic motors, actuators and flow control valves
C313.3	Students will be able to explain the different types of hydraulic circuits and systems
C313.4	Students will be able to explain the working of different pneumatic circuits and systems
C313.5	Students will be able to summarize the various trouble shooting methods and applications of hydraulic and pneumatic systems.

C314 (PE I- 2)	PR8592	WELDING TECHNOLOGY

Course Outcomes (Cos)

C314.1	Students will be able to understand the construction and working principles of gas and arc welding process.
C314.2	Students will be able to understand the construction and working principles of resistance welding process.
C314.3	Students will be able to understand the construction and working principles of various solid state welding process.
C314.4	Students will be able to understand the construction and working principles of various special welding processes.
C314.5	Students will be able to understand the concepts on weld joint design, weldability and testing of weldments.

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C315	ME8681	CAD / CAM LABORATORY

Course Outcomes (Cos)

C315.1	Draw 3D and Assembly drawing using CAD software.
C315.2	Demonstrate manual part programming with G and M codes using CAM,

C316	ME8681	DESIGN AND FABRICATION PROJECT

Course Outcomes (Cos)

C316.1	Use design principles and develop conceptual and engineering design of component/system.
C316.2	Fabricate components using appropriate manufacturing processes and assemble as a system.
C316.3	Test the system for the required outcomes using relevant standards.

C317	HS8581	PROFESSIONAL COMMUNICATION

Course Outcomes (Cos)

C317.1	Students will be able to make effective presentations.
C317.2	Students will be able to participate confidently in group discussions.
C317.3	Students will be able to attend job interviews and be successful in them.
C317.4	Students will be able to develop adequate soft skills required for the workplace.

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Department of Mechanical Engineering
Anna University Regulations 2017
Final Year Courses (VII & VIII Semester)
Course Outcomes (COs)

C401	ME8792	POWER PLANT ENGINEERING

Course Outcomes (Cos)

C401.1	Students will be able to explain the layout, construction and working of the components inside a thermal power plant.
C401.2	Students will be able to explain the layout, construction and working of the components inside a diesel, gas and combined cycle power plants.
C401.3	Students will be able to explain the layout, construction and working of the components inside nuclear power plants.
C401.4	Students will be able to explain the layout, construction and working of the components inside renewable energy power plants.
C401.5	Students will be able to explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

C402	ME8793	PROCESS PLANNING AND COST ESTIMATION

Course Outcomes (Cos)

C402.1	Students will be able to select the process, equipment and tools for various industrial products.
C402.2	Students will be able to prepare process planning activity chart.
C402.3	Students will be able to explain the concept of cost estimation.
C402.4	Students will be able to compute the job order cost for different type of shop floor.
C402.5	Students will be able to calculate the machining time for various machining operations.

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C403	ME8791	MECHATRONICS

Course Outcomes (Cos)

C403.1	Students will be able to discuss the interdisciplinary applications of electronics, electrical, mechanical and computer systems for the control of mechanical, electronic systems and sensor technology.
C403.2	Students will be able to discuss the architecture of microprocessor and microcontroller, pin diagram, addressing modes of microprocessor and microcontroller.
C403.3	Students will be able to discuss programmable peripheral interface, architecture of 8255 ppi, and various device interfacing
C403.4	Students will be able to explain the architecture, programming and application of programmable logic controllers to problems and challenges in the areas of mechatronic engineering.
C403.5	Students will be able to discuss various Actuators and Mechatronics system using the knowledge and skills acquired through the course and also from the given case studies

C404	OML751	TESTING OF MATERIALS

Course Outcomes (Cos)

C404.1	Students will be able to acquire basic knowledge on material testing fundamentals, testing organizations, testing standards and procedures
C404.2	Students will be able to comprehend different types of destructive testing methods and its applications
C404.3	Students will be able to comprehend different types of basic non-destructive testing methods and its applications
C404.4	Students will be able to explicate various optical instruments used for material characterization
C404.5	Students will be able to comprehend various thermal and chemical testing techniques.

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C405 (PE II – 4)	ME8073	UNCONVENTIONAL MACHINING PROCESS

Course Outcomes (Cos)

C405.1	Students will be able to explain the need for unconventional machining processes and its classification
C405.2	Students will be able to compare various thermal energy and electrical energy based unconventional machining processes.
C405.3	Students will be able to summarize various chemical and electro-chemical energy based unconventional machining processes.
C405.4	Students will be able to explain various nano abrasives based unconventional machining processes.
C405.5	Students will be able to distinguish various recent trends based unconventional machining processes.

C405 (PE II – 7)	GE8077	TOTAL QUALITY MANAGEMENT

Course Outcomes (Cos)

C405.1	The student will be able to discuss the evolution of quality, contributions of management gurus and how to focus on customers.
C405.2	The student will be able to explain the various principles of total quality management.
C405.3	The student will be able to apply different TQM tools and techniques in the manufacturing processes.
C405.4	The student will be able to apply different TQM tools and techniques in the service processes.
C405.5	The student will be able to describe the quality and environmental management systems.

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C406 (PE III – 1)	ME8099	ROBOTICS

Course Outcomes (Cos)

C406.1	Students will be able to explain the concepts of industrial robots, classification, specifications and coordinate systems. also summarize the need and application of robots in different sectors.
C406.2	Students will be able to illustrate the different types of robot drive systems as well as robot end effectors.
C406.3	Students will be able to apply the different sensors and image processing techniques in robotics to improve the ability of robots.
C406.4	Students will be able to develop robotic programs for different tasks and familiarize with the kinematics motions of robot.
C406.5	Students will be able to examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots.

C406 (PE III – 4)	ME8097	NON-DESTRUCTIVE TESTING AND EVALUATION

Course Outcomes (Cos)

C406.1	Students will be able to explain the fundamental concepts of NDT
C406.2	Students will be able to discuss the different methods of NDT
C406.3	Students will be able to explain the concept of thermography and eddy current testing
C406.4	Students will be able to explain the concept of ultrasonic testing and acoustic emission
C406.5	Students will be able to explain the concept of radiography

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C407	ME8711	SIMULATION AND ANALYSIS LABORATORY

Course Outcomes (Cos)

C407.1	Students will be able to simulate the working principle of air conditioning system, hydraulic and pneumatic cylinder and cam follower mechanisms using MATLAB.
C407.2	Students will be able to analyse the stresses and strains induced in plates, brackets and beams and heat transfer problems.
C407.3	Students will be able to calculate the natural frequency and mode shape analysis of 2D components and beams.
C407.4	Students will be able to analyse the thermal stresses and heat transfer analysis of various plates.
C407.5	Students will be able to analyse harmonic, transient and spectrum analysis of simple systems.

C408	ME8781	MECHATRONICS LABORATORY

Course Outcomes (Cos)

C408.1	Program the microprocessor, microcontrollers and PLC for the given applications/
C408.2	Demonstrate the functioning of mechatronics system with various pneumatic, hydraulic and electrical systems.
C408.3	Demonstrate the working of different types of sensors and their applications.

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C409	ME8712	TECHNICAL SEMINAR

Course Outcomes (Cos)

C409.1	Demonstrate their communication skills and presentation skills on technical topics of interest.
C409.2	To prepare and present technical papers or recent advances in engineering/technology (recent advances in Mechanical Engineering).

C410	MG8591	PRINCIPLES OF MANAGEMENT

Course Outcomes (Cos)

C410.1	The student will be able to discuss the evolution of management, functions and roles of managers.
C410.2	The student will be able to explain the different types of planning process and tools used for planning.
C410.3	The student will be able to elaborate different organization structures and functions of human resources manager.
C410.4	The student will be able to illustrate the different theories of motivation and leadership.
C410.5	The student will be able to describe the control techniques and the role of technology in management.

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C411 (PE IV- 1)	IE8693	PRODUCTION PLANNING AND CONTROL

Course Outcomes (Cos)

C411.1	To understand the process, equipment, and tools for various industrial products
C411.2	To perform and prepare process planning activity chart
C411.3	To apply suitable method of selecting the concept of cost estimation.
C411.4	To make the cost estimate for and compute the job order cost for different type of shop floor.
C411.5	To evaluate the machining time for various machining operations.

C412	ME8811	PROJECT WORK

Course Outcomes (Cos)

C412.1	Identify and formulate Engineering problems by detailed literature survey.
C412.2	Apply knowledge gained through core engineering courses to analyze and solve problem.
C412.3	Provide suitable interpretations to solutions correlating with theoretical concepts and existing literature.

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4. CO-PO & PSO Mapping for the Mechanical Engineering

Semester I

Course Code | **Subject Code & Subject Name**

C101 | HS8151 Communicative English

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1									2	1		1				2
CO2									2	3		1				2
CO3									2	3		2				2
CO4									1	1		2				2
CO5									2	2		2				2
Avg.									1.8	2		1.6				

Course Code | **Subject Code & Subject Name**

C102 | MA8151 Engineering Mathematics – I

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1																2
CO2	3															2
CO3		2											1			2
CO4				2							1		1			2
CO5			3		1							1				2
Avg.	3	2	3	2	1						1	1	1			

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Course Code	Subject Code & Subject Name
C103	PH8151 Engineering Physics

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1																2
CO2	3	3	3													2
CO3		2	2	2												2
CO4	1	1	1		1				1	1						2
CO5		2	2		2				2	2		2				2
Avg.	2	2	2	2	1.5				1.5	1.5		2				

Course Code	Subject Code & Subject Name
C104	CY8151 Engineering Chemistry

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1																2
CO2	2				2	3	1									2
CO3		2				2	2					1				2
CO4			2			2	2					2				2
CO5				3	3	2	3					2				2
Avg.	2	2	2	3	2.5	2.25	2					1.67				

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Course Code C105

Subject Code & Subject Name

GE8151Problem Solving and Python Programming

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2	1							1		1	2	1		2
CO2	3	2	1							1		1	2	1		2
CO3	3	2	1							1		1	2	1		2
CO4	3	2	1							1		1	2	1		2
CO5	3	2	1							1		1	2	1		2
Avg.	3	2	1							1		1	2	1		

Course Code C106

Subject Code & Subject Name

GE8152 Engineering Graphics

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1		3	1	2		2					3		2	2	2	3
CO2		3	1	2		2								2	2	3
CO3		3	1	2		2							2	2	2	3
CO4		3	1	2		2					3		2	2	2	3
CO5		3	1	2		2					3			2	2	3
Avg.		3	1	2		2					3		2	2	2	

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Course Code	**Subject Code & Subject Name**
C107	GE8161 Problem Solving and Python Programming Laboratory

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2	1		3					1		1	2	1		3
CO2	3	2	1		3					1		1	2	1		3
CO3	3	2	1		3					1		1	2	1		3
CO4	3	2	1		3					1		1	2	1		3
CO5	3	2	1		3					1		1	2	1		3
Avg.	3	2	1		3					1		1	2	1		

Course Code	**Subject Code & Subject Name**
C108	BS8161Physics and Chemistry Laboratory

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3															3
CO2		3														3
CO3					3				3			3				3
CO4										3						3
Avg.	3	3			3				3	3		3				

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Semester II

Course Code	Subject Code & Subject Name
C109	HS8251 Technical English

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1									1	1		1				2
CO2									1	2		2				2
CO3									2	3		1				2
CO4									1	2		2				2
CO5									3	3		2				2
Avg.									1.6	2.2		1.6				

Course Code	Subject Code & Subject Name
C110	MA8251 Engineering Mathematics II

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2															2
CO2	2											1				2
CO3		1											2			2
CO4				2												2
CO5			3									2				2
Avg.	2	1	3	2								1	2			

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Course Code | **Subject Code & Subject Name**

C111 | PH8251 Materials Science

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	3	3	2	1						2	1	2			2
CO2	3	3	3	2	2				1		2	1				2
CO3	3	3	2			1					1	1				2
CO4	3	3	2	2	1						1					2
CO5	3	3	2		2				2	2		1				2
Avg.	3	3	2.4	2	1.5	1			1.5	2	1.5	1	2			

Course Code | **Subject Code & Subject Name**

C112 | BE8253 Basic Electrical, Electronics and Instrumentation Engineering

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2											1	2		2
CO2	3	2	2													2
CO3			2											2	2	2
CO4	3	2														2
CO5	3		2										1			2
Avg.	3	2	2										1	2	2	

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Course Code	Subject Code & Subject Name
C113	GE8291 Environmental Science and Engineering

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1																2
CO2	1				3	3	3					3				2
CO3		3				2	3					3				2
CO4			2			2	3	3				3				2
CO5				3	3	2	3	2				3				2
Avg.	1	3	2	3	3	2.25	3	2.5				3				

Course Code	Subject Code & Subject Name
C114	GE8292 Engineering Mechanics

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2	2	2	2	1							2	2			2
CO2	2	3	2	3									2			2
CO3	1	3	2	3							2	2	2	2		2
CO4	2	2	1	2								2	2	2		2
CO5	2	2	2	2	2						2	2	2			2
Avg.	1.8	2.4	1.8	2.4	1.5						2	2	2	2		

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Course Code **Subject Code & Subject Name**

C115 GE8261 Engineering Practices Laboratory

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3												3			3
CO2			3											3		3
CO3			3		2	2		2	3			2		3		3
CO4						2		2		3					3	3
CO5	3		3			2		2		3		2	3			3
Avg.	3		3		2	2		2	3	3		2	3	3	3	

Course Code **Subject Code & Subject Name**

C116 BE8261 Basic Electrical, Electronics and Instrumentation Engineering Laboratory

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2															3
CO2		2														3
CO3									3			2				3
Avg.	2	2							3			2				

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Semester III

Course Code C201

Subject Code & Subject Name MA8353 Transforms and Partial Differential Equations

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1																2
CO2	2										1		1			2
CO3		3				1										2
CO4				2								1	1			2
CO5			2								2					2
Avg.	2	3	2	2		1					1.5	1	1			

Course Code C202

Subject Code & Subject Name ME8391-Engineering Thermodynamics

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2											2	2		2
CO2		2			2								2	3		2
CO3			2		2								2	1		2
CO4	2			2									3	2		2
CO5			2	1	2								2	1		2
Avg.	2.5	2	2	1.5	2								2.2	1.8		

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Course Code C203

Subject Code & Subject Name CE8394-Fluid Mechanics and Machinery

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2	1										1	3	3	1	2
CO2	2	2											2	2		2
CO3	3	2	3											3		2
CO4		3	3	2	1											2
CO5		3	3	2	2	1	1				1		3	1		2
Avg.	2.33	2.20	3.00	2.00	1.50	1.00	1.00				1.00	1.00	2.67	2.25	1.00	

Course Code C204

Subject Code & Subject Name ME8351Manufacturing Technology I

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3		2			2	3	1	1			1		2		2
CO2	3		2			2	3	1	1			1		2		2
CO3	3		2			2	2	1	1			1		2		2
CO4	2		2			2	2	1	1					2		2
CO5	3		2			2	2	1	1			1		2		2
Avg.	2.8		2			2	2.4	1	1			1		2		

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Course Code	**Subject Code & Subject Name**
C205	EE8353-Electrical Drives and Controls

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	**CO Target Level**
CO1	3	2	2	3												2
CO2	2	3	3	2			2	1								2
CO3	3	2		1	2	1							1	1		2
CO4	3	2	3	1		2		1						3		2
CO5	3	3	2		1		2						1	3		2
Avg.	2.8	2.4	2.5	1.8	1.5	1.5	2	1					1	2.33		

Course Code	**Subject Code & Subject Name**
C206	ME8361Manufacturing Technology Laboratory I

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**CO Target Level**
CO1	3		2			2	3	1	1			1		2		3
CO2	3		2			2	3	1	1			1		2		3
CO3	3		2			2	2	1	1			1		2		3
CO4	2		2			2	2	1	1					2		3
CO5	3		2		2	2	2	1	1			1		2		3

Avg.	2.8		2		2	2	2.5	1	1			1		2		

Course Code **Subject Code & Subject Name**

C207 ME8391Computer Aided Machine Drawing

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	1	2			3				3	2		3	2	2	2	3
CO2	1	2			3				3	2		3	2	2	2	3
CO3	1	2			3				3	2		3	2	2	2	3
CO4	1	2			3				3	2		3	2	2	2	3
Avg.	1	2			3				3	2		3	2	2	2	

Course Code **Subject Code & Subject Name**

C208 EE8361Electrical Engineering Laboratory

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3												3			3
CO2			3				2							3		3
CO3		2			3				3		1	2		3		3
CO4										3						3
Avg.	3	2	3		3		2		3	3	1	2	3	3		

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Course Code	**Subject Code & Subject Name**
C209	HS8381 Interpersonal Skills Listening & Speaking

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2															3
CO2		2														3
CO3									3			2				3
CO4										2						3
Avg.	2	2							3	2		2				

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Semester IV

Course Code **Subject Code & Subject Name**

C210 MA8452Statistics and Numerical Methods

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2															2
CO2	2											1				2
CO3		1											2			2
CO4				2												2
CO5			3									2				2
Avg.	2	1	3	2								1	2			

Course Code **Subject Code & Subject Name**

C211 ME8492-Kinematics of Machinery

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2							2				2	2	2	2
CO2	3	2	2										2	2	2	2
CO3	3	2	2										2	2	2	2
CO4	3	2	2										2	2	2	2
CO5	3	2	2										2	2	2	2
Avg.	3	2	2						2				2	2	2	

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Course Code C212

Subject Code & Subject Name ME8451Manufacturing Technology – II

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	3	3	3							2	1				2
CO2	3	3	2	1	2						1	1				2
CO3	3	2	2		2											2
CO4	3	3	2	2	3											2
CO5	3			3	3							1				2
Avg.	3	2.75	2.3	2.3	2.5						1.5	1				

Course Code C213

Subject Code & Subject Name ME8491Engineering Metallurgy

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	1	3	2								2	2	1	2	2
CO2	3	1	3	1		2		1				2	2	1	2	2
CO3	3	1	3									2	2	1	2	2
CO4	3	1	3				2					2	2	1	2	2
CO5	3	1	3	2	2							2	2	1	2	2
Avg.	3	1	3	1.67	2	2	2	1				2	2	1	2	

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Course Code C214

Subject Code & Subject Name CE8395Strength of Materials for Mechanical Engineers

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	3	2	2									2			2
CO2	3	3	3	2		2							2			2
CO3	3	3	1											2		2
CO4	2	2	2	1												2
CO5	2	3	3	3			1							2		2
Avg.	2.6	2.8	2.2	2		2	1						2	2		

Course Code C215

Subject Code & Subject Name ME8493-Thermal Engineering I

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2											3	2		2
CO2		3			2								3	2		2
CO3			2		2								2	1		2
CO4	2			3									3	2		2
CO5			2	1	2								2	1		2
Avg.	2.5	2.5	2	2	2								2.6	1.6		

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Course Code	Subject Code & Subject Name
C216	ME8462-Manufacturing Technology Laboratory – II

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2															3
CO2		2														3
CO3									3			2				3
CO4										2						3
CO5													2	2		3
Avg.	2	2							3	2		2	2	2		

Course Code	Subject Code & Subject Name
C217	CE8381-Strength of Materials and Fluid Mechanics and Machinery Laboratory

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2	1	3	3	1	1	1	3	1	1	2	2	2	1	3
CO2	3	2	1	3	3	1	1	1	3	1	1	2	3	2	1	3
CO3	3	3	2	3	2	1	1	1	3	1	1	2	3	2	1	3
CO4	3					1	1	1	3	1	1	2		2	1	3
Avg.	3	2.3	1.3	3	2.6	1	1	1	3	1	1	2	2.6	2	1	

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Course Code **Subject Code & Subject Name**

C218 HS8461Advanced Reading and Writing

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1																3
CO2									1	2		1				3
CO3									2	3		2				3
CO4									2	3		2				3
Avg.									1.67	2.67		1.67				

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Semester V

Course Code | **Subject Code & Subject Name**

C301 | ME8595Thermal Engineering II

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2				1								3	2		3
CO2	2	3											3	2		3
CO3		3	2	1									2			3
CO4	2	2	2										3	2		3
CO5			2		3										2	3
Avg.	2	2.67	2	1	2								2.75	2	2	

Course Code | **Subject Code & Subject Name**

C302 | ME8593Design of Machine Elements

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2	2	2										2			2
CO2	3	3	3	2									2	2		2
CO3	3	3	3	2									2	2		2
CO4	3	3	3	2									2	2		2
CO5	3	3	3	2									2	2		2
Avg.	3	3	3	2									2	2		

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Course Code | **Subject Code & Subject Name**

C303 | ME8501-Metrology and Measurements

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2	2	2					1			1	3	2	2	2
CO2	3	2	2	2					1			1	3	2	2	2
CO3	3	2	2	2					1			1	3	2	2	2
CO4	3	2	2	2					1			1	3	2	2	2
CO5	3	2	2	2					1			1	3	2	2	2
Avg.	3	2	2	2					1			1	3	2	2	

Course Code | **Subject Code & Subject Name**

C304 | ME8594-Dynamics of Machines

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3															2
CO2	2	3	2													2
CO3	2	3	2	3												2
CO4	3	3	1	2	2											2
CO5	2	2	2	3		1	1						1	1	2	2
Avg.	2.4	2	1.8	2.7	2	1	1						1	1	2	

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Course Code **Subject Code & Subject Name**

C305 OIM552-Lean Manufacturing

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1		3							2							2
CO2	3		3		3		2			2			3	2		2
CO3	3			2	3	3	2	3	2		3	2		2		2
CO4	3		3		3	3	3						3			2
CO5		3		3									3	3		2
Avg.	3	3	3		3	3	2	3	2	2	3	2	3	2		

Course Code **Subject Code & Subject Name**

C306 ME8511-Kinematics and Dynamics Laboratory

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3												3			3
CO2			3		3				3			2		3	3	3
Avg.	3		3		3				3			2	3	3	3	

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Course Code	**Subject Code & Subject Name**
C307	ME8512-Thermal Engineering Laboratory

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	**CO Target Level**
CO1	3												3			3
CO2			1											3		3
CO3					3				3			2			3	3
CO4										3					2	3
CO5	3												3			3
Avg.	3		1		3				3	3		2	3	3	2.5	

Course Code	**Subject Code & Subject Name**
C308	ME8513-Metrology and Measurements Laboratory

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**CO Target Level**
CO1	3				3					3		2	3			3
CO2			3						3					3	1	3
Avg.	3		3		3				3	3		2	3	3	1	

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Semester VI

Course Code C309

Subject Code & Subject Name ME8651-Design of Transmission Systems

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2		3										1	1	1	3
CO2	2		3										1	1	1	3
CO3	2		3										1	1	1	3
CO4	2		3										1	1	1	3
CO5	2		3										1	1	1	3
Avg.	2		3										1	1	1	

Course Code C310

Subject Code & Subject Name ME8691-Computer Aided Design and Manufacturing

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2	2	3		3									2	2	3
CO2		2	3		3											3
CO3			3		3											3
CO4	2		3		3									3	2	3
CO5			3		3									2	3	3
Avg.	2	2	3		3									2	2	

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Course Code

C311

Subject Code & Subject Name

ME8693-Heat and Mass Transfer

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2	2	2	1									3			3
CO2	2	2	2	1									3			3
CO3	2	3	2	1									3			3
CO4	2	2	2	1									3			3
CO5	2	1	2	1									3			3
Avg.	2	2	2	1									3			

Course Code

C312

Subject Code & Subject Name

ME8692-Finite Element Analysis

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	3		3												2
CO2	3	3	3	3												2
CO3	3	3	3	3									3			2
CO4	3	3	3												3	2
CO5	3	3	3		3											2
Avg.	3	3	3	3	3								3		3	

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Course Code **Subject Code & Subject Name**

C313 ME8694-Hydraulics and Pneumatics

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2	2										3	2		3
CO2	3	2	2											2		3
CO3	3				2									2		3
CO4	3	2	2											2		3
CO5	3		2		2								3			3
Avg.	3	2	2		2								3	2		

Course Code **Subject Code & Subject Name**

C314 PR8592 Welding Technology

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3				2								2	1		3
CO2	2				1								3	2		3
CO3		3			2								2			3
CO4	2	2											2	3		3
CO5			3		2										3	3
Avg.	2.3	2.5	3		1.75								2.25	2	3	

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Course Code
C315

Subject Code & Subject Name
ME8681-CAD / CAM Laboratory

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	2	2	2	2	3			2				1	3	3	1	3
CO2	2	2	2	2	3			2				1	3	3	1	3
Avg.	2	2	2	2	3			2				1	3	3	1	

Course Code
C316

Subject Code & Subject Name
ME8682-Design and Fabrication Project

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Avg.	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	

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Course Code
C317

Subject Code & Subject Name
HS8581-Professional Communication

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1																3
CO2									2	2		2				3
CO3									2	3		1				3
CO4									2	2		2				3
Avg.									2	2.67		1.67				

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Semester VII

Course Code | **Subject Code & Subject Name**

C401 | ME8792-Power Plant Engineering

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2		1			1						1	1		3
CO2	3	2											1	1		3
CO3	3	1		1		1	1						1	1		3
CO4	3	1		1		1	1						1	1	1	3
CO5	2	2				1	2				1				1	3
Avg.	2.8	1.6		1		1	1.25				1		1	1	1	

Course Code | **Subject Code & Subject Name**

C402 | ME8793-Process Planning and Cost Estimation

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2											2	3	1	3
CO2	2															3
CO3	1													1		3
CO4	1	2											2	3		3
CO5	2	2										1	2	2		3
Avg.	2	2										1	2	2.3	1	

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Course Code
C403

Subject Code & Subject Name
ME8791-Mechatronics

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2	3	2	1								3	3	3	3
CO2	2		2	2	1								3	3	2	3
CO3	2		2	2	1								3	2	2	3
CO4	2		2	1	1								2	2	2	3
CO5	3	2	3	2	1								3	3	3	3
Avg.	2.4	2	2.4	1.8	1								2.8	2.6	2.4	

Course Code
C404

Subject Code & Subject Name
OML751-Testing of Materials

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3												3	2		3
CO2	2	3	1										3	2		3
CO3	3	2	2										2	3		3
CO4	3	2	2										3	2		3
CO5	2	2	2	3									2			3
Avg.	2.6	2.3	1.8	3									2	2.3		

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Course Code	**Subject Code & Subject Name**
C405 **PE II - 7**	GE877-Total Quality Management

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	**CO Target Level**
CO1			1	1		2		2			2					3
CO2									3		3					3
CO3	2			1							2				2	3
CO4	2		2			3								3		3
CO5			1						2			2		3	2	3
Avg.	2		1.67	1		2.5		2	2.5		2.33	2		3	2	

Course Code	**Subject Code & Subject Name**
C405 **PE II - 4**	ME873-Unconventional Machining Process

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	**CO Target Level**
CO1	2				1								3	2		3
CO2	2	3											3	2		3
CO3	1	3	2	1									2			3
CO4	2	2	2										3	2		3
CO5			2		3										2	3
Avg.	1.75	2.67	2	1	2								3.67	2	2	

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Course Code

C406
PE III - 04

Subject Code & Subject Name

ME8097-Non-Destructive Testing and Evaluation

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3											2	1	1		3
CO2	3	3	2										2	2		3
CO3	3	2	2	3								2	2	2		3
CO4	3	2	2	3								2	2	2		3
CO5	3	2	2	3								2	2	2		3
Avg.	3	2.25	2	3								2	1.8	1.8		

Course Code

C406
PE III - 01

Subject Code & Subject Name

ME8099-Robotics

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	2	2										2			3
CO2	3	2	3	1									2			3
CO3	3	3	2	3										3	3	3
CO4	3	2	3	2	2										3	3
CO5	2	2											2			3
Avg.	2.8	2.2	2.5	2	2								2	3	3	

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Course Code	Subject Code & Subject Name
C407	ME8711-Simulation and Analysis Laboratory

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3												3			3
CO2			3											3		3
CO3					3				3			2			3	3
CO4										3					1	3
CO5	3				3				3			2		3	2	3
Avg.	3		3		3				3	3		2	3	3	2	

Course Code	Subject Code & Subject Name
C408	ME8781-Mechatronics Laboratory

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3												3			3
CO2			3											3		3
CO3					3				3			2			3	3
Avg.	3		3		3				3	3		2	3	3	2	

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Course Code	**Subject Code & Subject Name**
C409	ME8712-Technical Seminar

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	**CO Target Level**
CO1									3	3						3
CO2	3												3			3
Avg.	3								3	3			3			

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Semester VIII

Course Code	Subject Code & Subject Name
C410	MG8591-Principles of Management

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3	CO Target Level
CO1						3					2				2	3
CO2					2	3		2	2		3	3		2		3
CO3						3			3					2		3
CO4						3		3	2			2			2	3
CO5					2				3		3			3	3	3
Avg.					2	3		2.5	2.5		2.67	2.5		2.33	2.33	

Course Code	Subject Code & Subject Name
C411 **PE IV- 1**	IE8693-Production Planning and Control

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3										1		3	2		3
CO2	3	2	2								1		3	2		3
CO3	2	2	2								1		2			3
CO4	2	2	2								1		3	2		3
CO5	2		2								1					3
Avg	2.4	2	2								1		2.75	2		

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Course Code	**Subject Code & Subject Name**
C412	ME8811-Project Work

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	CO Target Level
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Avg.	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	

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5. Expected PO and PSO matrices for Mechanical Engineering 2019-2023 batch (Anna University Regulation 2017) is given in the below Table.

S. No	Course Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	C101									1.8	2		1.6			
2	C102	3	2	3	2	1						1	1	1		
3	C103	2	2	2	2	1.5				1.5	1.5		2			
4	C104	2	2	2	3	2.5	2.25	2					1.67			
5	C105	3	2	1							1		1	2	1	
6	C106		3	1	2		2					3		2	2	2
7	C107	3	2	1		3					1		1	2	1	
8	C108	3	3			3				3	3		3			
9	C109									1.6	2.2		1.6			
10	C110	2	1	3	2								1	2		
11	C111	3	3	2.4	2	1.5	1			1.5	2	1.5	1	2		
12	C112	3	2	2										1	2	2
13	C113	1	3	2	3	3	2.25	3	2.5				3			
14	C114	1.8	2.4	1.8	2.4	1.5						2	2	2	2	
15	C115	3		3		2	2		2	3	3		2	3	3	3
16	C116	2	2							3			2			
17	C201	2	3	2	2		1					1.5	1	1		
18	C202	2.5	2	2	1.5	2								2.2	1.8	
19	C203	2.33	2.2	3	2	1.5	1	1				1	1	2.67	2.25	1
20	C204	2.8		2			2	2.4	1	1			1		2	
21	C205	2.8	2.4	2.5	1.8	1.5	1.5	2	1					1	2.33	
22	C206	2.8		2		2	2	2.5	1	1			1		2	
23	C207	1	2			3				3	2		3	2	2	2
24	C208	3	2	3		3		2		3	3	1	2	3	3	
25	C209	2	2							3	2		2			
26	C210	2	1	3	2								1	2		
27	C211	3	2	2						2				2	2	2
28	C212	3	2.75	2.3	2.3	2.5						1.5	1			
29	C213	3	1	3	1.67	2	2	2	1				2	2	1	2
30	C214	2.6	2.8	2.2	2		2	1						2	2	
31	C215	2.5	2.5	2	2	2								2.6	1.6	
32	C216	2	2							3	2		2	2	2	

33	C217	3	2.3	1.3	3	2.6	1	1	1	3	1	1	2	2.6	2	1
34	C218									1.67	2.67		1.67			
35	C301	2	2.67	2	1	2								2.75	2	2
36	C302	3	3	3	2									2	2	
37	C303	3	2	2	2					1			1	3	2	2
38	C304	2.4	2	1.8	2.7	2	1	1						1	1	2
39	C305	3	3	3		3	3	2	3	2	2	3	2	3	2	
40	C306	3		3		3				3			2	3	3	3
41	C307	3		1		3				3	3		2	3	3	2.5
42	C308	3		3		3				3	3		2	3	3	1
43	C309	2		3										1	1	1
44	C310	2	2	3		3									2	2
45	C311	2	2	2	1									3		
46	C312	3	3	3	3	3								3		3
47	C313	3	2	2		2								3	2	
48	C314	2.3	2.5	3		1.75								2.25	2	3
49	C315	2	2	2	2	3			2				1	3	3	1
50	C316	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
51	C317									2	2.67		1.67			
52	C401	2.8	1.6		1		1	1.25				1		1	1	1
53	C402	2	2										1	2	2.3	1
54	C403	2.4	2	2.4	1.8	1								2.8	2.6	2.4
55	C404	2.6	2.3	1.8	3									2	2.3	
56	C405	2		1.67	1		2.5		2	2.5		2.33	2		3	2
57	C406	2.38	2.46	2	2	2							2	2.74	1.9	2
58	C407	2.8	2.2	2.5	2	2								2	3	3
59	C408	3		3		3				3	3		2	3	3	2
60	C409	3								3	3			3		
61	C410					2	3		2.5	2.5		2.67	2.5		2.33	2.33
62	C411	2.4	2	2								1		2.75	2	
63	C412	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Direct Attainment (DA)		**2.54**	**2.24**	**2.31**	**2.13**	**2.35**	**1.93**	**1.94**	**2.00**	**2.40**	**2.32**	**1.90**	**1.74**	**2.26**	**2.17**	**2.03**

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6. Attainment of Course Outcomes

In the outcome-based education, assessment is done through a process that identifies, collects and prepares data to evaluate the achievement of course outcomes (COs).

CO Assessment Process

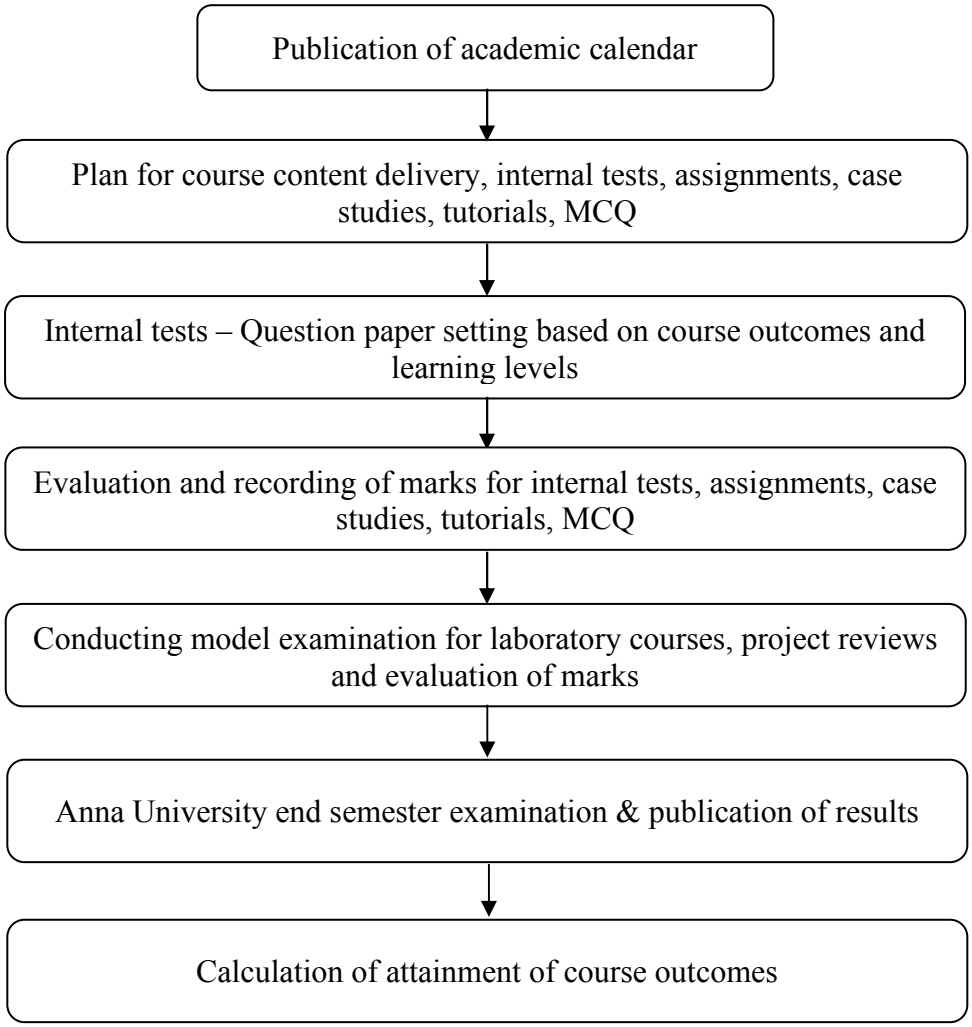

Fig. 2.1 Process employed for calculating CO attainment

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Measurement of CO attainment utilizes the data collected from continuous evaluation process. The performance of students in the continuous evaluation process like internal tests, assignments, tutorials, case studies, seminars and university examinations is used to evaluate the learning outcomes. Assessment of continuous evaluation process offers a sampling of what students know and/or can do. It also provides an evidence of knowledge and skills imparted to the students. The process employed for calculating CO attainment is shown in Figure 2.1, which includes (i) continuous evaluation process (ii) assessment tools employed for data collection (iii) frequency of assessment (iv) measurement of CO attainment.

i) Continuous Evaluation Process:

Internal tests are conducted for theory courses as per the academic calendar prepared in correlation with the academic schedule of Anna University, Chennai. The assignments, tutorials, multiple choice questions and/or mini projects are scheduled and implemented by the faculty members for all the courses. Such practices ensure regularity in the learning process and also provide feedback to the students on their performance in respective courses. Case studies and seminars are also provided to assess the understanding of students. Further, these activities enable the students to learn engineering applications and a habit of meeting the targets with a sense of punctuality.

ii) Assessment tools employed for data collection

Assessment Tools	Description
Internal Tests (Theory Courses)	➢ Internal tests are scheduled in the academic calendar, based on the academic schedule given by Anna University, Chennai. Each internal test is conducted for 50 marks and the duration is 90 minutes. The syllabus for the internal tests in each course ranges from 1.5 to 2 units. ➢ The question papers for the internal tests are prepared by the respective subject handling faculty members. The assessment process considers the marks scored by the students in the internal tests. ➢ These are used to continuously assess the attainment of COs associated with the learning levels of remember, understand, apply and analyse with respect to course objectives.
Evaluation of Laboratory Courses	➢ To enhance the hands on training and practical knowledge of students in various domains, laboratory courses are conducted as per the requirements related to equipment and software specified by Anna University.

	➢ The experiments conducted in the laboratory courses address the respective COs. CO attainment for each experiment is evaluated based on parameters such as basic knowledge about the experiment/procedure, output produced, results calculated and recording the same in the prescribed format. ➢ The students are instructed to maintain a record notebook for each laboratory course which documents the completion of experiments in each laboratory session. This is verified by the respective subject handling faculty member. ➢ After the completion of experiments specified in the syllabus, model examinations are conducted for 100 marks for 3 hours. ➢ The evaluation is done by the faculty members based on predefined COs. Internal marks for the laboratory courses are based on the performance of students during the laboratory sessions conducted throughout the semester and in the model examination.
University End Semester Examination (theory and practical)	➢ End semester examinations (theory or practical) are scheduled and conducted for 100 marks with the duration of 3 hours as prescribed by Anna University, Chennai. ➢ The descriptive type university examinations (theory) conducted by Anna University, Chennai are aimed at assessing COs that covers all the 5 units. The performance in the university practical examinations is also used as a metric for assessing whether the relevant COs are attained or not.
Final Year Projects	➢ Students are divided into groups/batches, which have a maximum limit of four students as prescribed by Anna University, Chennai. Each group is guided by a faculty member, who serves as an internal project guide. ➢ The internal guide for each project batch is allotted based on his/her area of interest and research work completed/in progress. ➢ Three project reviews are conducted and the performance of the students is reviewed by the panel, which consists of internal project guide, head of the department, industry expert member, senior faculty members and project coordinator. ➢ The project evaluation/ assessment process considers the marks scored in project review1, 2 and 3 (out of 100) ➢ Project viva-voce examination is conducted by the panel of internal and external examiners appointed by the Anna University, Chennai.

	➢ The external examiners examine the students and the marks are awarded based on the performance of students in the viva-voce examination. Then the marks are submitted to Anna University, Chennai.
Assignments	➢ For theory courses, three to five assignments are assigned to all the students. ➢ Assignments are considered as the qualitative assessment tool designed to assess the performance of students in problem solving skills. ➢ Further, to induce self-learning of the students, case studies are also included to assess the course outcomes.
Technical Seminars	➢ The Rubrics for Presentation Skills and Technical Seminar was prepared with 5 sub-headings namely, Presentation, Content, Person, Novelty and Questionnaire.
Tutorials/ Mini-projects/ MCQ/Quiz/Puzzles	➢ Tutorials, mini-projects, seminars, multiple choice questions, quiz and puzzles are also given to students, for assessing the course outcomes.

iii) Frequency of assessment

Sl. No	Methods/Tools	Frequency of assessment
1	Internal Tests	03/semester
2	Assignments	05/semester
3	University Examinations	01/semester
4	Model Examination (For Laboratories)	01/semester
5	Project Reviews	03/semester
6	Technical Seminars	03/semester

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Reg. No:

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Dindigul – Palani Highway, Dindigul 624 002

DEPARTMENT OF MECHANICAL ENGINEERING

INTERNAL TEST - III

Subject Code: **PR 8592**
Year & SEM: III &VI

Subject: **WELDING TECHNOLOGY**
Date & Session 15.06.2022 & FN
Max. Marks: 50

Answer all the questions

Part A (5 x2 = 10 marks)

1)	Write the chemical reaction involved in thermit welding process.	CO4
2)	Name the tool material used for joining high strength materials in friction stir welding.	CO4
3)	Sketch the welding symbol with location of elements.	CO5
4)	State process involved in thermit welding process.	CO4
5)	What is the purpose of conducting nick break test?	CO5

Part B (2 x16 = 32 marks)

6) a)	Explain the mechanism involved in Electron Beam Welding with construction and state the variables control the electron beam.	(16)	CO4
	OR		
7) a)	Describe any one welding automation system used in aerospace industries.	(16)	CO4
8) a)	With neat sketch explain the construction and working principle of Ultrasonic flaw detector used in weld defect identification process	(16)	CO5
	OR		
9) a)	Draw neat sketches and explain the welding symbols and sectional representation of weld	(16)	CO5

Part C (1 x 8 = 8 marks)

10) a)	A plate 50 mm wide and 12.5 mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50 KN. Find the length of the weld. Assume allowable shear strength to be 56 Mpa	(8)	CO5

Faculty-in-charge
P. SHANKAR KANNAN.

13/06/2022
HOD/Mech.

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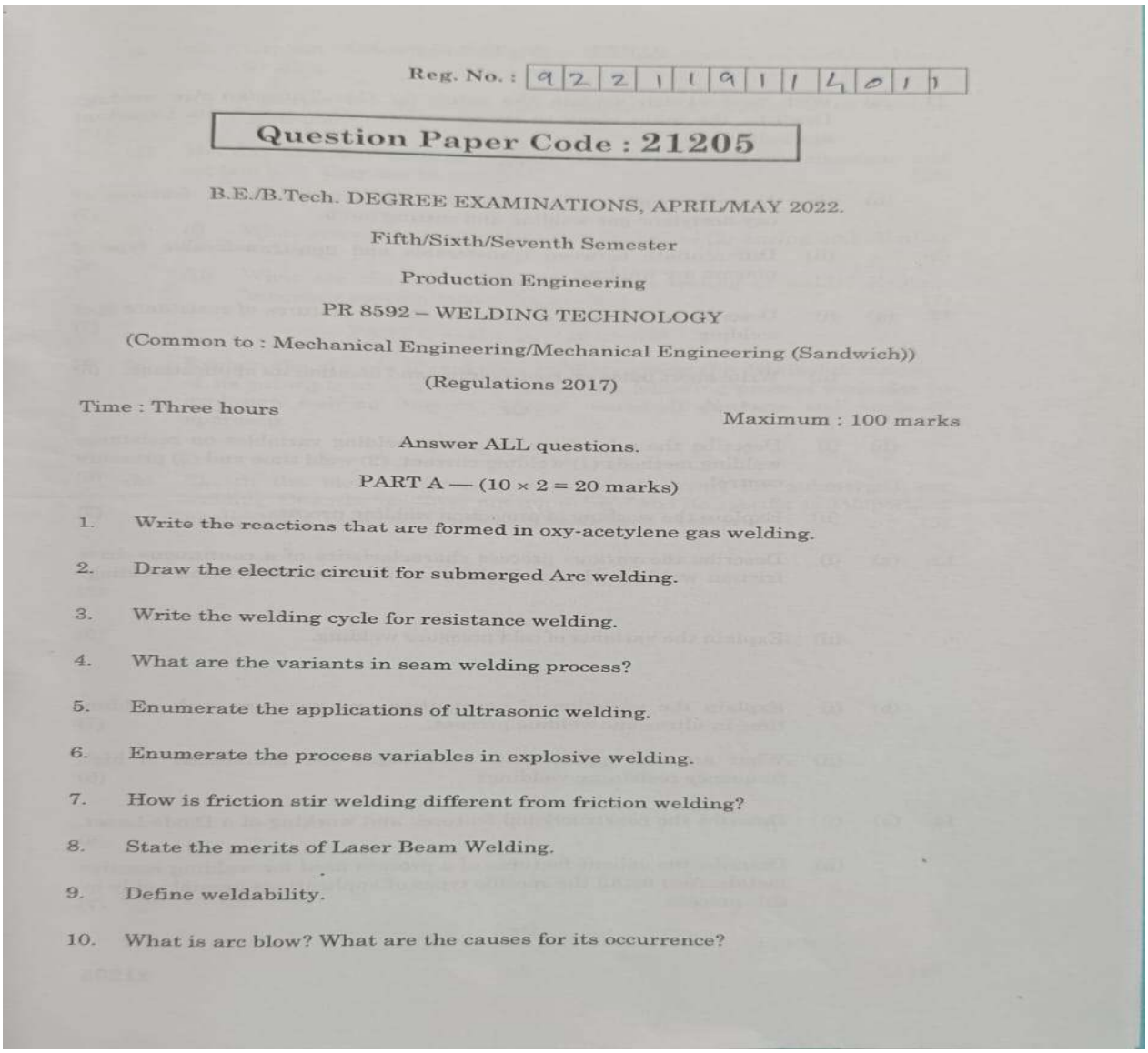

Reg. No. : 9 2 2 1 1 9 1 1 4 0 1 1

Question Paper Code : 21205

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Fifth/Sixth/Seventh Semester

Production Engineering

PR 8592 – WELDING TECHNOLOGY

(Common to : Mechanical Engineering/Mechanical Engineering (Sandwich))

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the reactions that are formed in oxy-acetylene gas welding.
2. Draw the electric circuit for submerged Arc welding.
3. Write the welding cycle for resistance welding.
4. What are the variants in seam welding process?
5. Enumerate the applications of ultrasonic welding.
6. Enumerate the process variables in explosive welding.
7. How is friction stir welding different from friction welding?
8. State the merits of Laser Beam Welding.
9. Define weldability.
10. What is arc blow? What are the causes for its occurrence?

University Examination Question Paper – PR8592 Welding Technology

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PART B — (5 × 13 = 65 marks)

11. (a) With neat sketch explain the setup for Gas Tungsten Arc welding. Describe the main steps in its operations. Also specify its important applications. (13)

Or

(b) (i) Describe with a neat diagram the constructional features of oxy-acetylene gas welding and cutting torch. (7)

(ii) Differentiate between transferable and non-transferable type of plasma arc welding. (6)

12. (a) (i) Describe with a neat sketch, the salient features of resistance spot welding. (7)

(ii) Write short notes on spot welding and mention its applications. (6)

Or

(b) (i) Describe the role of the following welding variables on resistance welding methods (1) welding current, (2) weld time and (3) pressure control. (6)

(ii) Explain the working of projection welding process. (7)

13. (a) (i) Describe the various process characteristics of a continuous drive friction welding. How is it different from inertia friction welding? (8)

(ii) Explain the variants of cold pressure welding. (5)

Or

(b) (i) Explain the variation of penetration and pressure with welding time in ultrasonic welding process. (7)

(ii) What are the applications, advantages and limitations of high frequency resistance welding? (6)

14. (a) (i) Describe the constructional features and working of a Diode Laser. (6)

(ii) Describe the salient features of a process used for welding reactive metals. Also detail the specific types of applications possible only by this process. (7)

Or

(b) (i) Explain the mechanism of key hole penetration in electron beam welding. (6)

(ii) Describe the principle and mechanism of Laser beam welding operation. (7)

15. (a) Mention any four welding defects, their causes and consequences and explain how they can be rectified. (13)

Or

(b) (i) What precautions are to be taken (1) before (2) during and (3) after welding? (6)

(ii) What are the uses of non-destructive testing of welds? Explain 'magnetic particle inspection' method. (7)

PART C — (1 × 15 = 15 marks)

16. (a) Explain the process of explosion welding, giving the detailed description of its principle of operation. Explain the following process variables in explosion welding: impact velocity, stand-off distance and angle of approach. (15)

Or

(b) Sketch the block diagram and electrical circuit for submerged arc welding. Describe the SAW process in brief and its specific and important applications. Write short notes on fluxes used in SAW. (15)

———————

- The Anna University, Chennai appoints external examiners for conducting university examinations in a transparent manner.
- For university examinations, assessments will be done on the basis of marks scored by students. Marks scored in each course will be mapped with the marks range as per Anna University, Chennai. However, for the purpose of reporting, the performance of a candidate is represented as grades based on the marks range, each carrying certain number of grade points as detailed in Table.2.1

Table 2.1 Grade classification R – 2017

Marks Range	Grade Points	Letter Grade
91-100	10	O
81-90	9	A+
71-80	8	A
61-70	7	B+
50-60	6	B
<50	0	U

- The statement of marks and provisional certificates will be issued to the students by Anna University, Chennai, at par with international standards incorporating Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA).
- Revaluation of answer scripts for the current semester is permissible and students can apply for revaluation in the prescribed format within 10 days from the date of publication of results. The photocopy of the answer script will be given by Anna University, Chennai.

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iv) Measurement of CO attainment:

The measurement of CO attainment for all kinds of courses (theory, laboratory and project work) is explained using the following figure 2.2

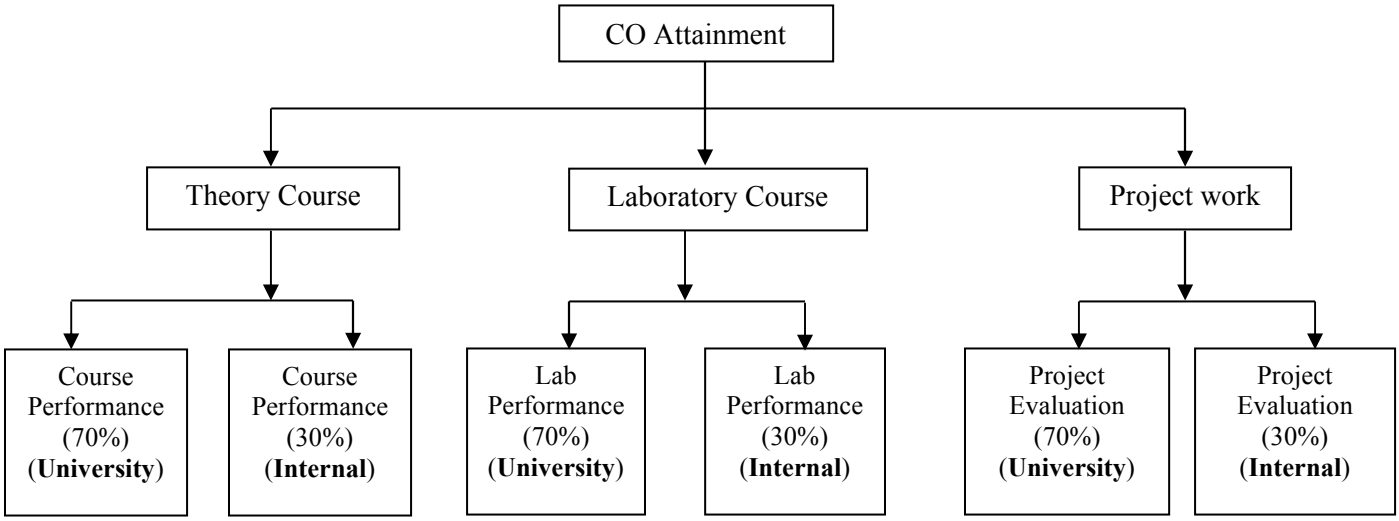

Fig. 2.2 Measurement of CO attainment for courses

Theory Course Performance – University Assessment

The performance of the students in university examinations is focused on the assessment of COs of respective courses. The calculation of overall CO attainment considers a weightage of 70% (for the percentage of students, who crosses the target of 50% marks) in university theory examination.

Theory Course Performance – Internal Assessment

The calculation of overall CO attainment considers a weightage of 30% in the continuous evaluation (internal tests and assignments/activities). The attainment of COs is distributed as shown in Table 2.2

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Table 2.2 Distribution of COs (Theory)

Assessment Type	CO1	CO2	CO3	CO4	CO5
Internal test -1	✓	✓			
Internal test -2		✓	✓		
Internal test -3				✓	✓
Assignments/ Activities	✓	✓	✓	✓	✓

7.Attainment of Course Outcomes of all courses with respect to set attainment levels

Course Outcomes are mapped to Program Outcomes in order to measure the attainment levels. Attainment Levels of COs are based on the percentage of students getting more than 50 marks in direct assessment methods, such as internal tests, Assignments, Project Reviews, Technical Presentations and University examinations as follows:

Attainment Level 1: less than 33% of students scoring more than 50% percentage marks in internal tests, Assignments and University Examination.

Attainment Level 2: less than 66% of students scoring more than 50% percentage marks in internal tests, Assignments and University Examination.

Attainment Level 3: 66% and above students scoring more than 50% percentage marks in Internal Test, Assignments and University Examination.

If targets are achieved, then all the course outcomes are attained for that year. If targets are not achieved, an action plan is put in place to attain the targets in subsequent years.

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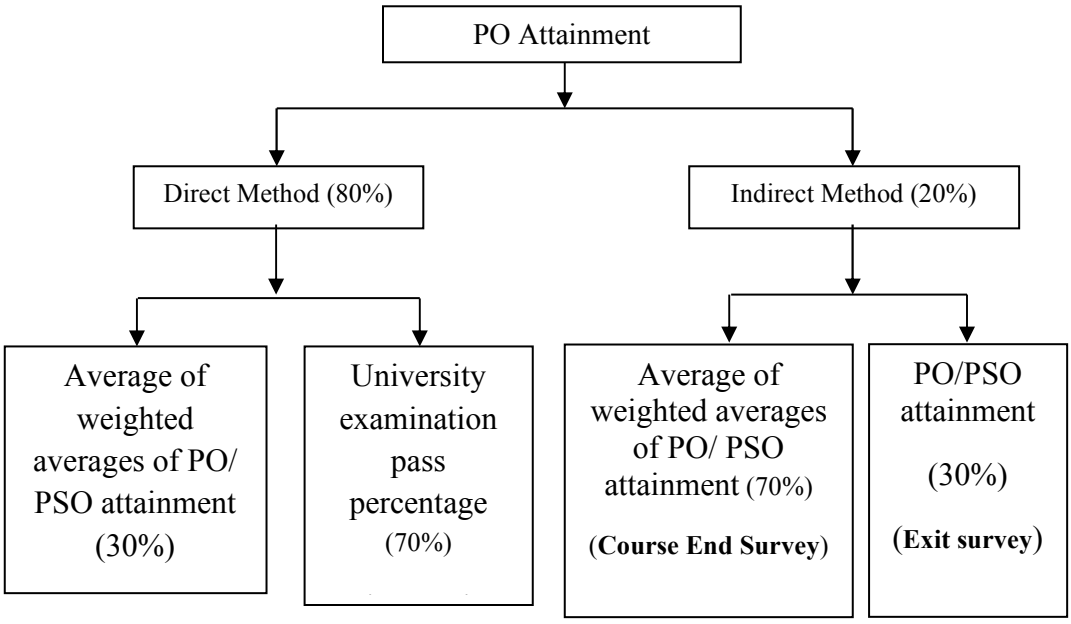
8. Assessment tools and processes used for measuring the attainment of each of the Program Outcomes and Program Specific Outcomes

PO Assessment Tools

PO assessment methods used to assess the program outcomes and program specific outcomes are categorized as direct and indirect method.



Direct method of measuring PO attainment

In direct method, CO attainment (internal) and university examination pass percentage are used to measure the attainment of program outcomes and program specific outcomes. CO attainment (internal) is calculated using the performance of students in internal tests, assignments, tutorials, mini projects and case studies. For all the courses, the weighted average of each PO or PSO attainment is determined using the respective CO– PO/PSO mapping levels and attainment of course outcomes(internal) calculated from the continuous evaluation process (refer equation).

$$\text{weighted average of } PO_i/PSO_j attainment = \left[\frac{CO_k attainment\ (internal)}{3}\right] * CO_k - PO_i/PSO_j\ mapping level$$

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Where, i=1,2,3...12 (number of POs), j=1,2,3 (number of PSOs defined) and k=1,2,3,…5 (number of COs defined).

Then, the average of weighted averages of PO_i / PSO_j attainment and university examination pass percentage is used to calculate the direct attainment of PO_i/PSO_j, using equation

$$PO_i/PSO_j attainment\ (direct) = [Average\ of\ weighteda verages\ of PO_i/PSO_j attainment * 0.30] + [University\ examination\ pass\ percentage * 0.70]$$

Where, i=1,2,3...12 (number of POs), j=1,2,3 (number of PSOs defined)

The range of attainment percentages of PO (direct) and the corresponding attainment level are given in table 2.3 below.

Table 2.3 Attainment level for internal assessment of PO

Attainment percentage of PO	Attainment Level
Greater than 66%	3
Between 33% and 66%	2
Less than 33%	1

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9. A sample PO & PSO attainment form using the direct assessment tools

COs	CO attainment % (internal)	CO- PO_1 mapping levels	Weighted average PO_1 attainment	Sample calculation
CO1	95%	-	0%	
CO2	93%	1	31%	=(PO_1 attainment in % =[(93 % / 3) * 1])
CO3	75%	-	0%	
CO4	93%	-	0%	
CO_5	93%	-	0%	
Average of weighted averages PO_1 attainment			31%	= (31/1)
University examination pass percentage			84%	
PO_1 attainment in % (Direct)			68.10%	= (31%*0.30 + 84% * 0.70)

PO_1 attainment level (Direct)			3	If (PO attainment % >66%), then attainment level is 3;
				If (33% <PO attainment % <66%), then attainment level is 2;
				If (PO attainment % < 33%), then attainment level is 1;

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10. Attainment of program outcomes (Pos) and Program Specific outcomes (PSOs) for 2019-2023 batch (R -2017)

S. No	Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	C101									1.63	1.82		1.6			
2	C102	2.4	1.76	2.23	1.8	1						1	1	1		
3	C103	1.92	1.92	1.92	1.8	1.5				1.4	1.32		1.9			
4	C104	1.78	1.78	1.78	1.78	1.78	1.78	2					1.67			
5	C105	2.2	1.8	1							1		1	1.76	1	
6	C106		2.8	1	1.92		1.92					2.62		1.92	1.92	1.92
7	C107	3	2	1		3					1		1	2	1	
8	C108	3	3			3				3	3		3			
9	C109									1.6	2.2		1.6			
10	C110	1.92	1	2.62	1.88								1	1.76		
11	C111	2.6	2.8	2.1	1.9	1.5	1			1.5	1.6	1.5	1	1.6		
12	C112	1.92	1.9	1.92										1	1.92	1.92
13	C113	0.98	2.6	1.9	2.2	2.2	2	2.3	2.1				2.2			
14	C114	1.6	2.1	1.6	2.1	1.3						1.92	1.92	1.92	1.92	
15	C115	3		3		2	2		2	3	3		2	3	3	3
16	C116	2	2							3			2			
17	C201	1.86	2.1	1.86	1.86		1					1.2	1	1		
18	C202	2.1	1.92	1.92	1.3	1.8								1.92	1.6	
19	C203	2.1	2	2.6	1.8	1.3	1	1				1	1	2.2	2.1	1
20	C204	2.4		1.8			1.68	2.1	0.9	0.9			0.9		1.9	
21	C205	2.4	2.1	2.2	1.6	1.2	1.2	1.9	0.86					0.86	1.9	
22	C206	2.8		2		2	2	2.5	1	1			1		2	
23	C207	1	2			3				3	2		3	2	2	2
24	C208	3	2	3		3		2		3	3	1	2	3	3	
25	C209	2	2							3	2		2			
26	C210	1.86	0.9	2.63	1.98								0.9	1.9		
27	C211	2.78	1.9	1.9						1.9				1.9	1.9	1.9
28	C212	2.72	2.35	2.12	2.12	2.3						1.32	1			
29	C213	2.8	1	2.78	1.5	1.96	1.96	1.96	1				1.65	1.65	1	1.6
30	C214	2.2	2.4	2	1.86		1.9	1						1.9	1.9	
31	C215	2	2	1.6	1.63	1.63								2	1.6	
32	C216	2	2							3	2		2	2	2	
33	C217	3	2.3	1.3	3	2.6	1	1	1	3	1	1	2	2.6	2	1

34	C218									1.67	2.67		1.67			
35	C301	1.9	1.12	1.71	1	1.65								2.2	1.6	1.7
36	C302	2.1	2.6	2.7	2									1.7	2	
37	C303	2.6	1.66	1.72	1.72					0.8			0.8	2.6	1.7	2
38	C304	2	1.9	1.6	2.2	1.8	1	1						1	1	1.7
39	C305	2.4	2.1	2.2		2.3	2.5	1.7	2.6	1.8	1.6	2.6	1.8	2.7	1.6	
40	C306	3		3		3				3			2	3	3	3
41	C307	3		1		3				3	3		2	3	3	2.5
42	C308	2.6		2.7		2.5				3	3		2	3	3	1
43	C309	1.7		2.4										0.7	0.7	0.7
44	C310	1	1	1.5		1.4									1.1	1.2
45	C311	1.7	1.7	1.6	1									2.2		
46	C312	1.3	1.3	1.3	1.3	1.3								1.3		1.3
47	C313	2.6	1.45	1.6		1.6								2.4	1.7	
48	C314	2.3	2.5	3		1.75								2.25	2	3
49	C315	2	2	2	2	3			2				1	3	3	1
50	C316	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
51	C317									2	2.67		1.67			
52	C401	2.4	1.4		1		1	1				1		1	1	1
53	C402	1	1										0.6	1	1	0.8
54	C403	2.2	1.78	2.16	1.72	1								2.4	2.23	2.1
55	C404	2.3	2.1	1.7	2.8									1.8	2.1	
56	C405	1.9		1.56	1		2.3		1.9	2.4		1.1	1.8		2.7	2
57	C406	2.3	2.4	2	2	2							2	2.6	1.9	2
58	C407	2.8	2.2	2.5	2	2								2	3	3
59	C408	3		3		3				3	3		2	3	3	2
60	C409	3								3	3			3		
61	C410					2	3		2.5	2.5		2.67	2.5		2.33	2.33
62	C411	2.4	2	2								1		2.75	2	
63	C412	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Direct Attainment (DA)		**2.26**	**1.97**	**2.06**	**1.90**	**2.09**	**1.81**	**1.83**	**1.91**	**2.36**	**2.27**	**1.73**	**1.69**	**2.06**	**2.01**	**1.89**
Indirect Attainment (IDA)		**2.1**	**2**	**2.4**	**2**	**2.3**	**2.05**	**2.1**	**2.2**	**2.63**	**2.38**	**2.1**	**2.2**	**2.3**	**2.2**	**2.3**
Overall Attainment (80% DA+ 20% IDA)		**2.23**	**1.98**	**2.12**	**1.92**	**2.13**	**1.86**	**1.88**	**1.96**	**2.41**	**2.29**	**1.80**	**1.79**	**2.11**	**2.05**	**1.97**

11. Indirect method of measuring PO-PSO attainment

Indirect method uses Course End Survey (CES) to calculate the PO/PSO attainment (indirect) of each course and the Exit Survey (ES). CES is the opinion or feedback of the students which is used to calculate the perceived level of CO attainment of each course. At the end of the programme, ES is collected from the students, to predict the perceived attainment of POs/PSOs through successful completion of that course. CES is a questionnaire based on COs on a 10 point scale and is shown in table 2.4. The students will be answering these questions based on their perceived level of the attainment of CO at the end of the course.

Table 2.4 Course End Survey

Course End Survey				
Name of the Subject with Subject Code:				
The course end survey is a questionnaire that is aimed at collecting students experience at the end of each course. The purpose of this survey is to help us understand how well this course enabled students to learn which in turn helps in improving course delivery in future.				
Name: Univ. Reg. No : Department: Year/Semester :				
II. Comments on materials presented and quality of teaching				
Parameters on Course delivery	**Excellent**	**Good**	**Average**	**Poor**
Lectures presented were				
Hand out materials for each unit were				
II. Assessment of Course Outcomes:				

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The course outcomes are statements that describe the expected accomplishments by the student at the end of the Course. Please rate each of them in terms of your preparedness for your end semester examinations.

Course Outcomes		Level of Preparedness / achievement			
		Excellent (>8)	Good (7 – 8)	Fair (5- 6)	Poor (<5)
CO1					
CO2					
CO3					
CO4					
CO5					

Signature of the Student

CO attainment is calculated based on the weighted average of attainment perception of all the students, which is shown in table.

CO attainment % is calculated from CES

(filled up from the table)

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Name of the student	Course End Survey				
	CO1	CO2	CO3	CO4	CO5
Average (sum of CO/No. of students)					
Average/10					
Count - Excellent (>8)					
Count - Good (7 -8)					

Count –Fair (5 - 6)					
Count –Poor (<5)					
CO Attainment %					

The weighted average of PO_i/PSO_j attainment is calculated from the CO attainment obtained from CES and CO_k– PO_i/ PSO_j mapping level, is given in the equation

$$\text{weighted average of } PO_i/PSO_j attainment = \left[\frac{CO_k attainment\ (asperCES)}{3}\right] * CO_k - PO_i/PSO_j\ mappinglevel$$

Where, i=1,2,3...12 (number of POs), j=1,2,3 (number of PSOs defined) and k=1,2,3,…5(number of COs defined)

The exit survey is a questionnaire prepared based on each PO/PSO on a 5 point scale and answered by every individual student after the completion of the course. The PO attainment from ES is calculated based on the weighted average of all the students of each PO and it is shown in table 2.5.

Table 2.5 -Exit survey evaluation

PO No	PO Description	1	2	3	4	5	Total	weighted Avg	% of Attainment
PO1	Ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.								
PO2	Ability to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.								

PO3	Ability to 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	Ability to 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	Ability to 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	Ability to 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	Ability to understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.								
PO8	Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.								
PO9	Ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.								
PO10	Ability to 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	Ability to 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	Ability to 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.								
PSO1	Ability to comprehend journal literature, do research on new mechanical engineering problems and publish the results through patents, journals, conferences and symposium.								
PSO2	Ability to realize professional experience through industry-interaction activities, internships, and in-plant training.								
	Signature of the Coordinator						Signature of the HOD		

Then, the average of weighted averages of PO_i/ PSO_j(calculated using CES) and PO attainment obtained from ES are used to calculate the indirect attainment of PO_i/PSO_j, using the equation

$$PO_i/PSO_j attainment\ (Indirect) = [Average of weighted averages of PO_i/PSO_j attainment calculated using CES * 0.70] + [PO_i/PSO_j attainment obtained from ES * 0.30]$$

Where, i=1,2,3...12 (number of POs) and j=1,2,3 (number of PSOs defined)

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The attainment percentages of PO/PSO (indirect) and the corresponding attainment levels are mentioned in the table 2.6 given below.

Table 2.6 Attainment level for internal assessment of PO

Attainment percentage of PO	Attainment Level
Greater than 66%	3
Between 33% and 66%	2
Less than 33%	1

The following table 2.6 reveals the sample calculation of PO attainment (indirect)

Table 2.6 Sample calculation for PO attainment (indirect)

COs	**CO Attainment % (As per Course End Survey)**	**PO_1 mapping**	**PO_1**	**Sample Calculation**
CO1	84%	-	0%	
CO2	88%	1	29.33%	=(PO_1attainment in % = [(88 % / 3) * 1])
CO3	85%	-	0%	
CO4	87%	-	0%	
CO5	86%	-	0%	
Average PO_1 attainment as per CES			29.33%	= ((0+29.33+0+0+0)/1)
PO_1 attainment % as per Exit Survey			90%	
PO_1 attainment in % (Indirect)			47.53%	= (29.33%*0.70 + 90% * 0.30)

PO_1 attainment level (Indirect)	2	If (>66%), then 3
		If (>33% &<66%), then 2
		If (<33%), then 1

Overall PO Attainment:

Then, the overall PO attainment of a course is calculated by sum of 80% of PO attainment (direct) and 20% of PO attainment (Indirect), as shown in the equation.

Overall PO attainment= 0.8*PO attainment (direct) + 0.2*PO attainment (Indirect)

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12. Summary of evaluation of each PO and PSO for 2019-2023 Batch

	Overall Attainment (80% DA+ 20% IDA)			Indirect Attainment (IDA)			Direct Attainment (DA)			
	%	Attained	Set Value	%	Attained	Set Value	%	Attained	Set Value	
PO1	83%	2.23	2.68	70%	2.1	3	89%	2.26	2.54	PO1
PO2	80%	1.98	2.47	67%	2	3	88%	1.97	2.24	PO2
PO3	84%	2.12	2.52	80%	2.4	3	89%	2.06	2.31	PO3
PO4	80%	1.92	2.39	67%	2	3	89%	1.90	2.13	PO4
PO5	84%	2.13	2.54	77%	2.3	3	89%	2.09	2.35	PO5
PO6	83%	1.86	2.25	68%	2.05	3	94%	1.81	1.93	PO6
PO7	83%	1.88	2.26	70%	2.1	3	94%	1.83	1.94	PO7
PO8	85%	1.96	2.30	73%	2.2	3	95%	1.91	2.00	PO8
PO9	94%	2.41	2.58	88%	2.63	3	99%	2.36	2.40	PO9
PO1	91%	2.29	2.52	79%	2.38	3	98%	2.27	2.32	PO1
PO11	81%	1.80	2.23	70%	2.1	3	91%	1.73	1.90	PO11
PO12	84%	1.79	2.12	73%	2.2	3	97%	1.69	1.74	PO12
PSO1	85%	2.11	2.48	77%	2.3	3	91%	2.06	2.26	PSO1
PSO2	85%	2.05	2.42	73%	2.2	3	93%	2.01	2.17	PSO2
PSO3	85%	1.97	2.32	77%	2.3	3	93%	1.89	2.03	PSO3

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