

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: BASIC MECHANICAL ENGINEERING

COURSE CODE: ME101

COURSE OBJECTIVES:

1. Be able to have the basic concepts of thermal sciences and temperature measurement on the basis of zeroth law of thermodynamics.
2. To understand and apply first and second law of thermodynamics to various processes and real systems.
3. Be able to model the problem using free-body diagrams and reach to solution by using equilibrium equations.
4. Be able to draw Shear Force Diagram (SFD) and Bending Moment Diagrams (BMD) for statistically determinate beams.
5. Be able to design simple components on the basis of knowledge of stress, strain and strength of material.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Explain basic concepts of thermal sciences and temperature measurement on the basis of zeroth law of thermodynamics.
CO2	Understand and apply first and second law of thermodynamics to various processes and real systems.
CO3	Model the problem using free-body diagrams and reach to solution by using equilibrium equations.
CO4	Draw Shear Force Diagram (SFD) and Bending Moment Diagrams (BMD) for statistically determinate beams.
CO5	Design simple components on the basis of knowledge of stress, strain and strength of material.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Explain basic concepts of thermal sciences and temperature measurement on the basis of zeroth law of thermodynamics.	3	2	2	1		2						3
C02	Understand and apply first and second law of thermodynamics to various processes and real systems.	3	3	3	2		3						3
C03	Model the problem using free-body diagrams and reach to solution by using equilibrium equations.	3	3	3	2		3						3
C04	Draw Shear Force Diagram (SFD) and Bending Moment Diagrams (BMD) for statically determinate beams.	3	2	2	2		3						3
C05	Design simple components on the basis of knowledge of stress, strain and strength of material.	3	3	2	1		3						3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

Course: - B. Tech

Semester: - Third

Subject Name: - Material Science

Subject Code: - ME-201

COURSE OBJECTIVES:

- To review physics and chemistry in the context of materials science & engineering.
- To describe the different types of bonding in solids, and the physical ramifications of these differences.
- Introduce the relation between processing, structure, and physical properties.
- Introduce metals, ceramics, polymers, and electronic materials in the context of a molecular level understanding of bonding.
- Give the beginning student an appreciation of recent developments in materials science & engineering within the framework of this class.

S.No.	CO Description
CO-1	Investigate the Structure of materials at various levels, essential ideas of crystalline materials like unit cell, FCC, BCC, HCP, APF (Atomic Packing Factor)
CO-2	Classify the different mechanical testing methods with their inherent merits and limitations
CO-3	Explain the concept of phase & phase diagram & understand the basic terminologies associated with metallurgy. Construction and identification of phase diagrams and reactions
CO-4	Demonstrate concepts related to electrical and magnetic properties and their applications
CO-5	Clarify highlights, arrangement, utilizations of more up to date class materials like smart materials, piezoelectric materials, biomaterials, composite materials and so on.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Investigate the Structure of materials at various levels, essential ideas of crystalline materials like unit cell, FCC, BCC, HCP, APF (Atomic Packing Factor)	3	3	2	3	2	2	1					3
C02	Classify the different mechanical testing methods with their inherent merits and limitations	3	3	3	3	3	3	1					3
C03	Explain the concept of phase & phase diagram & understand the basic terminologies associated with metallurgy. Construction and identification of phase diagrams and reactions	3	3	2	2	3	3	1					2
C04	Demonstrate concepts related to electrical and magnetic properties and their applications	3	2	2	1	3	2						2
C05	Clarify highlights, arrangement, utilizations of more up to date class materials like smart materials, piezoelectric materials, biomaterials, composite materials and so on.	3	1	3	1	3	3	3					3
3: Strong contribution, 2: average contribution, 1: Low contribution													

**INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF ELECTRICAL ENGINEERING**

**COURSE: APPLIED THERMODYNAMICS
COURSE CODE: ME202**

COURSE OBJECTIVES:

- To impart basic concepts of thermal sciences and their application in formulating the thermal engineering problems.
- To impart knowledge about steam generation, properties of steam and its application.
- To let understand the use of steam in power generation in the efficient manner.
- To impart concepts related to I.C. engine and gas turbine analysis.
- To impart basic concepts related to refrigeration and air conditioning.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Demonstrate basic concepts of thermal sciences and their application in formulating the thermal engineering problems
CO2	Demonstrate about steam generation, properties of steam and its application.
CO3	Demonstrate the use of steam in power generation in the efficient manner.
CO4	Demonstrate concepts related to I.C. engine and gas turbine and its analysis.
CO5	Analyze basic refrigeration and air conditioning systems.

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Demonstrate basic concepts of thermal sciences and their application in formulating the thermal engineering problems.	3	3	2	2	2	2	1					3
C02	Demonstrate about steam generation, properties of steam and its application.	3	3	3	2	2	3	1					2
C03	Demonstrate the use of steam in power generation in the efficient manner.	3	3	2	2	2	3						2
C04	Demonstrate concepts related to I.C. engine and gas turbine and its analysis.	3	2	2	2	3	3						2
C05	Analyze basic refrigeration and air conditioning systems.	3	1	1	1	1	3						2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: MANUFACTURING SCIENCE 1
COURSE CODE: ME 208

COURSE OBJECTIVES:

- Demonstrate understanding of various manufacturing processes.
- To make the student conversant with manufacturing of machine tool structures by using different manufacturing processes.
- To learn various analytical aspects of different manufacturing techniques such as various forging, rolling, extrusion, drawing and casting methods.
- To make acquainted the various unconventional manufacturing processes.
- Forming load estimation during different metal forming processes.
- Implement the Knowledge of Gained Subject in Industry.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students become able to understand the basics of various manufacturing processes and their application in industry.
CO2	Students will demonstrate the ability to apply the fundamentals of different manufacturing techniques such as various forging, rolling, extrusion, and drawing.
CO3	Students become able to understand the concepts of sheet metal process and their operations. They became able to find out the cutting force for sheet metal process.
CO4	Demonstrate the various unconventional manufacturing processes like powder metallurgy, electromagnetic forming processes, explosive forming processes etc.
CO5	Demonstrate the fundamentals of casting process and design process of their various parts like riser, runner, sprue etc.

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Students become able to understand the basics of various manufacturing processes and their application in industry.	3	3	2	3		2			2			3
CO2	Students will demonstrate the ability to apply the fundamentals of different manufacturing techniques such as various forging, rolling, extrusion, and drawing.	3	3	3	3		3			2			3
CO3	Students become able to understand the concepts of sheet metal process and their operations. They became able to find out the cutting force for sheet metal process.	3	3	3	3		3			2			2
CO4	Demonstrate the various unconventional manufacturing processes like powder metallurgy, electromagnetic forming processes, explosive forming processes etc.	3	3		3		3			2			2
CO5	Demonstrate the fundamentals of casting process and design process of their various parts like riser, runner, sprue etc.	3	3	2	3		3			2			2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: MEASUREMENT AND METROLOGY

COURSE CODE: ME 209

COURSE OBJECTIVES:

- To develop in students the knowledge of basics of Measurements, Metrology and measuring devices.
- To understand the concepts of various measurement systems & standards with regards to realistic applications.
- The application of principle of metrology and measurements in industries
- To develop competence in sensors, transducers and terminating devices with associated parameters
- To develop basic principles and devices involved in measuring surface textures.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Explain the basics of standards of measurement, limits, fits & tolerances industrial applications.
CO2	Identify the uses of gauges and comparators.
CO3	Understand the significance of measurement system, errors, transducers, intermediate modifying and terminating devices
CO4	Interpret measurement of field variables like force, torque and pressure.
CO5	Comprehend the fundamentals of thermocouple and strain measurement.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Explain the basics of standards of measurement, limits, fits & tolerances industrial applications.	3	3	2	2	2	2	1					3
C02	Identify the uses of gauges and comparators..	3	3	3	2	2	3	1					2
C03	Understand the significance of measurement system, errors, transducers, intermediate modifying and terminating devices.	3	3	2	2	2	3						2
C04	Interpret measurement of field variables like force, torque and pressure.	3	2	2	2	3	3						2
C05	Comprehend the fundamentals of thermocouple and strain measurement.	3	1	1	1	1	3						2
3: Strong contribution, 2: average contribution, 1: Low contribution													

**INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING**

**COURSE: POLYMER SCIENCE & TECHNOLOGY COURSE
CODE: ME213**

COURSE OBJECTIVES:

1. Understanding the fundamental of polymer science
2. Understanding the process and methods of different polymerization
3. To get updated about recent development of polymer industry
4. Knowledge of different polymers and their properties for developing the different products.
5. Understanding of various plastic processing methods.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Isolate the key design features of a product which relate directly to the material(s) used in its construction, List the processes and methods of manufacturing of different plastic products
CO2	Indicate how the properties of polymeric materials can be exploited by a product designer, Develop reaction pertaining to the polymerization of different polymers
CO3	Describe the role of rubber-toughening in improving the mechanical properties of polymers
CO4	Identify the repeat units of particular polymers and specify the isomeric structures which can exist for those repeat units
CO5	Estimate the number- and weight-average molecular masses of polymer samples given the degree of polymerization and mass fraction of chains present

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Isolate the key design features of a product which relate directly to the material(s) used in its construction, List the processes and methods of manufacturing of different plastic products	3	3	2	2	1	3						3
C02	Indicate how the properties of polymeric materials can be exploited by a product designer, Develop reaction pertaining to the polymerization of different polymers	3	3	3	2	1	1						2
C03	Describe the role of rubber-toughening in improving the mechanical properties of polymers	3	2	1	1	2	2	3					3
C04	Identify the repeat units of particular polymers and specify the isomeric structures which can exist for those repeat units	3	2	2	2	3	3						2
C05	Estimate the number- and weight-average molecular masses of polymer samples given the degree of polymerization and mass fraction of chains present	3	2	2	3	2	2	2					2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: KINEMATICS OF MACHINES
COURSE CODE: ME 218

COURSE OBJECTIVES:

- To impart understanding of different types of Mechanism and its inversion.
- To analyze the velocity and acceleration of planar mechanisms.
- To synthesize planar mechanisms based on motion requirements.
- Understanding of gear drives and analysis of gear trains.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Ability to identify and analyze the mechanisms required for a particular motion requirement.
CO2	Capability to analyze the velocity and acceleration of planar mechanisms.
CO3	Propensity to synthesize planar mechanisms for the given motion parameters
CO4	Ability to design and analyze various types of CAM.
CO5	Ability to understand the suitability of different gear drives for motion/power transmission and to analyze different types of gear trains.

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Ability to identify and analyze the mechanisms required for a particular motion requirement	3	3	2	2	2	2	1					3
C02	Capability to analyze the velocity and acceleration of planar mechanisms.	3	3	3	2	2	3	1					2
C03	Propensity to synthesize planar mechanisms for the given motion parameters	3	3	2	2	2	3						2
C04	Ability to design and analyze various types of CAM.	3	2	2	2	3	3						2
C05	Ability to understand the suitability of different gear drives for motion/power transmission and to analyze different types of gear trains.	3	1	1	1	1	3						2
3: Strong contribution, 2: average contribution, 1: Low contribution													

COURSE: FLUID FLOW AND SOLID HANDLING
COURSE CODE: ME 221

COURSE OBJECTIVES:

- To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
- To develop understanding about hydrostatic law, manometers and application energy equation in fluid flow.
- To imbibe basic laws and equations used for analysis of static and dynamic fluids.
- To inculcate the importance of fluid flow measurement and its applications in Industries.
- To give fundamental knowledge of centrifugal pump, reciprocating pump, positive displacement pump and blower
- To develop understanding about Properties of solids, screening, industrial screening equipment, Crushers, grinders and conveyers.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	State the Newton's law of viscosity and Explain the mechanics of fluids at rest and in motion by observing the fluid phenomena.
CO2	State the hydrostatic law and explain the pressure measuring devices.
CO3	Derive Euler's Equation of motion and Deduce Bernoulli's equation.
CO4	Explain the working principle and working of flow measuring devices
CO5	Explain the working of hydraulic machine like centrifugal pump, reciprocating pump, positive displacement pump etc.
CO6	Explain the handling of solid, industrial screening equipment and size reduction equipment.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	State the Newton's law of viscosity and Explain the mechanics of fluids at rest and in motion by observing the fluid phenomena.	3	3	2	1	1	3	2					3
C02	State the hydrostatic law and explain the pressure measuring devices.	3	3	1			2	2					3
C03	Derive Euler's Equation of motion and Deduce Bernoulli's equation.	3	3	1	2	1	2	1					3
C04	Explain the working principle and working of flow measuring devices	3	2	2			2	1					3
C05	Explain the working of hydraulic machine like centrifugal pump, reciprocating pump, positive displacement pump etc.	3	2	1		1	2						3
C06	Explain the handling of solid, industrial screening equipment and size reduction equipment.	3	3	1	2	1	2						3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: HEAT TRANSFER OPERATION
ME222

COURSE CODE:

COURSE OBJECTIVES:

1. Formulate and predict heat conduction problems without heat generation in composite walls and extended surfaces subjected to convective boundaries. Analyze 1D unsteady conduction problems.
2. Explain the concept of free convection mechanics, dimensionless number and introduction to the empirical correlation.
3. To develop understanding about heat transfer by phase change: boiling process, filmwise and dropwise condensation
4. Develop concept of monochromatic and total radiations, intensity of radiation, radiative heat exchange between two black bodies.
5. Calculate fluid temperatures, mass flow rates, pressure drops and heat exchange during parallel, counter and cross flow in heat exchangers.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Formulate and predict heat conduction problems with and without heat generation in composite walls, critical insulation thickness and extended surfaces subjected to convective boundaries. Analyze 1D steady conduction problems.
CO2	Explain the concept of free convection mechanics, dimensionless number and introduction to the empirical correlation.
CO3	Explain the concept of heat transfer by phase change: boiling process, filmwise and dropwise condensation
CO4	Explain the concept of radiation, monochromatic emissive power, total radiations, intensity of radiation and heat exchange between two black surfaces
CO5	Calculate fluid temperatures, mass flow rates and heat exchange during parallel and counter in heat exchangers.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Formulate and predict heat conduction problems with and without heat generation in composite walls, critical insulation thickness and extended surfaces subjected to convective boundaries. Analyze 1D steady conduction problems.	3	3	3	2	2	3	3					3
CO2	Explain the concept of free convection mechanics, dimensionless number and introduction to the empirical correlation.	3	2	2	2	2	3						3
CO3	Explain the concept of heat transfer by phase change: boiling process, filmwise and dropwise condensation	3	2	1	1	1	3						3
CO4	Explain the concept of radiation, monochromatic emissive power, total radiations, intensity of radiation and heat exchange between two black surfaces	3	1	3	2	2	3	1					3
CO5	Calculate fluid temperatures, mass flow rates and heat exchange during parallel and counter in heat exchangers.	3	2	2	2	2	3						3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: THERMODYNAMICS, REFRIGERATION AND AIR CONDITIONING

COURSE CODE: ME229

COURSE OBJECTIVES:

1. Be able to have the basic concepts of thermal sciences and application of first law of thermodynamics for closed system.
2. To understand and apply first and second law of thermodynamics to various processes.
3. To understand basic principle and analysis of different types of refrigeration systems.
4. To have knowledge about common refrigerants and basic of psychrometry.
5. To have basic knowledge about air conditioning principles.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Demonstrate basic concepts of thermal sciences and application of first law of thermodynamics for closed system.
CO2	Understand and apply first and second law of thermodynamics to various processes.
CO3	Understand basic principle and analysis of different types of refrigeration systems.
CO4	Demonstrate about common refrigerants and basic of psychrometry.
CO5	Demonstrate basic knowledge about air conditioning principles.

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: FLUID MECHANICS

COURSE CODE: CE 201

COURSE OBJECTIVES:

- To introduce and explain fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.
- To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
- To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
- To imbibe basic laws and equations used for analysis of static and dynamic fluids.
- To inculcate the importance of fluid flow measurement and its applications in Industries.
- To determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	State the Newton's law of viscosity and Explain the mechanics of fluids at rest and in motion by observing the fluid phenomena.
CO2	Compute force of buoyancy on a partially or fully submerged body and Analyze the stability of a floating body.
CO3	Derive Euler's Equation of motion and Deduce Bernoulli's equation.
CO4	Examine energy losses in pipe transitions and sketch energy gradient lines.
CO5	Evaluate pressure drop in pipe flow using Hagen-Poiseuille's equation for laminar flow in a pipe
CO6	Examine boundary layer over flat plate and analyze wall shear stress, drag force.

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: MACHINE DESIGN

COURSE CODE: ME301

COURSE OBJECTIVES:

1. Knowledge about the essentials of Advance Machine Design.
2. Knowledge of different materials and their properties for designing the components of machine elements
3. Understanding the motion of the component and the basic geometry, force analysis of the gears
4. Understanding the process and methods of design of machines and engine parts.
5. Abilities of developing equations pertaining to the design of machines.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Know the concept of Product Development and Design Process, Case Studies and Brainstorming, Design Process, Need Analysis, Need based developments. Know about the concepts and importance of Materials for static and fatigue loads, Design Methods, Standards in design and selection of preferred size, BIS system of designation of steels, rubber testing methods.
CO2	Know about Design against Static Load, Modes of failure Know about Design against Fluctuating Load, Stress concentration and its factors, Fluctuating/alternating stresses, Fatigue failure, Endurance limit, Design for finite and infinite life, Soderberg and Goodman criteria.
CO3	Identify the component and Design Welded joints, Screwed joints, Eccentric loading of these joints, Design for fatigue loading.
CO4	Know the classification and application of Shafts, Keys and Couplings and its Design Procedure.
CO5	Know about force analysis, classification and application of Mechanical Springs and leaf springs against static and fatigue loading. Design and Analyze screw jack.

CO-PO MAPPING: (Sub : MACHINE DESIGN, Sub Code : ME301)

COURSE OUTCOME (CO)		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Know the concept of Product Development and Design Process, Case Studies and Brain-storming, Design Process, Need Analysis, Need based developments. Know about the concepts and importance of Materials for static and fatigue loads, Design Methods, Standards in design and selection of preferred size, BIS system of designation of steels, rubber testing methods.	3	3	3	2	1	2	1	1	2	2	1	3
CO2	Know about Design against Static Load, Modes of failure Know about Design against Fluctuating Load, Stress concentration and its factors, Fluctuating/alternating stresses, Fatigue failure, Endurance limit, Design for finite and infinite life, Soderberg and Goodman criteria.	3	3	3	3	2	3	1	2	2	2	1	3
CO3	Identify the component and Design Welded joints, Screwed joints, Eccentric loading of these joints, Design for fatigue loading.	3	3	3	2	2	2	1	2	2	2	1	3
CO4	Know the classification and application of Shafts, Keys and Couplings and its Design Procedure.	3	3	3	3	2	3	1	1	1	2	1	3
CO5	Know about force analysis, classification and application of Mechanical Springs and leaf springs against static and fatigue loading. Design and Analyze screw jack.	3	3	3	2	2	3	1	3	3	2	1	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: MANUFACTURING SCIENCE -II
COURSE CODE: ME303

COURSE OBJECTIVES:

1. To inculcate specialized knowledge and skill in advanced manufacturing processes using the principles and methods of engineering analysis and design.
2. To cultivate the ability to develop and implement new improved manufacturing processes resulting in creation and distribution of value in engineering applications
3. To impart knowledge about the significance of controlling process parameters for the optimal performance for newly developed engineering materials used in industries and research organizations.
4. To impart knowledge about welding behavior of machine and process during welding, analysis of common and newer welding techniques and metallurgical and weldability aspects of different common engineering materials.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Know about the concepts and importance of Mechanics of metal cutting, Mechanics of chip formation ,Economics of metal cutting and Tool wear and tool life.
CO2	Know about the Principle and types of lathe, different operations on it, operations on shaper, planer and slotter, Milling cutters, up and down milling, Dividing head and indexing and Geometry of twist drills
CO3	know about Grinding wheel, different types of abrasives, Grinding wheel specification, Grinding Wheel wear, different types of grinding operations, Super finishing operations: Honing , lapping, Polishing
CO4	Know about the Arc welding: Power sources and consumables, TIG and MIG welding processes and their parameters, Resistance welding, Soldering and Brazing. ,Thermodynamic and Metallurgical aspects in welding, and defects in welds, their causes and remedies.
CO5	Know about the Need of unconventional manufacturing processes, Principle of ECM, AJM, EDM, EBM, LBM, USM ETC, Plasma arc welding, Explosive welding, EBW , LBW, USW.

CO-PO MAPPING: (Sub : MANUFACTURING SCIENCE -II, Sub Code : ME303)

COURSE OUTCOME (CO)		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Know about the concepts and importance of Mechanics of metal cutting, Mechanics of chip formation ,Economics of metal cutting and Tool wear and tool life..	3	3	2	2	2	2	1	2	2	2	1	3
C02	Know about the Principle and types of lathe, different operations on it, operations on shaper, planer and slotter, Milling cutters, up and down milling, Dividing head and indexing and Geometry of twist drills	3	3	3	2	2	2	1	2	2	2	1	2
C03	know about Grinding wheel, different types of abrasives, Grinding wheel specification, Grinding Wheel wear, different types of grinding operations, Super finishing operations: Honing , lapping, Polishing	3	2	3	2	2	2	1	3	2	2	1	3
C04	Know about the Arc welding: Power sources and consumables, TIG and MIG welding processes and their parameters, Resistance welding, Soldering and Brazing. ,Thermodynamic and Metallurgical aspects in welding, and defects in welds, their causes and remedies.	3	2	2	2	3	3	1	2	1	2	1	2
C05	Know about the Need of unconventional manufacturing processes, Principle of ECM, AJM, EDM, EBM, LBM, USM ETC, Plasma arc welding, Explosive welding, EBW , LBW, USW.	3	2	2	2	2	2	1	2	3	2	1	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: FUNDAMENTALS OF PRODUCTION AND OPERATIONS MANAGEMENT

COURSE CODE: BM 304

COURSE OBJECTIVES:

1. To study the scope and major decision areas of production management, facility locations and layouts.
2. To learn about the capacity planning, aggregate planning, mass production, shop floor and batch production.
3. To learn about work study, method study, work measurement and various productivity measures.
4. To study about materials management, purchase management, stores management and inventory management.
5. To study about total quality management, just in time (JIT), six sigma and maintenance management.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Know about the details of production management, facility locations and layouts.
CO2	Know about the application of capacity planning, aggregate planning and also the details of mass production, shop floor and batch production.
CO3	Know about the concept of work study, method study, work measurement and various productivity measures.
CO4	Know about the details of materials management, purchase management, stores management and inventory management.
CO5	Know about the concept of total quality management, just in time (JIT), six sigma and maintenance management.

CO-PO MAPPING: (Sub : Fundamentals of Production and Operations Management, Sub Code : BM304)

COURSE OUTCOME (CO)		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Know about the details of production management, facility locations and layouts.	3	3	2	2	2	3	2	2	2	2	2	3
C02	Know about the application of capacity planning, aggregate planning and also the details of mass production, shop floor and batch production.	3	3	3	3	2	2	2	2	2	2	2	3
C03	Know about the concept of work study, method study, work measurement and various productivity measures.	3	3	3	3	3	2	3	2	3	3	2	3
C04	Know about the details of materials management, purchase management, stores management and inventory management.	3	2	2	2	3	2	2	2	2	2	2	2
C05	Know about the concept of total quality management, just in time (JIT), six sigma and maintenance management.	3	3	2	2	2	2	2	2	2	3	2	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: MAINTENANCE ENGINEERING AND MANAGEMENT

COURSE CODE: ME306

COURSE OBJECTIVES:

1. Knowledge about the essentials of Maintenance Engineering and Management.
2. Study various types of maintenance procedures with proper importance.
3. Study the various equipment replacement procedures.
4. Learn about the Assignment Model and Waiting Time Model pertaining to industry related problems.
5. Study about the maintenance organization, manpower planning and economics of maintenance.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Know about the concepts and importance of Maintenance Engineering and Management.
CO2	Know about the various types of maintenance procedures with respective importance.
CO3	Identify the various equipment replacement procedures and their proper applications.
CO4	Know about the Assignment Model and Waiting Time Model in the background of industrial need.
CO5	Know about the maintenance organization, manpower planning and economics of maintenance organization.

CO-PO MAPPING: (Sub : Maintenance Engineering and Management, Sub Code : ME306)

COURSE OUTCOME (CO)		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Know about the concepts and importance of Maintenance Engineering and Management.	3	3	2	2	2	2	1	2	2	2	1	3
C02	Know about the various types of maintenance procedures with respective importance.	3	3	3	2	2	2	1	2	2	2	1	2
C03	Identify the various equipment replacement procedures and their proper applications.	3	2	3	2	2	2	1	3	2	2	1	3
C04	Know about the Assignment Model and Waiting Time Model in the background of industrial need.	3	2	2	2	3	3	1	2	1	2	1	2
C05	Know about the maintenance organization, manpower planning and economics of maintenance organization.	3	2	2	2	2	2	1	2	3	2	1	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

**INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING**

**COURSE: ENGINEERING PRODUCT DESIGN
COURSE CODE: ME308**

COURSE OBJECTIVES:

- To impart basic concepts of engineering product design and their applications.
- To impart knowledge about idea generation and creativity used in the development of a product.
- To let understand the use of economical aspect in product design.
- To impart concepts related to reliability and ergonomics.
- To impart basic knowledge about literature search, patents, standards and codes.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Explained the basic concepts of engineering product development design and their Applications. Also discussed the Design definitions, the role and nature of design, old and new design methods, Design by evolution. Physical reliability & Economic feasibility of design concepts.
CO2	Demonstrate about Morphology of Design. Divergent, transformation and convergent phases of product design.
CO3	Demonstrate the use of economical aspect in product design. Students come to know about utility concept, Utility value, Utility index, Fixed and variable costs. Break-even analysis.
CO4	Demonstrate the concepts of Reliability considerations in product design and the role of Ergonomic aspects in better design of a product.
CO5	Explained about the Information and literature search, patents, standards and codes. Environment and safety considerations.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Explained the basic concepts of engineering product development design and their Applications. Also discussed the Design definitions, the role and nature of design, old and new design methods, Design by evolution. Physical reliability & Economic feasibility of design concepts.	3	3	2	2	2	2	1					3
CO2	Demonstrate about Morphology of Design. Divergent, transformation and convergent phases of product design.	3	3	3	2	2	3						2
CO3	Demonstrate the use of economical aspect in product design. Students come to know about utility concept, Utility value, Utility index, Fixed and variable costs. Break-even analysis.	3	3	2	2	2	3					2	2
CO4	Demonstrate the concepts of Reliability considerations in product design and the role of Ergonomic aspects in better design of a product.	3	2	2	2	3	3	1					2
CO5	Explained about the Information and literature search, patents, standards and codes. Environment and safety considerations.	3	1	1	1	1	3	2					3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: IC engine

COURSE CODE: ME313

COURSE OBJECTIVES:

To equip graduates with the heat and mass transfer process that continuously takes place in buildings and human bodies and in various equipments employed in automobiles, electrical and electronic devices, chemical and process industries, power plants and refrigeration systems like condensers, evaporators, boilers, intercoolers, regenerators, etc. and to formulate simple problems and estimate rates of heat and mass transfer, temperature variation and efficiency of such equipments.

COURSE OUTCOMES (CO):

After taking this course the students should be able to

1. Formulate and predict heat conduction problems with and without heat generation in composite walls and extended surfaces subjected to convective boundaries. Analyze 1D unsteady and 2D steady conduction problems.
2. Develop concept of boundary layer formation over heated surfaces during forced and free convection, formulation of momentum and energy equations of the laminar boundary layers and their solution by approximate method.
3. Describe filmwise and dropwise condensation in condensers, Pool, forced, sub-cooled and saturated boiling in boilers and evaporators, bubble formation and critical heat flux.
4. Develop concept of monochromatic and total radiations, intensity of radiation, shape factor, radiation shields, solar radiation and estimation of radiative heat exchange between two or more surfaces of different geometries.
5. Calculate fluid temperatures, mass flow rates, pressure drops, heat exchange and effectiveness during parallel, counter and cross flow in heat exchangers, condensers, evaporators, etc. Evaluate diffusion and convective Mass transfers occurring in different applications

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Formulate and predict heat conduction problems with and without heat generation in composite walls, critical insulation thickness and extended surfaces subjected to convective boundaries. Analyze 1D steady conduction problems.
CO2	Develop the concept of hydrodynamic and thermal boundary formation over heated surfaces during forced and free convection, formulation of momentum and energy equations of the laminar boundary layers and their solution by approximate method.
CO3	Develop the Basic radiation, concept of monochromatic and total radiations, intensity of radiation, shape factor, radiation shields, solar radiation and estimation of radiative heat exchange between two surfaces of different geometries.
CO4	Describe filmwise and dropwise condensation in condensers, Pool, forced, sub-cooled and saturated boiling in boilers and evaporators, bubble formation and critical heat flux
CO5	Calculate fluid temperatures, mass flow rates, pressure drops, heat exchange and effectiveness during parallel, counter and cross flow in heat exchangers, condensers, evaporators, etc. Evaluate diffusion and convective Mass transfers occurring in different applications

After completion of the course, a student will be able to

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Formulate and predict heat conduction problems with and without heat generation in composite walls, critical insulation thickness and extended surfaces subjected to convective boundaries. Analyze 1D steady conduction problems.	3	3	3	2	2	3	3	2				3
C02	Develop the concept of hydrodynamic and thermal boundary formation over heated surfaces during forced and free convection, formulation of momentum and energy equations of the laminar boundary layers and their solution by approximate method.	3	2	2	2	2	3	3	2				3
C03	Develop the Basic radiation, concept of monochromatic and total radiations, intensity of radiation, shape factor, radiation shields, solar radiation and estimation of radiative heat exchange between two surfaces of different geometries.	3	3	3	2	2	3	3	3				3
C04	Describe filmwise and dropwise condensation in condensers, Pool, forced, sub-cooled and saturated boiling in boilers and evaporators, bubble formation and critical heat flux	3	2	2	2	2	3	3	3				3
C05	Calculate fluid temperatures, mass flow rates, pressure drops, heat exchange and effectiveness during parallel, counter and cross flow in heat exchangers, condensers, evaporators, etc. Evaluate diffusion and convective Mass transfers occurring in different applications	3	2	2	2	2	2	2					3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: FLUID MACHINERY

COURSE CODE: ME314

COURSE OBJECTIVES:

- Impart knowledge of basic principles of operation of various types of fluid machines (Turbines and Pumps) and impulse turbine designing.
- Demonstrate knowledge and skills of reaction turbine designing.
- knowledge of working / operation and design of centrifugal pump.
- Imparting knowledge of working / operation of positive displacement/rotary pump.
- Imparting knowledge about miscellaneous hydraulic machines (hydraulic lift, hydraulic crane, hydraulic ram hydraulic coupling etc.)

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Demonstrate basic principles of operation of various types of fluid machines (Turbines and Pumps) and impulse turbine designing.
CO2	Demonstrate knowledge and skills of reaction turbine designing.
CO3	Demonstrate knowledge of working / operation and design of centrifugal pump.
CO4	Demonstrate knowledge of working / operation of positive displacement/rotary pump.
CO5	Demonstrate knowledge about miscellaneous hydraulic machines (hydraulic lift, hydraulic crane, hydraulic ram hydraulic coupling etc.)

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Demonstrate basic principles of operation of various types of fluid machines (Turbines and Pumps) and impulse turbine designing.	3	3	2	2		3						3
CO2	Demonstrate knowledge and skills of reaction turbine designing.	3	3	3	2	2	3						2
CO3	Demonstrate knowledge of working / operation and design of centrifugal pump.	3	3	3	2	2	3						3
CO4	Demonstrate knowledge of working / operation of positive displacement/rotary pump.	3	3	3	2		3						2
CO5	Demonstrate knowledge about miscellaneous hydraulic machines (hydraulic lift, hydraulic crane, hydraulic ram hydraulic coupling etc.)	3	1	1	1		3						2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: REFRIGERATION & AIR CONDITONING

COURSE CODE: ME315

COURSE OBJECTIVES:

1. To impart the knowledge about air refrigeration cycles and methods air-craft refrigeration systems.
2. The course structures covers various types of Refrigeration Systems to familiarize the students with the fundamentals of Refrigeration System.
3. To give the knowledge about fundamentals of air conditioning and psychrometry.
4. To familiarize the students about the application and design of refrigeration and air conditioning equipments.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand air refrigeration cycles and its application to air craft refrigeration system.
CO2	Use p-h chart to solve vapour compression refrigeration problems and understand components of vapour compression refrigeration systems.
CO3	Understand temp-concentration and enthalpy concentration diagrams and its application in solving the problems of vapour absorption system. Understand components and working of vapour absorption system.
CO4	Use psychrometric chart in solving air conditioning problems. Understand the various types of air conditioning systems and its cooling and heating load calculation.
CO5	Know the application of refrigeration in food preservation ,cold storage ,freezers ,ice plant and water cooler. To design the transmission and distribution of air through ducts and fans.

CO-PO MAPPING: (SUB REFRIGERATION & AIR CONDITONING ,

SUB CODE : ME315)

COURSE OUTCOME (CO)		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Understand air refrigeration cycles and its application to air craft refrigeration system.	3	3	3	2	2	2	2	1	2	-	-	3
CO2	Use p-h chart to solve vapour compression refrigeration problems and understand components of vapour compression refrigeration systems.	3	3	3	2	2	2	2	1	2	-	2	2
CO3	Understand temp-concentration and enthalpy concentration diagrams and its application in solving the problems of vapour absorption system. Understand components and working of vapour absorption system.	3	3	3	2	2	2	2	2	2	-	2	3
CO4	Use psychrometric chart in solving air conditioning problems. Understand the various types of air conditioning systems and its cooling and heating load calculation.	3	3	3	2	3	3	2	1	2	-	2	2
CO5	Know the application of refrigeration in food preservation ,cold storage ,freezers ,ice plant and water cooler. To design the transmission and distribution of air through ducts and fans.	3	3	2	2	2	2	2	2	3	-	2	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: Six Sigma Methods, Approach & Application

COURSE CODE: ME-317

COURSE OBJECTIVES:

1. The overarching learning objective of this course is to develop a comprehensive set of skills that will allow the student to function effectively as a Six Sigma introducer.
2. The organizational structure body of knowledge includes techniques for both quantitative and non-quantitative analysis, as well as the team leadership skills necessary to get projects across the goal line.
3. Understanding required defining the metrics behind the operation in an industry to attain the highest level of improvement possible.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	1. Knowledge related to basic perspectives of quantitative and non-quantitative quality, its role in modern development, continuous improvement 2. Value of Six Sigma, its philosophy, history and goals
CO2	1. Responsibilities of Executive Leaders in deployment of Six Sigma, 2. Identify and apply various techniques to overcome these barriers 3. Case studies may lead to use Six Sigma instead of other problem solving approaches
CO3	1. Understand Six sigma methodology and tools
CO4	1. Interpret control charts and impact of Six Sigma Projects on customers, suppliers and stakeholders
CO5	1. Effect of Communication, process management, project development techniques using Six Sigma concepts to improve its performance.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	1. Knowledge related to basic perspectives of quantitative and non-quantitative quality, its role in modern development, continuous improvement 2. Value of Six Sigma, its philosophy, history and goals	3	3	3	2	3	3	1				3	3
C02	1. Responsibilities of Executive Leaders in deployment of Six Sigma, 2. Identify and apply various techniques to overcome these barriers 3. Case studies may lead to use Six Sigma instead of other problem solving approaches	3	3	3	3	3	3	1				3	3
C03	1. Understand Six sigma methodology and tools	3	3	3	3	3	3	1				3	3
C04	1. Interpret control charts and impact of Six Sigma Projects on customers, suppliers and stakeholders	3	2	3	2	3	3	1				3	3
C05	1. Effect of Communication, process management, project development techniques using Six Sigma concepts to improve its performance.	3	1	1	1	1	3	1				3	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: TRIBOLOGY
COURSE CODE: ME 316

COURSE OBJECTIVES:

- To develop a solution oriented approach by in depth knowledge of Industrial Tribology.
- To address the underlying concepts, methods and application of Industrial Tribology.
- Know the methods to reduce the friction for engineering surface.
- Have a knowledge of surface topography and know how to model a rough engineering surface.
- Understand Hertz contact and rough surface contact.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students will become familiar with mathematical tools used to analyze tribological processes.
CO2	Students will become familiar with common anti-friction and anti-wear components and the lubricants used therein.
CO3	Students will be able to describe the detailed operation of selected anti-friction or anti-wear components
CO4	Students will be able to design a tribological system for optimal performance
CO5	Students will be able to develop technical project reports and technical presentations

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Students will become familiar with mathematical tools used to analyze tribological processes.	3	3	2	2	2	2	1					3
C02	Students will become familiar with common anti-friction and anti-wear components and the lubricants used therein.	3	3	3	2	2	3	1					2
C03	Students will be able to describe the detailed operation of selected anti-friction or anti-wear components	3	3	2	2	2	3						2
C04	Students will be able to design a tribological system for optimal performance	3	2	2	2	3	3						2

CO5	Students will be able to develop technical project reports and technical presentations	3	1	1	1	1	3								2
		3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: ADVANCE MACHINE DESIGN

COURSE CODE: ME320

COURSE OBJECTIVES:

1. Knowledge about the essentials of Advance Machine Design.
2. Knowledge of different materials and their properties for designing the components of machine elements
3. Understanding the motion of the component and the basic geometry, force analysis of the gears
4. Understanding the process and methods of design of machines and engine parts.
5. Abilities of developing equations pertaining to the design of machines.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Know about the concepts, importance and analysis of Spur Gears, Involute Gears, Tooth loads, Strength of spur gears in bending and in wear.
CO2	Identify the motion of the component and the basic geometry of the gears. Further a student will know about force analysis, classification and application of following gears: Helical Gears: Tooth relationship, Design of helical gears, crossed helical gears. Worm Gear: Analysis of loads and stresses, Gear standards and proportions Bevel Gears: Analysis of loads and stresses
CO3	Identify the motion of the component and the basic geometry of Bearing , classification of bearings, Life of bearing, Reliability considerations. Know about the concepts Selection of ball and roller bearings and Lubrication and Lubricants, Mounting of bearings
CO4	know about force analysis, classification and application of Sliding Bearings, Hydrodynamic theory of lubrication, Types of bearings, Design of bearings using design charts.

CO5	Design the Engine Parts like connecting rod, crankshaft, and cylinder and piston.
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CO-PO MAPPING: (Sub : ADVANCE MACHINE DESIGN, Sub Code : ME320)

	COURSE OUTCOME (CO)	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Know about the concepts, importance and analysis of Spur Gears, Involute Gears, Tooth loads, Strength of spur gears in bending and in wear.	3	3	3	2	1	2	1	1	2	2	1	3
CO2	Identify the motion of the component and the basic geometry of the gears. Further a student will know about force analysis, classification and application of Helical Gears, crossed helical gears, Worm Gear, and Bevel Gears	3	3	3	3	2	3	1	2	2	2	1	3
CO3	Identify the motion of the component and the basic geometry of Bearing, classification of bearings, Life of bearing, Reliability considerations. Know about the concepts Selection of ball and roller bearings and Lubrication and Lubricants, Mounting of bearings	3	3	3	2	2	2	1	2	2	2	1	3
CO4	Know about force analysis, classification and application of Sliding Bearings, Hydrodynamic theory of lubrication, Types of bearings, Design of bearings using design charts.	3	3	3	3	2	3	1	1	1	2	1	3
CO5	Design the Engine Parts like connecting rod, crankshaft, and cylinder and piston.	3	3	3	2	2	3	1	3	3	2	1	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

Course: - B. Tech

Semester: - Fifth

Subject Name: - Applied Elasticity

Subject Code: - ME-322

COURSE OBJECTIVES:

- To provide the foundation for pursuing other solid mechanics courses such as theory of plates and shells, elastic stability, composite structures and fracture mechanics to familiarize students with basic equations of elasticity.
- Analyze and design compliant mechanisms
- Review fundamental concepts of elasticity and mechanisms
- Understand the difference between linear and nonlinear deflections.
- To build the necessary theoretical background for further structural analysis and design courses

S.No.	CO Description
CO-1	To analyze the fundamental concepts of stress for 3D dimensional elastic solids
CO-2	To analyze the fundamental concepts of strain for 3D dimensional elastic solids
CO-3	To built the basic concepts in stress strain relationship
CO-4	To apply the Basic Equations of Elasticity for Solids
CO-5	To analyze the structural sections subjected to torsion.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	To analyze the fundamental concepts of stress for 3D dimensional elastic solids	3	2	2	3	2	2						3
C02	To analyze the fundamental concepts of strain for 3D dimensional elastic solids	3	2	3	3	2	2						3
C03	To build the basic concepts in stress strain relationship	3	2	3	3	2	2						3
C04	To apply the Basic Equations of Elasticity for Solids	3	2	3	3	2	2						3
C05	To analyze the structural sections subjected to torsion.	3	1	3	3	2	2						3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: COMPUTER AIDED DESIGN

COURSE CODE: ME 701

COURSE OBJECTIVES:

- To impart fundamental knowledge to students in the latest technological topics on Computer Aided Design, Computer Aided Manufacturing and Computer Aided Engineering Analysis and to prepare them for taking up further research in the areas.
- To create congenial environment that promotes learning, growth and imparts ability to work with inter-disciplinary groups in professional, industry and research organizations.
- To broaden and deepen their capabilities in analytical and experimental research methods, analysis of data, and drawing relevant conclusions for scholarly writing and presentation.
- To provide guidance to students for their choices in research and professional career outlook and to encourage students to take up research.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Apply/develop solutions or to do research in the areas of Design and simulation in Mechanical Engineering
CO2	Have abilities and capabilities in developing and applying computer software and hardware to mechanical design and manufacturing fields.
CO3	Formulate relevant research problems; conduct experimental and/or analytical study and analyzing results with modern mathematical / scientific methods and use of software tools.
CO4	Review and document the knowledge developed by scholarly predecessors and critically assess the relevant technological issues.
CO5	Design and validate technological solutions to defined problems and communicate clearly and effectively for the practical application of their work.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Apply/develop solutions or to do research in the areas of Design and simulation in Mechanical Engineering	3	3	2	2	2	2	1					3
CO2	Have abilities and capabilities in developing and applying computer software and hardware to mechanical design and manufacturing fields	3	3	3	2	2	3	1					3
CO3	Formulate relevant research problems; conduct experimental and/or analytical study and analyzing results with modern mathematical / scientific methods and use of software tools	3	2	3	2	1	3						2
CO4	Review and document the knowledge developed by scholarly predecessors and critically assess the relevant technological issues.	3	2	2	2	3	3						2
CO5	Design and validate technological solutions to defined problems and communicate clearly and effectively for the practical application of their work.	3	2	1	1	2	3						2
3: Strong contribution, 2: average contribution, 1: Low contribution													

**INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING**

**COURSE: AUTOMOBILE ENGINEERING
COURSE CODE: ME407**

COURSE OBJECTIVES:

The purpose of this course is to impart adequate knowledge in both practically and theoretically, covering the various types of power-driven vehicles and to familiarize the students with the fundamentals of Automotive Engine System, Chassis and suspension system, braking and transmission system, and cooling system. The students are acquainted with the operation, maintenance and repairs of all components of the various transportation vehicles.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	1. List different types of Engine and their classifications..
CO2	Develop concept and define working of Automobile Engine cooling and lubrication system.
CO3	Describe functioning of Transmission train, conventional and non-conventional drives, Clutches, Gear boxes, Synchromesh device, Propeller shaft, Differential axle, braking system and Suspension systems.
CO4	Describe functioning of steering system, steering geometry wheel alignment and wheel angles for modern Automobile.
CO5	Describe starting system and electrical system

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	List different types of Engine and their classifications..	3	2	1	1	3	2	1					3
C02	Develop concept and define working of Automobile Engine cooling and lubrication system.	3	3	3	2	2	3	1					2
C03	Describe functioning of Transmission train, conventional and non-conventional drives, Clutches, Gear boxes, Synchromesh device, Propeller shaft, Differential axle, braking system and Suspension systems	3	3	2	2	2	3						2
C04	Describe functioning of steering system, steering geometry wheel alignment and wheel angles for modern Automobile	3	2	2	2	3	3	1					2
C05	Describe starting system and electrical system	3	1	1	1	1	3						2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: ADVANCE WELDING TECHNOLOGY
COURSE CODE: IME 706

COURSE OBJECTIVES:

- To impart knowledge on various advanced welding processes .
- Learn various advance welding techniques.
- To develop the knowledge on the design of welded joints and the quality control of weldments
- To impart Knowledge on metallurgical and thermal concept for weld zone ,HAZ.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Apply the knowledge of welding process for engineering applications
CO2	Understand the principles of radiant energy metal joining process.
CO3	Understand the fundamental principles of underwater welding process
CO4	Understand the knowledge of plasma arc in metal joining and cutting process
CO5	Understand the knowledge of design principles in weld joints. Apply the concept of quality control and testing of weldments in industrial environment

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Apply the knowledge of welding process for engineering applications	3	3	2	1	1	3						3
C02	Understand the principles of radiant energy metal joining process.	3	3	3	2	1	1						2
C03	Understand the fundamental principles of underwater welding process	3	2	1	1	2	2	3					3
C04	Understand the knowledge of plasma arc in metal joining and cutting process	3	2	2	2	3	3						2
C05	Understand the knowledge of design principles in weld joints. Apply the concept of quality control and testing of weldments in industrial environment	3	1	1	1	1	2	1					2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: INDUSTRIAL ENGINEERING

COURSE CODE: ME401

COURSE OBJECTIVES:

- Contribute to the success of companies through effective problem solving.
- Design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and environments
- Effectively manage business operations and project management teams.
- Continue to develop holistically, including the personal and professional skills necessary to adapt to our changing societal, technological, and global environments

- To be able to adapt and solve the increasingly complex problems faced by industry; embrace innovation through intellectual diversity and creative problem solving; and continue to develop holistically as a learner to become leaders of tomorrow

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Apply knowledge and understanding of productivity models in various industries. Design and develop the products and processes. Apply basic knowledge of product development and industrial process design.
CO2	Analyze the facility location and network models. Understanding of supply chain system.
CO3	Interpretation and analysis of data from aggregate output planning models. Knowledge and understanding of Human Factors Engineering and various job design techniques.
CO4	Select and analyze an inventory control model. Understanding of manufacturing resources and queuing systems.
CO5	Analyze and control the quality of an end product. Analysis of industrial systems using linear and non-linear programming approaches.

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Apply knowledge and understanding of productivity models in various industries. Design and develop the products and processes. Apply basic knowledge of product development and industrial process design..	3	3	2	2	2	2	1					3
C02	Analyze the facility location and network models. Understanding of supply chain system	3	3	3	2	2	3	1					2
C03	Interpretation and analysis of data from aggregate output planning models. Knowledge and understanding of Human Factors Engineering and various job design techniques.	3	3	2	2	2	3						2
C04	Select and analyze an inventory control model. Understanding of manufacturing resources and queuing systems.	3	2	2	2	3	3						2
C05	Analyze and control the quality of an end product. Analysis of industrial systems using linear and non-linear programming approaches.	3	1	1	1	1	3						2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: CAD/CAM
COURSE CODE: ME402

COURSE OBJECTIVES:

- Provide basic foundation in computer aided design / manufacturing
- Understand the fundamentals used to create and manipulate geometric models
- Get acquainted with the basic CAD software designed for geometric modeling
- Learn working principles of NC machines CNC control and part programming
- Understand concept of Group Technology, FMS and CIM

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Describe basic structure of CAD workstation, Memory types, input/output devices and display devices and computer graphics
CO2	Acquire the knowledge of geometric modeling and Execute the steps required in CAD software for developing 2D and 3D models and perform transformations
CO3	Explain fundamental and advanced features of CNC machines
CO4	Illustrate Group Technology, CAQC and CIM concepts
CO5	Know about the Concept of Mechatronics and Robotics

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Describe basic structure of CAD workstation, Memory types, input/output devices and display devices and computer graphics	3	3	2	1	1	3						3
C02	Acquire the knowledge of geometric modeling and Execute the steps required in CAD software for developing 2D and 3D models and perform transformations	3	3	3	2	1	1						2
C03	Explain fundamental and advanced features of CNC machines	3	2	1	1	2	2	3					3
C04	Illustrate Group Technology, CAQC and CIM concepts	3	2	2	2	3	3						2
C05	Know about the Concept of Mechatronics and Robotics	3	1	1	1	1	2	1					2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: DRILLING TECHNOLOGY FOR WATER, OILS AND MINERAL EXPLORATION
CODE: ME403

COURSE OBJECTIVES:

1. To Understand History of Drilling, Geology
2. Study of Classification of rocks
3. To know about application of Geo-physics
4. Geo-chemical prospecting and remote sensing for water
5. Soil testing location of site.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Isolate the key features of a drilling technology for oil, water, and minerals.
CO2	Indicate how the properties of drilling fluid affect drilling methods, Develop soil testing method and finding its site
CO3	Describe the role of drilling fluid in improving the material removal rate, Develop fundamental knowledge of the drilling fluid & its chemical composition
CO4	Identify the method of Geo-chemical prospecting and remote sensing for water
CO5	Estimate the different fluid property and develop the understanding of geo-physics

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Isolate the key features of a drilling technology for oil, water, and minerals.	3	3	2	2	1	3						3
C02	Indicate how the properties of drilling fluid affect drilling methods, Develop soil testing method and finding its site	3	3	3	2	1	1						2
C03	Describe the role of drilling fluid in improving the material removal rate, Develop fundamental knowledge of the drilling fluid & its chemical composition	3	2	2	1	2	2	3					3
C04	Identify the method of Geo-chemical prospecting and remote sensing for water	3	2	2	2	3	3						2
C05	Estimate the different fluid property and develop the understanding of geo-physics.	3	2	2	3	2	2	2					2
3: Strong contribution, 2: average contribution, 1: Low contribution													

**INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING**

COURSE: Total Quality Management**COURSE CODE: ME-404****COURSE OBJECTIVES:**

1. The overarching learning objective of this course is to develop a comprehensive set of skills that will allow the student to function effectively as Total Quality Managers and introducer of quality concepts.
2. The organizational structure body of knowledge includes techniques for both quantitative and non-quantitative analysis, as well as the team leadership skills necessary to get projects across the goal line.
3. Understanding required defining the metrics behind the operation in an industry to attain the highest level of improvement possible.
4. Identify ethical and unethical behavior in Quality Management and apply various quality improvement techniques.

COURSE OUTCOMES (CO):*After completion of the course, a student will be able to*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	1. Knowledge related to basic perspectives of quality for both quantitative and non-quantitative quality. 2. Role of Quality Gurus in modern quality development 3. Value of TQM, its philosophy, history and goals
CO2	1. About Leadership, its responsibilities. 2. Modern case studies to use 5S or Kaizen
CO3	1. Interpret control charts 2. Impact of evaluating Projects on customers, suppliers and stakeholders
CO4	1. Understand how to Improve Business Processes and Sustain Quality Improvement 2. Project progress in relation to goals & objectives
CO5	Requirements of ISO 9000-2000, Taguchi method, JIT

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	1. Knowledge related to basic perspectives of quality for both quantitative and non-quantitative quality. 2. Role of Quality Gurus in modern quality development 3. Value of TQM, its philosophy, history and goals	3	3	3	2	3	3	1				3	3
CO2	1. About Leadership, its responsibilities. 2. Modern case studies to use 5S or Kaizen	3	3	3	3	3	3	1				3	3
CO3	1. Interpret control charts 2. Impact of evaluating Projects on customers, suppliers and stakeholders	3	3	3	3	3	3	1				3	3
CO4	1. Understand how to Improve Business Processes and Sustain Quality Improvement 2. Project progress in relation to goals & objectives	3	2	3	2	3	3	1				3	3
CO5	Requirements of ISO 9000-2000, Taguchi method, JIT	3	1	1	1	1	3	1				3	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: Unconventional Manufacturing Processes
COURSE CODE: ME405

COURSE OBJECTIVES:

1. To impart understanding of different types of modern Machines.
2. To classify and analyze various non-conventional machines and their applications.

3. To analyse material removal mechanism in different unconventional machining processes.
4. To study the parameters involved in efficient working of the machines

An ability to apply knowledge of mathematics, science, engineering and computing using modern tools

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Know the principle and working and applications of unconventional machining process, need of unconventional manufacturing processes & its classification and its future possibilities.
CO2	Know the principle and working and application of unconventional machining processes like Electro-Discharge machining, Electrochemical machining
CO3	Know the principle and working and application of unconventional machining processes like Laser beam machining, Electron beam machining
CO4	Know the principle and working and application of Unconventional welding processes, Under water welding, Cladding.
CO5	Know the principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction

**CO-PO MAPPING: COURSE: Unconventional Manufacturing Processes
COURSE CODE: ME405**

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Know the principle and working and applications of unconventional machining process, need of unconventional manufacturing processes & its classification and its future possibilities.	3	1	2	2	2	2	1	1	1	1	1	2
C02	Know the principle and working and application of unconventional machining processes like Electro-Discharge machining, Electrochemical machining	3	3	2	2	3	3	1	1	1	1	1	3
C03	Know the principle and working and application of unconventional machining processes like Laser beam machining, Electron beam machining	3	3	2	2	2	3	1	1	2	1	1	3
C04	Know the principle and working and application of Unconventional welding processes, Under water welding, Cladding.	3	3	2	2	3	3	1	1	2	1	1	3
C05	Know the principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction	3	3	2	2	1	2	1	1	1	1	1	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: AUTOMOBILE ENGINEERING
COURSE CODE: ME407

COURSE OBJECTIVES:

The purpose of this course is to impart adequate knowledge in both practically and theoretically, covering the various types of power-driven vehicles and to familiarize the students with the fundamentals of Automotive Engine System, Chassis and suspension system, braking and transmission system, and cooling system. The

students are acquainted with the operation, maintenance and repairs of all components of the various transportation vehicles.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	1. List different types of Engine and their classifications..
CO2	Develop concept and define working of Automobile Engine cooling and lubrication system.
CO3	Describe functioning of Transmission train, conventional and non-conventional drives, Clutches, Gear boxes, Synchromesh device, Propeller shaft, Differential axle, braking system and Suspension systems.
CO4	Describe functioning of steering system, steering geometry wheel alignment and wheel angles for modern Automobile.
CO5	Describe starting system and electrical system

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
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C01	List different types of Engine and their classifications..	3	2	1	1	3	2	1							3
C02	Develop concept and define working of Automobile Engine cooling and lubrication system.	3	3	3	2	2	3	1							2
C03	Describe functioning of Transmission train, conventional and non-conventional drives, Clutches, Gear boxes, Synchromesh device, Propeller shaft, Differential axle, braking system and Suspension systems	3	3	2	2	2	3								2
C04	Describe functioning of steering system, steering geometry wheel alignment and wheel angles for modern Automobile	3	2	2	2	3	3	1							2
C05	Describe starting system and electrical system	3	1	1	1	1	3								2

3: Strong contribution, 2: average contribution, 1: Low contribution

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: Mechanical System Design

COURSE CODE: ME-408

COURSE OBJECTIVES:

1. To impart the knowledge about system concept of engineering, role of engineer, concurrent engineering, Problem formulation.
2. To know about system theories and system modeling.
3. To impart knowledge about linear graph analysis and optimization concepts.
4. To understand system evaluation and calculus methods for optimization.
5. To know about decision analysis and system simulation.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Apply system concept of engineering, engineering activity matrix, solve engineering problems and formulate problems.
CO2	Understand black box approach, state theory approach, concepts of linear graph modeling and mathematical modeling.
CO3	Analyze path problems, network flow problems and to understand the concept and methods of optimization.
CO4	Assess feasibility, plan horizon, financial analysis and to understand the concept of model with one and two decision variables.
CO5	Learn the elements of decision problem, utility value and to apply Baye's theorem.

CO-PO MAPPING: (SUB : Mechanical System Design , SUB CODE : ME-408)

COURSE OUTCOME (CO)		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	Apply system concept of engineering, engineering activity matrix, solve engineering problems and formulate problems.	3	2	3	2	2	2	1	1	3	1	2	3
CO2	Understand black box approach, state theory approach, concepts of linear graph modeling and mathematical modeling.	3	3	3	2	2	2	1	1	2	1	2	2
CO3	Analyze path problems, network flow problems and to understand the concept and methods of optimization.	3	3	3	2	2	2	1	2	3	1	1	3
CO4	Assess feasibility, plan horizon, financial analysis and to understand the concept of model with one and two decision variables.	3	3	3	2	1	3	1	1	3	2	3	2
CO5	Learn the elements of decision problem, utility value and to apply Baye's theorem.	3	3	2	2	2	2	1	2	2	1	1	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: ENERGY MANAGEMENT
COURSE CODE: ME409

COURSE OBJECTIVES:

- Teaching the basic concepts and fundamental aspects of industrial and domestic thermal systems' design.
- Prepare the students for the positions of energy management in energy intensive industries
- Ability to identify the energy management skills and strategies in the energy management system.
- Ability to understand various energy conservation methods useful in a particular industry.
- Ability to select appropriate energy conservation method for the critical area identified.
- Ability to prepare an energy audit report.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Identify the demand supply gap of energy in Indian scenario Demonstrate basic concepts and importance of non-destructive testing and their application and also the understanding of commonly used NDT methods.
CO2	Carry out energy audit of an industry/Organization.
CO3	Draw the energy flow diagram of an industry and identify the energy wasted or a waste stream
CO4	Select appropriate energy conservation method to reduce the wastage of energy.
CO5	Draw the energy flow diagram of an industry and identify the energy wasted or a waste stream and evaluate the techno economic feasibility of the energy conservation technique adopted

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Identify the demand supply gap of energy in Indian scenario	3	3	2	2	2	2	3				1	3
C02	Carry out energy audit of an industry/Organization.	3	3	3	2	2	3	2				2	2
C03	Draw the energy flow diagram of an industry and identify the energy wasted or a waste stream	3	3	2	2	2	3	2				2	2
C04	Select appropriate energy conservation method to reduce the wastage of energy.	3	2	2	2	3	3	2				1	2
C05	Draw the energy flow diagram of an industry and identify the energy wasted or a waste stream and evaluate the techno economic feasibility of the energy conservation technique adopted	3	1	1	1	1	3	3				2	2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: HEATING VENTILATION AND AIR CONDITIONING

COURSE CODE: ME411

COURSE OBJECTIVES:

- To Know about Human comfort requirement
- Air conditioning system and its type
- Central air conditioning system Vs unitary air conditioning system
- Building services and BMS
- Design and installation of central AC plant

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Isolate the key features Air conditioning system
CO2	Indicate how the central AC plant works.
CO3	Describe the various aspect of human comfort
CO4	Differentiate between central Ac and Unitary Ac , Develop skill to manage installation site of air conditioning plant.
CO5	Estimate the total cost of any HVAC project Develop fundamental knowledge of the types of ventilation system and heating, cooling system.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Isolate the key features Air conditioning system	3	3	2	2	2	3						3
C02	Indicate how the central AC plant works.	3	3	3	2	2	2						2
C03	Describe the various aspect of human comfort	3	2	2	1	2	2	3					3
C04	Differentiate between central Ac and Unitary Ac, Develop skill to manage installation site of air conditioning plant.	3	2	2	2	3	3						2
C05	Estimate the total cost of any HVAC project Develop fundamental knowledge of the types of ventilation system and heating, cooling system.	3	2	2	3	2	2	2					2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: NON DESTRUCTIVE TESTING

COURSE CODE: ME413

COURSE OBJECTIVES:

- Importance of NDT in quality assurance
- Introduction to Magnetic Particle Testing
- Introduction to penetrant testing
- Introduction to radiographic testing
- Introduction to ultrasonic testing

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Demonstrate basic concepts and importance of non-destructive testing and their application and also the understanding of commonly used NDT methods.
CO2	Understanding of Magnetism and Magnetizing devices and their properties its use in different magnetization techniques
CO3	Knowledge of aim and application areas of penetrant testing, test methods, types of penetrants and their properties
CO4	Understanding of properties of X and gamma rays and their generation and Radiographic exposure technique
CO5	Good knowledge of principles of wave propagation and working principle of ultrasonic testing techniques

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Demonstrate basic concepts and importance of non-destructive testing and their application and also the understanding of commonly used NDT methods.	3	3	2	2	2	2	1					3
C02	Understanding of Magnetism and Magnetizing devices and their properties its use in different magnetization techniques	3	3	3	2	2	3	1					2
C03	Knowledge of aim and application areas of penetrant testing, test methods, types of penetrants and their properties	3	3	2	2	2	3						2
C04	Understanding of properties of X and gamma rays and their generation and Radiographic exposure technique	3	2	2	2	3	3	1					2
C05	Good knowledge of principles of wave propagation and working principle of ultrasonic testing techniques	3	1	1	1	1	3						2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: Fuel and Combustion

COURSE CODE: ME414

COURSE OBJECTIVES:

1. To give the knowledge about different types of conventional and nonconventional fuels, their origins and properties.
2. To give them the basic understanding of combustion thermodynamics.
3. To equip students with the knowledge of chemical kinetics.
4. To give them an understanding of premixed and diffusion flames
5. To give them the knowledge about sources of pollutants produced during combustion, and its controlling methods.

COURSE OUTCOMES (CO):

This course is designed to offer basic knowledge to the students in the area of applied combustion. By studying this course, the student shall be able work in industrial power plants and automobile sector. He/she shall be able to find:

1. The flame temperature of commercial fuels burning in the combustion chambers of internal combustion engines.
2. The rate of chemical reactions and emission characteristics of hydrocarbon fuels used in power plants and transportation sector.
3. The burning velocity of premixed flames and important combustion characteristics of diffusion flames.
4. Thermodynamic and transport properties of fuels at elevated pressures and temperatures prevalent in the combustion chambers of actual engines.
5. Methods of controlling the pollutants produced during combustion.

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To give the knowledge about different types of conventional and nonconventional fuels, their origins and properties.
CO2	To give them the basic understanding of combustion thermodynamics.
CO3	To equip students with the knowledge of chemical kinetics.
CO4	To give them an understanding of premixed and diffusion flames
CO5	To give them the knowledge about sources of pollutants produced during combustion, and its controlling methods.

After completion of the course, a student will be able to

CO-PO MAPPING:

CO		PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
CO1	To give the knowledge about different types of conventional and nonconventional fuels, their origins and properties.	3	3	3	2	3	3	3	3				3
CO2	To give them the basic understanding of combustion thermodynamics.	3	3	3	2	2	3	3	3				2
CO3	To equip students with the knowledge of chemical kinetics	3	3	3	3	3	3	3	3				2
CO4	To give them an understanding of premixed and diffusion flames	3	3	3	2	2	3	3	3				2
CO5	To give them the knowledge about sources of pollutants produced during combustion, and its controlling methods.	3	3	3	2	2	3	3	3				3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: INDUSTRIAL ERGONOMICS

COURSE CODE: IME063

COURSE OBJECTIVES:

1. Have an ability to apply knowledge of the sciences of human factors and workplace ergonomics.
2. Have an ability to design and conduct experiments, as well as to analyze and interpret data.
3. Have an ability to design a system, component, or process to meet accepted human factors and workplace ergonomics standards within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Have an ability to function on multi-disciplinary teams.
5. Have an ability to identify, formulate and solve human factors and workplace ergonomics problems.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To identify, formulate and solve human factors and workplace ergonomics problems.
CO2	Have an understanding of professional and ethical responsibility.
CO3	Have the broad education necessary to understand the impact of human factors and workplace ergonomics solutions in a global, economic, environmental, and societal context.
CO4	Have a recognition of the need for, and an ability to engage in, life-long learning.
CO5	Have the knowledge of contemporary issues.

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	To identify, formulate and solve human factors and workplace ergonomics problems.	3	3	2	2	2	3						3
C02	Have an understanding of professional and ethical responsibility.	3	3	3	2	1	1						2
C03	Have the broad education necessary to understand the impact of human factors and workplace ergonomics solutions in a global, economic, environmental, and societal context.	3	2	2	1	2	2	3					3
C04	Have a recognition of the need for, and an ability to engage in, life-long learning.	3	2	2	2	3	3						2
C05	Have the knowledge of contemporary issues.	3	2	2	3	2	2	2					2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: NON CONVENTIONAL MANUFACTURING PROCESS

COURSE CODE: IEME 053

COURSE OBJECTIVES:

- To impart the knowledge of basics of different non conventional types of power generation & power plants in detail so that it helps them in understanding the need and role of Non-Conventional Energy sources particularly when the conventional sources are scarce in nature.
- Learn the various techniques to store the non-conventional energy sources.
- Outline division aspects and utilization of renewable energy sources for both domestic and industrial application
- Analyze the environmental aspects of renewable energy resources.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations
CO2	Know the need of renewable energy resources, historical and latest developments.
CO3	Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation
CO4	Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications. 5. Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications
CO5	Acquire the knowledge of fuel cells, wave power, tidal power and geothermal principles and application

CO-PO MAPPING:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modern tool usage	PO6 Engineer and Society	PO7 Environment and Sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communication	PO11 Project Management and Finance	PO12 Lifelong learning
C01	Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations	3	3	2	1	1	3						3
C02	Know the need of renewable energy resources, historical and latest developments.	3	3	3	2	1	1						2
C03	Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation	3	2	1	1	2	2	3					3
C04	Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications. 5. Understand the concept of Biomass energy resources and their classification, types of biogas Plants-applications	3	2	2	2	3	3						2
C05	Acquire the knowledge of fuel cells, wave power, tidal power and geothermal principles and application	3	1	1	1	1	2	1					2
3: Strong contribution, 2: average contribution, 1: Low contribution													

