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
CO1	Explain basic concepts of thermal sciences and temperature measurement on the basis of zeroth law of thermodynamics.	3	2	2	1		2						3
CO2	Understand and apply first and second law of thermodynamics to various processes and real systems.	3	3	3	2		3						3
CO3	Model the problem using free-body diagrams and reach to solution by using equilibrium equations.	3	3	3	2		3						3
CO4	Draw Shear Force Diagram (SFD) and Bending Moment Diagrams (BMD) for statistically determinate beams.	3	2	2	2		3						3
CO5	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: MECHANICAL ENGINEERING LAB
COURSE CODE: ME 102

COURSE OBJECTIVES:

- To understand the working and basic components of 4 stroke petrol engine and 4 stroke Diesel engine through study their models.
- To understand the working and basic components of 2 stroke petrol and vapor compression refrigeration system through model study.
- To understand basic components and working of water tube boiler through model study.
- To learn the technique for determine of hardness and impact strength of a material.
- To learn the technique for determine of compressive strength of a brick through UTM.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To understand the working and basic components of 4 stroke petrol engine and 4 stroke Diesel engine through study their models.
CO2	To understand the working and basic components of 2 stroke petrol and vapor compression refrigeration system through model study.
CO3	To understand basic components and working of water tube boiler through model study.
CO4	To learn the technique for determine of hardness and impact strength of a material.
CO5	To learn the technique for determine of compressive strength of a brick through UTM.

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 understand the working and basic components of 4 stroke petrol engine and 4 stroke Diesel engine through study their models.	3	2	2	1		2	1					3
CO2	To understand the working and basic components of 2 stroke petrol and vapor compression refrigeration system through model study.	3	2	3	2		3	1					3
CO3	To understand basic components and working of water tube boiler through model study.	3	2	3	2		3						3
CO4	To learn the technique for determine of hardness and impact strength of a material.	3	3	2	2		3						3
CO5	To learn the technique for determine of compressive strength of a brick through UTM.	3	3	2	1		3						3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: ENGINEERING GRAPHICS
COURSE CODE: ME103

COURSE OBJECTIVES:

- Main objective is to teach the fundamentals of Engineering Graphics.
- This course enhances visualisation skill and imagination power.
- To understand techniques of drawings in various fields of engineering
- To improve their technical communication skill in the form of communicative drawings.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Describe the fundamentals of engineering drawing, use of geometrical instruments and drawing steps.
CO2	To understand the concept of projection and acquire visualization skills, draw the projection of points, lines and planes.
CO3	Classify solids and projection of solids at different positions
CO4	To get the exact sectioned view of solids and development of their surfaces.
CO5	To draw isometric projection and perspective views of an object.

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	Describe the fundamentals of engineering drawing, use of geometrical instruments and layout for initial drawing.	3					1			1			3
CO2	To understand the concept of projection and acquire visualization skills, draw the projection of points, lines and planes.	3	2	2			1			1			3
CO3	Classify solids and projection of solids at different positions	3	2	2			1			1			3
CO4	Show sectioned view of solids and development of surface.	3	2	2			1			1			3
CO5	To draw isometric projection and perspective views of an object.	3	2	2			1			1			3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: WORKSHOP PRACTICE

COURSE CODE: ME104

COURSE OBJECTIVE:

1. To impart practical knowledge and hands-on practice on the lathe machine.
2. To impart practical knowledge of basic tools and operations in the fitting shop and carpentry shop.
3. To impart basic knowledge of smithy tools and hands-on practice in smithy shop.
4. To impart basic knowledge of different welding tools and equipment and hands-on practice of making different welding joints.
5. To impart practical knowledge of different types of sheet metal tools and equipments and hands-on practice of making sheet metal components.

COURSE OUTCOMES (CO):

After the successful course completion, students will be able to:

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Perform different operations on lathe machine.
CO2	Manufacture components using tools and equipments of fitting shop and carpentry shop.
CO3	Make components in smithy shop using different types of smithy tools and equipments.
CO4	Perform different joining operations using welding tools and equipments.
CO5	Make sheet metal components using different sheet metal tools and equipments.

CO-PO MAPPING:

CO	DESCRIPTION	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	Perform different operations on lathe machine.	3	2	2	2	3	2	0	0	2	0	2	3
CO2	Manufacture components using tools and equipments of fitting shop and carpentry shop.	3	2	2	3	2	2	0	0	2	0	2	3
CO3	Make components in smithy shop using different types of smithy tools and equipments.	2	2	2	2	2	2	0	0	2	0	2	3
CO4	Perform different joining operations using welding tools and equipments.	2	2	2	3	3	2	0	0	2	0	2	3
CO5	Make sheet metal components using different sheet metal tools and equipments.	2	2	2	3	2	2	0	0	2	0	2	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: - MATERIALS SCIENCE
COURSE CODE: - ME201

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.

COURSE OUTCOMES (CO):

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

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** Modem 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	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
CO2	Classify the different mechanical testing methods with their inherent merits and limitations	3	3	3	3	3	3	1					3
CO3	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
CO4	Demonstrate concepts related to electrical and magnetic properties and their applications	3	2	2	1	3	2						2
CO5	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 MECHANICAL 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
CO1	Demonstrate basic concepts of thermal sciences and their application in formulating the thermal engineering problems.	3	3	2	2	2	2	1					3
CO2	Demonstrate about steam generation, properties of steam and its application.	3	3	3	2	2	3	1					2
CO3	Demonstrate the use of steam in power generation in the efficient manner.	3	3	2	2	2	3						2
CO4	Demonstrate concepts related to I.C. engine and gas turbine and its analysis.	3	2	2	2	3	3						2
CO5	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: STRENGTH OF MATERIALS
COURSE CODE: ME203

COURSE OBJECTIVES:

1. To impart knowledge about the significance of strength of materials and testing of newly developed engineering materials used in industries and research organizations for elastic and plastic deformations.

2. To inculcate specialized knowledge and skill in designing of various components used in mechanical engineering for static loading.

3. To cultivate the ability to develop and implement new and improved advanced design elements and strength of materials resulting in creation and distribution of value in engineering applications.

4. To impart knowledge about Deflection of Beams, Thin & Thick cylinder, Column & Strut, Open and Closed coiled springs and different other common mechanical engineering design elements.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Fundamental concepts and importance of Compound stresses, Mohr's Circle. 3-D Stress, Theory of Failure, Castiglioni's Theorem, Impact Load & Strain energy.
CO2	Fundamental concepts and importance of Deflection of Beams, Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams. Fundamental knowledge of Torsion as well as combined bending & torsion of solid & hollow shafts.
CO3	Fundamental concepts and importance of Helical and Leaf Springs, Deflection of springs by energy method, helical springs under axial load and under axial twist axial both for open and closed coiled springs, Fundamental concepts and importance Columns and Struts, Combined bending and direct stress, middle third and middle quarter rules, Struts with different end conditions. Euler's theory and experimental results, Ranking Gordon Formulae.

CO4	Fundamental concepts and design of Thin Cylinders and Thick Cylinders**:** Hoop, Longitudinal and Radial stresses s and strains. Volumetric strain. Thick cylinders subjected to internal or external pressures, Compound cylinders.
CO5	Fundamental concepts and importance of Curved Beams: Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross- sections, stress in crane hooks, stress in circular rings subjected to tension or compression. Fundamental concepts and importance Unsymmetrical Bending: Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axis and about one axis) for I-section and channel-section. .

CO-PO MAPPING:

	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	Fundamental concepts and importance of Compound stresses, Mohr's Circle. 3-D Stress, Theory of Failure, Castiglioni's Theorem, Impact Load & Strain energy.	3	3	2	2	2	2	1	1	2	1	1	3
CO2	Fundamental concepts and importance of Deflection of Beams, Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams. Fundamental knowledge of Torsion as well as combined bending & torsion of solid & hollow shafts.	3	3	3	2	2	2	1	1	2	1	1	2
CO3	Fundamental concepts and importance of Helical and Leaf Springs, Deflection of springs by energy method, helical springs under axial load and under axial twist axial both for open and closed coiled springs, Fundamental concepts and importance Columns and Struts, Combined bending and direct stress, middle third and middle quarter rules, Struts with different end conditions. Euler's theory and experimental results, Ranking Gordon Formulae.	3	3	3	2	2	2	1	1	2	1	1	3
CO4	Fundamental concepts and design of Thin Cylinders and Thick Cylinders: Hoop, Longitudinal and Radial stresses s and strains. Volumetric strain. Thick cylinders subjected to internal or external pressures, Compound cylinders.	3	2	2	2	3	3	1	1	1	1	1	2

CO5	Fundamental concepts and importance of Curved Beams: Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross- sections, stress in crane hooks, stress in circular rings subjected to tension or compression. Fundamental concepts and importance Unsymmetrical Bending: Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axis and about one axis) for I-section and channel-section.	3	2	3	2	2	2	1	2	3	1	1	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: FLUID MECHANICS
COURSE CODE: CE201

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 and 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 and Examine energy losses in pipe transitions and sketch energy gradient lines.
CO4	Evaluate pressure drop in pipe flow using Hagen-Poiseuille's equation for laminar flow in a pipe
CO5	Examine boundary layer over flat plate and analyze wall shear stress, drag force.

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	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
CO2	Compute force of buoyancy on a partially or fully submerged body and Analyze the stability of a floating body.	3	3	2	1	1	2	2					3
CO3	Derive Euler's Equation of motion and Deduce Bernoulli's equation and Examine energy losses in pipe transitions and sketch energy gradient lines.	3	3	3	2	1	2	1					3
CO4	Evaluate pressure drop in pipe flow using Hagen-Poiseuille's equation for laminar flow in a pipe	3	3	2	2	1	2						2
CO5	Examine boundary layer over flat plate and analyze wall shear stress, drag force.	3	3	2	2	1	2						2
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: KINEMATICS OF MACHINES
COURSE CODE: ME207

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
CO1	Ability to identify and analyze the mechanisms required for a particular motion requirement	3	3	2	2	2	2	1					3
CO2	Capability to analyze the velocity and acceleration of planar mechanisms.	3	3	3	2	2	3	1					2
CO3	Propensity to synthesize planar mechanisms for the given motion parameters .	3	3	2	2	2	3						2
CO4	Ability to design and analyze various types of CAM. .	3	2	2	2	3	3						2
CO5	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													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: MANUFACTURING SCIENCE -1
COURSE CODE: ME208

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: MEASUREMENTS, METROLOGY & CONTROL
COURSE CODE: ME209

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 devises 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
CO1	Explain the basics of standards of measurement, limits, fits & tolerances industrial applications.	3	3	2	2	2	2	1					3
CO2	Identify the uses of gauges and comparators..	3	3	3	2	2	3	1					2
CO3	Understand the significance of measurement system, errors, transducers, intermediate modifying and terminating devices. .	3	3	2	2	2	3						2
CO4	Interpret measurement of field variables like force, torque and pressure. . .	3	2	2	2	3	3						2
CO5	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:

- Understanding the fundamental of polymer science
- Understanding the process and methods of different polymerization
- To get updated about recent development of polymer industry
- Knowledge of different polymers and their properties for developing the different products.
- 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
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	3	3	2	2	1	3						3
CO2	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
CO3	Describe the role of rubber-toughening in improving the mechanical properties of polymers	3	2	1	1	2	2	3					3
CO4	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
CO5	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: MATERIALS SCIENCE AND TESTING LAB
COURSE CODE: ME204

COURSE OBJECTIVES:

- To gain knowledge about identifying materials and the effect of corrosion.
- To understand and compare the changes in properties of materials by different heat treatment processes.
- To impart the knowledge of microstructures of different ferrous and non-ferrous metals and specimen preparation.
- To get the practical knowledge about tensile and compressive testing to find desired properties of materials by using UTM and spring testing machines.
- To develop an understanding and practical knowledge about the importance of impact and cupping test.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To acquire knowledge of material identification of 50 common items and learn about the corrosion and its effect.
CO2	To conduct and measure the hardness value of different metals before and after heat treatment processes by using Brinell hardness tester.
CO3	To learn about the specimen preparation for metallographic preparation and microstructure of different metals.
CO4	To conduct and analyse tensile and compressive tests over universal testing machine and spring testing machine.
CO5	To conduct and analyse the Izod impact test and cupping test over a given specimen.

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 Fi	**PO12** Lifelong learning
CO1	To acquire knowledge of material identification of 50 common items and learn about the corrosion and its effect.	3	2	2	2	2	3			3	2		3
CO2	To conduct and measure the hardness value of different metals before and after heat treatment processes by using Brinell hardness tester.	3	3	3	3	2	3			3	2		3
CO3	To learn about the specimen preparation for metallographic preparation and microstructure of different metals.	3	3	3	3	2	3			3	2		3
CO4	To conduct and analyse tensile and compressive tests over universal testing machine and spring testing machine.	3	3	3	3	2	3			3	2		3
CO5	To conduct and analyse the Izod impact test and cupping test over a given specimen.	3	3	2	3	2	3			2	2		3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: APPLIED THERMODYNAMICS LAB

COURSE CODE: ME205

COURSE OBJECTIVE

- Study of La-Mont Boiler and Loeffler Boiler and turbines.
- Able to understand the working of Turbo-Jet engine model.
- Able to understand the concept and working of domestic refrigerator and air conditioner.
- Be able to have the concepts of a 2 Stroke Petrol Engine and 4 Stroke Petrol Engine and Diesel Engine.
- To prepare heat balance sheet after performing Morse test on 4 stroke petrol engine.

COURSE OUTCOMES

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understanding and principal of working of different types of boilers. Concept of the basic working of a domestic refrigerator and air conditioner.
CO2	To learn about the working of Turbo-Jet engine model
CO3	Understand the concepts of the basic working of a domestic refrigerator and air conditioner.
CO4	To learn the basic concepts of a 2 Stroke Petrol Engine and 4 Stroke Petrol Engine and Diesel Engine.
CO5	Able to perform the Morse Test on a 4-Stroke 4 Cylinder Petrol Engine and learn to prepare heat balance sheet.

CO PO Mapping:

	CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/development of solutions	PO4 Conduct investigations into complex problems	PO5 Modem 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	Understanding and principal of working of different types of boilers. Concept of the basic working of a domestic refrigerator and air conditioner.	3	3	2	2	2	2	1					3
CO2	To learn about the working of Turbo-Jet engine model	3	3	3	2	2	3	1					3
CO3	Understand the concepts of the basic working of a domestic refrigerator and air conditioner.	3	3	2	2	2	3			2			3
CO4	To learn the basic concepts of a 2 Stroke Petrol Engine and 4 Stroke Petrol Engine and Diesel Engine.	3	2	2	2	3	3	1					3
CO5	Able to perform the Morse Test on a 4-Stroke 4 Cylinder Petrol Engine and learn to prepare heat balance sheet.	3	1	1	1	1	3			3			3
	3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: FLUID MECHANICS LAB

COURSE CODE: CE205

COURSE OBJECTIVES:

1. To impart practical knowledge/techniques to verify Bernoulli's Theorem and its application.
2. To impart practical knowledge/techniques to determine the Meta-centric height of a ship model and to verify Impulse Momentum equation experimentally.
3. To impart practical knowledge/techniques to study the transition from laminar to turbulent flow and determine the lower critical Reynolds number.
4. To impart practical knowledge/techniques to Plot the flow pattern net using the Hele-shaw apparatus and find the Coefficient of Discharge in rectangular and triangular notch.
5. To impart practical knowledge/techniques to determine the variation of friction factor 'f', for turbulent flow in commercial pipes

COURSE OUTCOMES (CO):

After the successful course completion, students will be able to :

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learn the concept of Bernoulli's Theorem and apply it to find the discharge using Venturi-meter and Orifice meter
CO2	Determine the Meta-centric height of a ship model and verify the Impulse Momentum equation experimentally.
CO3	Study the transition from laminar to turbulent flow and determine the lower critical Reynolds number
CO4	Plot the flow pattern net using the Hele-shaw apparatus and find the Coefficient of Discharge in rectangular and triangular notch
CO5	Determine the variation of friction factor 'f', for turbulent flow in commercial pipes

CO-PO MAPPING:

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Learn the concept of Bernoulli's Theorem and apply it to find the discharge using Venturi-meter and Orifice meter	3	3	2	2	2	3	0	0	3	2	0	3
CO2	Determine the Meta-centric height of a ship model and verify the Impulse Momentum equation experimentally	3	3	2	3	2	2	0	0	3	2	0	3
CO3	Study the transition from laminar to turbulent flow and determine the lower critical Reynolds number	3	3	3	2	2	2	0	0	3	2	0	3
CO4	Plot the flow pattern net using the Hele-shaw apparatus and find the Coefficient of Discharge in rectangular and triangular notch	3	3	3	3	3	3	0	0	3	2	0	3
CO5	Determine the variation of friction factor 'f', for turbulent flow in commercial pipes	3	3	3	3	2	3	0	0	3	2	0	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: MACHINE DRAWING LAB-1
COURSE CODE: ME206

COURSE OBJECTIVES:

- Helping the student in drafting their technical ideas
- Understanding the importance of the linking functional and visualization aspects in the preparation of the part drawings.
- Help the student in the visualization of assembly and sub assembly of various machine elements.
- To impart basic knowledge on Computer Aided Design methods and procedures.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Know and understand the parts and detailed assembly drawing of various machine elements like Steam engine cross head, Eccentric, Lathe tail stock, screw jack, machine vice etc.
CO2	Able to understand product symbols of Surface roughness and Machining.
CO3	Interpret engineering drawings using fundamental of Limit fits and tolerances.
CO4	Improve their visualization skills so that they can apply these skills in developing new products by understanding simple machine parts.
CO5	Gain the basic concepts of Auto- CAD and the methods of advance engineering drawing using intermediate geometry and comprehend the theory of projection.

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	Know and understand the parts and detailed assembly drawing of various machine elements like Steam engine cross head, Eccentric, Lathe tail stock, screw jack, machine vice etc.	3	3	2	2	2	3	1	1				3
CO2	Able to understand product symbols of Surface roughness and Machining.	3	2	3	2	2	3	2	1				3
CO3	Interpret engineering drawings using fundamental of Limit fits and tolerances.	3	3	2	2	3	2	2	1				3
CO4	Improve their visualization skills so that they can apply these skills in developing new products by understanding simple machine parts.	3	3	3	2	2	2	1	1				3
CO5	Gain the basic concepts of Auto- CAD and the methods of advance engineering drawing using intermediate geometry and comprehend the theory of projection.	3	2	3	2	2	3	1	1				3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: Manufacturing Science Lab I **COURSE CODE**: ME210

COURSE OBJECTIVE:

1. To impart knowledge of patterns for mould making.
2. To know about melting of metals with the help of furnaces.
3. To impart basic knowledge of sand quality.
4. To understand metal working using metal working machines.
5. To know about use and operations for sheet metal.

COURSE OUTCOMES

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Knowledge of pattern and able to make mould for casting
CO2	To operate furnace to melt metal for casting
CO3	Understand the concepts of the basic knowledge of sand quality by experiment.
CO4	Learned basic concepts metal working and types of metal working.
CO5	Performed basic sheet metal working operations and power press

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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	Knowledge of pattern and able to make mould for casting.	3	2	2	2	2	2						3
CO2	To operate furnace to melt metal for casting	3	3	1	2	2	3	1					3
CO3	Understand the concepts of the basic knowledge of sand quality by experiment.	3	3	1	2	2	3			2			3
CO4	Learned basic concepts metal working and types of metal working.	3	2	2	2	3	3	1					3
CO5	Performed basic sheet metal working operations and power press	3	1	3	1	1	3			3			3
	3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: MEASUREMENTS, METROLOGY & CONTROL LAB
COURSE CODE: ME211

COURSE OBJECTIVES:

- To impart practical knowledge/ techniques to determine least count of Vernier Caliper & Micrometer.
- To impart practical knowledge/ techniques to determine ovality of shaft using dial indicator.
- To impart practical knowledge/ techniques to determine rpm of a shaft using stroboscope.
- To impart practical knowledge/ techniques to calibrate digital instrument using strain gauge.
- Imparting knowledge to measure the unknown taper angle of a given object with the help of sine bar and slip gauges.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Demonstrate basic experimental technique to determine least count of Vernier Caliper & Micrometer.
CO2	Demonstrate basic experimental technique to measure the unknown taper angle of a given object with the help of sine bar and slip gauges.
CO3	Demonstrate basic experimental technique to determine ovality of a shaft using dial indicator
CO4	Demonstrate basic experimental technique to calibrate digital instrument using strain gauge.
CO5	Demonstrate the ability to determine rpm of a shaft using stroboscope.

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 experimental technique to determine least count of Vernier Caliper & Micrometer.	3	3	3	3	3	3			2			3
CO2	Demonstrate basic experimental technique to measure the unknown taper angle of a given object with the help of sine bar and slip gauges.	3	2	2	3	3	3			2			3
CO3	Demonstrate basic experimental technique to determine ovality of shaft using dial indicator.	3	3	2	3	3	3			3			3
CO4	Demonstrate basic experimental technique to calibrate digital instrument using strain gauge.	3	3	2	3	3	3			3			3
CO5	Demonstrate the ability to determine rpm of a shaft using stroboscope.	3	2	2	2	3	3			2			3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: MACHINE DRAWING LAB-II
COURSE CODE: ME212

COURSE OBJECTIVES:

- Creating knowledge about the various practices with regard to the dimensioning, sectioning and development of views.
- Review of fundamental machine parts and preparation of the part or assembly drawings as per the conventions.
- Interpretation of machine drawings that in turn help the students in the preparation of the production drawings
- To impart basic knowledge on Computer Aided Design methods and procedures.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Construct basic and intermediate geometry and comprehend the theory of projection.
CO2	Know and understand the parts and detailed assembly drawing of various machine elements like Steam engine cross head, Eccentric, Lathe tail stock, stop valve, gate valve, safety valve, air valve, screw jack, machine vice, swivel vice.
CO3	Improve their technical communication skill in the form of communicative drawings using fundamental of Materials, Limit fits and tolerances and standards of surface.
CO4	Improve their visualization skills so that they can apply these skills in developing new products.
CO5	Gain the basic concepts of Auto- CAD and the methods of advance engineering drawing using intermediate geometry and comprehend the theory of projection.

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	Construct basic and intermediate geometry and comprehend the theory of projection.	3	3	2	2	2	3	1	1				3
CO2	Know and understand the parts and detailed assembly drawing of various machine elements like Steam engine cross head, Eccentric, Lathe tail stock, stop valve, gate valve, safety valve, air valve, screw jack, machine vice, swivel vice.	3	2	3	2	2	3	2	1				3
CO3	Improve their technical communication skill in the form of communicative drawings using fundamental of Materials, Limit fits and tolerances and standards of surface.	3	3	2	2	3	2	2	1				3
CO4	Improve their visualization skills so that they can apply these skills in developing new products.	3	3	3	2	2	2	1	1				3
CO5	Gain the basic concepts of Auto- CAD and the methods of advance engineering drawing using intermediate geometry and comprehend the theory of projection.	3	2	3	2	2	3	1	1				3
3: Strong contribution, 2: average contribution, 1: Low contribution													

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 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.
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 Proceedure.
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:

	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 Proceedure.	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: DYNAMICS OF MACHINES
COURSE CODE: ME302

COURSE OBJECTIVES:

- Understand basic principles associated with theory of machine.
- Construct turning moment diagram.
- Perform dynamic analysis of mechanisms.
- To understand the basics concepts of turning moment diagrams for IC engines and governors.
- Design and Solve problems on power transmission elements.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Construct turning moment diagram.
CO2	To Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.
CO3	To develop knowledge of solve problems on power transmission elements
CO4	Differentiate between various types of governors and its working along with the different important measures.
CO5	Analyse effect of gyroscopic couple on vehicles, ships and aeroplanes. To Develop understanding of vibrations and its significance on engineering design

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	Construct turning moment diagram.	3	3	2	2	2	3						3
CO2	To Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.	3	3	3	2	2	2						2
CO3	To develop knowledge of solve problems on power transmission elements	3	2	2	1	2	2	3					3
CO4	Differentiate between various types of governors and its working along with the different important measures.	3	2	2	2	3	3						2
CO5	Analyse effect of gyroscopic couple on vehicles, ships and aeroplanes. To Develop understanding of vibrations and its significance on engineering design	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: 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
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..	3	3	2	2	2	2	1	2	2	2	1	3
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	3	3	3	2	2	2	1	2	2	2	1	2
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	3	2	3	2	2	2	1	3	2	2	1	3
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.	3	2	2	2	3	3	1	2	1	2	1	2
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.	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: HEAT AND MASS TRANSFER
COURSE CODE: ME304

COURSE OBJECTIVES:

1. Students will understand the basic concepts of conduction, convection and radiation heat transfer and able to solve one and two-dimensional conduction heat transfer problems.
2. Students will understand the fundamentals of extended surfaces and able to solve the problems of steady and unsteady heat transfer process.
3. Students will understand the fundamentals of the relationship between fluid flow and convection heat transfer. Students will apply empirical correlations for both forced and free convection to determine values for the convection heat transfer coefficient.
4. Students will understand the basic concepts of radiation heat transfer to include both black body radiation and gray body radiation.
5. Students will understand the concepts of heat transfer process in heat exchangers and able to design the exchanger by LMTD and NTU method.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Basic concepts of conduction, convection and radiation heat transfer. Formulate and solve one and two-dimensional conduction heat transfer problems.
CO2	Fundamentals of heat transfer in extended surface and unsteady heat transfer process.
CO3	Widening the concepts of convection and solving problems related to its applications.
CO4	Strengthening the basics of radiation and understanding the related laws.
CO5	Fundamentals of heat exchangers and its analysis using LMTD and NTU methods and understanding of mass transfer using analogy with heat transfer.

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	Basic concepts of conduction, convection and radiation heat transfer. Formulate and solve one and two-dimensional conduction heat transfer problems.	3	3	3	2	2	3	3	2				3
CO2	Fundamentals of heat transfer in extended surface and unsteady heat transfer process.	3	2	2	2	2	3	3	2				3
CO3	Widening the concepts of convection and solving problems related to its applications.	3	3	3	2	2	3	3	3				3
CO4	Strengthening the basics of radiation and understanding the related laws.	3	3	3	2	2	3	3	2				3
CO5	Fundamentals of heat exchangers and its analysis using LMTD and NTU methods and understanding of mass transfer using analogy with heat transfer.	3	3	2	2	3	3	3				3	

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: PROJECT MANAGEMENT
COURSE CODE: ME305

COURSE OBJECTIVES:

- To know about the project characteristics, nature and context of project management and project environment. Organizing human resources and project direction.
- To learn about the various types of organizations, project contracts and its various types.
- To know about the various types of project appraisals, cost analysis of project and project performance analysis.
- To learn about network analysis based on PERT/CPM and crashing of network.
- To know about the complexities of project scheduling, resource leveling and allocation in project scheduling. Also, to know about the common software packages of projects.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Know about the project characteristics, nature and context of project management and project environment. Organizing human resources and project direction.
CO2	Know about the various types of organizations, project contracts and its various types.
CO3	Know about the various types of project appraisals, cost analysis of project and project performance analysis.
CO4	Know about network analysis based on PERT/CPM and crashing of network.
CO5	Know about the complexities of project scheduling, resource leveling and allocation in project scheduling and also about the common software packages of projects.

CO-PO MAPPING:

	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 project characteristics, nature and context of project management and project environment. Organizing human resources and project direction.	3	3	2	2	2	3	2	2	2	2	2	3
CO2	Know about the various types of organizations, project contracts and its various types.	3	3	3	2	2	2	2	2	2	2	2	2
CO3	Know about the various types of project appraisals, cost analysis of project and project performance analysis.	3	3	3	2	3	2	2	2	2	2	2	3
CO4	Know about network analysis based on PERT/CPM and crashing of network.	3	3	2	2	3	3	2	2	3	3	2	2
CO5	Know about the complexities of project scheduling, resource leveling and allocation in project scheduling and also about the common software packages of projects.	3	3	2	2	2	2	2	2	2	2	2	2
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:

- Knowledge about the essentials of Maintenance Engineering and Management.
- Study various types of maintenance procedures with proper importance.
- Study the various equipment replacement procedures.
- Learn about the Assignment Model and Waiting Time Model pertaining to industry related problems.
- 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
CO1	Know about the concepts and importance of Maintenance Engineering and Management.	3	3	2	2	2	2	1	2	2	2	1	3
CO2	Know about the various types of maintenance procedures with respective importance.	3	3	3	2	2	2	1	2	2	2	1	2
CO3	Identify the various equipment replacement procedures and their proper applications.	3	2	3	2	2	2	1	3	2	2	1	3
CO4	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
CO5	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: INTERNAL COMBUSTION ENGINES
COURSE CODE: ME313

COURSE OBJECTIVES:

1. To give an overview of Internal Combustion Engines, their classification, and to carry out thermodynamic analysis of various cycles of operation, to give complete knowledge of type of conventional and nonconventional fuels used in IC engines
2. To give the knowledge about carburetors, MPFI system, Combustion phenomenon in SI engine, and Ignition system in SI engines.
3. To describe the fuel injection in CI engines, combustion phenomena in IC engines, and knocking in CI engine
4. To explain engine cooling, Lubrication, and supercharging of the engines.
5. To give the knowledge about different types of Compressors used in IC engines.

COURSE OUTCOMES (CO):

After taking this course the students should be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To classify various types of I.C. Engines and Cycles of operations and have good knowledge about conventional and nonconventional fuels used in IC engine. Express the effect of various operating variables on engine performance
CO2	Understand the Fuel supply method, and ignition methods used in SI and CI engines
CO3	Distinguish normal and abnormal combustion phenomena in SI and CI engines
CO4	Understand the cooling, lubrication and supercharging systems used in IC engines
CO5	Understand the suitability of different types of compressors used in IC engines

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 classify various types of I.C. Engines and Cycles of operations and have good knowledge about conventional and nonconventional fuels used in IC engine. Express the effect of various operating variables on engine performance.	3	3	3	2	2	3	3	2				3
CO2	Understand the Fuel supply method, and ignition methods used in SI and CI engines	3	2	2	2	2	3	3	2				3
CO3	Distinguish normal and abnormal combustion phenomena in SI and CI engines	3	3	3	2	2	3	3	3				3
CO4	Understand the cooling, lubrication and supercharging systems used in IC engines	3	2	2	2	2	3	3	3				3
CO5	Understand the suitability of different types of compressors used in IC engines	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 CONDOTIONING
COURSE CODE: ME315

COURSE OBJECTIVES:

1. To impart the knowledge about air refrigeration cycles and methods air-craft refrigeration systems.
2. The course structures cover 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:

	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: TRIBOLOGY
COURSE CODE: ME316

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
CO1	Students will become familiar with mathematical tools used to analyze tribological processes.	3	3	2	2	2	2	1					3
CO2	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
CO3	Students will be able to describe the detailed operation of selected anti-friction or anti-wear components	3	3	2	2	2	3						2
CO4	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: 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 purpose of Six Sigma course is to gain break-through knowledge on how to improve processes to do things better, faster, and at lower cost.
3. Understanding required defining the metrics behind the operation in an industry to attain the highest level of improvement possible.
4. Understanding project level of a typical industry and manage the project to completion while demonstrating their skill at applying the Six Sigma methodology.
5. 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.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Knowledge related to basic perspectives of quantitative and non-quantitative quality, its role in modern development, continuous improvement using statistical measurements.
CO2	Develop a basic understanding of Six Sigma principles and practices focused by problem solving case studies.
CO3	Identify and apply various techniques to overcome these barriers by understand Six sigma methodology and tools.
CO4	Interpret control charts and impact of Six Sigma Projects on customers, suppliers and stakeholders
CO5	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
CO1	Knowledge related to basic perspectives of quantitative and non-quantitative quality, its role in modern development, continuous improvement using statistical measurements.	3	3	3	2	3	3	1				3	3
CO2	Develop a basic understanding of Six Sigma principles and practices focused by problem solving case studies.	3	3	3	3	3	3	1				3	3
CO3	Identify and apply various techniques to overcome these barriers by understand Six sigma methodology and tools.	3	3	3	3	3	3	1				3	3
CO4	Interpret control charts and impact of Six Sigma Projects on customers, suppliers and stakeholders	3	2	3	2	3	3	1				3	3
CO5	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: Power Plant Engineering **COURSE CODE: ME318**

Course Objectives

1. To give basic knowledge of different types of Power Plants and their site selection criteria.
2. To understand Power Plant Economics, load calculation of power plant.
3. To give knowledge of different types of boilers and fluidized bed combustion systems.
4. To give knowledge of fuel handling system, ash handling system, feed water treatment and condensers and cooling system.
5. To give basic knowledge of electrical System of the power plant.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Will have basic knowledge of different types of Power Plants like steam power plant, diesel power plant, gas turbine power plant, nuclear power plant and hydroelectric power plant and their site selection criteria.
CO2	Will be able to know Power Plant Economics, various energy storage devices and environmental considerations
CO3	Will understand the working of different types of boilers. Fluidized bed combustion systems.
CO4	Will have basic knowledge of different systems such as fuel handling system, ash handling system, feed water treatment and condensers and cooling system.
CO5	Will have basic knowledge of electrical System such as generators and generator cooling, transformers and their cooling, bus bar. Listing of various control rooms, Pollution due to power generation

CO-PO MAPPING: (Subject: Power Plant Engineering SUB CODE : ME318)

	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	Will have basic knowledge of different types of Power Plants like steam power plant, diesel power plant, gas turbine power plant, nuclear power plant and hydroelectric power plant and their site selection criteria.	3	3	3	3	2	3	3	3	2	-	2	3
CO2	Will be able to know Power Plant Economics, various energy storage devices and environmental considerations	3	3	3	3	2	3	3	3	2	-	3	2
CO3	Will understand the working of different types of boilers. Fluidized bed combustion systems.	3	3	3	3	2	3	3	2	2	-	2	3
CO4	Will have basic knowledge of different systems such as fuel handling system, ash handling system, feed water treatment and condensers and cooling system.	3	3	3	3	3	3	3	3	2	-	2	3
CO5	Will have basic knowledge of electrical System such as generators and generator cooling, transformers and their cooling, bus bar. Listing of various control rooms, Pollution due to power generation.	3	3	3	3	2	3	3	2	2	-	2	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. To understand fundamental approaches for static and dynamic design of complex members.
2. To study design concepts in order to enhance the basic design.
3. To study behavior of mechanical components under fatigue and creep
4. To understand the application of data book in the design of mechanical members.
5. To develop ability to analyze critically and solve complex problems analytically.

CO1	The student can understand the application of gears, its classification, profiles, and strength of spur gears in bending and in wear.
CO2	The student can understand force analysis and design of and Helical Gears, Bevel Gears and Worm gears and their applications
CO3	The student can understand nomenclature, classification, application and force analysis of roller bearings.
CO4	The student can understand and design Sliding contact bearings and its applications
CO5	Design the Engine Parts like connecting rod, crankshaft, and cylinder and piston.

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

	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	The student can understand the application of gears, its classification, profiles, and strength of spur gears in bending and in wear.	3	2	3	2	1	3						3
CO2	The student can understand force analysis and design of and Helical Gears, Bevel Gears and Worm gears and their applications	3	3	3	3	2	3						2
CO3	The student can understand nomenclature, classification, application and force analysis of roller bearings.	3	2	3	3	1	3						2
CO4	The student can understand and design Sliding contact bearings and its applications	3	3	3	3	2	3						2
CO5	Design the Engine Parts like connecting rod, crankshaft, and cylinder and piston.	3	3	3	3	1	3						3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: INDUSTRIAL ERGONOMICS
COURSE CODE: ME321

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
CO1	To identify, formulate and solve human factors and workplace ergonomics problems.	3	3	2	2	2	3						3
CO2	Have an understanding of professional and ethical responsibility.	3	3	3	2	1	1						2
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.	3	2	2	1	2	2	3					3
CO4	Have a recognition of the need for, and an ability to engage in, life-long learning.	3	2	2	2	3	3						2
CO5	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: Applied Elasticity
Course Code: ME322

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

COURSE OUTCOMES (CO):

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

S.No.	CO Description
CO1	To analyze the fundamental concepts of stress for 3D dimensional elastic solids
CO2	To analyze the fundamental concepts of strain for 3D dimensional elastic solids
CO3	To built the basic concepts in stress strain relationship
CO4	To apply the Basic Equations of Elasticity for Solids
CO5	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
CO1	To analyze the fundamental concepts of stress for 3D dimensional elastic solids	3	3	2	3	2	2			1		1	3
CO2	To analyze the fundamental concepts of strain for 3D dimensional elastic solids	3	3	3	3	2	2			1		1	3
CO3	To built the basic concepts in stress strain relationship	3	3	3	3	2	2			1		1	3
CO4	To apply the Basic Equations of Elasticity for Solids	3	3	3	3	2	2			1		1	3
CO5	To analyze the structural sections subjected to torsion.	3	3	3	3	2	2			1		1	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

COURSE: Advance Fluid Mechanics
COURSE CODE: ME323

COURSE OBJECTIVES:

- To provide knowledge regarding Fluid-flow phenomenon observed in mechanical engineering system such as potential flow, vortex flow, boundary layer flow ets.
- To undertake sustained learning in fluid mechanics to advance their knowledge in this field
- To enhance the understanding of fluid mechanics, including the control volume analysis such as Reynolds Transport Theorem
- To impart advance knowledge of the solution of differential analysis of fluid flow problems
- To impart basic concepts related to compressible flow and energy equation in compressible flow

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Recognize the particular flow regimes present in the typical engineering system.
CO2	Calculate the vorticity of given velocity field and analyze the vorticity in forced and free vortex flow.
CO3	Demonstrate the concept of stream function potential function and boundary layer.
CO4	Choose appropriate fluid mechanics principles need to analyze the fluid flow situation in compressible flow.
CO5	Recognize the fluid flow theory can be employed in a modern mechanical engineering design 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
CO1	Recognize the particular flow regimes present in the typical engineering system.	3	3	2	2	2	2	1				
CO2	Calculate the vorticity of given velocity field and analyze the vorticity in forced and free vortex flow.	3	3	3	2	2	3	1				
CO3	Demonstrate the concept of stream function potential function and boundary layer.	3	3	2	2	2	3					
CO4	Choose appropriate fluid mechanics principles need to analyze the fluid flow situation.	3	2	2	2	3	3					
CO5	Recognize the fluid flow theory can be employed in a modern mechanical engineering design environment.	3	3	3	2	2	3					

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

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: **MACHINE DESIGN LAB**

COURSE CODE: ME309

COURSE OBJECTIVE:

1. To impart and apply basic design approach on simple members such as shafts, keys etc.
2. To design complex machines parts like coupling, screw jack and springs.
3. To impart design for important joints like welded joints, riveted joints etc. under static and dynamic load.
4. To provide working knowledge on Computer Aided Design methods and procedures

COURSE OUTCOMES

COURSE OUTCOME (CO)	DESCRIPTION
CO1	The student can understand the concepts of static analysis applied on shafts
CO2	Understand design and applications of mechanical fasteners and joints such as welded joints, screwed joints and riveted joints for various loads.
CO3	Understand the design and drawing of a knuckle joint/ cotter joint.
CO4	The student can design complex machines parts like coupling, screw jack and springs
CO5	The student can draw with proper dimensions on Computer Aided Design software.

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	The student can understand the concepts of static analysis applied on shafts	3	2	3	2	1	3						3
CO2	Understand design and applications of mechanical fasteners and joints such as welded joints, screwed joints and riveted joints for various loads.	3	3	3	2	2	3						3
CO3	Understand the design and drawing of a knuckle joint/ cotter joint.	3	2	3	2	1	3						3
CO4	The student can design complex machines parts like coupling, screw jack and springs	3	2	3	2	2	3						3
CO5	The student can understand the concepts of static analysis applied on shafts	1	1	3	2	1	3			3			3

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: DYNAMICS OF MACHINES LAB
COURSE CODE: ME310

COURSE OBJECTIVES:

- To impart practical knowledge/ techniques to determine the torque and velocity ratio for epicyclic gear train.
- To impart practical knowledge/ techniques to determine the controlling force at given speed, sensitiveness at given limits of lift and governor effort and governor power of governor apparatus.
- To impart practical knowledge/ techniques to determine the gyroscopic couple by gyroscopic apparatus.
- Imparting knowledge to determine the critical speed of the shaft and compares it with the theoretical value.
- Imparting knowledge to compare different types of vibrations .

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Demonstrate basic experimental technique to determine the torque and velocity ratio for epicyclic gear train.
CO2	Demonstrate basic experimental technique to determine controlling force at given speed, sensitiveness at given limits of lift and governor effort and governor power of governor apparatus.
CO3	Demonstrate basic experimental technique to determine the gyroscopic couple by gyroscopic apparatus.
CO4	Demonstrate basic experimental technique to determine critical speed of the shaft and compares it with the theoretical value.
CO5	Demonstrate basic experimental technique to determine different types of vibrations.

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 experimental technique to determine the torque and velocity ratio for epicyclic gear train.	3	3	2	3	2	3			3	2		3
CO2	Demonstrate basic experimental technique to determine controlling force at given speed, sensitiveness at given limits of lift and governor effort and governor power of governor apparatus.	3	3	2	3	2	3			3	2		3
CO3	Demonstrate basic experimental technique to determine the gyroscopic couple by gyroscopic apparatus.	3	3	2	3	2	3			3	2		3
CO4	Demonstrate basic experimental technique to determine critical speed of the shaft and compares it with the theoretical value.	3	3	2	3	2	3			3	2		3
CO5	Demonstrate basic experimental technique to determine different types of vibrations.	3	2	2	2	2	3			2	2		3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: Manufacturing Science Lab II
COURSE CODE: ME311

COURSE OBJECTIVE:

5. To impart knowledge of tool used in metal cutting
6. To impart basic knowledge of Lathe operations.
7. To be able to perform grinding operation on grinding machine
8. To be able to perform common welding operation.
9. To be able to operate welding machine.

COURSE OUTCOMES

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Knowledge of tools used in manufacturing industry.
CO2	Performed various types of operation on Lathe machine.
CO3	Understand the concepts of grinding and able to perform Surface Grinding.
CO4	Learned the basic concepts of welding machine.
CO5	Able to perform basic welding operation on Arc welding and Resistance welding.

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	Knowledge of tools used in manufacturing industry.	3	2	2	2	2	2						3
CO2	Performed various types of operation on Lathe machine.	3	3	1	2	2	3	1					3
CO3	Understand the concepts of grinding and able to perform Surface Grinding.	3	3	1	2	2	3			2			3
CO4	To learn the basic concepts of welding machine.	3	2	2	2	3	3	1					3
CO5	Able to perform basic welding operation on Arc welding and Resistance welding	3	1	3	1	1	3			3			3
	3: Strong contribution, 2: average contribution, 1: Low contribution												

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: Heat and mass Transfer Lab
COURSE CODE: ME 312

COURSE OBJECTIVES:

1. To understand the basic heat transfer processes like conduction, convection and radiation.
2. To impart practical knowledge of heat transfer occurring in various equipment.
3. To equip the students to design the different types of heat transfer devices.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To understand the heat transfer processes like conduction, convection and radiation practically.
CO2	To learn the use of thermocouples and temperature indicators, measurement of current, voltage and flow rate/velocity.
CO3	To understand the concept of heat pie, fin and it practical application in cooling of various devices.
CO4	To find the thermal conductivity of any material.
CO5	To understand the concept of heat exchanger, and it practical application in heating and cooling.

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 understand the heat transfer processes like conduction, convection and radiation practically.	3	3	3	2	2	3	2	1				3
CO2	To learn the use of thermocouples and temperature indicators, measurement of current, voltage and flow rate/velocity.	3	2	3	2	3	3	1	1				3
CO3	To understand the concept of heat pie, fin and it practical application in cooling of various devices.	3	3	3	2	3	3	2	1				3
CO4	To find the thermal conductivity of any material.	3	3	3	2	2	2	1	1				3
CO5	To understand the concept of heat exchanger, and it practical application in heating and cooling.	3	2	2	2	2	2	1	1				3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: FLUID MACHINERY LAB
COURSE CODE: ME324

COURSE OBJECTIVES:

- To impart practical knowledge/ techniques to determine impact of jet on vane and efficiency of Pelton turbine test rig.
- To impart practical knowledge/ techniques to determine efficiency of Francis turbine test rig and Centrifugal pump test rig.
- To impart practical knowledge/ techniques to determine efficiency of positive displacement pump i.e. Reciprocating pump and Gear oil pump.
- To impart practical knowledge/ techniques to determine efficiency of hydraulic ram test rig.
- Imparting knowledge to compare performance characteristics of different type of turbines and pump or experimental technique to determine efficiency of Kaplan turbine.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Demonstrate basic experimental technique to determine impact of jet on vane and efficiency of Pelton turbine.
CO2	Demonstrate basic experimental technique to determine efficiency of Francis turbine and Centrifugal pump.
CO3	Demonstrate basic experimental technique to determine efficiency of positive displacement pump i.e. Reciprocating pump and Gear oil pump.
CO4	Demonstrate basic experimental technique to determine efficiency of hydraulic ram.
CO5	Demonstrate the ability to compare performance characteristics of different type of turbines and pump or experimental technique to determine efficiency of Kaplan turbine.

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 experimental technique to determine impact of jet on vane and efficiency of Pelton turbine.	3	3	2	3	2	3			3	2		3
CO2	Demonstrate basic experimental technique to determine efficiency of Francis turbine and Centrifugal pump.	3	3	2	3	2	3			3	2		3
CO3	Demonstrate basic experimental technique to determine efficiency of positive displacement pump i.e. Reciprocating pump and Gear oil pump.	3	3	2	3	2	3			3	2		3
CO4	Demonstrate basic experimental technique to determine efficiency of hydraulic ram.	3	3	2	3	2	3			3	2		3
CO5	Demonstrate the ability to compare performance characteristics of different type of turbines and pump or experimental technique to determine efficiency of Kaplan turbine.	3	2	2	2	2	3			2	2		3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICALENGINEERING

COURSE: REFRIGERATION AND AIR CONDITIONING LAB
COURSE CODE: ME325

COURSE OBJECTIVES:

- To impart practical knowledge/ techniques to determine C.O.P of air conditioning test rig.
- To impart practical knowledge/ techniques to determine C.O.P vapor compression test rig.
- To impart practical knowledge of basic components of window air conditioner.
- To impart practical knowledge about various expansion devices.
- Imparting knowledge about types of evaporator used and various air conditioning processes through air conditioning models.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Demonstrate basic experimental technique to determine C.O.P of air conditioning test rig
CO2	Demonstrate basic experimental technique to determine C.O.P vapor compression test rig
CO3	Demonstrate, study of basic components of window air conditioner
CO4	Demonstrate study on various expansion devices
CO5	Demonstrate study about types of evaporator used and various air conditioning processes through air conditioning models.

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 experimental technique to determine C.O.P of air conditioning test rig	3	3	2	3	2	3			3	2		3
CO2	Demonstrate basic experimental technique to determine C.O.P vapor compression test rig.	3	3	2	3	2	3			3	2		3
CO3	Demonstrate study of basic components of window air conditioner.	3	3	2	3	2	3			3	2		3
CO4	Demonstrate study on various expansion devices.	3	3	2	3	2	3			3	2		3
CO5	Demonstrate study about types of evaporator used and various air conditioning processes through air conditioning models.	3	2	2	2	2	3			2	2		3
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
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..	3	3	2	2	2	2	1					3
CO2	Analyze the facility location and network models. Understanding of supply chain system	3	3	3	2	2	3	1					2
CO3	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
CO4	Select and analyze an inventory control model. Understanding of manufacturing resources and queuing systems.	3	2	2	2	3	3						2
CO5	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
CO1	. Describe basic structure of CAD workstation, Memory types, input/output devices and display devices and computer graphics	3	3	2	1	1	3						3
CO2	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
CO3	Explain fundamental and advanced features of CNC machines	3	2	1	1	2	2	3					3
CO4	Illustrate Group Technology, CAQC and CIM concepts	3	2	2	2	3	3						2
CO5	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:

- To Understand History of Drilling, Geology
- Study of Classification of rocks
- To know about application of Geo-physics
- Geo-chemical prospecting and remote sensing for water
- 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
CO1	Isolate the key features of a drilling technology for oil, water, and minerals.	3	3	2	2	1	3						3
CO2	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
CO3	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
CO4	Identify the method of Geo-chemical prospecting and remote sensing for water	3	2	2	2	3	3						2
CO5	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: ME404

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	Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems.
CO2	Identify the key aspects of the quality improvement cycle and to select and use appropriate tools and techniques for controlling, improving and measuring quality like 5S or Kaizen
CO3	Critically appraise the organizational, communication and teamwork requirements for effective quality management
CO4	Critically analyze the strategic issues in quality management, including current issues and developments, and to devise and evaluate quality implementation plans
CO5	Develop research skills that will allow them to understand 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	Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems.	3	3	3	2	3	3	1				3	3
CO2	Identify the key aspects of the quality improvement cycle and to select and use appropriate tools and techniques for controlling, improving and measuring quality like 5S or Kaizen	3	3	3	3	3	3	1				3	3
CO3	Critically appraise the organizational, communication and teamwork requirements for effective quality management	3	3	3	3	3	3	1				3	3
CO4	Critically analyze the strategic issues in quality management, including current issues and developments, and to devise and evaluate quality implementation plans	3	2	3	2	3	3	1				3	3
CO5	Develop research skills that will allow them to understand 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 PROCESS
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
5. 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
CO1	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
CO2	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
CO3	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
CO4	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
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	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
CO1	List different types of Engine and their classifications..	3	2	1	1	3	2	1					3
CO2	Develop concept and define working of Automobile Engine cooling and lubrication system.	3	3	3	2	2	3	1					2
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	3	3	2	2	2	3						2
CO4	Describe functioning of steering system, steering geometry wheel alignment and wheel angles for modern Automobile	3	2	2	2	3	3	1					2
CO5	Describe starting system and electrical system	3	1	1	1	1	3						2
3: Strong contribution, 2: average contribution, 1: Low contribution													

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INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: Mechanical System Design
COURSE CODE: ME408

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
CO1	Identify the demand supply gap of energy in Indian scenario	3	3	2	2	2	2	3				1	3
CO2	Carry out energy audit of an industry/Organization.	3	3	3	2	2	3	2				2	2
CO3	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
CO4	Select appropriate energy conservation method to reduce the wastage of energy.	3	2	2	2	3	3	2				1	2
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	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: HEAT 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

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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
CO1	Isolate the key features Air conditioning system	3	3	2	2	2	3						3
CO2	Indicate how the central AC plant works.	3	3	3	2	2	2						2
CO3	Describe the various aspect of human comfort	3	2	2	1	2	2	3					3
CO4	Differentiate between central Ac and Unitary Ac, Develop skill to manage installation site of air conditioning plant.	3	2	2	2	3	3						2
CO5	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
CO1	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
CO2	Understanding of Magnetism and Magnetizing devices and their properties its use in different magnetization techniques	3	3	3	2	2	3	1					2
CO3	Knowledge of aim and application areas of penetrant testing, test methods, types of penetrants and their properties	3	3	2	2	2	3						2
CO4	Understanding of properties of X and gamma rays and their generation and Radiographic exposure technique	3	2	2	2	3	3	1					2
CO5	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):

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

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.

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: CAD/CAM LAB
COURSE CODE: ME421

COURSE OBJECTIVES:

- To impart basic knowledge on Computer Aided Design methods and procedures.
- Demonstrate different methods for geometric modeling in CAD.
- To introduce the fundamentals of solid modeling.
- To impart basic knowledge of CNC machine structures and part programming.

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Introduction to CAD , Historical developments, Industrial look at CAD, Comparison of CAD with traditional designing, Application of computers in Design
CO2	Students will demonstrate the ability to apply the fundamentals of Transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling.
CO3	Demonstrate the process of Shearing, rotation, reflection and translation, combined transformations, orthographic and perspective projections, reconstruction of 3-D objects.
CO4	Demonstrate the Algebraic and geometric forms, tangents and normal, blending functions, straight lines, conics, cubic splines, Bezier curves and B-spline curves.
CO5	To understand the difference among NC, CNC and DNC systems and to understand CNC machine structures and part programming.

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	Introduction to CAD , Historical developments, Industrial look at CAD, Comparison of CAD with traditional designing, Application of computers in Design	3	3	2	2	2	3	1	1				3
CO2	Students will demonstrate the ability to apply the fundamentals of Transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling.	3	2	3	2	2	3	2	1				3
CO3	Demonstrate the process of Shearing, rotation, reflection and translation, combined transformations, orthographic and perspective projections, reconstruction of 3-D objects.	3	3	2	2	3	2	2	1				3
CO4	Demonstrate the Algebraic and geometric forms, tangents and normal, blending functions, straight lines, conics, cubic splines, Bezier curves and B-spline curves.	3	3	3	2	2	2	1	1				3
CO5	To understand the difference among NC, CNC and DNC systems and to understand CNC machine structures and part programming.	3	2	3	2	2	3	1	1				3
3: Strong contribution, 2: average contribution, 1: Low contribution													

INTEGRAL UNIVERSITY, LUCKNOW

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE: I.C ENGINE & AUTOMOBILE ENGINEERING LAB
COURSE CODE: ME422

COURSE OBJECTIVES:

- To study basics of principles of actual automobile systems.
- To study importance and features of different systems like axle, differential, brakes, steering, suspension, and balancing etc.
- To study working of various Automobile Systems.
- To know some modern trends in Automotive Vehicles.
- Understand the fundamentals, operation and function of automotive engines

COURSE OUTCOMES (CO):

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

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the Construction, working and other details about Internal Combustion Engines used in automobiles.
CO2	Study of working, preventive maintenance, trouble shooting and diagnosis of various Automobile Systems.
CO3	Study and understand importance and features of different systems like axle, differential, brakes, steering, suspension, and balancing etc.
CO4	Identify Modern technology and safety measures used in Automotive Vehicles.
CO5	Demonstrate the working of MPFI 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
CO1	Understand the Construction, working and other details about Internal Combustion Engines used in automobiles.	3	3	2	3	2	3			3	2		3
CO2	Study of working, preventive maintenance, trouble shooting and diagnosis of various Automobile Systems.	3	3	2	3	2	3			3	2		3
CO3	Study and understand importance and features of different systems like axle, differential, brakes, steering, suspension, and balancing etc.	3	3	2	3	2	3			3	2		3
CO4	Identify Modern technology and safety measures used in Automotive Vehicles.	3	3	2	3	2	3			3	2		3
CO5	Demonstrate the working of MPFI system.	3	2	2	2	2	3			2	2		3
3: Strong contribution, 2: average contribution, 1: Low contribution													