GLOBAL INSTITUTE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)
COURSE CATALOGUE
REGULATIONS B.TECH – GR - 24
MECHANICAL ENGINEERING
II YEAR II SEMESTER

Course Code	Course Name	Subject Area	Category	Periods Per Week			Credits	Scheme of Examination Max Marks		
				L	T	P		CIA	SEE	Total
THEORY										
ME401PC	Basic Electrical and Electronics Engineering	PCC	CORE	3	0	0	3	40	60	100
ME402PC	Kinematics of Machines	PCC	CORE	3	0	0	3	40	60	100
ME403PC	Fluid Mechanics & Hydraulic Machines	PCC	CORE	3	0	0	3	40	60	100
ME404PC	IC Engines & Gas Turbines	PCC	CORE	3	0	0	3	40	60	100
ME405PC	Instrumentation and Control Systems	PCC	CORE	3	0	0	3	40	60	100
PRACTICAL										
ME406PC	Basic Electrical and Electronics Engineering Laboratory	PCC	CORE	0	0	2	1	40	60	100
ME407PC	Fluid Mechanics & Hydraulic Machines Laboratory	PCC	CORE	0	0	2	1	40	60	100
ME408PC	Instrumentation and Control Systems Laboratory	PCC	CORE	0	0	2	1	40	60	100
ME409PC	Real-time Research Project/ Field-Based Project	PROJ	PROJECT	0	0	4	2	40	60	100
MANDATORY COURSE										
*MC410	Intellectual Property Rights	MC – IV	MC	3	0	0	0			
			Total Credits	**18**	**0**	**10**	**20**			

COURSE CONTENT

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING								
II Year - II Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME401PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Nil								

1. COURSE OVERVIEW

This course enables knowledge on electrical quantities such as current, voltage, and power, energy to know the impact of technology in global and societal context. It provides the knowledge on basic DC and AC circuits used in electrical and electronic devices, highlights the importance of electrical machines and basics of semiconductor devices like diodes and transistors.

2. COURSE OBJECTIVE

The students will try to Learn:

1) The fundamentals of electrical circuits and analysis of circuits with DC and AC excitation using circuit laws.
2) The construction and operation of Electrical machines.
3) The operational characteristics of semiconductor devices with their applications.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Make use of basic electrical laws for solving DC and AC circuits.
CO 2	Apply network theorems for analysis of simple electrical circuits.
CO 3	Demonstrate the fundamentals of electromagnetism for the operation of DC and AC machines.
CO 4	Utilize the characteristics of semiconductor devices for the application of rectifiers and regulators.
CO 5	Interpret the transistor configurations for BJT & FET.

4. COURSE CONTENT

UNIT-I:

D.C. Circuits: Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation.

A.C. Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits, Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-II:

Electrical Installations: Components of LT Switch-gear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB,

Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

UNIT-III:

Electrical Machines: Working principle of Single-phase transformer, equivalent circuit, losses in transformers, efficiency, Three-phase transformer connections. Construction and working principle of DC generators, EMF equation, working principle of DC motors, Torque equations and Speed control of DC motors, Construction and working principle of Three-phase Induction motor, Torques equations and Speed control of Three-phase induction motor. Construction and working principle of synchronous generators.

UNIT-IV:

P-N Junction and Zener Diode: Principle of Operation Diode equation, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Zener diode characteristics and applications.

Rectifiers and Filters: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L-section Filters, π- section Filters.

UNIT-V:

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations.

Field Effect Transistor (FET): Construction, Principle of Operation, Comparison of BJT and FET, Biasing FET.

5. TEXT BOOKS

1) Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University.
2) Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education.

6. REFERENCE BOOKS

1) Electronic Devices and Circuits – R. L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2) Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e, 1998.
3) Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4) Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition by Raymond A. De Carlo and Pen-Min-Lin, Oxford University Press-2004.
5) Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
6) Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
7) L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
8) E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
9) V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989

5. ELECTRONIC RESOURCES

- https://www.kuet.ac.bd/webportal/ppmv2/uploads/1364120248DC%20Machines
- https://www.eleccompengineering.files.wordpress.com/2014/08/a-textbook-of-electrical-technologyvolume-ii-ac-and-dc-machines-b-l-thferaja.pdf
- https://www.geosci.uchicago.edu/~moyer/GEOS24705/Readings/Klempner_Ch1.pdf
- https://www.ibiblio.org/kuphaldt/electricCircuits/DC/DC.pdf
- https://www.users.ece.cmu.edu/~dwg/personal/sample.pdf.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**										**2**	**3**	**2**
CO 2	**2**	**3**										**2**	**2**	**3**
CO 3	**2**	**3**											**2**	**3**
CO 4	**3**	**-**	**1**		**2**								**3**	**-**
CO 5	**3**	**3**			**1**							**2**	**3**	**3**

COURSE CONTENT

KINEMATICS OF MACHINES								
II Year - II Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME402PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Basic principles of Mechanics								

1. COURSE OVERVIEW

The course Kinematics of Machinery aims to familiarize students with mechanism fundamentals, analyze and synthesize planar mechanisms for position, velocity, and acceleration using analytical and graphical techniques, understand and design cams and gears, and apply these principles to analyze and design machinery for industrial applications.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To introduce the concept of machines, mechanisms and related terminologies and the relative motion, velocity, and accelerations of the various elements in a mechanism.
2) To make the students become familiar with the most commonly used mechanisms such as four bar, slider crank, double slider crank mechanisms and their inversions.
3) To provide an overview of straight line motion mechanisms, steering mechanisms and Hooke's joint.
4) To familiarize higher pairs like cams and principles of cams design.
5) To understand the kinematic analysis of gears and gear trains.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Understand the various elements in mechanism and the inversions of commonly used mechanisms such as four bar, slider crank and double slider crank mechanisms.
CO 2	Draw the velocity and acceleration polygons for a given configuration of a mechanism.
CO 3	Understand the conditions for straight line motion mechanisms, steering mechanism and the usage of Hooke's joint.
CO 4	Draw the displacement diagrams and cam profile diagram for followers executing different types of motions and various configurations of followers.
CO 5	Calculate the number of teeth and velocity ratio required for a given combination of gears.

4. COURSE CONTENT

UNIT-I:

Mechanisms: Elements or Links, Classification, Rigid Link, Flexible and Fluid link, Types of kinematics pairs, Sliding, Turning, Rolling, Screw and spherical pairs, Lower and Higher pairs, Closed and open pairs, Constrained motion, Completely, Partially or successfully and incompletely constrained.

Mechanism and Machines: Mobility of Mechanisms: Grubler's criterion, classification of machines, Kinematics chain, Inversions of mechanism, Inversions of quadric cycle chain, Single and double slider crank chains, Mechanical Advantage.

UNIT-II:

Kinematics: Velocity and acceleration, Motion of link in machine, Determination of Velocity and acceleration, Graphical method, Application of relative velocity method.

Plane motion of body: Instantaneous center of rotation, Centrodes and Axodes, Three centers in line theorem, Graphical determination of instantaneous center, Determination of angular velocity of points and links by instantaneous center method. Kliens construction, Coriolis acceleration, Determination of Coriolis component of acceleration.

Analysis of Mechanisms: Analysis of slider crank chain for displacement, Velocity and Acceleration of slider, Acceleration diagram for a given mechanism.

UNIT-III:

Straight Line Motion Mechanisms: Exact and approximate copied and generated types, Peaucellier, Hart, Scott Russel, Grasshopper, Watt, Tchebicheff's and Robert Mechanism, Pantographs.

Steering Gears: Conditions for correct steering, Davis Steering gear, Ackerman's steering gear.

Hooke's Joint: Single and double Hooke's joint, Velocity ratio, Application, Problems.

UNIT – IV:

Cams and Followers: Definitions of cam and followers and their uses, Types of followers and cams, Terminology, Types of follower motions, Uniform velocity, Simple harmonic motion, Uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of motion of followers: Tangent cam with Roller follower, Circular arc cam with straight, Concave and Convex flanks.

UNIT – V:

Higher Pair: Friction wheels and toothed gears, Types, Law of gearing, Condition for constant velocity ratio for transmission of motion, Velocity of sliding.

Forms of teeth, Cycloidal and involutes profiles, Phenomena of interferences, Methods of interference. Condition for minimum number of teeth to avoid interference, Expressions for arc of contact and path of contact of Pinion, Gear, Pinion and Rack Arrangements, Introduction to Helical, Bevel and worm gearing.

Gear Trains: Introduction to Gear Trains, Types, Simple, Compound and reverted gear trains, Epicyclic gear trains. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box, Differential gear for an automobile.

5. TEXT BOOKS

1) Rattan, S.S, "Theory of Machines", 4th Edition, Tata McGraw-Hill, 2014.
2) Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4th Edition, Oxford University Press, 2014.

6. REFERENCE BOOKS

1) Sadhu Sigh, "Theory of Machines", Third Edition, Pearson Education, 2012.
2) Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
3) Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
4) Rao. J.S. and Dukkipati. R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**		**1**								**3**	**1**
CO 2	**3**	**3**	**2**	**2**	**1**		**1**						**3**	**2**
CO 3	**3**	**3**	**3**	**2**	**2**								**3**	**3**
CO 4	**3**	**2**	**2**	**2**	**3**								**2**	**2**
CO 5	**2**	**2**	**2**	**2**	**3**		**2**						**3**	**3**

COURSE CONTENT

FLUID MECHANICS & HYDRAULIC MACHINES								
II Year - II Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME403PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite:								

1. COURSE OVERVIEW

This course introduces the fundamentals of fluid mechanics, covering fluid properties, pressure measurement, and flow classification. It explores fluid kinematics and dynamics, including Bernoulli's and momentum equations. Boundary layer theory and closed conduit flow are examined with emphasis on losses and flow measurement techniques. Students study hydraulic machinery, focusing on turbines, pumps, and their performance characteristics. Practical applications and efficiency analysis are integrated throughout for engineering insight.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To understand fluid properties and pressure concepts to analyse their impact on fluid behaviour and measurement techniques.
2) To apply principles of fluid kinematics and dynamics to classify flow types and solve problems using continuity, Bernoulli's, and momentum equations.
3) To examine boundary layer phenomena and pipe flow characteristics including energy losses and flow measurement methods.
4) To analyse hydraulic machinery operations such as turbines and pumps, focusing on design, efficiency, and performance parameters.
5) To evaluate real-world fluid systems through practical applications involving flow measurement, energy transfer, and hydraulic design.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Demonstrate understanding of fluid properties and pressure measurement techniques used in analysing static and dynamic fluid systems.
CO 2	Apply fluid flow principles and equations to solve problems involving continuity equation, Bernoulli's equation, and momentum equation in various flow conditions.
CO 3	Analyse boundary layer behaviour and pipe flow characteristics including energy losses and flow measurement using standard instruments
CO 4	Evaluate the performance of hydraulic turbines and pumps through velocity diagrams, efficiency calculations, and design considerations
CO 5	Interpret and assess fluid machinery characteristics for selection and operation in engineering applications involving fluid transport and energy conversion.

4. COURSE CONTENT

UNIT – I:

Fluid statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity, and surface tension - vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT – II:

Fluid kinematics: Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform & non-uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three-dimensional flows.

Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT – III:

Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: Pitot tube, venturi meter, and orifice meter, Flow nozzle.

UNIT – IV:

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT – V:

Centrifugal pumps: Classification, working, work done – barometric head- losses and efficiencies specific speed- performance characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

5. TEXT BOOKS

1) Hydraulics, Fluid Mechanics and Hydraulic Machinery - MODI and SETH, 21st Edition, Standard Book House.
2) Fluid Mechanics and Hydraulic Machines by Er. R. K. Rajput, S. Chand,2019.

6. REFERENCE BOOKS

1) Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria & Sons, 2018
2) Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International Publishers.
3) Hydraulic Machines by T.R. Banga & S.C. Sharma, 7th Edition, Khanna Publishers.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**1**									**1**	**3**	**3**
CO 2	**3**	**3**	**2**	**2**								**1**	**3**	**3**
CO 3	**3**	**2**	**2**	**2**								**1**	**2**	**1**
CO 4	**3**	**2**	**3**	**2**	**1**								**2**	**3**
CO 5	**3**	**2**	**3**	**2**	**1**								**3**	**3**

COURSE CONTENT

IC ENGINES & GAS TURBINES								
II Year - II Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME404PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite:								

1. COURSE OVERVIEW

This course covers the fundamentals of internal combustion (I.C.) engines, including classification, working principles, and engine systems for both spark ignition (SI) and compression ignition (CI) engines. It explores normal and abnormal combustion processes, fuel requirements, and engine performance testing methods. The course also delves into various compressors, from reciprocating to rotary and dynamic types, examining their operation, efficiency, and performance. In addition, it covers thermodynamic principles, including property tables and phase transformations. The final unit focuses on gas turbines, their ideal and actual cycles, and performance parameters.

2. COURSE OBJECTIVE

The students will try to Learn:

1) Explain the Components of IC Engines and systems.
2) Analyse the stages of combustion to improve the performance of IC engines with respect to fuel economy and control of emissions in global, environmental and social context.
3) Understand and evaluate the performance analysis of the major components and systems of IC engines and their applications.
4) Explore to the components and working principles of rotary, reciprocating, dynamic and axial compressors.
5) Understand the significance of gas turbines in real context in power generation.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Elaborate the working principles of IC Engine systems and its classification.
CO 2	Explore the combustion stages of SI and CI engines, and factors influence for better combustion.
CO 3	Evaluate the testing and performance parameters of IC engines.
CO 4	Explain the function and working principles of rotary, reciprocating, dynamic axial compressors.
CO 5	Understand the working principle of gas turbine and its classification with thermodynamic analysis.

4. COURSE CONTENT

UNIT-I:

I.C. Engines: Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Carburettor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry.

UNIT-II:

Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirements and fuel rating, anti-knock additives – combustion chamber – requirements, types of SI engines.

Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating.

UNIT-III:

Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart

Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types.

Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimum work condition for staged compression.

UNIT-IV:

Rotary Compressor (Positive displacement type): Roots Blower, vane sealed compressor, mechanical details and principle of working – efficiency considerations.

Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

UNIT-V:

Gas Turbines: Simple Gas Turbine Plant – Ideal Cycle – Closed Cycle and Open Cycle for Gas Turbines, Constant Pressure Cycle, Constant Volume Cycle, Efficiency – Work Ratio and Optimum Pressure Ration for Simple Gas Turbine Cycle. Parameters of Performance, Actual Cycle.

5. TEXT BOOKS

1) I.C. Engines, V. Ganesan, 4th Edition, Mc Graw Hill
2) Thermal Engineering, Mahesh M Rathore, Tata Mc Graw Hill, 2010.

6. REFERENCE BOOKS

1) Applied Thermodynamics for Engineering Technologists, Eastop & McConkey, Pearson
2) Fundamentals of Classical Thermodynamics, Vanwylen G.J., Sonntag R.E., Wiley Eastern
3) Internal Combustion Engines Fundamentals, John B. Heywood, McGraw Hill Ed.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**		**1**								**3**	**2**
CO 2	**3**	**3**	**2**	**2**	**1**		**2**						**3**	**2**
CO 3	**3**	**3**	**3**	**2**	**2**								**3**	**3**
CO 4	**3**	**2**	**2**	**2**	**3**								**2**	**3**
CO 5	**3**	**2**	**2**	**2**	**3**		**2**						**3**	**3**

COURSE CONTENT

INSTRUMENTATION AND CONTROL SYSTEMS								
II Year - II Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME405PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite:								

1. COURSE OVERVIEW

This course covers the fundamentals of measurement and instrumentation, including principles, systems, and error analysis. It explores techniques for measuring displacement, temperature, pressure, level, flow, speed, acceleration, and vibration using various transducers. Students learn stress-strain analysis, humidity, force, torque, and power measurement. The course concludes with control system basics, focusing on open/closed loops, servomechanisms, and transfer functions.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To understand fundamental measurement principles and the configuration of various instrumentation systems, including error analysis and performance characteristics.
2) To apply appropriate transducers and techniques for measuring physical quantities such as displacement, temperature and pressure.
3) To analyse and implement methods for level measurement, flow measurement, speed, acceleration and vibration measurement using instruments.
4) To analyse and implement methods for stress-strain measurement, humidity detection, and force, torque, and power evaluation using specialized instruments.
5) To explore control system elements including open and closed loop systems, servomechanisms, and transfer functions for mechanical system analysis.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Identify and explain key measurement principles and instrumentation system components.
CO 2	Select suitable transducers for measuring temperature and pressure with accuracy.
CO 3	Apply measurement techniques for level measurement, flow measurement, speed, acceleration and vibration measurement using instruments.
CO 4	Apply measurement techniques for stress, strain, humidity, force, torque, and power.
CO 5	Analyse control systems using block diagrams and transfer functions for basic applications.

4. COURSE CONTENT

UNIT – I:

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional description of measuring instruments – examples. Static and Dynamic performance characteristics– sources of errors, Classification and elimination of errors.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Using Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers; Calibration procedures.

UNIT – II:

Measurement of Temperature: Various Principles of measurement-Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Changes in Chemical Phase: Fusible Indicators and Liquid crystals. Measurement of Pressure: Different principles used- Classification: Manometers, Dead weight pressure gauge Tester (Piston gauge), Bourdon pressure gauges, Bulk modulus pressure gauges, Bellows, Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges, ionization pressure gauges, McLeod pressure gauge.

UNIT – III:

Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators –Bubbler level indicators.
Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flowmeter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).
Measurement of Speed: Mechanical Tachometers, Electrical tachometers, non-contact type Stroboscope; Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle- Piezo electric accelerometer.

UNIT – IV:

Stress-Strain measurements: Various types of stress and strain measurements –Selection an installation of metallic strain gauges; electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending, compressive and tensile strains – Temperature compensation techniques, Use of strain gauges for measuring torque, Strain gauge Rosettes.
Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter.
Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – V:

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems-Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems-Transfer functions- First and Second order mechanical systems.

5. TEXT BOOKS

1) Principles of Industrial Instrumentation & Control Systems/Chennakesava R Alavala, -Cengage Learning/1st Edition, 2009.
2) Basic Principles – Measurements (Instrumentation) & Control Systems /S. Bhaskar/ Anuradha Publications.

6. REFERENCE BOOKS

1) Measurement Systems: Applications & design, E. O. Doebelin, TMH, Tata McGraw Hill/6th Edition, 2017.
2) Instrumentation, Measurement & Analysis, B.C. Nakra & K.K. Choudhary, TMH, 4th Edition, 2016.
3) Experimental Methods for Engineers / Holman
4) Mechanical and Industrial Measurements / R. K. Jain/ Khanna Publishers.
5) Mechanical Measurements / Sirohi and Radhakrishna / New Age International, 3rd Edition, 2013.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**				**2**							**1**	**3**	**2**
CO 2	**3**	**2**			**2**							**1**	**3**	**2**
CO 3	**3**	**3**	**2**		**2**							**1**	**3**	**2**
CO 4	**3**	**3**	**2**		**2**							**1**	**3**	**2**
CO 5	**3**	**3**	**3**	**2**	**2**							**1**	**2**	**1**

COURSE CONTENT

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY								
II Year - II Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME406PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite:								

1. COURSE OVERVIEW

This lab course provides hands-on experience in **basic electrical experiments**, including verification of Ohm's law, Kirchhoff's laws, and circuit theorems. It includes practical exposure to **AC and DC machines**, transformers, and measurements using electrical instruments. On the **electronics side,** students explore characteristics of **P-N junction and Zener diodes**, and analyze their behavior in circuits. Experiments on **rectifiers and filters** help understand AC to DC conversion and signal smoothing. The lab builds foundational skills in circuit construction, testing, and analysis for both electrical and electronics domains.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To introduce the concepts of electrical circuits and its components
2) To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
3) To study and understand the different types of DC/AC machines and Transformers.
4) To import the knowledge of various electrical installations.
5) To introduce the concept of power, power factor and its improvement.
6) To introduce the concepts of diodes & transistors, and
7) To impart the knowledge of various configurations, characteristics and applications.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	**To analyze** and solve electrical circuits using network laws and theorems	Apply
CO 2	**Understand** and analyze basic Electric and Magnetic circuits	Apply
CO 3	**Study** the working principles of Electrical Machines	Apply
CO 4	**To introduce** components of Low Voltage Electrical Installations	Apply
CO 5	**To identify** and characterize diodes and various types of transistors.	Apply

4. LIST OF EXPERIMENTS / DEMONSTRATIONS:

PART- A: ELECTRICAL

1) Verification of KVL and KCL
2) (i) Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
   (ii) Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star) in a Three Phase Transformer
3) Measurement of Active and Reactive Power in a balanced Three-phase circuit

4) Performance Characteristics of a Separately Excited DC Shunt Motor
5) Performance Characteristics of a Three-phase Induction Motor
6) No-Load Characteristics of a Three-phase Alternator

PART-B: ELECTRONICS

1. Study and operation of
   (i) Multi-meters (ii) Function Generator (iii) Regulated Power Supplies (iv) CRO.
2. PN Junction diode characteristics
3. Zener diode characteristics and Zener as voltage Regulator
4. Input & Output characteristics of Transistor in CB / CE configuration
5. Full Wave Rectifier with & without filters
6. Input and Output characteristics of FET in CS configuration

5. TEXT BOOKS:

1) Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University.
2) Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education.

6. REFERENCE BOOKS:

1) Electronic Devices and Circuits – R. L. Boylestead and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2) Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e, 1998.
3) Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4) Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition by Raymond A. De Carlo and Pen-Min-Lin, Oxford University Press-2004.
5) Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
6) Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
7) L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
8) E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
9) V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

7. ELECTRONICS RESOURCES:

https://www.nptel.ac.in/Courses/117106108
https://www.gnindia.dronacharya.info/EEEDept/labmanuals.html
https://www.textofvideo.nptel.iitm.ac.in
https://www.textofvideo.nptel.iitm.ac.in/

8. MATERIALS ONLINE:

Course template
Lab manual

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**3**	**1**	**1**	**0**	**2**	**1**	**1**	**0**	**0**	**1**	**1**	**2**	**2**
CO 2	**3**	**3**	**1**	**2**	**0**	**2**	**1**	**1**	**0**	**0**	**2**	**3**	**2**	**2**
CO 3	**3**	**2**	**1**	**2**	**0**	**2**	**1**	**1**	**0**	**0**	**3**	**2**	**2**	**2**
CO 4	**3**	**2**	**1**	**2**	**0**	**2**	**1**	**1**	**0**	**0**	**3**	**2**	**2**	**2**
CO 5	**3**	**2**	**1**	**2**	**0**	**2**	**1**	**1**	**0**	**0**	**3**	**2**	**2**	**2**

COURSE CONTENT

FLUID MECHANICS & HYDRAULIC MACHINES LABORATORY								
II Year - II Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME407PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite: Fluid Mechanics & Hydraulic Machines								

1. COURSE OVERVIEW

This course is designed to provide hands-on experience with fluid flow measurement techniques and hydraulic machines. Through a series of structured experiments, students will gain practical insights into the behaviour of fluids under various conditions and the performance characteristics of turbines and pumps used in engineering applications.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To understand fluid dynamics principles.
2) To evaluate performance of hydraulic machines.
3) To develop experimental and analytical skills.
4) To apply theoretical knowledge to real systems.
5) To foster technical reporting and communication.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Practically understand core fluid mechanics concepts such as Bernoulli's theorem, frictional losses, and flow measurement techniques.
CO 2	Conduct performance tests on turbines and pumps, interpret efficiency curves, and assess operational characteristics under varying conditions.
CO 3	Set up experiments, collect accurate data, and analyse results using scientific methods and engineering calculation.
CO 4	Bridge the gap between classroom theory and industrial applications by exploring the behaviour of fluid systems and hydraulic machines in controlled lab environments.
CO 5	Document experimental procedures, observations, and conclusions effectively through structured lab reports and oral presentations

4. COURSE CONTENT

List of Experiments:

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturi meter.

9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli's Theorem.

5. REFERENCE BOOKS

1) Experiments in Fluid Mechanics by Dr. Baljeet Kapoor, Khanna Publishers.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**	**2**	**1**							**1**	**3**	**2**
CO 2	**3**	**2**	**3**	**2**	**2**							**1**	**3**	**3**
CO 3	**3**	**3**	**2**	**3**	**2**								**3**	**2**
CO 4	**2**	**2**	**3**	**2**	**3**					**1**			**2**	**3**
CO 5	**1**	**2**	**2**	**2**	**2**								**1**	**2**

COURSE CONTENT

INSTRUMENTATION AND CONTROL SYSTEMS LABORATORY								
II Year - II Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME408PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite: Basic principles of Instrumentation and Control Systems								

1. COURSE OVERVIEW

This course offers practical exposure to calibrating sensors and transducers for measuring pressure, temperature, displacement, flow, and vibration. It includes hands-on experiments with LVDTs, strain gauges, thermocouples, RTDs, and capacitive pickups. Students also explore dynamic measurements using speed pickups, rotameters, and McLeod gauges. SCADA integration enables real-time monitoring and control of industrial processes. The focus is on accurate instrumentation, calibration techniques, and data-driven analysis.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To develop proficiency in calibrating sensors and transducers for measuring pressure, temperature, displacement, flow, and vibration.
2) To understand the working principles and applications of LVDTs, strain gauges, thermocouples, RTDs, and capacitive transducers.
3) To perform dynamic measurements using photoelectric, magnetic speed pickups, rotameters, and McLeod gauges.
4) To implement SCADA systems for real-time monitoring and control of industrial parameters such as pressure, level, and temperature.
5) To analyse and interpret experimental data for evaluating sensor performance and process control accuracy.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Demonstrate the ability to calibrate sensors and transducers for measuring pressure, temperature, displacement, flow, and vibration.
CO 2	Analyse the operational characteristics of LVDTs, strain gauges, thermocouples, RTDs, and capacitive transducers through experimental methods.
CO 3	Apply appropriate techniques to measure dynamic parameters using speed pickups, rotameters, and McLeod gauges.
CO 4	Implement SCADA systems for monitoring and controlling industrial processes involving pressure, level, and temperature.
CO 5	Interpret experimental data to evaluate sensor performance and validate control system responses.

4. COURSE CONTENT

List of Experiments:

1) Calibration of Pressure Gauges.
2) Calibration of transducer for temperature measurement.
3) Study and calibration of LVDT transducer for displacement measurement.
4) Calibration of strain gauge for temperature measurement.
5) Calibration of thermocouple for temperature measurement.
6) Calibration of capacitive transducer for angular displacement.
7) Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8) Calibration of resistance temperature detector for temperature measurement.
9) Study and calibration of a rotameter for flow measurement.
10) Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11) Study and calibration of McLeod gauge for low pressure.
12) Measurement and control of Pressure of a process using SCADA system.
13) Measurement and control of level in a tank using capacitive transducer with SCADA.
14) Measurement and control of temperature of a process using resistance temperature detector with SCADA.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**	**1**	**2**							**1**	**3**	**2**
CO 2	**3**	**3**	**2**	**2**	**2**							**1**	**3**	**2**
CO 3	**3**	**2**	**2**	**2**	**2**								**3**	**2**
CO 4	**2**	**2**	**3**	**3**	**3**								**2**	**3**
CO 5	**3**	**3**	**2**	**3**	**2**							**1**	**2**	**2**

COURSE CONTENT

INTELLECTUAL PROPERTY RIGHTS								
II Year - II Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
***MC410**	**Mandatory**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**-**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite:								

1. COURSE OVERVIEW

The Intellectual Property Rights (IPR) course is designed to provide students with a comprehensive understanding of the legal frameworks that protect creative and innovative works. It covers the principles, laws, and practices surrounding the protection of intellectual property such as: Patents, Trademarks, Copyrights, Designs and Trade Secrets.

2. COURSE OBJECTIVE

The students will try to Learn:

1) Significance of intellectual property and its protection.
2) Introduce various forms of intellectual property.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Distinguish and Explain various forms of IPRs.
CO 2	Identify criteria to fit one's own intellectual work in particular form of IPRs.
CO 3	Apply statutory provisions to protect particular form of IPRs.
CO 4	Appraise new developments in IPR laws at national and international level
CO 5	Understand the new development of intellectual property.

4. COURSE CONTENT

UNIT – I **(10L)**

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II **(10L)**

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III **(10L)**

Law of copyrights: Fundamental of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, international copyright law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV **(9L)**

Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V **(9L)**

New development of intellectual property: new developments in trade mark law; copyright law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copyright law, international patent law, and international development in trade secrets law.

5. TEXT BOOKS

1) Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

6. REFERENCE BOOKS

1) Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**		**2**					**2**	**2**	**2**		
CO 2	**3**	**3**	**2**		**2**					**2**	**2**	**2**		
CO 3	**3**	**2**	**3**	**2**	**2**					**2**	**2**	**2**		
CO 4	**3**	**2**	**3**	**2**	**2**					**2**	**2**	**2**		
CO 5	**3**	**2**	**2**	**3**	**3**					**2**	**2**	**2**		