

AME 201: AIRCRAFT LEGISLATION

Course Title	Aircraft Legislation	Course Code	AME 201
Semester	II	Course Group	Theory
Teaching Scheme in Periods (L:T:P)	4:1:0	Credits	3.0
Methodology	Lecture+ Tutorial	Total Contact Periods	75
CIE	60 Marks	Semester End Examination (SEE)	40 Marks

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Know Aircraft rules, role of Civil aviation organisations, DGCA
CO2	Become familiar with DGCA policy and procedures
CO3	Understand Aircraft maintenance rules
CO4	Understand various miscellaneous aircraft maintenance requirements
CO5	Explain Aircraft safety management System
CO6	Understand aviation fuel requirements, storage and safety rules.

COURSE CONTENTS

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UNIT I: REGULATORY FRAME WORK

Regulatory Frame work : Role of International Civil Aviation Organization; The Aircraft Act and Rules made there under Role of the DGCA;-Relationship between CAR-21, CAR-M, CAR-145, CAR-66, CAR 147- The aircraft rules, Aeronautical Information Circulars (Applicable to Aircraft Maintenance and Release)-CAR Sections 1 and 2

UNIT II : DGCA POLICY AND PROCEDURES: (General) - general policy & procedures adopted by DGCA-approval of organizations-CAR 145-Approved Maintenance Organisations, Detailed understanding of CAR 145 and CAR M Subpart F

UNIT III: MAINTENANCE RULES

Applicable National and International Requirements - Maintenance Programme, Maintenance checks and inspections- 1 Master Minimum Equipment Lists, Minimum Equipment List, Dispatch Deviation Lists; Airworthiness Directives; Service Bulletins, manufacturers service information-Modifications and repairs; Maintenance documentation: maintenance manuals, structural repair manual, illustrated parts catalogue, etc.-

UNIT IV: Miscellaneous Requirements: Continuing airworthiness; Test Flights, ETOPS/EDTO, maintenance and dispatch requirements; RVSM, maintenance and dispatch requirements, RNP, MNPS operations All weather operations, Category 2/3 operations and minimum equipment requirements.

UNIT V: SAFETY MANAGEMENT

Safety Management System: State Safety Programme, Basic Safety Concepts Hazards & Safety Risks SMS Operation, SMS Safety performance, Safety Assurance CAR M 2, 25, Approved Maintenance Training Organization (Type Training)- Acceptance of Foreign Approved Maintenance Organization (FAMO)- Acceptance of Foreign Approved Organization (FAO) Establishment of a Safety Management System (SMS) -.

UNIT VI: Fuel Tank Safety—Aviation fuel, Aviation Lubricants and special products CAR 147-requirements of aircraft fuel, refueling of aircraft and calibration of aircraft fuels- Aircraft fueling procedures Aviation fuel at airport - Storage, handling and quality control, Special Federal Aviation Regulations (SFARs) from 14 CFR SFAR 88 of the FAA and of JAA TGL 47 Concept of CDCCL Airworthiness Limitations Items (ALI)

Recommended Books

1. Civil Aviation Requirements, Section-2 'Airworthiness'
2. Aircraft Manual vol-I&II
3. Airworthiness Advisory Circular

CO-PO MATRICS

Course Outcome/ Programme Outcome	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, and Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO 1	2	2			3			1,2,5
CO 2	2	2			3			1,2,5
CO 3	2	2			3			1,2,5
CO 4	2	2			3			1,2,5
CO 5	2	2			3		2	1,2,5,7
CO 6	2	2			3		2	1,2,5,7
	2	2			3		2	1,2,5

Learning Outcomes

Upon successful completion of the course, the student will be able to:

1. Explain the regulatory framework of civil aviation, including the role of ICAO, DGCA, Aircraft Act, and Aircraft Rules.
2. Describe DGCA policies, procedures, and approval requirements related to CAR-145, CAR-M, CAR-66, and CAR-147 organizations.
3. Interpret national and international aircraft maintenance requirements, maintenance programs, airworthiness directives, and maintenance documentation.
4. Analyze continuing airworthiness requirements, ETOPS/EDTO, RVSM, RNP operations, and dispatch procedures applicable to aircraft maintenance.
5. Apply principles of Safety Management Systems (SMS), hazard identification, safety risk management, and safety assurance in aviation organizations.
6. Explain aviation fuel requirements, fuel storage, handling procedures, lubrication systems, and safety regulations related to aircraft fueling operations

AME-202 THERMAL ENGINEERING

Course Title	Thermal Engineering	Course Code	AME 202
Semester	II	Course Group	Core
Teaching Scheme in Periods (L:T:P)	4:1:0	Credits	3.0
Methodology	Lecture+ Tutorials	Total Contact Periods	75
CIE	60 Marks	Semester End Examination (SEE)	40 Marks

Course outcomes

Upon completion of the course, the student shall be able to

CO1	Explain basic thermodynamic concepts and systems..
CO2	Apply first and second laws to analyze energy transfer.
CO3	Analyze processes using entropy and work–heat relations.
CO4	Evaluate air standard and gas power cycles for efficiency.
CO5	Explain working principles and classification of IC engines and Compressors
CO6	Analyze engine systems and performance parameters

CO – PO Mapping Matrix

Correlation Scale:

1 - Low

2 – Medium

3 - High

Course Outcome/ Programme Outcome	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO 1	3	2						1,2
CO 2	3	3		2				1,2,4
CO 3	3	3		2				1,2,4
CO 4	3	3	2	2			1	1,2,3,4,7
CO 5	3	2				1	1	1,2,6,7
CO 6	3	3	2	2	1	1	1	1,2,3,4,5,6,7
Average PO Attainment								

COURSE CONTENT

Unit-1: Basics of Thermodynamics

Duration: 12 Periods (L: 10-T: 2)

Introduction- macroscopic -microscopic view point- control volume
 -Thermodynamic systems – Property, state, path and process -
 Different properties – Thermodynamic Equilibrium -Quasi static
 process-reversible -irreversible process-Thermodynamic cycle –
 reversible -irreversible cycle- Zeroth law of TD – thermometric
 property -Heat transfer and Work transfer -path function -with sign
 convention – Specific heat at constant volume – constant pressure-
 Internal Energy -flow work.

Unit-2: Laws of Thermodynamics

Duration: 13 Periods (L: 10-T: 3)

First law of TD -applied to closed system undergoing a cycle –
 undergoing a change of state -energy a property of the system–
 internal energy- enthalpy-energy of an isolated system-PMM1-
 Limitations of first law of TD- first law applied to flow process -

SFEE- application to various engineering systems-Second Law of Thermodynamics - energy reservoirs - Heat Engine -K-P Statement and Clausius statement of Second Law of TD -Refrigerator and Heat pump-Efficiency and Coefficient of performance -PMM2

Unit-3: Thermodynamic processes

Duration:13Periods(L: 10-T: 3)

Clausius inequality – definition of entropy –principle of entropy-entropy change in reversible and irreversible process - first and second laws combined- PMM3-Third law of Thermodynamics-Expression for work done and heat supplied (without derivation) for Isochoric, Isobaric,Isothermal, Isentropic, Polytrophic processes – Relation between Pressure, Volume and Temperature in Adiabatic process and Polytrophic process

Unit-4: AirStandardCycles and Gas power Cycles

Duration:12Periods(L: 10-T: 2)

Calorific values (Heating value) of fuels -Air standard cycle – assumptions -compression ratio -cut off ratio-swept volume-clearance volume - Carnot's cycle -Ottocycle,Diesels cycle -Brayton cycle with regeneration – inter cooling and reheat -Rankine cycle– Expression forefficiencyofthesecycles(withoutderivation)–

Unit-5: Working Principles of IC Engines and Air Compressors

Duration:13Periods(L:10-T:3)

Heat engines – Internal combustion engines and external combustion engines – classificationof ICengines – Components of IC engines and their function –Principleofworking and comparison offourstrokeSI engine and CI engine – Comparison between four stroke engine and two stroke engines. Air Compressors -compression process – single stage -multi stage compressor with and without inter cooler (withoutderivation)- rotary compressor

Unit-6: Systemsused in Engines and performanceof engines

Duration: 12 Periods (L: 10-T: 2)

Fuelsystems– Battery Ignitionsystem -Coolingsystems– Lubricationsystems– Firing order-Performance of IC engines – Indicated power, Brake power, Frictional power, indicated mean effective pressure, Brake mean effective pressure, Specific fuel consumption- Air Consumption-Speed- Mechanical efficiency - Thermal Efficiency-Indicated thermal efficiency-Brake thermal efficiency- Air Fuel Ratio-Volumetric efficiency

Learning outcomes

Unit–1: Basics of Thermodynamics

After completing this unit, students will be able to:

1. Define basic thermodynamic terms and concepts.
 2. Differentiate between macroscopic and microscopic approaches.
 3. Explain thermodynamic systems, properties, states, and processes.
 4. Distinguish reversible and irreversible processes and cycles.
 5. Apply sign conventions for heat and work transfer.
 6. Explain internal energy, flow work, and specific heats.
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Unit–2: Laws of Thermodynamics

After completing this unit, students will be able to:

1. State and apply the First Law of Thermodynamics to closed and flow systems.
 2. Analyze energy transfer in thermodynamic systems.
 3. Apply SFEE to engineering devices.
 4. Explain the limitations of the First Law.
 5. State Kelvin–Planck and Clausius statements of the Second Law.
 6. Evaluate the performance of heat engines, refrigerators, and heat pumps.
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Unit–3: Thermodynamic Processes

After completing this unit, students will be able to:

1. Explain entropy and Clausius inequality.
 2. Determine entropy changes in reversible and irreversible processes.
 3. Apply combined First and Second Laws of Thermodynamics.
 4. Analyze isothermal, isobaric, isochoric, isentropic, and polytropic processes.
 5. Use pressure–volume–temperature relations for adiabatic and polytropic processes.
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Unit–4: Air Standard Cycles and Gas Power Cycles

After completing this unit, students will be able to:

1. Explain the assumptions of air standard cycles.
2. Define compression ratio, cut-off ratio, swept volume, and clearance volume.

3. Describe the working of Carnot, Otto, Diesel, Brayton, and Rankine cycles.
 4. Compare different thermodynamic cycles.
 5. Calculate efficiencies of air standard and gas power cycles.
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Unit–5: Working Principles of IC Engines and Air Compressors

After completing this unit, students will be able to:

1. Classify heat engines and IC engines.
 2. Describe components and working principles of SI and CI engines.
 3. Compare two-stroke and four-stroke engines.
 4. Explain the operation of single-stage and multistage compressors.
 5. Describe the working of rotary compressors.
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Unit–6: Systems Used in Engines and Performance of Engines

After completing this unit, students will be able to:

1. Explain the functions of fuel, ignition, cooling, and lubrication systems.
2. Describe firing order in IC engines.
3. Determine engine performance parameters such as IP, BP, FP, and efficiencies.
4. Calculate fuel consumption and air–fuel ratio.
5. Evaluate volumetric and thermal efficiencies of engines.

REFERENCEBOOKS

1. Engineering Thermodynamics by P.K. Nag TMH Publishers
2. Thermal Engineering by R.K Rajput
3. Thermodynamics and Heat Engines Vol 1 and Vol 2 by R.Y. Yadav
4. IC Engines by Gill and Smith

ME-203 Basic Electrical and Electronics Engineering

Course Title	Basic Electrical Electronics Engineering	Course Code	AME 203
Semester	II	Course Group	Core
Teaching Scheme in Periods (L:T:P)	4:1:0	Credits	3.0
Methodology	Lecture+ Tutorials	Total Contact Periods	75
CIE	60 Marks	Semester End Examination (SEE)	40 Marks

Pre-requisites

This course requires the basic knowledge of Basic mathematics-Physics-Chemistry

Course Outcomes

CO1	Explain the source and nature of electrical charges and their distribution. Explain the electrical conduction in metals and basic factors affecting the conduction process. .
CO2	Understand the principle of electrical power generation and their sources.
CO3	Explain the working principle, types, and characteristics of Resistor, capacitors, and inductors
CO4	Apply the laws of electricity to find out current and voltage in a given circuit. Calculate the electrical energy and power dissipation in a given circuit
CO5	Explain the electrical properties of semiconductor materials and the formation and behaviour of a PN junction, diodes, transistors and their applications
CO6	Analyse the working of electronic circuits including rectifiers, clippers, clampers, and voltage multiplier circuits amplifiers, oscillators, multivibrators.

CO – PO Mapping Matrix

Correlation Scale:

1 - Low

2 – Medium

3 - High

Course Outcome/ Programme Outcome	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO 1	3			3				1,4
CO 2	3	2	2	3				1,2,3,4
CO 3	3	3	3	3				1,2,3,4
CO 4	3	3	3	3				1,2,3,4
CO 5	3	3	3					1,2,3
CO 6	3	3	3	3				1,2,3,4
Average PO Attainment								

UNIT-1: Basics of Electricity

Structure and distribution of electrical charges within: atoms, molecules, ions, compounds. Molecular structure of conductors, semiconductors and insulators. Static Electricity and Conduction: Static electricity and distribution of electrostatic charges Electrostatic laws of attraction and repulsion; Units of charge, Coulomb's Law; Conduction of electricity in insulating materials, solids, liquids, gases and vacuum, Electrical Terminology: Define terms, their units and factors affecting them:-potential difference, electromotive-force, voltage, current, resistance, conductance charge, conventional current flow, electron flow.

UNIT-2: Electricity Generation

Generation of Electricity: Production of electricity by the following methods: Light, heat, friction, pressure, chemical action, magnetism and motion-.DC Sources of Electricity: Construction and basic chemical action of: primary cells, secondary cells, lead acid cells, nickel cadmium cells, other alkaline cells; cells connected in series and parallel. Internal resistance and its effect on a battery; Construction, materials and operation of thermocouples; Operation of photo-cells, Faraday's law of Electromagnetic Induction.

UNIT-3: Elements of Electricity

1 Resistance/Resistor Resistance and affecting factors; Specific resistance; Resistor color code, values and tolerances, preferred values, wattage ratings.Positive and negative temperature coefficient conductance.. Resistors in series and parallel; Calculation of total resistance using series, parallel . 2 Capacitance /Capacitor: Operation and function of a capacitor; Factors affecting capacitance area of plates, distance between plates, number of plates, dielectric and dielectric constant, working voltage, voltage rating; Capacitor types, construction and function; Capacitor colour coding; Calculations of capacitance and voltage

in series and parallel circuits; Exponential charge and discharge of a capacitor, time constants; Testing of capacitors.3 Define Inductors-units 4 Ideal source: Practical DC Source, Significance of the internal resistance of a supply. AC Source-Fundamentals of sine Wave form equation, Definition of Avg, RMS, $V_m \sin \omega t$, frequency

UNIT-4: Electrical circuits

DC Circuits: Ohms Law, Kirchhoff's Voltage and Current Laws; Calculations using the above laws to find resistance, voltage and current; Construction of potentiometers and rheostats; Construction of Wheatstone bridge, combinations. Operation and use of potentiometers and rheostats. Operation of Wheatstone bridge. Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power Formula. Calculations involving power, work and energy.

UNIT V: Semiconductors and Diodes:

Duration: 13 Periods (L: 10 – T: 3)

Materials, electron configuration, electrical properties; P and N type materials: effects of impurities on conduction, majority and minority characters; PN junction in a semiconductor, development of a potential across a PN junction in unbiased, forward biased and reverse biased conditions; Diode symbols; Diode characteristics and properties; Main characteristics and use of silicon-controlled rectifiers (thyristors), light emitting diode, photo conductive diode, varistor, rectifier diodes; Functional testing of diodes. Applications of the following devices: silicon-controlled rectifier (thyristor), light emitting diode, Schottky diode, photo conductive diode, varactor diode, varistor, rectifier diodes, Zener diode. -

UNIT VI

Duration: 13 Periods (L: 10 – T: 3)

Transistors: (a) Transistor symbols; BJT Component description and orientation; Transistor characteristics and properties. (b) Construction and operation of PNP and NPN transistors; Base, collector and emitter configurations; Testing of transistors. Basic appreciation of other transistor types and their uses. Application of transistors: classes of amplifier (A, B, C);

Operation and function of diodes in the following circuits: clippers, clampers, full and half wave rectifiers, bridge rectifiers, voltage doublers and triplets Simple circuits including: bias, decoupling, feedback and stabilisation; Multistage Amplifier circuit principles: cascades, push-pull, oscillators, multivibrators, 555 timers.

Unit-wise Learning Outcomes

Unit–1: Basics of Electricity

After completing this unit, students will be able to:

1. Explain the structure of atoms, molecules, ions, and compounds.
2. Differentiate conductors, semiconductors, and insulators based on molecular structure.
3. Describe static electricity and electrostatic charge distribution.

4. Apply Coulomb's law to electrical charge interactions.
 5. Explain electrical conduction in solids, liquids, gases, and vacuum.
 6. Define electrical terms such as current, voltage, EMF, resistance, conductance, and charge.
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Unit–2: Electricity Generation

After completing this unit, students will be able to:

1. Explain different methods of electricity generation.
 2. Describe the construction and operation of primary and secondary cells.
 3. Compare lead-acid, nickel-cadmium, and alkaline cells.
 4. Analyze series and parallel battery connections.
 5. Explain internal resistance and its effect on battery performance.
 6. Describe the operation of thermocouples and photo-cells.
 7. State and apply Faraday's Law of Electromagnetic Induction.
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Unit–3: Elements of Electricity

After completing this unit, students will be able to:

1. Explain resistance, conductance, and factors affecting them.
 2. Interpret resistor colour codes, tolerances, and wattage ratings.
 3. Calculate equivalent resistance in series and parallel circuits.
 4. Explain capacitor construction, operation, and types.
 5. Calculate capacitance and voltage in series and parallel capacitor circuits.
 6. Analyze capacitor charging and discharging characteristics.
 7. Define inductance and inductors.
 8. Differentiate ideal and practical DC sources.
 9. Explain AC waveform fundamentals including RMS value, average value, frequency, and sinusoidal equations.
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Unit–4: Electrical Circuits

After completing this unit, students will be able to:

1. Apply Ohm's law in electrical circuit calculations.
2. Use Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL) for circuit analysis.
3. Analyze electrical circuits to determine voltage, current, and resistance.
4. Explain the construction and operation of potentiometers and rheostats.
5. Describe the operation of Wheatstone bridge circuits.

6. Calculate electrical power, work, and energy in DC circuits.
 7. Determine power dissipation in resistive circuits.
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Unit–5: Semiconductors and Diodes

After completing this unit, students will be able to:

1. Explain semiconductor materials and electron configuration.
 2. Differentiate P-type and N-type semiconductors.
 3. Describe the formation and operation of PN junction diodes.
 4. Analyze diode behavior under forward and reverse bias conditions.
 5. Explain characteristics and applications of rectifier diodes, LEDs, SCRs, Zener diodes, Schottky diodes, varactors, and photo-diodes.
 6. Perform functional testing of semiconductor diodes.
 7. Apply semiconductor devices in practical electronic circuits.
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Unit–6: Transistors and Electronic Circuits

After completing this unit, students will be able to:

1. Identify transistor symbols and terminal configurations.
2. Explain the construction and operation of PNP and NPN transistors.
3. Analyze transistor characteristics and configurations.
4. Test and troubleshoot transistor circuits.
5. Describe amplifier classes and transistor applications.
6. Explain the operation of rectifier, clipper, clamper, and voltage multiplier circuits.
7. Analyze multistage amplifier circuits, oscillators, multivibrators, and 555 timer applications.

Recommended books:

- A textbook of electrical technology (vol-1 & vol-4) by B.L. Theraja & A.K. Theraja
- A Textbook of Electrical Technology (vol-1 & vol-4) by V.K. Mehta
- AC 65-9A Airframe & Powerplant mechanics, General handbook
- Aircraft Electrical and electronic systems by Thomas & Esmin
- Basic Electrical Engineering by V.K. Mehta & Rohit Mehta
- Aircraft Electrical System by E.H.J. Pallett

AME 204 – Aircraft Materials and Metallurgy

Course Title	Aircraft Systems	Course Code	AME 204
Semester	II	Course Group	Core
Teaching Scheme in Periods (L:T:P)	:4:1: 0	Credits	3.0
Methodology	Lecture+ Tutorial	Total Contact Periods	75
CIE	60 Marks	Year End Examination (YEE)	40 Marks

Pre requisites

This course requires the basic knowledge of materials, basic metallurgy, and chemical properties of metals.

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Explain aircraft metallurgy principles and identify properties, heat treatment, and applications of ferrous aircraft materials.
CO2	Test ferrous aircraft materials for mechanical properties and interpret results for maintenance use.
CO3	Identify non-ferrous aircraft materials and describe their properties, heat treatment, and applications.
CO4	Test non-ferrous materials and analyze composite and non-metallic materials for defects and repairs.
CO5	Identify materials, defects, inspection, preservation, and repair of wooden aircraft structures and fabric coverings.
CO6	Explain corrosion mechanisms and identify bearing types, materials, construction, loads, and applications in aircraft systems.

CO – PO Mapping Matrix

Correlation Scale: 1 - Low 2 – Medium 3 - High

Course Outcome/ Programme Outcome	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO 1	3	1	–	–	–	–	2	1,2,7
CO 2	3	1	–	–	–	–	2	1,2,7
CO 3	3	–	–	1	1	–	2	1,4,5,7
CO 4	3	–	–	1	–	–	2	1,4,7
CO 5	3	1	–	1	–	–	2	1,2,4,7
CO 6	3	–	–	1	1	–	2	1,4,5,7

COURSE CONTENTS

UNIT–I: Aircraft Metallurgy and Ferrous Materials

Aircraft metallurgy; basic concepts of metallurgy; crystal structure of metals; mechanical properties of aircraft materials; characteristics, properties and identification of common alloy steels used in aircraft; heat treatment of alloy steels; applications of alloy steels in aircraft.

UNIT–II: Testing of Ferrous Materials

Testing of ferrous materials; hardness testing; tensile strength testing; fatigue strength testing; impact resistance testing; significance of material testing in aircraft maintenance.

UNIT–III: Aircraft Materials – Non-Ferrous

Characteristics, properties and identification of common non-ferrous materials used in aircraft; aluminum, magnesium, titanium and copper alloys; heat treatment of non-ferrous materials; applications of non-ferrous materials in aircraft.

UNIT–IV: Testing of Non-Ferrous Materials and Composite Materials

Testing of non-ferrous materials for hardness, tensile strength, fatigue strength and impact resistance; composite and non-metallic materials (excluding wood and fabric); characteristics, properties and identification of common composite and non-metallic materials; sealants and bonding agents; detection of defects and deterioration; repair of composite and non-metallic materials.

UNIT–V: Wooden Structures and Fabric Covering

Construction methods of wooden airframe structures; characteristics, properties and types of wood and glue used in aero planes; preservation and maintenance of wooden structures; types and detection of defects in wood and wooden structures; repair of wooden structures; characteristics, properties and types of fabrics used in aero planes; inspection methods for fabric covering; types of defects in fabric; repair of fabric covering.

UNIT–VI: Corrosion and Bearings

Chemical fundamentals of corrosion; formation of corrosion by galvanic action, microbiological action and stress; types of corrosion and their identification; causes of corrosion; material types and susceptibility to corrosion; purpose of bearings; bearing loads; bearing materials and construction; types of bearings and their applications in aircraft

Unit-wise Learning Outcomes

Unit–I: Aircraft Metallurgy and Ferrous Materials

After completing this unit, students will be able to:

1. Explain the basic concepts of aircraft metallurgy.
 2. Describe crystal structures and mechanical properties of metals.
 3. Identify common alloy steels used in aircraft.
 4. Explain heat treatment processes for alloy steels.
 5. Describe the applications of ferrous materials in aircraft structures.
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Unit–II: Testing of Ferrous Materials

After completing this unit, students will be able to:

1. Explain the importance of material testing in aircraft maintenance.
 2. Perform hardness testing of ferrous materials.
 3. Analyze tensile strength characteristics of aircraft materials.
 4. Explain fatigue strength testing procedures.
 5. Describe impact resistance testing and its significance.
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Unit–III: Aircraft Materials – Non-Ferrous

After completing this unit, students will be able to:

1. Identify common non-ferrous materials used in aircraft.

2. Explain the properties and characteristics of aluminium, magnesium, titanium, and copper alloys.
 3. Describe heat treatment methods for non-ferrous materials.
 4. Explain the applications of non-ferrous materials in aircraft construction.
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Unit–IV: Testing of Non-Ferrous Materials and Composite Materials

After completing this unit, students will be able to:

1. Perform testing methods for non-ferrous materials.
 2. Explain the characteristics and properties of composite and non-metallic materials.
 3. Identify sealants and bonding agents used in aircraft.
 4. Detect defects and deterioration in composite materials.
 5. Describe repair techniques for composite and non-metallic structures.
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Unit–V: Wooden Structures and Fabric Covering

After completing this unit, students will be able to:

1. Explain the construction methods of wooden airframe structures.
 2. Identify types and properties of wood and adhesives used in aircraft.
 3. Describe preservation and maintenance methods for wooden structures.
 4. Detect defects in wooden structures and fabric coverings.
 5. Explain repair methods for wooden structures and fabric coverings.
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Unit–VI: Corrosion and Bearings

After completing this unit, students will be able to:

1. Explain the chemical fundamentals of corrosion.
2. Identify different types of corrosion and their causes.
3. Analyze material susceptibility to corrosion.
4. Describe corrosion prevention and control methods.
5. Explain the purpose, construction, and materials of bearings.
6. Classify bearings based on load and application in aircraft systems.

Reference Books:

- 1. Aircraft Materials and Processes – William K. J. / McGraw Hill**
- 2. Aircraft Materials and Metallurgy – R. P. Singh**
- 3. Mechanical Metallurgy – G. E. Dieter**
- 4. Composite Materials for Aircraft Structures – Dieter K. Schmidt**
- 5. Corrosion and Corrosion Control in Aircraft – S. R. Roberge**

Aircraft Maintenance and Repair – Michael J. Kroes & William A. Watkins

AME-205: Artificial Intelligence and Machine Learning

Course Title	Artificial Intelligence and Machine Learning	CourseCode	AME 205
Semester	II	CourseGroup	Core
TeachingSchemeinMinutes (L:T:P)	4:1:0	Credits	3
Methodology	Physical Lectures+ Assignments	TotalContact Hours	75
CIE	60 Marks	SEE	40 Marks

Prerequisites: Basics of Python Programming, Linear Algebra, Probability and Statistics

COURSE OUTCOMES

COs	At the end of the course, the students will have the ability to:
CO1	Understand the importance of applied Mathematics, Data Science in Machine Learning.
CO 2	Explore the fundamentals of Python programming language and AI/ML specific libraries with their applications in AI/ML.
CO 3	Apply the concepts of Supervised Machine Learning algorithms like linear regression, KNN etc to solve real world problems.
CO 4	Apply the concepts of Unsupervised Machine Learning algorithms like K-Means and Hierarchical clustering etc to solve real world problems.
CO 5	Apply Deep learning algorithms like NN, CNN, RNN to solve real world problems in NLP, Computer Vision, Generative AI etc.
CO 6	Evaluate the concepts of Generative AI and its application along with challenges associated with AI Governance.

MODULE 1: Fundamentals required for AI and ML

Duration:6 Periods(L 2P4)

- Introduction to Artificial Intelligence and Machine Learning
- Need of AI and ML
- Basic Mathematical concepts related to AI and ML
- Data Collection, Data Processing and Cleaning
- Types of Data Sources
 - Structured Data
 - Unstructured Data
 - Semi Structured
 - Realtime Data
 - Open Data Set

MODULE 2: Programming and Data Manipulation concepts for AI and ML

Duration:6 Periods(L 2P4)

- Introduction to Artificial Intelligence and Machine Learning
 - Python Basics
 - Python Structure
 - NumPy
 - Pandas
 - Matplotlib and Seaborn
 - Scikit-learn
- Data Pre-Processing
- Data Cleaning
 - Outlier Detection and Removal
 - Duplicate Data

MODULE 3: Introduction to Supervised Machine & Unsupervised Learning

Duration:9 Periods(L 3P6)

Types of Supervised Machine Learning Techniques

Supervised Learning

- Regression
- Classification
- Logistic Regression
- Decision Tree
- K – Nearest Neighbors (KNN)
- Use cases of Regression and Classification

MODULE 4:Introduction to Supervised Machine &Unsupervised Learning

Duration:9 Periods(L 3P6)

Types of Unsupervised and Reinforcement Machine Learning Techniques

- Unsupervised Learning
 - K – Means Clustering
 - Hierarchical Clustering
- Dimensionality Reduction
- Anomaly Detection
- Use cases of clustering and Dimensional Reduction
- Building Machine Learning Model
- Model Evaluation and Validation
- Machine Learning Model Deployment

MODULE 5: Deep Learning, Reinforcement Learning and Natural Language Processing

Duration:9 Periods(L 3P6)

Types of Deep Learning Techniques and Frameworks

- Fundamentals of Deep Learning using TensorFlow and Keras
- Neural Network
- Convolutional Neural Networks (CNNs)
- Natural Language Processing

Practical Applications

- Computer Vision
- Natural Language Processing
- Speech Recognition
- Model Deployment

MODULE 6: AI and AI/ML Governance

Duration:6 Periods(L 2P4)

- Generative AI | AI Agents
 - Introduction of Gen AI
 - Applications of Gen AI
 - Deployment of Gen AI model
 - Agentic AI
 - AI Agents
- AI/ML Governance
 - Ethics in AI and ML
 - Accountability and Responsibility
 - Privacy and Data Protection
 - Social Impact of AI
 - Ethical Guidelines

Module-wise Learning Outcomes

Module–1: Fundamentals Required for AI and ML

After completing this module, students will be able to:

1. Explain the concepts and importance of Artificial Intelligence and Machine Learning.
 2. Describe the need and applications of AI and ML in various domains.
 3. Apply basic mathematical concepts used in AI and ML.
 4. Identify different types of data sources.
 5. Differentiate structured, unstructured, semi-structured, real-time, and open datasets.
 6. Explain the processes of data collection, processing, and cleaning.
-

Module–2: Programming and Data Manipulation Concepts for AI and ML

After completing this module, students will be able to:

1. Understand Python programming fundamentals for AI/ML applications.
 2. Use NumPy for numerical computations.
 3. Apply Pandas for data manipulation and analysis.
 4. Create data visualizations using Matplotlib and Seaborn.
 5. Use Scikit-learn for machine learning preprocessing tasks.
 6. Perform data cleaning, outlier detection, and duplicate data removal.
-

Module–3: Introduction to Supervised Machine Learning

After completing this module, students will be able to:

1. Explain supervised machine learning concepts.
 2. Differentiate regression and classification techniques.
 3. Implement regression and logistic regression models.
 4. Apply decision tree and K-Nearest Neighbours (KNN) algorithms.
 5. Analyze use cases of supervised learning methods.
 6. Evaluate supervised learning models for prediction tasks.
-

Module–4: Introduction to Unsupervised Learning and Model Development

After completing this module, students will be able to:

1. Explain unsupervised and reinforcement learning concepts.
 2. Apply K-Means and hierarchical clustering techniques.
 3. Perform dimensionality reduction and anomaly detection.
 4. Analyze practical applications of clustering methods.
 5. Build machine learning models using suitable algorithms.
 6. Evaluate and validate machine learning models.
 7. Understand basic concepts of machine learning model deployment.
-

Module–5: Deep Learning, Reinforcement Learning and Natural Language Processing

After completing this module, students will be able to:

1. Explain the fundamentals of deep learning frameworks such as TensorFlow and Keras.
 2. Describe the structure and operation of neural networks and CNNs.
 3. Apply natural language processing techniques to text data.
 4. Analyze AI applications in computer vision, NLP, and speech recognition.
 5. Develop and deploy basic deep learning models.
 6. Understand practical applications of reinforcement learning and deep learning systems.
-

Module–6: AI and AI/ML Governance

After completing this module, students will be able to:

1. Explain the concepts and applications of Generative AI.
2. Describe AI agents and Agentic AI systems.
3. Understand the deployment process of Generative AI models.
4. Analyze ethical issues in AI and ML systems.
5. Explain accountability, responsibility, and privacy concerns in AI.
6. Evaluate the social impact of AI technologies and ethical guidelines for responsible AI development.

Suggested Student Activities

Student activity like mini-project, quizzes, etc. should be done in group of 5-10 students.

1. Each group should do any one of the following type of activity or any other similar activity related to the course with prior approval from the course coordinator and program coordinator concerned.
2. Each group should conduct different activity and no repetition should occur.
3. Explore and analyze topics to improve the level of creativity and analytical skill by taking Quiz/ tests/ assignments. Documents have to be maintained as a record.
4. Create a power point presentation on the topic relevant to course or advanced topic as an extension to the course to improve the communication skills. Documents have to be maintained as a record.
5. Visit different sites relevant to topics. Listen to the lectures and submit a handwritten report
6. Data Acquisition from different sources.
7. Model building

Reference Books:

1. Keith Frankish and William M. Ramsey (Eds.), *The Cambridge Handbook of Artificial Intelligence*, Cambridge University Press, ISBN: 978-0-521-69191-8.
2. Bharath Ramsundar&Reza BosaghZadeh,*TensorFlow for Deep Learning*, Shroff/O'Reilly, ISBN- 13:978-1-491-98045-3.
3. John Zelle, *Python Programming: An introduction to computer science*, 3rd Edition Tom Sumner, 2012, ISBN 978-1-590-28275-5.
4. Nina Zumel and John Mount, *Practical Data Science with R*, Manning Publications Co., 2014, ISBN 978-1-617-29156-2.
5. Aurelien Geron, *Hands-On Machine Learning with Scikit-Learn and TensorFlow*, First Edition, O'Reilly Media, Inc., March 2017, ISBN :978-1-491-96229-9.
6. Jeff Heaton, *Artificial Intelligence for Humans, Volume 1: Fundamental Algorithms* Create Space Independent publishing Platform, 2013, ISBN-13: 978-1-493-68222-5

AME 206 MATERIAL TESTING & METROLOGY LAB

Course Title	Material Testing & Metrology Lab	Course Code	AME 206
Semester	II	Course Group	Core
Teaching Scheme in Periods (L:T:P)	1:0:2	Credits	2.0
Methodology	Lecture+ practice	Total Contact Periods	45
CIE	60 Marks	Semester End Examination (SEE)	40 Marks

Pre-requisites

This course requires the basic knowledge of:

- Engineering materials
- Lab safety
- Basic measurements

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Perform tensile tests.
CO2	Conduct hardness and torsion tests.
CO3	Analyze microstructure of materials.
CO4	Perform non-destructive testing.
CO5	Use metrology instruments accurately.
CO6	Prepare and interpret lab reports.

CO – PO Mapping Matrix

Course Outcome/ Programme Outcome	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO 1	3	2		3	2		1	1,4,7
CO 2	3	2		3	2		1	1,4,7
CO 3	3	1		2	2		1	1,5,7
CO 4	3	2		3	2		1	1,4,7
CO 5	3	2		3	2		1	1,4,7
CO 6	3	1		2	1		1	1,7
Average PO Attainment	3.0	1.7		2.7	1.8		1.0	1,4,7

C26 Curriculum –Material Testing & Metrology Lab

SUBJECT CODE: AME 206

Course contents:

1. Analyze the various parameters in UTM machine.
2. Determine the ultimate crushing strength of wood. When the load applied perpendicular to grains and load applied along the grains of the wooden block.
3. Determine the impact strength or toughness of material by conducting an impact test.
4. Calculate the hardness number of the specimen on Brinell's hardness testing machine.
5. Calculate modulus of rigidity by conducting torsion test on solid shaft and hollow shaft

6. Analyze the micro structure of the metals and alloys

7. Non-Destructive Testing (NDT)

a. Dye penetrant testing

b. Magnetic particle testing

Metrology:

1. Introduction to Metrology

2. Measure the angle of the machined surface using a sine bar with slip gauges

Experiment-wise Learning Outcomes

1. Universal Testing Machine (UTM)

After completing this experiment, students will be able to:

1. Identify the components and working principles of a UTM.
 2. Analyze load, stress, and deformation parameters during testing.
 3. Interpret test results for material behaviour under loading.
-

2. Crushing Strength of Wood

After completing this experiment, students will be able to:

1. Determine the crushing strength of wood along the grain direction.
 2. Determine the crushing strength of wood perpendicular to the grain direction.
 3. Compare the effect of grain orientation on wood strength.
-

3. Impact Test

After completing this experiment, students will be able to:

1. Conduct impact testing using standard procedures.
2. Determine the toughness or impact strength of materials.
3. Analyze the behaviour of materials under sudden loading conditions.

4. Brinell Hardness Test

After completing this experiment, students will be able to:

1. Perform hardness testing using the Brinell hardness testing machine.
 2. Calculate the Brinell Hardness Number (BHN).
 3. Compare hardness values of different engineering materials.
-

5. Torsion Test on Shafts

After completing this experiment, students will be able to:

1. Conduct torsion tests on solid and hollow shafts.
 2. Determine the modulus of rigidity of shaft materials.
 3. Compare torsional behaviour of solid and hollow shafts.
-

6. Metallography

After completing this experiment, students will be able to:

1. Prepare metal specimens for microscopic examination.
 2. Analyze the microstructure of metals and alloys.
 3. Correlate microstructure with material properties.
-

7. Non-Destructive Testing (NDT)

a) Dye Penetrant Testing

After completing this experiment, students will be able to:

1. Explain the principle of dye penetrant testing.
2. Detect surface defects in engineering components.
3. Interpret test indications for defect analysis.

b) Magnetic Particle Testing

After completing this experiment, students will be able to:

1. Explain the principle of magnetic particle testing.
 2. Detect cracks and discontinuities in ferromagnetic materials.
 3. Analyze magnetic particle test results.
-

Metrology Learning Outcomes

1. Introduction to Metrology

After completing this module, students will be able to:

1. Explain the importance and applications of metrology in engineering.
 2. Identify commonly used precision measuring instruments.
 3. Understand standards and accuracy in measurements.
-

2. Measurement Using Sine Bar and Slip Gauges

After completing this experiment, students will be able to:

1. Measure angles of machined surfaces using a sine bar.
2. Use slip gauges for precision measurement.
3. Calculate angular measurements accurately using trigonometric relations.

Text Books (Indian Authors)

1. **Jain, Raghuvanshi& Gupta**
Engineering Metrology and Measurements, Khanna Publishers.
2. **Gop Chandran, K.R.**
Material Testing, Cengage Learning India.

Reference Books

3. **Sharma, P.C.**
Manufacturing Technology – Metrology & Inspection, S. Chand.
4. **Gupta, I.C.**
Engineering Metrology, Dhanpat Rai Publications.

E-Learning Resources

5. **NPTEL – Metrology and Measurement Systems**
<https://nptel.ac.in>
6. **YouTube – NPTEL / IIT Metrology Lab Demonstrations**

AME-207 Basic Electrical and Electronics Engineering Lab

Course Title	Basic Electrical and Electronics Engineering Lab	Course Code	AME 207
Semester	II	Course Group	Core
Teaching Scheme in Periods (L:T:P)	1:0:2	Credits	2
Methodology	Lecture+ Practical	Total Contact Periods	45
CIE	60 Marks	Semester End Examination (SEE)	40 Marks

Pre-requisites

This course requires the basic knowledge of Basic Electrical and Electronics

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Demonstrate of production of electricity by light, heat, magnetism, and chemical action,
CO2	Perform experiments on DC sources – batteries, primary cells, secondary cells, lead-acid and Ni-Cd batteries,
CO3	Verification of Ohm's law, Kirchhoff's law, Identification of capacitors and color coding-Connection of capacitors in series and parallel-Testing of capacitors
CO4	Measure amplitude, frequency, and time period of a given signal from function generator by using CRO
CO5	Draw the characteristics of Bipolar Junction (BJT) Transistor by conducting suitable experiments
CO6	Construct and build RC coupled amplifier and Hartley oscillator and verify and observe wave form on CRO.

CO – PO Mapping Matrix

Course Outcome/ Programme Outcome	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO 1	3	3						1,2
CO 2		3	3	3				2,3
CO 3	3			3	3			1,4
CO 4				3	3			4,5
CO 5				3	3			4,5
CO 6				3	3			

Correlation Scale:

1 - Low

2 – Medium

3 - High

Average PO Attainment								
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COURSE CONTENTS

1. Demonstration of production of electricity by **light, heat, magnetism, and chemical action**, Demonstration and use of **electrical measuring instruments**.
2. Demonstration of **DC sources** – primary cells, secondary cells, lead-acid and Ni-Cd batteries, **battery internal construction** Exercise on **connecting cells in series and parallel**-Exercise on **charging and discharging of lead-acid battery**
3. Identification of **resistors and color coding**-Connection of **resistors in series and parallel**-Calculation of **total resistance** in series, parallel, and series-parallel circuits-**Testing of resistors**
4. **Verification of Ohm's law, Kirchhoff's law**
5. Identification of **capacitors and color coding**-Connection of **capacitors in series and parallel**-**Testing of capacitors**
6. Exercise on **soldering techniques**-Measure amplitude, frequency, and time period of a given signal from function generator by using CRO.
7. Construct and test a switching circuit with diode as switching element.
8. Draw characteristics of SCR
9. Draw the regulation characteristics of a regulated power supply constructed using Zener diode.
10. Build Full-wave center-tapped rectifier with filter. Build Full-wave Bridge rectifier with filter
11. Draw the characteristics of Bipolar Junction (BJT) Transistor by conducting suitable experiment.
12. Construct RC coupled amplifier and draw its frequency response.
13. Build Hartley oscillator and verify the effect of varying tank circuit component values and observe wave form on CRO.

Experiment-wise Learning Outcomes

1. Electricity Generation and Measuring Instruments

After completing this experiment, students will be able to:

1. Demonstrate electricity generation using light, heat, magnetism, and chemical action.
 2. Identify and use basic electrical measuring instruments.
 3. Measure electrical quantities such as voltage and current.
-

2. DC Sources and Batteries

After completing this experiment, students will be able to:

1. Identify different types of DC sources and batteries.
 2. Explain the construction and operation of lead-acid and Ni-Cd batteries.
 3. Connect cells in series and parallel configurations.
 4. Perform charging and discharging of lead-acid batteries safely.
-

3. Resistors and Resistance Circuits

After completing this experiment, students will be able to:

1. Identify resistors using colour coding.
 2. Connect resistors in series and parallel circuits.
 3. Calculate equivalent resistance in combined circuits.
 4. Test resistors using measuring instruments.
-

4. Verification of Ohm's Law and Kirchhoff's Laws

After completing this experiment, students will be able to:

1. Verify Ohm's law experimentally.
 2. Verify Kirchhoff's Voltage Law (KVL) and Current Law (KCL).
 3. Analyze voltage and current distribution in circuits.
-

5. Capacitors and Capacitor Circuits

After completing this experiment, students will be able to:

1. Identify capacitors using colour coding.
 2. Connect capacitors in series and parallel.
 3. Test capacitor functionality and behavior in circuits.
-

6. Soldering and CRO Measurements

After completing this experiment, students will be able to:

1. Demonstrate proper soldering techniques.
 2. Use a CRO to measure amplitude, frequency, and time period.
 3. Analyze waveforms generated by a function generator.
-

7. Diode Switching Circuit

After completing this experiment, students will be able to:

1. Construct a diode-based switching circuit.
 2. Explain the switching behavior of diodes.
 3. Test and analyze switching circuit performance.
-

8. SCR Characteristics

After completing this experiment, students will be able to:

1. Draw and analyse the characteristics of an SCR.
 2. Explain SCR operation under different biasing conditions.
 3. Identify triggering and conduction characteristics.
-

9. Zener Diode Regulated Power Supply

After completing this experiment, students will be able to:

1. Construct a regulated power supply using a Zener diode.
 2. Draw and analyse voltage regulation characteristics.
 3. Explain the role of Zener diode regulation.
-

10. Rectifier Circuits

After completing this experiment, students will be able to:

1. Build full-wave centre-tapped rectifier circuits with filters.
2. Build bridge rectifier circuits with filters.

3. Analyze rectifier output waveforms and filtering effects.
-

11. BJT Characteristics

After completing this experiment, students will be able to:

1. Conduct experiments to determine BJT characteristics.
 2. Plot transistor input and output characteristics.
 3. Analyze transistor operation in different regions.
-

12. RC Coupled Amplifier

After completing this experiment, students will be able to:

1. Construct an RC coupled amplifier circuit.
 2. Measure amplifier gain and frequency response.
 3. Analyze amplifier performance at different frequencies.
-

13. Hartley Oscillator

After completing this experiment, students will be able to:

1. Construct a Hartley oscillator circuit.
 2. Observe and analyse oscillator waveforms using CRO.
 3. Study the effect of tank circuit component variations on frequency generation.
-

AME-208-THERMAL ENGINEERING LAB

Course Title	Thermal Engineering Lab	Course Code	AME 208
Semester	II	Course Group	Practical
Teaching Scheme in Periods(L:T:P)	1:0:2	Credits	2
Methodology	Lecture + Practical	Total Contact Hours:	45
CIE	60Marks	SEE	40Marks

COURSE CONTENT

S. No	THERMAL ENGINEERING LAB
1	Flash and Fire point test using Cleveland Apparatus/ Pesky Martens Apparatus/ Abels Apparatus
2	Viscosity measurementtest using Redwood viscometer/ Saybolt viscometer
3	Calorific value test using Junkers gas calorimeter
4	Calorific value test using Bomb calorimeter
5	Performance test on 4 stroke IC. Engine
6	Morse Test on 4-stroke multicylinder IC Engine
7	Estimate Heat Balance of given IC Engine
8	Study of Marcet Boiler
9	Performance test on reciprocation air compressor

Experiment-wise Learning Outcomes

1. Flash and Fire Point Test

(Using Cleveland Apparatus / Pensky-Martens Apparatus / Abel's Apparatus)

After completing this experiment, students will be able to:

1. Explain the concepts of flash point and fire point.
 2. Operate Cleveland, Pensky-Martens, and Abel apparatus safely.
 3. Determine the flash and fire points of fuels and lubricants.
 4. Analyze the suitability of fuels based on safety characteristics.
-

2. Viscosity Measurement Test

(Using Redwood Viscometer / Saybolt Viscometer)

After completing this experiment, students will be able to:

1. Explain the concept and importance of viscosity.
 2. Measure viscosity using Redwood and Say bolt viscometers.
 3. Compare viscosity characteristics of lubricants and fuels.
 4. Analyze the effect of viscosity on engine performance.
-

3. Calorific Value Test Using Junkers Gas Calorimeter

After completing this experiment, students will be able to:

1. Explain the principle of gas calorimetry.
 2. Determine the calorific value of gaseous fuels.
 3. Calculate heat energy released during combustion.
 4. Analyze fuel efficiency based on calorific value.
-

4. Calorific Value Test Using Bomb Calorimeter

After completing this experiment, students will be able to:

1. Explain the working principle of a bomb calorimeter.
 2. Determine the calorific value of solid and liquid fuels.
 3. Calculate higher calorific value (HCV) of fuels.
 4. Interpret combustion characteristics from test data.
-

5. Performance Test on Four-Stroke IC Engine

After completing this experiment, students will be able to:

1. Conduct performance testing on a four-stroke IC engine.
 2. Measure engine parameters such as fuel consumption, power, and efficiency.
 3. Calculate brake power, thermal efficiency, and specific fuel consumption.
 4. Analyze engine operating characteristics.
-

6. Morse Test on Four-Stroke Multicylinder IC Engine

After completing this experiment, students will be able to:

1. Explain the purpose and principle of Morse test.
 2. Determine indicated power of individual cylinders.
 3. Calculate friction power and mechanical efficiency.
 4. Evaluate the performance of multicylinder IC engines.
-

7. Heat Balance Test on IC Engine

After completing this experiment, students will be able to:

1. Estimate the heat balance of an IC engine.
 2. Determine heat distribution in engine systems.
 3. Calculate useful work output and heat losses.
 4. Analyze engine energy utilization and efficiency.
-

8. Study of Marcet Boiler

After completing this experiment, students will be able to:

1. Explain the construction and working of a Marcet boiler.
2. Study the pressure-temperature relationship of steam.

3. Verify steam table relationships experimentally.
 4. Analyze thermodynamic behaviour of saturated steam.
-

9. Performance Test on Reciprocating Air Compressor

After completing this experiment, students will be able to:

1. Conduct performance testing on a reciprocating air compressor.
2. Determine compressor efficiency and work input.
3. Analyze pressure-volume relationships during compression.
4. Evaluate compressor performance characteristics.

AME 209 Artificial Intelligence and Machine Learning LAB

Course Title	Artificial Intelligence and Machine Learning LAB	Course Code	AME 209
Semester	II	Course Group	Practical
Teaching Scheme in Periods(L:T:P)	1:0:2	Credits	2
Methodology	Lecture + Practical	Total Contact Hours:	45
CIE	60Marks	SEE	40Marks

Prerequisites Basics of Python Programming, Linear Algebra, Probability and Statistics.

Course Outcomes

On successful completion of the course, the students will be able to

CO'S	Description
CO1	Understand the importance of applied Mathematics, Data Science in Machine Learning.
CO2	Explore the fundamentals of Python programming language and AI/ML specific libraries with their applications in AI/ML.
CO3	Apply the concepts of Supervised Machine Learning algorithms like linear regression, KNN etc to solve real world problems.
CO4	Apply the concepts of Unsupervised Machine Learning algorithms like K-Means and Hierarchical clustering etc to solve real world problems.
CO5	Apply Deep learning algorithms like NN, CNN, RNN to solve real world problems in NLP, Computer Vision, Generative AI etc.
CO6	Evaluate the concepts of Generative AI and its application along with challenges associated with AI Governance.

Course Content

Unit Number	Unit Name	Periods
1	Programming Fundamentals required for AI and ML	6
2	Programming and Data Manipulation concepts for AI and ML	6
3	Introduction to Supervised Machine & Unsupervised Learning	9
4	Introduction to Supervised Machine & Unsupervised Learning	9
5	Deep Learning, Reinforcement Learning and Natural Language Processing	9
6	AI and AI/ML Governance	6
Total		45

Course Learning Outcomes (CLOs)

After successful completion of this course, students will be able to:

CLO–1: Programming Fundamentals for AI/ML

Understand basic programming concepts required for Artificial Intelligence and Machine Learning, including syntax, logic building, and computational problem-solving.

CLO–2: Data Manipulation and Pre-processing

Apply programming tools and libraries to collect, clean, transform, and visualize data for AI/ML applications.

CLO–3: Supervised Learning Techniques

Analyze and implement supervised machine learning algorithms such as regression, classification, decision trees, and KNN for predictive modeling tasks.

CLO–4: Unsupervised Learning Techniques

Apply unsupervised learning methods such as clustering, dimensionality reduction, and anomaly detection to identify patterns in unlabeled data.

CLO–5: Deep Learning and NLP Applications

Understand and implement deep learning models, reinforcement learning concepts, and natural language processing techniques for real-world AI applications.

CLO–6: AI Governance and Responsible AI

Explain ethical, legal, and governance aspects of AI systems, including fairness, accountability, privacy, and societal impact of AI/ML technologies.

Recommended Books

7. Keith Frankish and William M. Ramsey (Eds.), *The Cambridge Handbook of Artificial Intelligence*, Cambridge University Press, ISBN: 978-0-521-69191-8.
8. Bharath Ramsundar & Reza BosaghZadeh, *TensorFlow for Deep Learning*, Shroff/O'Reilly, ISBN- 13:978-1-491-98045-3.
9. John Zelle, *Python Programming: An introduction to computer science*, 3rd Edition Tom Sumner, 2012, ISBN 978-1-590-28275-5.
10. Nina Zumel and John Mount, *Practical Data Science with R*, Manning Publications Co., 2014, ISBN 978-1-617-29156-2.
11. Aurelien Geron, *Hands-On Machine Learning with Scikit-Learn and TensorFlow*, First Edition, O'Reilly Media, Inc., March 2017, ISBN :978-1-491-96229-9.
12. Jeff Heaton, *Artificial Intelligence for Humans, Volume 1: Fundamental Algorithms* Create Space Independent publishing Platform, 2013, ISBN-13: 978-1-493-68222-5

List of Exercises

1. Explore Python programming with different Libraries.
2. Data manipulation, preprocessing and visualisation using Pandas, Numpy and Matplotlib.
3. Apply Linear Regression model for prediction of price of a product.
4. Implement K – Means clustering to segment customer based on purchasing behaviour.
5. Build a Machine Learning Model – Decision Tree/ Random Forest/ Anomaly Detection.
6. Build SVM model and evaluate performance (Precision, Recall, F-Score and Confusion Matrix).
7. Build a Neural Network using Keras or TensorFlow to classify the handwritten digits.
8. Implement a Convolutional Neural Network to classify images of handwritten digits datasets.
9. Implementation of NLP for speech recognition.
10. Compare two different Gen AI models.
11. Integrate a Trained Machine Learning Model in Mobile APP for Prediction.
12. Case Studies

AME 210-COMMUNICATION AND LIFE SKILLS LAB