Electrical Engineering

Code	Credit Hours
EE-103	2-1

COURSE DESCRIPTION:

This course is an introduction to electric circuit elements and electronic devices and a study of circuits containing such devices. Students are taught sources and circuit parameters of electrical systems, circuit laws and theorems governing electric circuits. AC fundamentals and operational amplifiers are also included in the course to lay a strong foundation of electrical engineering

TEXT AND MATERIAL

Textbooks:

Electric Circuits Latest Available Edition by James W. Nilsson (Author), Susan Riedel (Author)
Electrical Fundamentals by Aviation Maintenance Technician Certification Series, Latest Available Edition
Electronic Fundamentals by Aviation Maintenance Technician Certification Series, Latest Available Edition

Reference Books:

Engineering Circuit Analysis by W H Hayt

ASSESSMENT SYSTEM FOR THEORY

Quizzes	10%
Assignments	10%
Mid Terms	30%
ESE	50%

ASSESSMENT SYSTEM FOR LAB:

Quizzes	10%-15%
Assignments	5% - 10%
Lab Work and Report	70-80%
Lab ESE/Viva	20-30%

TOPIC COVERED

Week No	Topics	Learning Outcomes	Delivery Method
1	Principles of Electricity	1. System of Units, Energy, Electric Charge and Current. 2. Electric Potential and Potential Difference 3. Ohm's Law and Resistors 4. Static electricity and distribution of electrostatic charges; 5. Electrostatic laws of attraction and repulsion; Units of charge, Coulomb's Law; 6. Conduction of electricity in solids, liquids, gases and a vacuum.	Lecture and discussion
2	Series and Parallel Circuits	1. Series and Parallel Circuit Characteristics (Current, Voltage, Power) 2. Voltage and Current Relationships: References, KVL, KCL, the voltage and Current Dividers 3. Max Power Transfer 4. Series and Parallel Connected Voltage Sources	Lecture and discussion
3	Series Parallel Circuits	1. Analyzing Series-Parallel Circuits 2. Wheatstone bridge, Delta Wye Circuits	Lecture and discussion
4	Network Theorems	1. Superposition Theorem 2. Thevenin's Theorem 3. Application of Thevenin's Theorem	Lecture and discussion
5	Network Theorems	1. Norton's Theorem 2. Application of Norton's Theorem	Lecture and discussion
6	Problems and	Revision of course material for	Lecture and

	Revision	MID TERM IN WEEK 9 (TENTATIVE)	discussion
7	Alternating Current	1. AC overview 2. Magnitude, Values & Measurements 3. Sine Waves: Phase Measurements and Ins. Values 4. Static and Dynamic Values, DC offsets and Harmonics 5. Nonsinusoidal Waveforms	Lecture and discussion
8	Inductors	1. Inductance 2. Phase relationship between inductor current and voltage 3. Inductors in Series and Parallel 4. Inductive Reactance 5. Transformers and Power	Lecture and discussion
9	**MID TERM EXAM**		
10	RL Circuits	1. Series RL Circuits: Characteristics and Power 2. Parallel RL Circuits Characteristics 3. Series-Parallel Circuits Analysis	Lecture and discussion
11	Capacitors	1. Capacitors and Capacitance 2. Series and Parallel Capacitors 3. Alternating voltage and Current Characteristics 4. Capacitive Reactance	Lecture and discussion
12	Power and Electricity	1. Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion. 2. Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy	Lecture and discussion
13-14	Resistive-Capacitive Circuits	1. Series Circuits 2. Power Characteristics and Calculation 3. Parallel RC Circuits	Lecture and discussion

		4. Series-Parallel RC Circuit Analysis	
15	RLC Circuits	1. Series and Parallel LC Circuits 2. Resonance 3. Series and Parallel RLC Circuits 4. Series-Parallel RLC Circuit Analysis	Lecture and discussion
16	Operational Amplifiers	1. Op-amp Operation Overview 2. Differential Amplifiers and Op-Amp Specifications 3. Inverting & Noninverting Amplifiers 4. Op-Amp Circuits	Lecture and discussion
17/1	DC Motors and Generators	Basic motor and generator theory; Construction and purpose of components in DC generator; Operation of, and factors affecting output and direction of current flow in DC generators; Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors; Series wound, shunt wound and compound motors; Starter Generator construction.	Lecture and discussion
17/2	AC Generators and Motos	Rotation of loop in a magnetic field and waveform produced; Operation and construction of revolving armature and revolving field type AC generators; Single phase, two phase and three phase alternators; Three phase star and delta connections advantages and uses; Permanent Magnet Generators. Construction, principles of operation and characteristics of: AC synchronous and induction	

		motors both single and polyphase; Methods of speed control and direction of rotation; Methods of producing a rotating field: capacitor, inductor, shaded or split pole.	
18	End semester exam (ESE)		

Lab work

Week No	Topics	List of Experiments	Assessment
1	Basic Concepts and Circuit Element	Using the Multimeter. Resistance color code. Resistance Measurement by Meter	Lab reports and viva
2	Basic Concepts and Circuit Element	Electric shock and Safety Rules. (a) Measurement of resistance between various parts of the body. (b) Rules for safe practice to avoid electric shock	Lab reports and viva
3	Power supply	Power Supplies, Instruments, and equipment. To learn how to use ac/dc power supplies, instruments, and related equipment.	Lab reports and viva
4	AC/DC	Measurement of DC Voltage and DC Current. Using Voltmeter. Measuring Voltage and Current. Control of Current by Resistance and Voltage.	Lab reports and viva
5	Ohm's Law / Kirchhoff's Laws	Kirchhoff Law. Ohm's law. Voltage Divider / Kirchhoff's Voltage Law. Kirchhoff's Current Law.	Lab reports and viva
6	Series and Parallel Circuits	Series-Parallel circuits Characteristics of series-Parallel Circuits.	Lab reports and viva
7	Voltage-Current Characteristics.	Voltage-Current Characteristics of filament lamps (tungsten, carbon) and radiant heater.	Lab reports and viva
8	Capacitors	Capacitor testing and identification. Capacitor charge and discharge (RC Time	Lab reports and viva
9	Electric Current and Magnetism.	Magnetic Field Produced Around Current-carrying conductor.	Lab reports and viva
10	Induced Force	Force produced on a current carrying conductor lying in a magnetic field.	Lab reports and viva
11	Electromagnetic Induction	Inducing voltage in a coil. Polarity of Induced voltage. Magnitude of induced voltage.	Lab reports and viva

12	AC voltage and current measurement	To Measure the effective value of an alternating voltage. To learn the use of ac voltmeters and ammeter. To verify Ohm's law for ac circuits.	Lab reports and viva
13	Measuring AC with Oscilloscope	To learn Oscilloscope Controls. Measuring ac and dc voltages and frequency.	Lab reports and viva
14	Phase angle, Real and Apparent Power, Capacitive Reactance, and Inductive Reactance	To study the meaning of phase angle. To study the relationship between real and apparent power. To study behavior of capacitor and inductor in ac circuits, capacitive reactive power, and inductive power.	Lab reports and viva
15		**End semester exam (ESE)**	