

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**  
**COURSE CURRICULUM**

Course Title: Basics of Electrical & Electronics Engineering  
(Code: 3300014)

Diploma Programmes in which this course is offered	Semester in which offered
Fabrication Technology	<b>First Semester</b>
Automobile Engineering	<b>Second Semester</b>

### 1. RATIONALE

In fabrication engineering, there are many equipment that are electrically operated. Therefore, the basic know of electrical engineering will greatly help the technical person concerned in working effectively in his/her profession. Small faults could be identified and rectified so that the down time of the equipment is reduced. This course is therefore designed to provide the basic understanding of electrical engineering

### 2. LIST OF COMPETENCIES

The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies.

- i. **Measure basic electrical quantities/parameters.**
- ii. **Use major electrical/electronic machines//instrument/equipment.**

### 3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE	PA	ESE	PA	<b>150</b>
3	0	2	5	70	30	20	30	

**Legends:** L-Lecture; T – Tutorial/Teacher Guided Student Activity; P - Practical; C – Credit;  
ESE - End Semester Examination; PA - Progressive Assessment.

### 4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
<b>Unit – I Fundamentals of Electric And Magnetic Circuits</b>	1.1 Determine the current, voltage and resistance in an electric circuit using Ohm's law. 1.2 Explain the terms related with electric and magnetic circuits. 1.3 Determine the energy and power consumed in an electric circuit.	1.1 Ohm's law. 1.2 Definitions of EMF, Current, Potential Difference, Power and Energy. 1.3 Study of terms: - M.M.F, magnetic force, permeability, hysteresis loop, reluctance, leakage factor etc. 1.4 Comparison of magnetic and electric circuit.

Unit	Major Learning Outcomes	Topics and Sub-topics
<b>Unit– II AC Fundamentals and Electromagnetic Induction</b>	2.1 Explain Faraday’s law of electromagnetic induction. 2.2 State the difference between self and mutual induced emf 2.3 Describe the use of capacitors and inductors in AC circuits. 2.4 Explain power consumed in an electric circuit with AC and DC sources.	2.1 State Faraday’s law of electro magnetic induction. 2.2 Dynamically induced emf. 2.3 Statically induced emf.-Self induced emf; Mutually induced emf. 2.4 Definitions and equations of self and mutual inductance. 2.5 Define cycle, frequency, periodic time, amplitude, RMS value, maximum value, instantaneous value, angular velocity or Frequency with reference to alternating emf and current. 2.6 A.C. through pure a) resistors, b) inductors and c) capacitors
<b>Unit– III Electrical Measuring Instruments and Basic Electronics</b>	3.1 Use multimeter in the measurement of voltage, current and resistance 3.2 Select instruments for a given measurement 3.3 Connect measuring instruments correctly in circuits 3.4 Record readings from measuring instruments 3.5 Explain the functions of semiconductor devices & their application.	3.1 Voltmeter, Ammeter, Wattmeter, Megger, Clip-on meter, Energy meter, Luxmeter and Multimeter. 3.2 Methods of connecting various indicating instruments. 3.3 Conductors, insulators and semi conductors; 3.4 P & N type semi conductor. 3.5 Basic function and identification of diode, Transistor and SCR, Photo diode, Photo transistor, Solar cell, LED, LCD, LDR, 555 Timer IC and OPAM.
<b>Unit– IV Transformer and protective devices</b>	4.1 Describe the construction of a simple transformer. 4.2 Describe the types and uses of transformers 4.3 List the types of transformers used in various devices 4.4 State the differences of MCB and ELCB 4.5 State the need of HRC fuses. 4.6 Describe how earthing is done for a domestic building	4.1 General construction and principle of transformers. 4.2 Emf equation and transformation ratio of transformers. 4.3 List various losses in transformers and equation of efficiency. 4.4 Applications of Transformers. 4.5 Construction and uses of auto transformers. 4.6 Different protective devices such as fuse, M.C.B. and ELCB. HRC fuses 4.7 Uninterruptible Power Supplies (UPS) 4.8 Earthing principles and pipe earthing
<b>Unit– V Electrical Machines</b>	5.1 Describe the working principle of DC generator and alternator 5.2 Label the parts of a squirrel cage induction motor 5.3 Describe the working principle of a 3 phase squirrel cage induction motor 5.4 Describe the working principle of a wound rotor induction motor	5.1 DC generator and alternator 5.2 Classification of induction motors. 5.3 Construction, working principle 5.4 Squirrel cage and wound rotor induction motor

**5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS**

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Fundamentals of Electric and Magnetic Circuits	8	6	4	2	12
2.	A.C Fundamentals and Electromagnetic Induction	9	6	6	4	16
3.	Electrical Measuring Instruments and Basic Electronics	9	7	7	4	18
4.	Transformers and protective devices	8	5	4	3	12
5.	Electrical Machines	8	4	6	2	12
Total		42	28	27	15	70

**Legends:** R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

**6. SUGGESTED LIST OF EXPERIMENTS/PRACTICAL EXERCISES**

The experiments/practical exercises should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the above mentioned competencies.

Out of the present list of experiments/practical minimum 10 may be selected, however it will be better to select more experiments/practical.

S. No.	Unit No.	Experiment/Practical Exercises
1	I	To verify ohm's law.
2	I	To measure voltage, current & power in 1-phase circuit. ( with resistive load)
3	II	To measure the voltage across a coil with variable frequency AC input.
4	II	Study AC circuit with resistor, inductor and capacitor at constant frequency.
5	II	Study AC circuit with resistor, inductor and capacitor with variable frequency.
6	II	Explain RC time constant for a 555 Timer in multivibrator application.
7	III	Use Techometer to find speed of a motor at different speeds.
8	III	Use digital multimeter for the measurement of voltage, resistance and current.
9	III	Connect voltmeter, ammeter and energy meter correctly in AC and DC circuits and record readings at different frequency (AC only) and voltages in tables.
10	III	Use multimeter to find working/damaged transistors, resistances, transformers, coils and capacitors.
11	III	Check battery potential and determine polarity by the use of multimeter.
12	III	Use Luxmeter to measure light, at increasing distances/directions from source, from an incandescent lamp, Tube light and CFL.
13	III	Use Solar cell for recording solar insolation at different times in a day.
14	III	Study the use of photo diode, photo transistor and Light Dependent

		Resistor (LDR) in detection and measurement of light.
15	III	Study of different electronics components.
16	III	View the output of half wave & full wave rectifiers on CRO.
17	IV	Measure transformation ratio K of 1- phases transformers.
18	IV	To find efficiency of transformers by OC & SC test.
19	IV	Study the electric Earthing circuit in the institution.
20	IV	Study the types of Fuses used in the institution.
21	IV	Study the functioning of MCB & ELCB.
22	V	Study of DC motor parts & their identification.
23	V	To study three phase induction motor parts & their identification.
24	V	Study the UPS used in the electrical/electronics laboratory.

## 7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities like: course/topic based seminars, internet based assignments, teacher guided self learning activities, course/library/internet/lab based mini-projects.....etc. These could be individual or group-based.

For example:

1. Students may be asked to make a list of following items used in electric and electronics circuits. Compare their properties, usage, cost and availability. Collections can be made for small inexpensive items. Each of these can be offered as a project.

- a. Conductors - Copper, Aluminum, Graphite, Carbon, Nichrome, Tin
- b. Commonly used insulators
- c. Transistors
- d. Capacitors
- e. Resistors
- f. Diodes and Rectifiers
- g. Transformers
- h. SCRs, TRIACs, DIACs
- i. LEDs, LCDs
- j. Devices for industrial and residential illumination
- k. Heaters and furnaces
- l. Motors and Alternators
- m. Switches, micro-switches and relays
- n. Soldering, desoldering, welding devices and equipment.
- o. Fans, Blowers and pumps
- p. General purpose digital and analog ICs
- q. General purpose batteries, accumulators, batteries used in mobile phones, cameras and similar devices.
- r. Alarms, Speakers, Beepers, Becons, Hooters, Bells used in industrial and residential locations.
- s. Types of indicators used on electrical/electronics display panels.
- t. Temperature, humidity measuring devices used in electrical/electronics installations.
- u. Smoke detectors, fire alarms used in electrical/electronics installations.
- v. High voltage devices and equipment used and their safety features.

2. Prepare a report on the electrical and electronic devices and equipment used in the Electrical/Electronics department. Tabulate and justify the devices on the basis of their requirement, voltage and power rating, frequency of operation, size of conductor used, protection devices etc.

3. Prepare a report on the indoor and outdoor electrical/electronics devices and equipment. Compare their requirements on the basis of enclosure, rating, portability, noise, safety, repairs & maintenance and similar features.

## 8. SUGGESTED LEARNING RESOURCES

### A. List of Books

S.No.	Author	Title of Books	Publication/Year
1	Bhargava & Gupta	Basic Electronics & Linear Circuits	McGraw Hill Education, New Delhi, ISBN: 0074519654
2	B.L.Theraja	A text book of Electrical Technology vol.1	S.Chand Publication
3	B.L.Theraja	A text book of Electrical Technology vol.2	S.Chand Publication
4	V.K.Mehta	Principles of Power System	S.Chand Publication
5	A K Sawhney	A Course In Electrical And Electronic Measurements And Instrumentation	Dhanpat Rai & Co.
6	V.K.Mehta	Basic electronics	S.Chand Publication

### B. List of Major Equipment/ Instrument

1. Voltmeter, Ammeter, Multimeter, Magger, Energy meter, Watt meter, Frequency meter
2. Auto transformer, battery, Resistances, DC/AC power supplies, variable resistances, UPS.
3. CRO, Thermometer, Lux meter, Lamp load for testing.
4. D.C. Machines, Alternator, Squirrel Cage and Wound rotor Induction motors.
5. Capacitors, MCB & ELCB.
6. Semiconductor Diode, Transistor, LED, LCD, SCR, Photo Diode, Photo Transistor, Solar cell, 555 Timer, LM series Operational Amplifier.
7. Half wave and full wave rectifiers.
8. Breadboard, soldering/desoldering facility, PCB development facility.
9. First Aid kits and safety measures against injury due to accident, high voltage and acid hazards.

### C. List of Software/Learning Websites

- i. <http://www.animations.physics.unsw.edu.au//jw/AC.html>
- ii. <http://en.wikipedia.org/wiki/Transformer>
- iii. <http://www.alpharubicon.com/altenergy/understandingAC.htm>

## 9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### Faculty Members form Polytechnics

- **Prof. D.A.Dave**, H.O.D., Auto.Dept. Sir Bhavsinhji Polytechnic Inst., Bhavnagar.
- **Shri A.C. Suthar**, Lecturer, Automobile Dept. MLIDS Polytechnic, Bhandu.

### NITTTR Bhopal Co-ordinator and Faculty Members

- **Dr Ajit Dixit**, Associate Professor, Dept. of Education, NITTTR, Bhopal
- **Dr. Joshua Earnest**, Professor and Head, Dept. of Electrical & Electronics Engg, NITTTR, Bhopal