

# **Ramgarhia Polytechnic College, Phagwara**



## **Electrical Engineering Department**

Head of Department:	Er. Gaurav Kumar
Name of the Faculty:	Er. Medha Er. Sandeep Singh
Discipline:	Mechanical Engineering Department
Semester:	3 <sup>rd</sup>
Subject:	Elements of Electrical and Electronics Engineering
Lesson Plan Duration:	16 Weeks

### **RATIONALE**
















The objective of this subject is to impart fundamental knowledge and skills regarding basic electrical and electronics engineering, which diploma holders will come across in their professional life. This course will provide the students to understand the basic concepts and principles of d.c. and a.c. fundamentals, electromagnetic induction, batteries, transformers, motors, distribution system,

domestic installation, electrical safety etc. The students will also learn basic electronics including diodes and transistors and their applications.

### Learning Outcomes

After undergoing this course, the students will be able to:

- CO1. Measure basic electrical quantities.
- CO2. Measure and improve power factor in a given circuit.
- CO3. Explain the construction, working principle, performance and applications of transformers.
- CO4. Identify different wires of distribution system.
- CO5. Select and operate single phase and three phase motors.
- CO6. Follow electrical safety measures.
- CO7. Describe the characteristics and applications of diodes, transistors and thyristor.

PO 	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 							
CO1							
CO2							
CO3							
CO4							
CO5							
CO6							
CO7							

## Syllabus

Units	Details	Hours
1.	Application and Advantage of Electricity Difference between ac and dc, various applications of electricity, advantages of electrical energy over other types of energy	(03 hrs)
2.	Basic Electrical Quantities Definition of voltage, current, power and energy with their units, name of instruments used for measuring above quantities, connection of these instruments in an electric circuit	(04 hrs)
3.	AC Fundamentals Electromagnetic induction-Faraday's Laws, Lenz's Law; Fleming's rules, Principles of a.c. Circuits; Alternating emf, Definition of cycle, frequency, amplitude and time period. Instantaneous, average, r.m.s and maximum value of sinusoidal wave; form factor and Peak Factor. Concept of phase and phase difference. Concept of resistance, inductance and capacitance in simple a.c. circuit. Power factor and improvement of power factor by use of capacitors. Concept of three phase system; star and delta connections; voltage and current relationship (no derivation)	(08 hrs)
4.	Transformers Working principle and construction of single phase transformer, transformer ratio, emf equation, losses and efficiency, cooling of transformers, isolation transformer, CVT, auto transformer (brief idea), applications.	(06 hrs)
5.	Distribution System Difference between high and low voltage distribution system, identification of three-phase wires, neutral wire and earth wire in a low voltage distribution system. Identification of voltages between phases and between one phase and neutral. Difference between three-phase and single-phase supply	(06 hrs)
6.	Electric Motor Description and applications of single-phase and three-phase	(08 hrs)

	motors. Connection and starting of three-phase induction motors by star-delta starter. Changing direction of rotation of a given 3 phase induction motor. Motors used for driving pumps, compressors, centrifuge, dyers etc. Totally enclosed submersible and flame proof motors	
7.	Domestic Installation Distinction between light-fan circuit and single phase power circuit, sub-circuits, various accessories and parts of domestic electrical installation. Identification of wiring systems. Common safety measures and earthing.	(04 hrs)
8.	Electrical Safety Electrical shock and precautions against shock, treatment of electric shock, concept of fuses and their classification, selection and application, concept of earthing and various types of earthing, applications of MCBs and ELCBs.	(04hrs)
9.	Basic Electronics Basic idea of semiconductors – P and N type; diodes, zener diodes and their applications, transistor – PNP and NPN, their characteristics and uses. Characteristics and applications of a thyristor, characteristics and applications of stepper motors and servo motors in process control.	(05 hrs)

### **LIST OF PRACTICALS**

1. Connection of a three-phase motor and starter with fuses and reversing of direction of rotation
2. Connection of a single-phase induction motor with supply and reversing of its direction of rotation
3. Troubleshooting in domestic wiring system, including distribution board
4. Connection and reading of an electric energy meter
5. Use of ammeter, voltmeter, wattmeter, and multi-meter
6. Measurement of power and power factor in a given single phase ac circuit
7. Study of different types of fuses, MCBs and ELCBs
8. Study of zener diode as a constant voltage source and to draw its V-I characteristics
9. Study of earthing practices
10. To draw V-I characteristics of a
  - (i) NPN transistor
  - (ii) thyristor (SCR)
11. Study of construction and working of a
  - (i) stepper motor and
  - (ii) servo motor

## **INSTRUCTIONAL STRATEGY**

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

### **Reference Books:**

1. Elements of Electrical and Electronics Engineering by S.K. Sahdev
2. Basic Electrical Engineering by JB Gupta, S Kataria and Sons, Delhi
3. Basic Electronics by VK Mehta; S Chand and Co., New Delhi

### **Delivery/Instructional Methodologies**

Sr.No.	Description
1.	Chalk and Talk
2.	PowerPoint Presentation

### Assessment Methodologies

Sr. No.	Description	Type
1.	Student Assignment	Direct
2.	Test	Direct
3.	Board Examination	Direct
4.	Student Feedback	Direct

### Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
	N/A	N/A	N/A

### Topics beyond syllabus/advanced topics

Units	Details	Hours
N/A	N/A	N/A

### Web Source References

Sr. No.	URL
1.	<a href="https://nptel.ac.in/">https://nptel.ac.in/</a>

## Lesson Plan

Week	Theory		Practical	
	Lecture Day		Practical Day	
1 <sup>st</sup>	1 <sup>st</sup>	Introduction Difference between ac and dc	1.	Connection of a three-phase motor and starter with fuses and reversing of direction of rotation
	2 <sup>nd</sup>	Various applications of electricity, advantages of electrical energy over other types of energy		
	3 <sup>rd</sup>			
2 <sup>nd</sup>	4 <sup>th</sup>	Introduction to Basic Electrical Quantities	2.	Connection of a single-phase induction motor with supply and reversing of its direction of rot
	5 <sup>th</sup>	Definition of voltage, current, power and energy with their units		
	6 <sup>th</sup>	Name of instruments used for measuring above quantities, ,		
3 <sup>rd</sup>	7 <sup>th</sup>	connection of these instruments in an electric circuit	3.	Troubleshooting in domestic wiring system, including distribution board
	8 <sup>th</sup>	Introduction to AC Fundamentals		
	9 <sup>th</sup>	Electromagnetic induction- Faraday's Laws, Lenz's Law		
4 <sup>th</sup>	10 <sup>th</sup>	Fleming's rules, Principles of a.c. Circuits, Alternating emf	4.	Connection and reading of an electric energy meter
	11 <sup>th</sup>	Definition of cycle, frequency, amplitude and time period. Instantaneous, average		
	12 <sup>th</sup>	R.M.S. and maximum value of sinusoidal wave; form factor and Peak Factor		
5 <sup>th</sup>	13 <sup>th</sup>	Concept of phase and phase difference		Use of ammeter, voltmeter, wattmeter,
	14 <sup>th</sup>	Concept of resistance, inductance and capacitance in		

		simple a.c. circuit.	5.	and multi-meter
	15 <sup>th</sup>	Power factor and improvement of power factor by use of capacitors		
6 <sup>th</sup>	16 <sup>th</sup>	Concept of three phase system; star and delta connections; voltage and current relationship (no derivation)	6.	Revision
	17 <sup>th</sup>	<b>REVISION</b>		
	18 <sup>th</sup>	<b>1<sup>st</sup> Sessional Test (Tentative)</b>		
7 <sup>th</sup>	19 <sup>th</sup>	Transformers Working principle and construction of single phase transformer	7.	Measurement of power and power factor in a given single phase ac circuit
	20 <sup>th</sup>	Transformer ratio, Emf equation, Losses and efficiency		
	21 <sup>st</sup>			
8 <sup>th</sup>	22 <sup>nd</sup>	Cooling of transformers, isolation transformer	8.	Study of different types of fuses, MCBs and ELCBs
	23 <sup>rd</sup>	CVT, auto transformer (brief idea), applications.		
	24 <sup>th</sup>	Distribution System Difference between high and low voltage distribution system,		
9 <sup>th</sup>	25 <sup>th</sup>	Identification of three-phase wires, Neutral wire and earth wire in a low voltage distribution system.	9.	Study of zener diode as a constant voltage source and to draw its V-I characteristics
	26 <sup>th</sup>			
	27 <sup>th</sup>	Identification of voltages between phases and between one phase and neutral.		
	28 <sup>th</sup>	Electric Motor Difference between three-phase and single-phase supply		Study of earthing



10 <sup>th</sup>	29 <sup>th</sup>	Description and applications of single-phase and three-phase motors	10.	practices
	30 <sup>th</sup>	Connection and starting of three-phase induction motors by star-delta starter		
11 <sup>th</sup>	31 <sup>st</sup>	Changing direction of rotation of a given 3 phase induction motor	11.	To draw V-I characteristics of a (i) NPN transistor (ii) thyristor (SCR)
	32 <sup>nd</sup>	Motors used for driving pumps, compressors, centrifuge, dyers etc		
	33 <sup>rd</sup>	<b>REVISION</b>		
12 <sup>th</sup>	34 <sup>th</sup>	<b>PTM</b>	12.	Revision
	35 <sup>th</sup>	<b>2<sup>nd</sup> Sessional Test (Tentative)</b>		
	36 <sup>th</sup>	Totally enclosed submersible and flame proof motors.		
13 <sup>th</sup>	37 <sup>th</sup>	Domestic Installation Distinction between light-fan circuit and single phase power circuit, sub-circuits, various accessories and parts of domestic electrical installation	13.	Study of construction and working of a (i) stepper motor and (ii) servo motor
	38 <sup>th</sup>	Identification of wiring systems		
	39 <sup>th</sup>	Common safety measures and earthing		
14 <sup>th</sup>	40 <sup>th</sup>	Electrical Safety Electrical shock and precautions against shock, treatment of electric shock	14	<b>Revision of Exp-1 &amp;2</b>
	41 <sup>st</sup>	Concept of fuses and their classification, selection and application, concept of earthing and various types of earthing, applications of MCBs and ELCBs		
	42 <sup>nd</sup>			

15 <sup>th</sup>	43 <sup>rd</sup>	Basic idea of semiconductors – P and N type; diodes, zener diodes and their applications	15.	<b>Revision of Exp- 8&amp; 10</b>
	44 <sup>th</sup>	transistor – PNP and NPN, their characteristics and uses		
	45 <sup>th</sup>	Characteristics and applications of a thyristor, characteristics and applications of stepper motors and servo motors in process control.		
16 <sup>th</sup>	46 <sup>th</sup>	<b>PTM</b>	16.	<b>Revision of Exp- 11</b>
	47 <sup>th</sup>	<b>REVISION</b>		
	48 <sup>th</sup>	<b>3<sup>rd</sup> Sessional Test (Tentative)</b>		