Government of Karnataka

**Department of Technical Education**

**Board of Technical Examinations, Bengaluru**

| | | | |
|---|---|---|---|
| Course Title: **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB** | | Course Code | : **15EE02P** |
| Semester | : **I /II/ III** | Course Group | : **Core** |
| Teaching Scheme (L:T:P) | : **0:2:4**(in Hours) | Credits | : **3 Credits** |
| Type of course | : **Tutorial + Practical** | Total Contact Hours | : **78** |
| CIE | : **25 Marks** | SEE | : **50 Marks** |
| Programme: Mechanical (GL), Mechanical (Instr.), MTT, HPT, WSM, Mechatronics, Printing Technology, Textile Technology, Ceramics, Mining Engg., Metallurgical Engg. | | | |

| | |
|---|---|
| **Pre-requisites** | **:** Basic Electrical and Electronics Engineering theory in Diploma curriculum. |
| **Course Objectives** | **:** To provide practical knowledge about the DC &AC circuits, different wiring circuits, Battery, Relay, three phase AC motor, Panel board, semiconductor diodes, rectifiers and basic logic gates. |

## Course Outcomes:

*On successful completion of the Course, the student will be able to:*

1. Understand verification of Ohm's law experimentally.
2. Rig-up various wiring control circuits, panel board and meter board individually and test.
3. Rig-up circuits to measure power and energy in ac circuit.
4. Test and report the conditions and ratings of Battery.
5. Start and reverse the three phase induction motor.
6. Understand the operation of relay, diode circuits, rectifier circuits and logic gates

## List of Graded Experiments:

1. Construct a suitable circuit to verify Ohm's law.
2. Rig up and test the wiring circuit to control a lamp and a three pin socket independently.
3. Rig up and test the wiring circuit to control two lamps independently.
4. Construct and test fluorescent lamp circuit.
5. Construct and test the staircase wiring circuit (control from 2 places).
6. Construct and test Meter board wiring using single phase Energymeter, MCB/ELCB, Kit-kat fuse and neutral link.
7. Build and test a circuit to measure power and power factor in a single phase ac circuit.
8. Construct a circuit to measure energy in KWh in a single phase ac circuit.
9. Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL/ Star-Delta/ Auto-Transformer starter.
10. Test and make a report of the fully charged and discharged conditions of a given Lead-acid battery.
11. Construct a circuit using a single Relay to turn ON a lamp connected to NC and to turn OFF another lamp connected to NO contacts of Relay.
12. Construct a circuit to obtain the forward bias characteristic of a Diode.
13. Construct and test Zener diode as a voltage regulator.
14. Build and test halfwave rectifier circuit.
15. Build and test full wave bridge rectifier circuit (without filter).
16. Construct a circuit to verify the truth tables of NOT,AND, OR, NOR and NAND gates.
17. Identify and draw the layout diagram for a simple PANEL BOARD/consisting of bus bars, CB/MCB/ELCB, meters, HRC fuses, magnetic contactors, cables, earthing points.

## ReferenceBooks:


1. Experiments in Basic Electrical Engineering by S.K.Bhattacharya, New Age International Publications, 2007 Edition.
2. A Text book on Laboratory courses in Electrical Engg. by S.G. Tarnekar and P.K.Karbanda.


## e-Resources:

1. http://www.scribd.com/doc/39578646/New-First-year-Electrical-lab-manual#scribd
2. http://mrcet.ac.in/newwebsite/pdfs/Labmanuals-13/ECE/LabManuals/ DC%20LAB%20%28180%29%20II-I.pdf

## Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

| Sl. No. | Educational Component | Weightage (%) |
|---|---|---|
| 1 | Remembering | 20 |
| 2 | Understanding | 20 |
| 3 | Application/ Analysis | 60 |
| **Total** | | **100** |

## Mapping Course Outcomes with Program Outcomes: (Course Outcome linkage to Cognitive Level)

| Course Outcome | | Experiment linked | PO Mapped | Cognitive Level | Lab Sessions |
|---|---|---|---|---|---|
| **CO1** | Understand verification of Ohm's law experimentally. | 1 | 2, 3, 8, 9, 10 | R/U/A | 3 |
| **CO2** | Rig-up various wiring control circuits, panel board and meter board individually and test. | 2,3,4,5,6,17 | 2, 3, 8, 9, 10 | U/A | 18 |
| **CO3** | Rig-up circuits to measure power and energy in ac circuit. | 7,8 | 2, 3, 8, 9, 10 | U/A | 6 |
| **CO4** | Test and report the conditions and ratings of Battery. | 10 | 2, 3, 8, 9, 10 | U/A | 3 |
| **CO5** | Start and reverse the three phase induction motor | 9 | 2, 3, 8, 9, 10 | U/A | 3 |
| **CO6** | Understand the operation of relay, diode circuits, rectifier circuits and logic gates | 11,12,13, 14,15,16 | 2, 3, 8, 9, 10 | U/A | 18 |

**U-Understanding; A-application/ Analysis; App-Application**

## Course-PO Attainment Matrix

| Course | Programme Outcomes | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| **Basic Electrical and Electronics Lab** | **-** | **3** | **3** | **-** | **-** | **-** | **-** | **3** | **3** | **3** |

**LEVEL 3- HIGHLY ADDRESSED, LEVEL 2-MODERATELY ADDRESSED, LEVEL 1-LOW ADDRESSED.**

METHOD IS TO RELATE THE LEVEL OF PO WITH THE NUMBER OF HOURS DEVOTED TO THE COS WHICH ADDRESS THE GIVEN PO.
IF ≥40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 3
IF 25 TO 40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 2
IF 5 TO 25% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 1
IF < 5% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS CONSIDERED NOT-ADDRESSED.

## Course Delivery:

The Course will be delivered through Tutorial, classroom interaction, group discussion, practical exercises and assignments.

### Tutorial - 1Hr:

Staff-in-charge will

1. Explain the concept of experiment to be conducted.
2. Teach required selection of components/ meters/ equipment/ suitable wires for the experiment to be conducted.
3. Ask students to draw the circuit.
4. Give clear instructions about safety precautions to be followed while conducting experiment.

### Conduction/ Execution- 2 Hr:

Student will rig up the circuit diagram and conduct experiment individually under the supervision of the staff-in-charge.

## Course Assessment and Evaluation:

| | What | | To Whom | Frequency | Practical | Evidence Collected | Course Outcomes |
|---|---|---|---|---|---|---|---|
| Direct Assessment Method | CIE (Continuous Internal Evaluation) | I A Tests | Students | Two IA tests for Practical (Average marks of both the tests to be computed) | 10 | Blue Books | 1 to 6 |
| | | Record Writing | | Record Writing (Average of Marks allotted for each experiment.) | 10 | Lab Record | 1 to 6 |
| | | | | Student activity | 05 | Log of Activity | 1 to 6 |
| | | | | **TOTAL** | **25** | | |
| | SEE (Semester End Examination) | End Exam | Students | End of the Course | 50 | Answer Scripts | 1 to 6 |
| Indirect Assessment Method | Student Feedback on course | | Students | Middle of The Course | Feed Back Forms | | 1 to 3 |
| | End of Course Survey | | | End of The Course | Questionnaire | | 1 to 6 |

***CIE** – Continuous Internal Evaluation ***SEE** – Semester End Examination

**Note:**

1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.

## Suggested Student Activities:

Each Student has to prepare a self-hand written report of 3 pages or solved in a blue book considering any one of the following topics.

1. Mini-Projects: Like preparing extension box, switch box and wiring models,
2. Make a plan of building wiring for a lab/ room, etc.

3. Visit nearby Battery charging shop or show room and prepare a report of the visit.
4. Prepare a report of the conditions of batteries available in the Polytechnic.
5. For given voltage, current, Ah ratings of individual cell, and required voltage and current rating of battery, prepare a report of calculations for number of cells and their method of connections.
6. List out the different protective devices used in your laboratories or house with their ratings.
7. List out the different types of wiring systems used in your laboratories or house with their representation.

**MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY ( Course Coordinator)**

| Dimension | Scale | | | | | Students score (Group of five students) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 Unsatisfactory | 2 Developing | 3 Satisfactory | 4 Good | 5 Exemplary | 1 | 2 | 3 | 4 | 5 |
| 1 | Descriptor | Descriptor | Descriptor | Descriptor | Descriptor | 3 | | | | |
| 2 | Descriptor | Descriptor | Descriptor | Descriptor | Descriptor | 2 | | | | |
| 3 | Descriptor | Descriptor | Descriptor | Descriptor | Descriptor | 5 | | | | |
| 4 | Descriptor | Descriptor | Descriptor | Descriptor | Descriptor | 4 | | | | |
| **Note: Concerned faculty (Course coordinator) must devise appropriate rubrics/criteria for assessing Student activity for 5 marks**<br>**One activity on any one CO (course outcome) may be given to a group of FIVE students**<br>**Grand Average/Total** | | | | | | 14/4 =3.5 ≈4 | | | | |

**Example only: MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY-**
**Task given- Industrial visit and report writing**

| Dimension | Scale | | | | | Students score (Five students) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 Unsatisfactory | 2 Developing | 3 Satisfactory | 4 Good | 5 Exemplary | 1 | 2 | 3 | 4 | 5 |
| 1.Organisation | Has not included relevant info | Has included few relevant info | Has included some relevant info | Has included many relevant info | Has included all relevant info needed | 3 | | | | |
| 2. Fulfill team's roles & duties | Does not perform any duties assigned | Performs very little duties | Performs partial duties | Performs nearly all duties | Performs all duties of assigned team roles | 2 | | | | |
| 3.Conclusion | Poor | Less Effective | Partially effective | Summarises but not exact. | Most Effective | 5 | | | | |
| 4.Convensions | Frequent Error | More Error | Some Error | Occasional Error | No Error | 4 | | | | |
| | | | | | Total marks | 14/4=3.5 ≈4 | | | | |

## Scheme of Valuation for SEE(Semester End Examination)

| Sl. No. | Particulars | Marks |
|---|---|---|
| 1. | Identification of meters/ equipments/ wires/ tools/ etc. | 05 |
| 2. | Writing Circuit diagram and Procedure* | 10 |
| 3. | Conduction | 20 |
| 4. | Results | 05 |
| 5. | Viva-voce | 10 |
| **Total** | | **50** |

***Question Paper will have any ONE question from the list of experiments.**

## Model Question Bank:

| Course Title: **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB** | Course Code: **15EE02P** |
|---|---|

1. Construct a suitable circuit to verify Ohm's law. Also plot Graph.
2. Conduct an experiment to find the Resistance of a given unknown Resistor.
3. Rig up and test the wiring circuit to control a lamp and a three pin socket independently.
4. Rig up and test the wiring circuit to control two lamps independently.
5. Construct and test fluorescent lamp circuit.
6. Construct and test the staircase wiring circuit (control from 2 places).
7. Conduct an experiment to control a lamp from two places.
8. Construct and test Meter board wiring using single phase Energy meter, MCB/ELCB, Kit-kat fuse and neutral link.
9. Conduct a suitable experiment to test the Meter board wiring circuit.
10. Build and test a circuit to measure power and power factor in a single phase ac circuit.
11. Construct a circuit to measure energy in KWh in a single phase ac circuit.
12. Conduct an experiment to measure the single phase energy consumed in KWh for the given electrical load.
13. Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL starter.
14. Construct a suitable circuit to start and reverse the direction of three phase induction motor using Star-Delta starter.
15. Construct a suitable circuit to start and reverse the direction of three phase induction motor using three phase auto-transformer starter.
16. Test and make a report of the fully charged and discharged conditions of a given Lead-acid battery.
17. Construct and test a circuit using a Relay to turn ON/ OFF a lamp connected to 230 Volts ac supply.
18. Conduct an experiment to control a lamp using a Relay.
19. Construct a circuit using a single Relay to turn ON a lamp connected to NC and to turn OFF another lamp connected to NO contacts of Relay.
20. Conduct an experiment to turn ON a lamp and turn OFF another lamp using a single Relay.
21. Construct a circuit to obtain the forward bias characteristic of a Diode.
22. Conduct an experiment to Plot the forward bias characteristic of a PN Junction Diode.
23. Construct and test Zener diode as a voltage regulator. Also, plot the Graph.
24. Build and test half wave rectifier circuit. Also, trace the input and output waveforms.

25. Build and test full wave bridge rectifier circuit (without filter). Also, trace the input and output waveforms.
26. Construct a circuit to verify the truth tables of NOT and AND gates.
27. Construct a circuit to verify the truth tables of OR, NOR gates.
28. Construct a circuit to verify the truth tables of NAND and AND gates.
29. Conduct an experiment to verify the truth tables of given logic gates.
30. Identify and draw the layout diagram for a simple PANEL BOARD consisting of bus-bars, CB/MCB/ELCB, meters, HRC fuses, magnetic contactors, cables, earthing points.

## Lab Equipment Requirement:

**Students Intake : 60**
**Students per Batch : 20**

| Sl. No. | Name of Equipment and Specification | Quantity Required |
|---|---|---|
| 1 | Dual Channel 30 V, 2 A continuously variable DC Regulated Power Supply with Current and Overload Protection | 05 Nos. |
| 2 | +/- 15 V, 2 A, fixed DC Regulated Power Supply | 05 Nos. |
| 3 | Portable Moving Coil DC Voltmeters<br>a) 0 - 1 V<br>b) 0 - 10 V<br>c) 0 - 30 V | Each 05 Nos. |
| 4 | Portable Moving Iron AC Voltmeters<br>a) 0 - 300 V<br>b) 0 - 600 V | Each 05 Nos. |
| 5 | Portable Moving Coil DC Ammeters<br>a) 0 - 100 mA<br>b) 0 - 1 A<br>c) 0 - 2 A | Each 05 Nos. |
| 6 | Portable Moving Iron AC Ammeters<br>a) 0 - 2 A<br>b) 0 - 5 A<br>c) 0 - 10 A | Each 05 Nos. |
| 7 | Watt-meters<br>a) 150/ 300V, 2 A, UPF<br>b) 300/ 600 V, 5/ 10 A, LPF | Each 02 Nos. |
| 8 | Rheostats – 25 Ohms, 50 Ohms, 150 Ohms, 220 Ohms (all rated at 3 A) | Each 05 Nos. |
| 9 | Rheostat Loads s – 1 KW, 230 V | 02 Nos. |
| 10 | Wire wound Resistors- 5 Ohms 2 Watts, 25 Ohms 5 Watts, 330 Ohms 2 Watts, 560 Ohms 2 Watts, etc. | Each 05 Nos. |
| 11 | Soldering Iron 60 W | 05 Nos. |
| 12 | Fluorescent lamp sets | 10 Nos. |
| 13 | Single Phase Energy meter 10 A, 230 V, 50 Hz, Digital type | 05 Nos. |
| 14 | Multi-meter Digital ¾” | 06 Nos. |
| 15 | Duel Trace Oscilloscope – 30 MHz | 02 Nos. |
| 16 | Three Phase Induction Motors :1 HP – 440 V 50 Hz,2 HP – 440 V 50 Hz. | Each 02 Nos. |
| 17 | Three phase DOL, Star-Delta, Auto transformer starter | Each 02 Nos. |
| 18 | UPS 1 KVA | 01 Nos. |
| 19 | Battery Lead-Acid type, 140 A-hr and Hydrometers | 02 Nos. |

| Sl. No. | Name of Equipment and Specification | Quantity Required |
|---|---|---|
| 20 | I C Trainer kit | 05 Nos |
| 21 | Digital IC's 7400, 7402, 7404, 7408, 7486 etc | Each 10 Nos. |
| 22 | Wooden Wiring board (2x3) ft | 10 |
| 23 | Wiring accessories<br>a) PVC conduit - ¾" - 10 lengths<br>b) Cap and casing - ¾" - 10 lengths<br>c) Switches Single Pole- 5A, 230 V<br>d) Switches two way – 5 A, 230 V<br>e) 3 Pin Sockets 5A, 230 V<br>f) Bulb Holders – 5 A, 230 V<br>g) 3 Pin Plug 5A, 230 V<br>h) 60 Watts Lamps<br>i) 100 Watts Lamps<br>j) 15 W CFL lamps<br>k) Copper Wires of sizes<br>1.5 $mm^2$, 2.5 $mm^2$, 4 $mm^2$ – 1 coil each<br>l) Gang boxes (1+1, 2+1, 2+2)<br>m) Kit –Kat fuses 5A, 15 A<br>n) MCB 16 A & 32 A/ 230 V, Single and Double Pole<br>o) ELCB 16 A & 32 A/ 230 V, Double Pole<br>p) Neutral link- 16 A, 230 V<br>q) Screws of assorted sizes<br>r) Testers | Each 10 Nos. |
| 24 | Electronic Components<br>a) Diodes - BY 127 and IN 4001<br>b) Zener Diodes – 6.2 V, 5.6 V, 7.8 V<br>c) Relays – solid state Sugar cube type, SPST,<br>Coil 6V, Power circuit 230 V, 5 A.<br>d) Spring Boards<br>e) Bread Boards<br>f) Tag Boards. | Each 10 Nos. |
| 25 | Simple PANEL BOARD/ CUBICAL consisting of bus-bars, CB/MCB/ELCB, meters, HRC fuses, magnetic contactors, cables, earthing points. | 1 No |