

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title: CONCEPTS OF ELECTRICAL AND ELECTRONICS ENGINEERING	Course Code : 15EC01T
Semester : I	Course Group : Core
Teaching Scheme (L:T:P) : 4:0:0 (in Hours)	Credits : 4 Credits
Type of course : Lecture + Assignments	Total Contact Hours : 52
CIE : 25 Marks	SEE : 100 Marks
Programme: Computer Science and Engineering	

Pre-requisites	: Mathematics and Science in Secondary Education.
Course Objectives	:To introduce the concept of electrical current, voltage, power, energy, electrical circuits and measuring instruments, magnetic fields, electromagnetic induction and fundamentals of AC circuit. Introduction of Transformers, and Motors, protective devices and Earthing in Computer field. Introduction to Battery, UPS, electronic components and their applications.

Course Unit-wise Weightage of Marks:

Unit Nos.	Topics	Teaching Hours	SEE Max. Marks
1	ELECTRIC CIRCUIT FUNDAMENTALS	10	30
2	ELECTROMAGNETISM	04	10
3	AC FUNDAMENTALS	14	40
4	TRANSFORMERS & STEPPER MOTORS	4	10
5	PROTECTIVE DEVICES	6	15
6	BASICS OF ELECTRONICS& UPS	14	40
Total		52	145

Course Outcomes

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

1. Understand the fundamentals of electric circuits, parameters, measuring instruments, and different laws. Solve problems.
2. Understand the basic concepts of magnetic fields and electromagnetic induction.
3. Understand the fundamentals of AC circuits and solve problems.
4. Differentiate the applications of transformers, stepper motors and brushless DC motor.
5. Explain the need of protective devices in Computer field.
6. Understand the concept of Electronics, select UPS and maintenance of battery.

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 (%)	Total Marks (Out of 145)
1	Remembering	25	35
2	Understanding	45	65
3	Application	30	45
Total		100	145

Course Outcome linkage to Cognitive Level

Cognitive Level Legend: R- Remember, U- Understand, A- Application

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Understand the fundamentals of electric circuits, parameters, measuring instruments, and different Laws. Solve problems.	<i>R/U/A</i>	1,2,10	10
CO2	Understand the basic concepts of magnetic fields and electromagnetic induction.	<i>R/U</i>	1,2,10	04
CO3	Understand the fundamentals of AC circuits and solve problems.	<i>R/U/A</i>	1,2,10	14
CO4	Differentiate the applications of transformers, stepper motors and brushless DC motor.	<i>U/A</i>	2,10	4
CO5	Explain the need of protective devices in Computer field.	<i>U/A</i>	2,10	6
CO6	Understand the concept of Electronics, select UPS and maintenance of battery.	<i>R/U/A</i>	1,2,10	14
			Total sessions	52

Legend: R; Remember, U: Understand A: Application

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Max. Marks per Unit	Questions to be set for (5marks) PART - A			Questions to be set for (10marks) PART - B			Marks weightage (%)
				R	U	A	R	U	A	
1	ELECTRIC CIRCUIT FUNDAMENTALS	10	30	1	1			1	1	20
2	ELECTROMAGNETISM	04	10	1				0.5		7
3	AC FUNDAMENTALS	14	40		1	1	1	1	1	28
4	TRANSFORMERS & STEPPER MOTORS	4	10		1				0.5	7
5	PROTECTIVE DEVICES	6	15			1		1		10
6	BASICS OF ELECTRONICS& UPS	14	40	1	1		1	1	1	28
Total		52	145	9 (45 Marks)			10 (100 Marks)			100

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
CONCEPTS OF ELECTRICAL AND ELECTRONICS ENGINEERING	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 $\geq 40\%$ 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 Contents

UNIT-I

ELECTRIC CIRCUIT FUNDAMENTALS: Current, Voltage- EMF and Resistance, Ohm's Law, Problems on Ohm's law equivalent resistance of resistors connected in series and parallel. Problems on resistance combinations .Circuit conditions – open, close and short circuit, Kirchoff's voltage and current laws, Problems on KVL, KCL, Electrical Power and Energy, Problems on Electrical Power and energy. Meters used to measure Current, Voltage, Resistance, inductance and capacitance ,Power and Energy.

UNIT-II

ELECTROMAGNETISM: Magnetic field, Magnetic Flux, Flux density, MMF, Reluctance, permeability, Faraday's Laws of Electro Magnetic induction, Inductance, Statically induced EMF, Dynamically Induced EMF, Self-inductance, Mutual inductance, Self-induced EMF, Mutually induced EMF.

UNIT-III

AC FUNDAMENTALS: Alternating current, amplitude, frequency and time period, Average value, Maximum value, RMS value and Form factor for sine wave, Simple problems, phase difference, Differentiate between single phase and three phase AC supply, Vector diagram, Impedance Diagram, Voltage triangle, and Wave forms , Resistance, Reactance and Impedance , Power and power factor in pure R, pure L, pure C , series R-L, series R-C, series R-L-C circuits. Problems to find X_L , X_c , and Z, Power, Power Factor in R-L, R-C, R-L-C series circuit. Comparison of DC and AC current.

UNIT-IV

TRANSFORMERS & STEPPER MOTORS: Construction and working of Transformer, Turns ratio, current and voltage ratios, ratings of transformers; Types of transformers and their applications, Applications of Stepper motor, Spindle motor, and Brushless DC motors.

UNIT-V

PROTECTIVE DEVICES: Switch- different types of switches with their symbols, Fuse- necessity of fuse, ratings and types, Relay- symbol, working principle of relay. Necessity of grounding/earthing of any electrical/electronic equipment. Need of spike busters for protection of computers. Need of antistatic device and types of antistatic devices for protection of computer components.

UNIT-VI

BASICS OF ELECTRONICS: Conductors, insulators and semiconductors with examples Intrinsic and Extrinsic Semi-conductors, Operation and V-I characteristics of PN junction diode, Working of Half wave, full wave and bridge rectifier circuits, Filters- Types of filters, C filter, Transistor – symbol, types, applications, Transistor as a switch, Op-Amp - Block diagram, Ideal characteristics and Op-Amp as Inverting Amplifier and Non-Inverting amplifier. SMPS – Meaning, working, block diagram, advantages, ratings

UPS:

Need of UPS, UPS block diagram ,UPS ratings and back-up time with example, Criteria for Selection of UPS ; Battery- Types , Ah rating, Maintenance of battery.

References:

1. Principles of Electronics ,V.K. Mehta &Rohit Mehta, S. Chand Technical Publication
2. A Textbook of Electrical Technology, B.L.Theraja &A.K.Theraja, S. Chand Volume I
3. Electronic Components - Dr. K Padmanabhan & P. Swaminathan, Laxmi Publications, ISBN :978-81-318-0714-9
4. Electronic Principles, Albert Malvino and David Bates, Tata Mcgraw Hill Publication, ISBN 9780070634244.

Course Delivery:

The Course will be delivered through lectures, classroom interaction, animations, group discussion, exercises and assignments.

Course Assessment and Evaluation

	What		To Whom	Frequency	Max Marks	Evidence Collected	Course Outcomes
Direct Assessment	CIE (Continuous Internal Evaluation)	I A Tests	Students	Three IA tests for Theory: (Average marks of Three Tests to be computed).	20	Blue Books	1 to 6
		Classroom Assignments		Student Activities	05	Log of Activity	1 to 6
	TOTAL				25		
	SEE (Semester End Examination)	End Exam	Students	End Of the Course	100	Answer Scripts at BTE	ALL CO's
Indirect Assessment	Student Feedback on course		Students	Middle Of The Course	Feed Back Forms		All Cos
	End Of Course Survey			End Of The Course	Questionnaires		All Cos

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

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.

- Using suitable meters/ instruments give the practical working circuits to measure Resistance, Current, Voltage, Inductance, Capacitance, Power and Energy in DC and AC (Single phase) Circuits.
- Report on different materials used for electromagnets with their properties.
- Applications of Electro Magnetic Induction, statically induced and dynamically induced emf, self and mutual induced emfs.
- Practical applications of Single Phase AC supply and Three phase AC supply with their operating voltages and other electrical parameters.
- Report on Construction and working of Stepper motor, Spindle motor, and Brushless DC motors.
- Report on modern methods to protect Computer/ Server system/ Super Computers from Power and Transient surges.
- Report on safety measures and rules to be followed while servicing Computers and also in Computer laboratory.
- Visit nearby Battery charging and inverter (UPS) shop or show room and prepare a report of the visit.
- Report on working conditions of Batteries in laboratories of your Polytechnic.
- Visit nearby electronics shop/ market and identify the different diodes and rectifier with their ratings.

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				
<p>Note: Concerned faculty (Course coordinator) must devise appropriate rubrics/criteria for assessing Student activity for 5 marks</p> <p>One activity on any one CO (course outcome) may be given to a group of FIVE students</p> <p style="text-align: right;">Grand Average/Total</p>						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. Conventions	Frequent Error	More Error	Some Error	Occasional Error	No Error	4				
Total marks						14/4=3.5 ≈4				

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks			
Ex: I test/6 th week of sem 10-11 Am	I/II SEM		20			
	Year:					
Name of Course coordinator : CO's: _____			Units: __			
Question no	Question		MARKS	CL	CO	PO
1						
2						
3						
4						

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks		
2 nd Test/ 10 th week, 15Sept 15, 10-11 AM	I SEM, C S& Engg.	Concepts of Electrical and Electronics Engg.	20		
	Year: 2015-16	Course code: 15EC01T			
Name of Course coordinator :					
Units Covered :3 and 4					
Course Outcomes : 3 and 4					
Instruction : (1). Answer all questions (2). Each question carries five marks					
Question No.	Question		CL	CO	PO
1	Define the following with SI units, (a). Amplitude (b). Time period (c). Frequency.		R	3	1,2,10
2	List out the differences between Single phase and Three phase AC supply. OR A Series RL circuit with $R = 20 \Omega$ and $L = 20 \text{ mH}$ is connected across 230 V, 50 Hz ac supply. Calculate the Impedance, Current and Power factor.		U A	3	1,2,10
3	Explain the different types of Transformers.		U	4	2, 10
4	What is a Stepper Motor? List out the applications of Stepper Motors. OR A transformer with 240 turns on the primary and 60 turns on the secondary draws 0.6A from a 230V ac supply. Find the secondary current and emf.		U A	4	2, 10

CL: Cognitive Level, R-Remember, U-Understand, A-Application, PO: Program Outcomes

Model Question Paper

I Semester Diploma Examination
Concepts of Electrical and Electronics Engineering Code: 15EC01T

Time: 3Hours

Max Marks: 100

Note:

- 1) Answer any **SIX** questions from a set of 9 questions From **PART A**. Each question carries 5 marks.
- 2) Answer any **SEVEN** questions from a set of 10 questions from **PART B**. Each question carries 10 marks.

PART-A

- 1) State and explain Ohm's law. What are its limitations?
- 2) Define and mention their units:
 - i) MMF
 - ii) Mutual induction
- 3) State and explain Faraday's laws of Electro Magnetic induction.
- 4) Bring out the comparison between DC and AC supply.
- 5) Explain the necessity of grounding.
- 6) List the applications of motors.
- 7) Explain the working of transistor as a switch.
- 8) Draw the block diagram of an Op-amp.
- 9) Write a short note on maintenance of battery.

PART-B

- | | |
|--|---|
| 10) a) Define the following and mention their units | 4 |
| i) Electric current | |
| ii) Potential difference | |
| b) Explain the different circuit conditions. | 6 |
| 11) a) State and explain Kirchhoff's current law. | 5 |
| b) Define the following and mention their units | |
| i) Magnetic flux density | |
| ii) Reluctance | 5 |
| 12) a) Differentiate between single phase and three phase AC supply. | 6 |

b) Define the following	4
i) RMS value	
ii) Average value	
13) a) Explain the principle of operation of a stepper motor.	6
b) Write a short note on fuses.	4
14) a) Explain the working of a transformer.	5
b) Explain the types of transformers.	5
15) a) Define conductor, semiconductor and insulator with examples.	6
b) Define	4
i) Intrinsic Semiconductor	
ii) Extrinsic Semiconductor	
16) a) Explain the working of half wave rectifier.	6
b) Explain the necessity of filters. List the types of filters.	4
17) a) With a neat circuit diagram, explain the working of OP-Amp inverting amplifier.	5
b) List the characteristics of ideal OP-Amp.	5
18) a) What is an inductor? Mention its different types.	5
b) What do you mean by a switch? Classify the switches based on their operation.	5
19) a) Define turns ratio, current ratio, voltage ratio.	5
b) What is a transistor? Mention different types of transistors with their symbols.	5

Model Question bank

Course Title: CONCEPTS OF ELECTRICAL AND ELECTRONICS ENGINEERING	Course Code: 15EC01T
---	-----------------------------

Cognitive Level: REMEMBER

- 1) Define Electric Current, voltage, and resistance. Write the SI units.
- 2) Mention the meters to measure Electric Current, voltage, and resistance.
- 3) Define ohms law. What are the limitations of it?
- 4) Define Electric Power and ii) Energy, write its SI units and meters used to measure
- 5) Define self-inductance and mutual inductance mention their units:
- 6) Define flux density and mmf and mention their units:
- 7) State and explain Faraday's laws of Electro Magnetic induction.
- 8) Define and explain self-inductance.
- 9) Define and explain mutual inductance
- 10) Define self-induced emf and mutual induced emf.
- 11) Explain self-induced emf?
- 12) Define RMS value.
- 13) Define Average value and RMS value
- 14) Define inductive reactance and capacitive reactance
- 15) Define power factor. Give the relation between resistance, impedance and power factor.
- 16) What is rectifier?
- 17) List different types of filters.

Cognitive level: UNDERSTAND

- 18) State and explain Ohm's law. What are its limitations?
- 19) Explain open, close and short circuit conditions.
- 20) State and explain Kirchhoff's current law.
- 21) Draw AC voltage wave form and mark all the parameters.
- 22) Explain Construction and working of Transformer,
- 23) Explain working of Transformer.
- 24) List out different types of Transformers and write its applications.
- 25) List out different types of Motors and write its applications.
- 26) List out different types of switches and write its symbols.
- 27) Explain working principle of relay.

- 28) What is the necessity of earthing? Write its types.
- 29) Explain conductors, insulator and semiconductors with examples.
- 30) Explain Intrinsic and Extrinsic Semi-conductors.
- 31) Explain operation and VI characteristics of PN junction diode,
- 32) Explain operation of Diode using VI characteristics.
- 33) Explain half wave rectifier with a neat circuit diagram.
- 34) Explain working of half wave rectifier.
- 35) Explain working of full wave rectifier.
- 36) Explain working of bridge rectifier.
- 37) List types of filters and explain any one.
- 38) Explain Ideal characteristics of an Op-Amp.
- 39) List the ideal characteristics of OP-AMP .
- 40) Name different types of batteries and list its applications
- 41) Explain the working of SMPS with block diagram.

Cognitive Level: APPLICATION

- 42) Explain Kirchhoff's voltage and current laws.
- 43) A 100 W light bulb burs on an average of 10 hours a day. Find the weekly consumption of energy.
- 44) If the voltage across a 10 K Ohm resistor is 500V, what is the power dissipated in the resistor.
- 45) State Faraday's laws of Electro Magnetic induction.
- 46) Differentiate between single phase and three phase AC supply.
- 47) An RLC series AC circuit has $R=200\text{Ohm}$ and $L=0.05\text{ H}$ and $C= 3.53\text{ micro farads}$.
If it is connected across 230V 50 HZ supply. Calculate i) Current ii) Power factor iii) Power
- 48) Compare single phase system with three phase system.
- 49) A transformer with 240 turns on the primary and 30 turns on the secondary draws 0.6A from a 240V line. Find the secondary current.
- 50) Explain brushless DC Motor.
- 51) List the applications of stepper motor.
- 52) Explain Transistor as a switch.
- 53) Explain working principle of relay.
- 54) What is the necessity of earthing? Mention its types.
- 55) Explain the Need of spike busters for protection of computers.
- 56) Explain the need of antistatic device for protection of computer components.

- 57) List the types of antistatic devices for protection of computer components
- 58) Differentiate conductors, insulator and semiconductors with examples.
- 59) Explain UPS with block diagram.