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

Course Title :	**Basics of Electrical and Electronics Engineering**	Course Code	: **15EC11T**
Semester	: **1**	Course Group	: **Core**
Teaching Scheme in Hrs(L:T:P)	: **4:0:0**	Credits	: **4**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **52**
CIE	: **25 Marks**	SEE	: **100 Marks**

Prerequisites

Knowledge of Physics and Mathematics in Secondary Education.

Course Objectives

To expose to the field of electrical &electronics engineering, and to acquire the fundamental knowledge in the field.

Course Outcomes

On successful completion of the course, the students will be able to -

1. Understand the basic terminology/definitions of electrical and electronics engineering
2. Apply the knowledge of theorems/laws to analyze the simple circuits
3. Use the principles of electromagnetic induction in electrical applications.
4. Construct and analyze simple AC circuits.
5. Select the electrical machines for different applications.
6. Prepare for next-level learning in design aspects.

On successful completion of the course, the students will be able to attain CO:

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Understand the basic electrical and electronics engineering terminologies, definitions, units, laws and relationship between different terms.	***R/U/A***	1,2,5,6,7	**10**
CO2	Understand the basic definitions of electrostatic terminologies, concepts of capacitor and analysis.	***R/U/A***	1,2	**06**
CO3	Understand the basic definitions of electro- magnetic terminologies, concepts of Inductor and analysis.	***R/U/A***	1,2	**07**
CO4	Understand and Analyze the AC fundamentals, AC circuits, phase relation and quality factor	***R/U/A***	1,2	**10**
CO5	Understand the working, features and classification of transformer, DC and AC machines, problem solving.	***U/A***	1,2	**09**
CO6	Understand the basic passive components, features, specifications, classification and applications.	***U/A***	1,2,5,6	**10**
		Total sessions		**52**

Course-Po Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Basics of Electrical and Electronics Engineering	3	3	--	--	2	2	1	--	--	--

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 Content and Blue Print of Marks for SEE

Unit No	Unit Name	Hour	Questions to be set for SEE			Marks Weightage	Weightage (%)
			R	U	A		
1	Basics of Electricity	10	05	10	15	30	20
2	Electrostatics	06	05	10	--	15	12
3	Electromagnetic Induction	07	05	05	10	20	14
4	AC Circuits	10	05	10	20	35	20
5	Electrical Machines	09	--	10	10	20	16
6	Passive Components	10	--	10	15	25	18
	Total	**52**	**20**	**45**	**80**	**145**	**100**

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

Course Contents

UNIT - 1: Basics of Electricity Duration: 10 Hr.

Overview: Overview of electronics and communication engineering field, applications and as a programme. **Terminology and Definitions:** Current, EMF/voltage/electric potential, potential difference, resistance and conductance, components and circuit. **Ohm's law:** Statement, specific resistance, limitations, resistors in parallel and series and their combinations. Simple problems. **Kirchhoff's laws:** Statements of current and voltage laws and simple problems. **Power and Energy:** Definitions, units and simple problems. **Cells:** Definition, classification (primary and secondary), comparison with examples, features of Lead Acid Battery, Lithium Ion and Nickel Metal Hydride, analyze series and parallel combination of cells, and list the precautions to be taken in battery maintenance.

UNIT - 2: Electrostatics Duration: 06 Hr.

Definitions: Charge, electric field, electric flux, flux density and field strength. **Coulomb's law:** Statement and illustration with simple problems. **Capacitor:** Definition of capacitor and capacitance, dielectric strength, absolute permittivity, relative permittivity, working principle, equation of capacitance, analysis of series and parallel combination of capacitors with simple problems. Charging and discharging (with equations) and the concept of time-constant and capacitive reactance.

UNIT –3:Electromagnetic Induction Duration: 07 Hr.

Electromagnetic Laws: Statements of Faraday's and Lenz's laws. **Definitions:** Flux, MMF, reluctance, absolute permeability, relative permeability, self-inductance, mutual inductance. **Inductors:** Energy stored in an inductor-equation, analysis of inductance in series and parallel, co-efficient of coupling, simple problems, inductive reactance and definition of quality factor.

UNIT - 4:AC Circuits Duration: 10 Hr.

DC and AC: Definition and comparison. **Sinusoidal Wave/signal:** Amplitude, peak value, cycle, frequency, time period and phase and half-sine wave. **Definitions:** Phase difference, leading and lagging phase angles, RMS, average value, form factor, and peak factor. Simple problems.**RLC Circuits:** Current and voltages in a pure R, L and C circuit with phasor diagrams. Analysis of RL, RC and RLC series circuits-voltage, currents, impedance, phasor diagrams. AC quantities in complex form-polar and rectangular. Simple problems.

UNIT -5: Electrical Machines Duration: 09 Hr.

Classification: Static and dynamic (rotary) machines, examples. **Transformer:** Definition, study of principle of operation of transformer, derivation of EMF equation, turns ratio, voltage transformation ratio, step-up and step-down transformers, losses, efficiency, regulation, and simple problems. **Classification Transformers:** Based on cores, frequency, power and application, and their features. Applications of isolation and pulse transformers. Working principle and applications of auto-transformer. **DC machines:** Principle of operation and features of DC motors and generators. **AC machines:** Features of AC motors and alternators.

UNIT- 6: Passive Components Duration: 10Hr.

Definition: Passive and active components. **Resistors:** Specification of resistors. Classification of resistors based on construction and their features, features and examples of fixed and variable resistors, features of linear and logarithmic potentiometers, and principle of operation, applications of LDR, VDR and thermistor. **Capacitors:** Specifications of capacitors. Classification of capacitors based on dielectric materials and applications and their features. **Inductors:** Specifications of inductors. Classification based on core and frequency .Applications of inductors.

References

1. *Basic Electrical Engineering,* V. K. Mehta and Rohit Mehta, S. Chand and Company Publishers, RE 2012, ISBN 81219087
2. *Fundamentals of Electrical and Electronics Engineering,* B. L. Theraja, S. Chand and Company.REPRINT 2013, ISBN 8121926602
3. *Electronic Components,* Dr. K. Padmanabhan and P. Swaminathan, Lakshmi Publications, 2006.
4. http://electrical4u.com/
5. www.electronics-tutorials.ws

Course Assessment and Evaluation Scheme

Assessment Method	What		To Whom	When/Where (Frequency in the course)	Max. Marks	Evidence Collected	Course Outcomes
Direct Assessment method	CIE	IA	Students	Three Tests (Average of three tests will be computed)	20	Blue Books	1 to 6
				Assignment	05	Assignment Books	1 to 6
	SEE	End Exam		End of the Course	100	Answer Scripts at BTE	1 to 6
				Total	125		
Indirect Assessment	Student Feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3 Delivery of course
	End of Course Survey			End of the Course	Nil	Questionnaires	1 to 6, Effectiveness of Delivery of Instructions & Assessment Methods

Note: 1 I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

2. For CIE assignment activity Information collection related to course and Quiz activity.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Blue books(20 marks)
2. Student suggested activities report for 5 marks and should be assessed on RUBRICS
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

Course Delivery

The course will be delivered through lectures, presentations and support of modern tools.

Model of Rubrics for Assessing Student Activity

Dimension	Scale					Students Score				
	1	2	3	4	5	1	2	3	4	5
1	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor					
2	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor					
3	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor					
4	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor					
Grand Average/Total										

MODEL OF RUBRICS FOR ASSESSING STUDENT ACTIVITY

Dimension	Scale					Students exam Reg no/ Score				
	1.Unsatisfactory	2.Developing	3.Satisfactory	4.Good	5.Exemplary	Reg 1	Reg 2	Reg 3	Reg 4	Reg 5
1.Research and gather information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3				
2.Full fills teams roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2				
3.Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5				
4.listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3				
					Total Marks	13/4=3 .25=04				

Model Question Paper (CIE)

Test/Date and Time	Semester/Year		Course/Course Code	Max Marks
I test/6 th week Time:10-11 am	I SEM		**Basics of Electrical and Electronics Engineering**	20
	Year: 2015-16		Course code:15EC11T	
	Name of Course coordinator :			CO:1 & 2
	Note: Answer all questions			

Question no	Question	Marks	CL	CO	PO
1	Define and explain the terms current, e.m.f, electric potential	05	U	1	1,2
2	List the precautions to be taken for maintenance of Battery OR State Ohm's law and mention the limitations.	05	R	1	1,2
3	Determine the equivalent resistance when 2 resistors are connected in parallel. OR State and explain the Coulomb's law.	05	A,R	1,2	1,2
4	Calculate capacitance of a capacitor with 10 Sq.mm area, 10 mm distance between the plates and relative permittivity of 2	05	A	2	2

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak 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).

Composition of Educational Components

Questions for CIE and SEE will be designed to evaluate the various educational components such as shown in the following table.

Sl. No.	Component	Weightage (%)
1	Remembering and Understanding	40
2	Applying the knowledge acquired from the course	40
3	Analysis	20

Study and Question-Paper Pattern

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Unit No.	Unit Name	StudyDuration(Hrs.)	No. Questions for End-exam	
			5 Marks PART - A	10 Marks PART - B
I	Basics of Electricity	10	02	02
II	Electrostatics	06	01	01
III	Electromagnetic Induction	07	02	01
IV	AC Circuits	10	01	03
V	Electrical Machines	09	02	01
VI	Passive Components	10	01	02
	Total	**52**	**09 (45 Marks)**	**10 (100 Marks)**

Model Question Paper

Course Title : **Basics of Electrical and Electronics Engineering**
Course Code : **15EC11T**
Semester :**First**
Time : **3 Hrs**
Max.Marks : **100**
Instructions :*1. Answer any **SIX** question from **Part A**(5x6=30 Marks)*
*2. Answer any **SEVEN** full questions from **Part B**(7x10=70 Marks)*

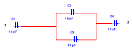
Part A

1. State and explain Ohm's law. List its limitations.
2. Formulate the expression for equivalent resistance when a series combination of R1 and R2 is cascaded to a parallel combination of R3 and R4, where R1, R2, R3 and R4 are resistors.
3. State and explain Coulomb's laws with relevant equations.
4. State the Faraday's Laws of electromagnetic induction.
5. Explain how leading power factor can be converted to lagging power factor in an RLC circuit.
6. Calculate the current through series RL circuit having R=10 Ω and L=1mH when $v=10\sin(628t)$ V is applied across the circuit.
7. Write a short note on transformer losses.
8. Illustrate how to calculate resistance by color coding technique.
9. Distinguish between LDR and VDR.

Part B

1. a) Distinguish between power and energy.(4)
   b) Apply KCL to calculate current through R3 in the circuit shown below.(6)

2. (a) List the features of Lead Acid Battery. (4)
   (b) Illustrate the different ways of cascading two cells and infer the effect in each case. (6)
3. a) Justify the unit of RC (time constant) is Second. (5)
   b) Determine equivalent capacitance for the circuit between terminals 1&2. (5)



4. (a) State Lenz's law and define mutual inductance. (4)
   (b) Write the expression for the energy stored in an inductor and explain its validity. (6)
5. Calculate theimpedance of series RLC circuitgiven that L= 10mH,R=100 Ω, C=1μF and f = 100Hz.Also calculate the resonant frequency and Q-factor for the same RLC circuit.
6. Calculate the frequency, rms value, average value and maximum value of the signal$v= 100 \sin (314t)$ V. Also sketch the waveform.
7. (a) Explain the principle of operation of a transformer. (6)
   (b) It is required to apply a peak value of 6.486KV to drive a machine. Select the turns ratio of the transformer to achieve this from a mains supply of 230V. (4)
8. (a) List the applications of RFT,AFT and Pulse transformers. (6)
   (b) Write the symbol, working principle andthe need for autotransformer. (4)
9. Compare the features of carbon composition, metal film and wire-wound resistors.
10. (a) Compare the features of capacitor and inductor. (6)
    (b) List the features of thermistor. (4)

Model Question Bank

Course Title : **Basics of Electrical and Electronics Engineering**	Course Code: **15EC11T**

Note: The questions in the question bank are indicative but not exhaustive.

UNIT-1

5-mark questions

Remember

1. Define and explain the terms current, emf, electric potential
2. State and apply KCL for a simple circuit.

3. State and apply KVL for a simple circuit.
4. State Ohm's law and mention the limitations.
5. Define and explain the terms power and energy.

Understand

1. Write a short note on DC energy source.
2. Describe the working of an electromagnetic relay.

Application

1. Determine the equivalent resistance when 2 resistors are connected in parallel.
2. List the precautions to be taken for maintenance of Battery.

10-mark Questions

Understand

1. Explain construction and working of a lead acid Battery.

Application

1. Apply KCL for a given circuit and calculate the current through a particular resistor.
2. Apply KVL for a given circuit and calculate the current through a particular resistor.
3. Analyze series and parallel combination of resistors.
4. Analyze series and parallel combination of cells.

UNIT-2

5-mark questions

Remembering

1. Define the terms electric charge, electric field, flux, flux density and field strength.
2. Define the terms Dielectric, Dielectric constant, Dielectric Strength, Absolute permittivity, relative permittivity.
3. State and explain the Coulomb's law.

Understand

1. Explain the factors affecting the capacitance of a capacitor.
2. Analyze series and parallel combination of capacitors with an illustration.

10-mark Questions

Understand

1. Describe the significance of dielectric strength, relative permittivity and absolute permittivity.
2. Explain charging and discharging of capacitor with response plots and equations.

Application

1. Calculate capacitance of a capacitor with 10 Sq.mm area, 10 mm distance between the plates and relative permittivity of 2.
2. Calculate force between two unlike charges each of 10μF and placed 2mm apart.
3. Estimate the equivalent capacitance in each case separately when C1=C2=C3 = 5μF in parallel and in series.

UNIT-3

5-mark Questions

Remembering

1. Define and explain Flux, MMF and Reluctance
2. Define absolute permeability, relative permeability, Mutual Inductance and Self

Inductance

Understand

1. State and explain Faraday's Laws
2. State and explain Lenz's laws
3. State and explain the co-efficient of coupling between two inductors.

Application

1. Derive theexpression ofenergy storage in an inductor

10-mark Questions

Understand

1. Define maximum value, rms value, average value, time period and frequency and mention their units.

Application

1. Formulate the expressions separately for two inductors in series and parallel.
2. Write the expressions for inductive reactance and quality factors and justify them.
3. Calculate X_L and Q offered by a coil of inductance 10mH and R= 20 Ωfor an applied voltage at 50 Hz frequency.

UNIT-4

5-mark Questions

Remembering

1. Define the terms phase difference, leading and lagging phase shifts for sine waves.

Understand

1. Explain the terms amplitude, peak to peak value and cycle for a sine wave.
2. Explain the terms frequency, time period and phase for a sine wave.
3. Explain the significance of RMS value.
4. Compare form factor, average value and peak value with reference to a sine wave.

Application

1. Solve for the current through a 100 Ω resistorin a circuit whenthe applied voltage across the resistor is v = 100 sin (314t).
2. Analyze the behavior of pure resistive circuit for AC input.
3. Calculate inductive reactance and power factor in R_L series circuit with L = 10 mH, R= 100 Ω and f = 50 Hz.
4. Calculatecapacitive reactance and power factor in RC series circuit with C = 10 μF, R= 100 Ω and f = 50 Hz.

10-mark Questions

Application

1. Analyze behavior of RLC series circuit for AC input.
2. Calculate inductive reactance, impedance & power factor in RLC series circuit with data L = 10 mH, C = 10 μfarad, R= 100 Ω and f = 50 Hz.
3. Calculate capacitive reactance, impedance and power factor in a RLC series circuit given that C = μF, L = 10 mH, R= 100 Ω and f = 50 Hz.
4. Analyze behavior of RL series circuit for AC input.
5. Analyze behavior of RC series circuit for AC input.

UNIT-5

5-mark Questions

Remembering

1. List the features of pulse transformer
2. List the features of DC generator
3. List the features of isolation transformer
4. List applications of a transformer

Understand

1. Describe the physical structure of Transformer
2. Describe the principle of operation of Transformer

3. Explain the terms turn ratio, voltage and transformation ratio

Application

1. Write a short note on transformer losses
2. Explain the classification of transformers based on core
3. Explain the classification of transformers based on frequency
4. Compare the features of RF and AF transformers

10-mark Questions

Remembering

1. (a) List the features of Transformer
   (b) Explain the need for transformer.

Understand

1. (a) Compare static and dynamic electrical machines
   (b) Explain the working principle of DC motor.

Application

1. Write EMF equation and explain its validity with necessary waveforms
2. (a) List the different types of losses in transformer.
   (b) Select the type of transformer and estimate its transformation ratio required to drive a load at 5KV from the main supply of 230V.
3. Explainphysical structure, working and applications of autotransformer.

UNIT-6

5-mark Questions

Remembering

1. Define resistance. List applications of resistors
2. List the features of Carbon composition potentiometer
3. List the feature of wire-wound potentiometers
4. List the applications of capacitors
5. List the applications of inductors

Understand

1. Classify Capacitors based on Dielectric materials and list their features.
2. Classify inductors based on core and frequency

Application

1. Write a short note on specifications of resistor
2. (a) Define resistance. (b) Estimate the resistance of a resistor having a color bands given as

Blue-Black-Yellow	Gold

10-Mark Questions

Remembering

1. (a) List features of Carbon composition resistors
   (b) List the features of LDR

Understand

1. (a) Explain the specifications, with examples, of a resistor
   (b) List the features of VDR
2. Write a note on linear and logarithmic potentiometers.
   (b) List the features of VDR

Application

1. (a) Write a note on color codes of resistors.
   (b) Compare the features of resistor with that of capacitor
2. (a) Is resistance of a resistor increases with increase in temperature? Justify your answer.

(b) Compare the features of an inductors and resistors.

3. (a) Distinguish between electrolytic and ceramic capacitors
   (b) Compare the features of capacitors and inductors.
4. (a) Compare the features of LDR and VDR
   (b) List the features of thermistor

End