Government of Karnataka

DEPARTMENT OF TECHNICAL EDUCATION

Curriculum Structure

II Semester Scheme of Studies

Sl. No.	Teaching Department	Course Code	Course Name	Hours per week			Total Contact Hours/ week	Credits	CIE Marks		Theory SEE Marks		Practice SEE Marks		Total Marks
				L	T	P			Max	Min	Max	Min	Max	Min	
Integrated Courses															
1	SC	25SC21I	Engineering Mathematics-II	4	0	4	8	6	50	20	50	20	-	-	100
2	CS	25CS01I	IT Skills	3	0	4	7	5	50	20	-	-	50	20	100
3	ENG	25EG01I	Essential English Communication	4	0	4	8	5	50	20	-	-	50	20	100
4	EE	25EE21I	Concepts of Electrical Circuit	4	0	4	8	6	50	20	50	20	-	-	100
Audit Course															
5	EE	25EE22T	Indian Constitution	2	0	0	2	2	50	20	-	-	-	-	50
6	Personality Development		NCC/NSS/YOGA/SPORTS…	Students are expected to engage in any one of these activities from 1st semester to 6th semester (No Credits)											
			Total	**17**	**0**	**16**	**33**	**24**	**250**	**-**	**100**	**-**	**100**	**-**	**450**

Government of Karnataka
DEPARTMENT OF TECHNICAL EDUCATION

Program	Electrical & Electronics Engineering	**Semester**	**II**
Course Name	Concepts of Electrical Circuits	**Type of Course**	Integrated
Course Code	**25EE21I**	**Contact Hours**	8 hours/week (104 hours/semester)
Teaching Scheme	L: T:P- 4:0:4	**Credits**	6
CIE Marks	**50**	**SEE Marks**	**50 (Theory)**

1. **Rationale:**
   Concepts of Electrical Circuits is essential for a diploma in Electrical & Electronics engineering. It covers the identification of passive elements, their use in electrical circuits, applying laws and theorems to analyse the dc circuits. Basic knowledge of single-phase and three-phase ac circuits are required to understand the concepts of courses in electrical machines, generation, transmission & distribution, utilization, switchgear, protection etc.

2. **Course Outcomes :**At the end of the Course, the student will be able to:

CO-01	Understand the concept of electrostatics, identify the passive elements, measure and use them in electrical circuits.
CO-02	Apply the concepts of KCL/KVL and network theorems in solving DC circuits.
CO-03	Demonstrate the electromagnetic induction principle and its applications.
CO-04	Analyze single-phase and three-phase AC circuits

3. **Course Content**

WEEK	CO	PO	Theory	Practice
1	1	1,2,4	**Electrostatics** Define ● Electric charge ● Electric field ● Explain laws of electrostatics	Simple experiments on static electricity such as Static flyer, salt and pepper static electricity experiment, electrostatic soap bubble science experiment, bending water with static electricity
			Define ● Electrostatic induction ● Electric flux ● Electric field intensity ● Flux density	
			● Electric potential and potential difference ● Potential gradient	
			Breakdown voltage and dielectric strength	
2	1	1,2,4	**Capacitors** Definition, types, and applications ● Capacitance – definition, unit ● list factors affecting capacitance of Capacitors ● Dielectrics, different materials, ● Dielectric constant.	Verification of effective capacitance by calculation and measurement using LCR meter a) Capacitors in series b) Capacitors in Parallel c)Capacitors in Series Parallel Identification of different types of inductors.
			Connection of Capacitors ● In series, parallel and series parallel ● Expression for energy stored in a capacitor (No derivation)	
			● Simple problems on series, parallel Connection of Capacitors.	
			Inductors ● Define, unit, types and applications, ● Expression for energy stored in an inductor (No derivation)	
3	2	1.2.4	**Secondary Cells and Batteries:** ● Faraday's laws of Electrolysis. ● Define cell and Battery ● Difference between Cell and a Battery. (Primary and Secondary)	Connect secondary cells in series to a simple circuit and measure emf and current. Connect secondary cells in parallel to a simple circuit and measure total emf and current.
			● Grouping of cells. ● Problems on grouping of cells. ● Classification of Secondary Batteries Based on their Uses	
			● Ampere-hour efficiency and watt hour efficiency. ● Types and applications of batteries (Ni-Cd, Li-Ion, Lead-acid, Ni-Mh, Ni-Polymer) ● Explain Construction and working of lithium ion battery	Connect secondary cells in Series - Parallel group to a simple circuit and measure emf and current. Test and report the condition of car battery of 12 V rating using hydro meter and cell tester.
			Types of Charging Systems ● Constant-current System ● Constant-voltage System ● Trickle Charging ● Indication of a fully charged and discharged cell	
4	2	1,2,4	**Define:** ● Circuit, parameters, Linear circuit, ● Non-linear circuit, Bilateral, Unilateral,	For simple circuit verify KCL and compare with Theoretical value

			● Electric network, Passive network, Active network, ● Node, Branch, Loop, Mesh, give examples for each.	For simple circuit verify KVL and compare with Theoretical value
			● State and explain Kirchhoff's current law, ● Solve Simple problems	
			● State and explain Kirchhoff's Voltage law, ● Solve Simple problems	
5			● Ideal Voltage, Ideal Current source, conversion from voltage to current and current to voltage conversion.	Video demonstration on converting star to delta delta to star transformation and prepare report
			● Simple problems	
			● Star - delta Transformation ● Problems on Star - delta Transformation	
			● delta - Star Transformation ● Problems on delta - Star Transformation	
6	2	1,2,4	**Network theorems** ● State and explain Thevinin's Theorem, ● simple problems	verify experimentally Thevenin's theorem.
			● State and explain Norton Theorem ● simple problems	
			● State and explain Maximum power transfer Theorem.	Verify experimentally Maximum power transfer Theorem.
			● simple problems on the above	
7	3	1,2,4	**Magnetism and Magnetic circuits** ● Define: Magnetic flux, magnetic field, flux density, Magnetic field strength(H), Absolute Permeability, ● Relative permeability, Mention their units.	Demonstrate measurement of magnetic flux using flux meter.
			● Define magnetic circuit, MMF, Reluctance, laws of reluctance, ● Define flux density, magnetic leakage, leakage coefficient, permanence, and mention their units.	
			● State the relationship between Flux, flux density, MMF and Reluctance ● Compare Electric circuit with magnetic circuit	Demonstrate the measurement of permeability of silicon steel.
			● Solve simple problems on magnetic circuit	
8	3	1,2,4	**Electromagnetic Induction** ● Describe the magnetic field around a current carrying conductor. ● State and apply the Cork Screw Rule field around a current carrying conductor. ● Right Hand Thumb Rule to find the direction of induced emf .	Rig up a circuit to demonstrate Faraday's laws of electromagnetic induction and the field due to a current carrying conductor.
			● State and explain Faraday's laws of Electromagnetic Induction.	
			● Solve simple problems on Electromagnetic Induction.	Demonstrate the use Fleming's Right hand rule to find the direction of emf

			● State and explain Fleming's Right Hand Rule. ● State and explain Lenz's law. ● Define statically and dynamically induced emfs and their applications.	and current induced in a conductor.
9	3	1.2.4	● Define self-induced Emf, mutually induced emf ● Differences between Self-induced emf and Mutually induced emf and state their applications.	Demonstrate the concept of self and mutual induced emf.
			● Define Self-inductance and Coefficient of Self-inductance. ● Define Mutual inductance and Coefficient of Mutual inductance	
			● Expression for the energy stored in a magnetic field (No derivation)	
			● Simple simple problems on above	
10	4	1,2,4	**A.C. Principles** ● Generation of Single phase AC voltage in a single turn coil. ● Define: Cycle, Frequency, Amplitude, Time Period and mention their units.	Measurement of AC Voltage by CRO - Amplitude, Peak to Peak Value, Frequency, Time, Period ,
			● Maximum value, RMS value, Average value, Form factor and Peak factor of a sinusoidal wave	
			● Instantaneous value of Voltage and Current in terms of their maximum value and time. ● phase and phase difference, ● problems on above	Measure power in a single phase AC circuit using ammeter, voltmeter, Wattmeter and calculate power, power factor for different loads like mercury vapour lamp/sodium vapour lamp/fluorescent lamp/LED lamp.
			● Vectorial representation of AC quantities for lagging and leading quantities, ● Define true power, apparent power, reactive power and mention their units. ● Equation for Power, and Power factor in AC circuits	
11	4	1,2,4	**Vector Algebra** ● Represent vectors in Rectangular, Trigonometrically and Polar forms. ● Convert Rectangular form into Polar form and vice--versa ● Simple problems	Measure experimentally the impedance of a series R-L circuit for different frequencies using function generator, CRO and verify it with theoretical impedance value.
			● Perform the following operation in rectangular form- (1) Addition (2) Subtraction ● Perform the following operations in Polar form (3) Multiplication (4) Division ● Simple problems	
			Single Phase AC Circuits ● Current, power and power factor in a pure resistive circuit	Measure experimentally the impedance of a series R-C circuit for different frequencies using function generator, CRO and verify it with theoretical impedance value.
			● Analyze the nature of voltage and current in R-L series circuit through wave forms and vector diagrams. ● Calculate Impedance, Inductive reactance, Current, Power and Power factor of R-L series circuit.	

12	4	1,2,4	● Analyze the nature of voltage and current in R-C series circuit through wave forms and vector diagrams. ● Problems on R-C series circuit.	Measure experimentally the impedance of a series RLC circuit for different frequencies using function signal generator, CRO and verify it with theoretical impedance value.
			● Analyze the nature of voltage and current in R-L-C series circuit through wave forms and vector diagrams. ● Problems on R-L-C series circuit	
			● Explain series resonance. State the condition for resonance with vector diagrams and waveforms. Resonant frequency and Q-factor and mention their units	
			● Problems on resonance	
13	4	1,2,4	**Meaning of 3 phase supply,** ● Define phase sequence ● Comparison between single phase and three phase supply. ● Advantages of three phase supply over single phase supply	Demonstrate generation of 3 phase voltage using video. Measure three phase power and energy in a three phase ac circuit.
			● Connect a 3-ph system in Star and Delta. ● Relationship between line Voltage, phase voltage and line Current and phase current in 3-ph Star and Delta system.	
			● Equation for a 3-ph power. ● Simple problems on 3-ph power calculation using the formula.	Measure 3-ph. Star and delta voltages and currents. Verify with theoretical values.
			● Simple problem on3 phase power calculation given ,Line Voltage ,Line Current ,Power Factor (cosφ)	

4. References:

1. Electrical Technology volume-1 by B.L. Theraja.
2. Principles of Electrical Engineering by B. R. Gupta
3. Basic Electrical Engineering by V.K. Mehta &Rohit Mehta.
4. Electrical circuits by K.V.N Gowda
5. Fundamentals Hand book of Electrical Science, Module 1, Basic Electrical Theory, Department of Energy, U. S. Department of Energy, June 1992.6. https://www.educationcorner.com/static-electricity-experiments/7. https://wonders.physics.wisc.edu/static-electricity/
8. http://www.freeengineeringbooks.com/Electrical/Basic-Electrical-Engineering.php
9. https://www.youtube.com/watch?v=vwIdZjjd8fo&t=172s

5. CIE Assessment Methodologies

Sl. No	CIE Assessment	Test Week	Duration (minutes)	Max marks	
1.	CIE-1TheoryTest	4	90	50	Average of all CIE=50 Marks
2.	CIE-2 Practice Test	7	180	50	
3	CIE-3TheoryTest	10	90	50	
4.	CIE-4 Practice Test	13	180	50	
5	CIE-5 Portfolio evaluation of all the activities through Rubrics	1-13		50	
				Total	**50 Marks**

6. SEE - Theory Assessment Methodologies

Sl. No	SEE – Theory Assessment	Duration	Exam Paper Max marks	Exam Paper Max Marks scale down to (Conversion)	Min marks to pass
1.	Semester End Examination-Theory	3 Hours	100	50	20

7. CIE Theory Test model question paper

Program	Electrical & Electronics Engineering			Semester -II	
Course Name	Concepts of Electrical Circuits			Test	I
Course Code	25EE21I	Duration	90 min	Marks	50

Name of the Course Coordinator:

Note: Answer any one full question from each section. Each full question carries equal marks.

Q.No	Questions	Cognitive Level	Course Outcome	Marks
	Section - 1			
1	a) Define Electric charge,Electric field b) Explain laws of electrostatics c) Define: Electrostatic induction,Electric flux d) A battery consists of 4 cells, each of emf 1.46V. The cells are connected in parallel to an external resistance of 0.525Ω. If the current supplied by the battery is 0.8A, find the internal resistance of each cell. e) Two batteries A and B are connected in parallel and load of 10 Ω is connected across their terminals. A has an e.m.f. of 12 V and an internal resistance of 2 Ω ; B has an e.m.f. of 8 V and an internal resistance of 1 Ω. Use Kirchhoff's laws to determine the values and directions of the currents flowing in each of the batteries and in the external resistance. Also determine the potential difference across the external resistance.	L1 L1 L1 L3 L3	CO1	5 5 5 5 5
2	a) Define breakdown voltage and dielectric strength. b) Define the terms (i) Electric charge and (ii) Electric field. c) List the types and applications of capacitors. d) A resistance of 10 W is connected in series with two resistances each of 15 W arranged in parallel. What resistance must be shunted across this parallel combination so that the total current taken shall be 1.5 A with 20 V applied? e) A resistance of 5 W is connected in series with a combination of two parallel resistances of 10 W and 20 W. This entire combination is connected across a supply of 100 V. Determine (i) effective resistance of the circuit (ii) total current.	L1 L1 L1 L3 L3	CO1	5 5 5 5 5
	Section - 2			
3	a) Define (i) Capacitance (ii) Dielectric strength of a medium. b) Explain laws of electrostatics. c) Differentiate between a cell and a battery. d) Explain ampere-hour efficiency and watt-hour efficiency e) Three capacitors have capacitances of 5μF, 8μF and 15μF respectively. Calculate the total capacitance when they are connected (i) in series (ii) in parallel.	L1 L2 L2 L2 L3	CO1 CO1 CO2 CO2 CO1	5 5 5 5 5 5 5 5 5 5

4	a) List the types and applications of inductors. b) Explain the effect of temperature on resistance and temperature coefficient. c) List the applications of Ni-cd and Lead-acid batteries. d) Explain trickle charging of battery e) Three inductors of 60mH,120mH, and 75mH respectively are connected together in parallel combination with no mutual inductance between them. Calculate the total inductance of parallel combination.	L1 L2 L1 L2 L3	CO1 CO1 CO2 CO2 CO1	5 5

Signature of the Course Coordinator **Signature of the HOD** **Signature of the IQAC Chairman**

8. CIE Practice Test model question paper

Program	**Electrical & Electronics Engineering**			**Semester**	**II**
Course Name	**Concepts of Electrical Circuits**			**Test**	**II**
Course Code	**25EE21I**	**Duration**	**180 min**	**Marks**	**50**
Name of the Course Coordinator:					

Questions	**CO**	**Marks**
NOTE : Any ONE of the following questions may be allotted to each student 1. Verification of effective resistance by calculation and measurement a) Series Resistance Network b) Parallel Resistance Network /c) Series Parallel Network 2. calculate the specific resistance of Copper, Nichrome, (compare the values obtained and get the inference) 3. Verification of effective capacitance by calculation and measurement using LCR meter 4. Capacitors in series b) Capacitors in Parallel/c) Capacitors in Series Parallel 5. Connect secondary cells in Series - Parallel group to a simple circuit and measure emf and current. 6. For a given circuit verify KCL. 7. For a given circuit verify KVL. 8. verify experimentally Thevenin's theorem. 9. Verify experimentally Maximum power transfer Theorem. 10. Demonstrate measurement of magnetic flux using flux meter. 11. Demonstrate the measurement of permeability of silicon steel.	**1,2**	**50**
Scheme of assessment a) Graded exercises b) Identification of passive components c) Circuit diagram, tabular column, procedure formulae, standard graphs if any. d) Conduction e) Results f) Viva-voce		05 05 10 20 05 05
	Total Marks	**50**

Signature of the Course Coordinator **Signature of the HOD**

9. Suggestive Activities for Tutorials:

The List is an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose **any two** activities that are relevant to the topic

Sl.No.	Suggestive Activities for Tutorials
01	Report on different materials used for resistors, inductors and capacitors with their properties.
02	Report on applications of Thevenin's, Norton's and Maximum power transfer theorem/ Solve the given problems on Thevenin's/Norton's/Maximum power transfer theorems
03	Solve the given electrical network using KVL and KCL and submit the report.
04	Prepare a working model to demonstrate electromagnetic induction applications and submit the report.
05	Solve the problems on RL, RC and RLC series circuits to determine the total impedance, current, power and power factor. Draw the vector and wave diagrams.
06	Prepare chart showing vector diagram of on R-L-C Series circuit under different power factor conditions.

10. Rubrics for Assessment of Activity(Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
	Average Marks=(8+6+2+2)/4=4.5						**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

11. Equipment/software list with Specification For Batch Of 30 Students

Sl.No.	Particulars	Specification	Quantity
01	Regulated power supply	0-30V/60V,5/10A	10
02	Wire wound rheostats range-assorted	100 ohms, 1.5A	30
03	Portable DC Moving coil ammeter –multirange	(0-1-2-5-lOA)	30
04	Portable DC Moving coil Voltmeters –multirange	(0-2-10-15-30-75-150- 300V)	20
05	Portable Moving iron ammeter –multirange	(0-1-2-5-lOA)	20
06	Portable Moving iron Voltmeters -multirange	(0-5-10-15-30-75-150- 300-600V)	20
07	Multimeters analog and digital		06
08	Dynamometer type UPF Wattmeter	75/300/600V,5/10A	04
09	Knife switches SPST,DPST,DPDT,TPST,TPDT etc.		20
10	Galvanometers center zero type		10
11	Storage oscilloscope/CRO	100 MHz, Memory depth 500Mpts	05
12	Signal generator/Function generator	Sine, triangle, square	05
13	Thermometer industrial range		02
14	Standard screw gauge		02
15	Cells	1.5 v	20
16	Batteries	6v,12v,24v	05 each
17	Decade resistance boxes		05
18	Decade condenser boxes		05
19	Decade inductor boxes		05
20	Rheostats assorted		20
21	Dimmer stat/ single phase auto transformer	0-300 V, 10 A	05
22	Three phase auto transformer	0-600 V , 20 A	03
23	Resistive load/Lamp load	5 kW	05
24	Soldering iron	25W-10,60w-05	15
25	continuously variable power supply with current limit.	0-15 V at 2/lA	10
26	choke	230v,40Watts	05
27	bulbs	230v, 100 W	10
28	fan capacitor.	230v	05
29	continuously variable power supply with current limit	0-30V at 2/lA	10