Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electrical and Electronics Engineering
Scheme of Teaching and Examination effective from the Academic Year 2024-25 (Batches 2022 - 23)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	EET301	Engineering Mathematics III	MAT	3	2	0		03	50	50	100	4
2	IPCC	EEU302	Electronic Devices and Circuits	EEE	3	0	2		03	50	50	100	4
3	IPCC	EEU303	Electric Circuit Analysis	EEE	3	0	2		03	50	50	100	4
4	PCC	EET304	Electrical Machines	EEE	3	0	0		03	50	50	100	3
5	PCCL	EEL305	Electrical Machines Laboratory	EEE	0	0	2		03	50	50	100	1
6	ESC	EET306x	ESC/ETC/PLC	EEE	3	0	0		03	50	50	100	3
7	UHV	HST307	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	EEL308A	Basic Electrical Lab (Ability Enhancement Course/Skill Enhancement Course – III)		If the course is a Theory: 1	0	0		01	50	50	100	1
					If a course is a laboratory: 0	0	2		02				
9	HS	CDN309	Aptitude and Verbal Ability Skill-I	Placement Cell	2	0	0		--	50	--	50	PP/NP
10	MC	NSN310	National Service Scheme (NSS)	NSS coordinator	0	0	2		--	100	---	100	PP/NP
		PEN310	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		YON310	Yoga	Yoga Teacher									
									Total	550	350	900	21

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, S= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation. K: This letter in the course code indicates common to all the streams of Engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

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Engineering Science Course (ESC/ETC/PLC) 22XXT306x			
EET306A	**Electrical & Electronic Measurements & Instrumentation**	**EET306B**	**Operating Systems**
Ability Enhancement Course – III 22XXT308x **OR** 2XXL308x			
EEL308A	**Basic Electrical Lab**	**EEL308B**	**Integrated Circuit Laboratory**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Course Title	**ELECTRONIC DEVICES AND CIRCUITS**						
Course Code	**EEU302**						
Category	**IPCC**						
Scheme and Credits	No. of Hours/Week					Total teaching + Lab hours	Credits
	L	T	P	SS	Total		
	03	**00**	**02**	**00**	**05**	**40+20**	**04**
CIE Marks: **30T+20L**	SEE Marks: **50**		Total Max. marks:**100**		Duration of SEE**: 03 Hours**		

COURSE OBJECTIVE:

1. To study the basic diode circuits such as clippers, clampers.
2. To analyze and design of different BJT, FETs, LICs circuit biasing and oscillator circuits
3. To construct various electronic circuits using OPAMPs.
4. To provide an understanding on Karnaugh map techniques.
5. To analyze combinational & sequential circuits.

COURSE CONTENT:

UNIT I **8 hours**

a. Diode Circuits: Diode characteristics, resistance, current, clipping and clamping circuits.

b. Transistor Circuits: Biasing, operating point & stability concepts, switching circuits. BJT as two port network and h – parameter model, RC coupled amplifiers.

UNIT II **8 hours**

a. FETs: Construction, working and characteristics of JFETs and MOSFETs, biasing, small signal FET model, ac equivalent circuit, common source amplifier only.

b. Oscillators: Principle of operation, Barkhausen criterion, analysis and design of phase shift, RF & crystal oscillator.

UNIT III **8 hours**

a. Op-Amp Applications: Op-Amp description – circuit symbol and terminal block diagram, inverting and non-inverting configuration, voltage follower, integrator and differentiator, zero crossing detector, Schmitt trigger circuits.

b. Active Filters: First & Second order high pass & low pass Butterworth filters, band pass filters and band stop filter.

UNIT IV **8 hours**

Principles of Combinational Logic: Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4 variables, Incompletely specified functions (Don‘t care terms). Decoders, encoders (Block diagram approach), multiplexers -Using multiplexers as Boolean function generators, Binary comparators.

UNIT V **8 hours**

Analysis of Sequential Circuits: The master-slave flip-flops (pulse triggered flip-flops): SR flip-flops, JK flip-flops, Edge triggered flip- flops- Positive Edge Triggered and Negative Edge Triggered, Characteristic equations universal shift register, binary ripple counters, synchronous binary counters. , Counters based on shift registers- ring and Johnson counter.

S.No	Laboratory Component	# Hrs
	Introduction: Identification of resistors, capacitors, diodes, transistors. Operation of power supplies, signal generators, CROs, identification of ICs, IC trainer kit.	**2**
1	**Diode Circuits**: Design and testing of diode Shunt clipping and clamping circuits.	**2**
2	**Amplifier Circuits:** Design of single stage i) Fixed bias and ii) Self biased BJT/ FET amplifier and determination of the gain-frequency response, input and output impedances	**2**
3	**Oscillator circuits**: Design and testing for the performance RC Phase shift and Crystal oscillator for given frequency.	**2**
4	**Basic Op Amp circuits:** Design op – amp circuit as (i) voltage follower (ii) inverting, (iii) non - inverting amplifier.	**2**
5	**Op Amp circuits:** (i) adder (ii) subtractor (iii) integrator and (iv) differentiator.	**2**
6	**Boolean expressions:** Simplification, realization using logic gates/Universal gates.	**2**
7	**Converters and Decoders**: a) Decoder chip to drive LED/LCD Display and b) Realization Binary to Gray Code converter and vice versa.	**2**
8	**Flip Flop circuits**: Truth table for logic operation: 1) J-K Master Slave 2) T-Type 3) D-Type.	**2**
	Optional Experiments	
9	**Power amplifiers:** Design and testing of Class A and Class B amplifiers.	
10	**Op-amps circuits:** Design and testing of ZCD, Schmitt Trigger circuits.	

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Describe the basic functioning and modelling of electronic devices.

CO2: Explain the construction of K- maps, FETs and Op-Amps and to perform a specific function.

CO3: Analyze various filter circuits using linear integrated circuits.

CO4: Analyze the combinational, sequential and various other electronic circuit functions.

CO5: Design various electronic circuits according to given specifications.

TEXT BOOKS

1. Robert L. Boylestad and Louis Nashelsky, " Electronic Devices and Circuit Theory", 11th Edition, Pearson Education, 2015.
2 David A Bell, " Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
3. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, Pearson, 4th Edition 2015.
4. Operational Amplifiers and Linear ICs, David A. Bell, Oxford, 3rd Edition 2011
5. Lab manual for practical's
6. Digital Logic and Computer Design- M. Morris Mano, Prentice Hall PearsonEducation
7. Logic Design – R D Sudhaker Samuel, Sanguine Technical Publishers.

REFERENCE BOOKS

1. Muhammad Rashid, " Microelectronics Circuits Analysis and Design", 2nd edition, Cengage Learning, 2014
2. B.L. Theraja, A.K. Theraja, " A Text Book of Electrical Technology, Electronic Devices and Circuits", edition, S. Chand Reprint, 2013

3. Anil K. Maini Vasha Agarval, " Electronic Devices and Circuits",1st edition, Wiley publisher, 2009.
4. S.Salivahanan N.Suresh, " Electronic Devices and Circuits",3rd edition, Mc Graw Hill publisher, 2013
5 Millman and Halkias, " Electronic Devices and Circuits", 4th Edition, Mc Graw Hill, 2015
6. Thomas L Floyd, " Fundamentals of Analog Circuits", 2nd edition, Pearson publisher, 2012.
7. B.Somanathan Nair,, "Linear Integrated Circuits - Analysis, Design and Applications", First Edition, Wiley India, 2009
8. S. Salivahanan, V S KanchanaBhaaskaran, "Linear Integrated Circuits", Second Edition , McGraw Hill, 2015
9. Stanley William D, "Operational amplifiers with Linear Integrated Circuits", Fourth Edition Pearson Education, 2002
10. Digital Logic Applications and principles- John Yarbrough, Pearson Education

ONLINE RESOURCES

1. https://www.electronics-tutorials.ws/
2. https://www.tutorialspoint.com/electronic_circuits/electronic_circuits_introduction.htm
3. https://www.electronicshub.org/tutorials/4.
4. https://www.allaboutcircuits.com/video-tutorials/
5. https://nptel.ac.in/courses/108/108/108108111/
6. https://www.yumpu.com/en/document/view/60502162/e-book-op-amps-and-linear-integrated-circuit-technology-by-ramakant-a-gayakwad
7. http://www.panstanford.com/pdf/9789814364591fm.pdf
8. https://easyengineering.net/digital-logic-and-computer-design-by-morris-mano/
9. https://www.sciencedirect.com/book/9780750645829/digital-logic-design
10. https://easyengineering.net/fundamentals-of-digital-circuits-by-anand-kumar/

SCHEME FOR EXAMINATIONS

(i) The question paper will have ten full questions carrying equal marks.
(ii) Each full question will be for 20 marks.
(iii) There will be two full questions from each module.
(iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
(v) The students have to answer five full questions, selecting one full question from each module.
(vi) Only CIE evaluation for lab component no SEE for lab.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO2	PSO3
CO11	3	3						1		1		1	3		1
CO2	3	3						1		1		1	3		1
CO3	3	3						1		1		1	3		1
CO4	3	3						1		1		1	3		1
CO5	3	3						1		1		1	3		1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**ELECTRIC CIRCUIT ANALYSIS**						
Course Code	**EEU303**						
Category	**Integrated Professional Core Course (IPCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**01**	**00**	**04**	**40+20**	**04**
CIE Marks: 30T+20L	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

COURSE OBJECTIVE:

1. Familiarize with the basic concepts of an electrical circuit and the methods of analyzing electrical circuits
2. Understand the concepts of network theorems and the concept of resonance.
3. Analyze three-phase circuits, two port networks, and networks with non-sinusoidal inputs.
4. Understand the importance of initial conditions, their evaluation, and transient analysis of R-L and R-C circuits with dc and ac excitations.
5. Impart basic knowledge on network analysis using Laplace transforms.

UNIT I **08 hours**

Basic Concepts: Understanding of active and passive elements; the concepts of ideal and practical sources. Introduction to source transformation and source shifting techniques. Explanation of Super-Mesh and Super-Node analysis.

Analysis of networks by: Analysis of electrical networks using: Mesh and Nodal analysis techniques for both DC and AC circuits containing independent and dependent sources. Network reduction methods, including Star–Delta transformations.

UNIT II **08 hours**

Network Theorems: Super Position theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem.. Analysis of networks with and without dependent AC and DC sources.

UNIT III **08 hours**

Resonant Circuits: Analysis of simple series RLC and parallel RLC circuits under resonances.(No numerical)

Transient Analysis: Transient analysis of RL and RC circuits under DC excitations: Behavior of circuit elements under switching action, Evaluation of initial conditions.

UNIT IV **08 hours**

Laplace Transformation: Laplace transformation (LT), LT of Impulse, Step, Ramp, Sinusoidal signals, and shifted functions. Waveform synthesis. Initial and Final value theorems.

UNIT V **08 hours**

Unbalanced Three Phase Systems: Analysis of unbalanced three-phase systems. (No numerical)

Two Port networks: Definition, Open circuit impedance, Short circuit admittance, and Transmission parameters and their evaluation for simple circuits, and relationships between parameter sets.

Sl. No	Experiments	Hours
01.	Simulation of independent and dependent types of sources using mesh analysis for the given electrical circuits.	2
02.	Simulation of independent and dependent types of sources using nodal analysis for the given electrical circuits.	2
03.	Simulation and verification Thevenin's and Norton's theorem.	2
04.	Simulate and verify Super Positions theorem.	2
05.	Simulation and verification Reciprocity theorem.	2
06.	Simulation and verification Maximum Power Transfer theorem.	2
07.	Determination of Resonance frequency and Bandwidth for series and parallel RLC circuits.	2
	Optional Experiments	
9	Determination of **T and inverse T** parameters for the given two port circuits.	2
10	Determination of **Z and Y parameters** for the given two port circuits.	2

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Apply Kirchhoff's laws to perform loop and nodal analysis for resistive and reactive networks.

CO2: Apply the basic electrical laws and theorems to simplify and analyze the complex electric circuits.

CO3: Evaluate the initial and final conditions of RL, RC and RLC circuits and determine the transient response of electrical circuits.

CO4: Apply Laplace Transform techniques to solve first and second order electrical circuits in the s-domain and analyze the electrical waveforms using standard test signals.

CO5: Determine the parameters of two port networks (Z, Y, h, and T) and analyse their behaviour in interconnected networks

TEXT BOOKS

1. Hayt, Kemmerly and Durbin, "Engineering Circuit Analysis", 10th Edition, TMH Publication, 2015.
2. Roy Choudhury,"Networks and systems", 2nd Edition, New Age International Publications, 2016.
3. M. E. Van Valkenburg,"Network Analysis",3rd Eedition, PHI publisher, 2009.

REFERENCE BOOKS

1. A K Chakraborty, S P Ghosh, "Network Analysis and Synthesis", 1st Edition, TMH publisher, 2009.
2. Robert L and Boylestad "Introductory Circuit Analysis", 4TH edition, Pearson publisher, 2010.
3. M Nahvi and J A Edminister, "Electric Circuits", 2nd Edition, Schaum's Series , 2002.
4. Charles K Alexander Matthew N O Sadiku, "Fundamentals of Electric Circuits",Mc Graw Hill, 5th Edition, 2013.

ONLINE RESOURCES

1. https://www.khanacademy.org/science/electrical-engineering/ee-circuit-analysis-topic.
2. https://www.circuitlab.com/
3. https://www.youtube.com/watch?v=sqxzQkAdJm0
4. https://www.allaboutcircuits.com
5. https://www.electronics-tutorials.ws

SCHEME FOR EXAMINATIONS

(i) The question paper will have ten full questions carrying equal marks.
(ii) Each full question will be for 20 marks.
(iii) There will be two full questions from each module.
(iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
(v) The students have to answer five full questions, selecting one full question from each module.
(vi) Only CIE evaluation for lab component no SEE for lab.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3			3							1	3	3	
CO2	3	3			3							1	3	3	
CO3	3	3			3							1	3	3	
CO4	3	3			3							1	3	3	
CO5	3	3			3							1	3	3	
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**ELECTRICAL MACHINES**						
Course Code	**EET304**						
Category	**Professional Core Course (PCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**40**	**03**
CIE Marks: 40 + 5(A) + 5(GA)	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

COURSE OBJECTIVE:

1. To gain knowledge on construction and working of electrical machines
2. To analyze characteristics and applications of electrical machines.
3. To evaluate various methods of testing, losses and efficiency of electrical machines.
4. To analyze the methods of determining voltage regulation of a synchronous generator.
5. To analyze the operation of a synchronous machine (both as a generator and motor)

COURSE CONTENT

UNIT I **8 hours**

DC Machines: Classification of DC machines, types of armature winding, emf equation, Back emf and its significance

Transformer: Principle of operation, constructional details of shell type and core type, EMF equation. Concept of ideal transformer, losses and efficiency, condition for maximum efficiency.

Phasor diagrams. Equivalent circuit, Open circuit and Short circuit tests, commercial and all-day efficiency, Voltage **r**egulation, Sumpner's test.

UNIT II **8 hours**

Three-phase Transformers: Transformer connection for three phase operation – star/star, delta/delta, star/delta, delta /star and V/V**.** Phase conversion - Scott connection for three-phase to two-phase conversion. Current inrush in transformers.

Parallel operation (Single-phase & Three-phase): Need, conditions to be satisfied for parallel operation. Load sharing in case of similar and dissimilar transformers.

Auto Transformer and Tap changing transformer

UNIT III **8 hours**

Three phase Induction Motor: Concept of rotating magnetic field, Construction and Principle of operation, Slip, torque, torque-slip characteristic. Maximum torque. Phasor diagram. Equivalent circuit, losses, efficiency. No-load and blocked rotor tests – equivalent circuit. cogging and crawling.

Starters & Speed Control of Three-phase Induction Motors: Need for starter. Direct on line (DOL) starters, Star-Delta and autotransformer starting. Rotor resistance starting. Soft (electronic) starters. Speed control - voltage, frequency, and rotor resistance. (only qualitative treatment)

Induction generator – externally excited and self-excited. Importance.

UNIT IV **8 hours**

Single-phase Induction Motor: Double revolving field theory and principle of operation. Types of single-phase induction motors: split-phase, capacitor start, shaded pole and reluctance motors.

Modern machines: Stepper motor, SRM, BLDC, PMDC motor, Servo motor (AC & DC), Linear Induction motor – Construction, Working principle, Characteristics and Application (No numericals)

UNIT V **8 hours**

Synchronous machines: Principle of operation, construction of salient & non-salient pole synchronous machines, emf equation, distribution and chording of winding, Armature reaction, synchronous reactance, leakage reactance, phasor diagram of non-salient type alternator.

Voltage Regulation: Voltage regulation by EMF, MMF, ZPF & ASA method. Short circuit ratio and its importance. Two reaction theory-direct and quadrature axis reactance, phasor diagram. Slip test and

regulation. Synchronizing to infinite bus bars, parallel operation of alternators, power angle characteristics excluding armature resistance, operation for fixed input and variable excitation.
Synchronous motor: Principle of operation, 'V' and 'inverted V curves', Methods of starting of synchronous motors.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Explain the types, working and characteristics of DC, synchronous machines and special machines.
CO2: Apply the knowledge of DC machines, synchronous machines and special machines to test, operate and determine their performance characteristics.
CO3: Analyse synchronous machines in parallel and on infinite bus bars.
CO4: Evaluate voltage regulation of synchronous generators by various methods.
CO5: Solve problems on DC machines, synchronous machines and special machines.

TEXT BOOKS

1. DP Kothari, I.J.Nagarath "Electrical Machinery" Fourth Edition, TMH 2010
2. P.S Bhimbra "Electrical Machines, Seventh Edition, Khanna Publishers
3. AshfaqHussain, "Electrical Machines" DhanpatRai Publications.
4. EG Janardhanan "Special Electrical Machines" PHI Publication, 2014

REFERENCE BOOKS

1. M. G. Say, "Performance& Design of Alternating Current machines" Third Edition, CBS publishers, 2002
2. A.E Clayton & N.N.Hancock "The Performance & Design of DC machines", Third edition CBS Publication, 2004
3. Mulukuntla.S.Sarma, "Electric Machines", First edition, Cengage Learning, 2009

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108/102/108102146/
2. http://nptel.vtu.ac.in/econtent/courses/EEE/10EE54/index.php
3. https://nptel.ac.in/courses/108/105/108105017/

SCHEME FOR EXAMINATIONS

(i) The question paper will have ten full questions carrying equal marks.
(ii) Each full question will be for 20 marks.
(iii) There will be two full questions from each module.
(iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
(v) The students have to answer five full questions, selecting one full question from each module.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO2	PSO3
CO1	3	2		1			1			1		2	3	2	1
CO2	3	2		1			1			1		2	3	2	1
CO3	3	2		1			1			1		2	3	2	1
CO4	3	2		1			1			1		2	3	2	1
CO5	3	2		1			1			1		2	3	2	1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**ELECTRICAL MACHINES LABORATORY**						
Course Code	**EEL305**						
Category	**Professional Core Course Laboratory (PCCL)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	**00**	**02**	**00**	**02**	**24**	**01**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

COURSE OBJECTIVE: To introduce

1. Performance test on DC machines.
2. Various tests on Transformers – Single Phase and Three phase
3. Performance test on Induction machines.
4. Methods to find voltage regulation of synchronous generator.
5. Synchronization of alternator and to study synchronous machine on infinite busbars.

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COURSE CONTENT:

Expt No	**Laboratory Component**	No.of Hours	BTL
1	(a) Predetermination of efficiency and regulation by Open Circuit and Short circuit tests on single - phase transformer. (b) Calculation of equivalent circuit parameters from the test data and determination of efficiency, Regulation from the equivalent circuit to correlate results obtained earlier.	2	L4
2	Sumpner's test on similar transformers and determination of combined and individual transformer efficiency	2	L4
3	Parallel operation of two dissimilar (different kVA) single-phase transformers and determination of load sharing and analytical verification given the Open Circuit and Short circuit tests details.	2	L4
4	Load test on 3-phase Induction motor and determination of performance characteristics.	2	L4
5	Load test on - Induction generator.	2	L4
6	Load test on Single - Phase Induction motor.	2	L4
7	Open circuit characteristics of DC machine and Load characteristics of a D.C. shunt generator	2	L4
8	Voltage regulation of alternator by EMF, MMF and ZPF method.	2	L4
9	Slip test and determination of voltage regulation.	2	L4
10	Performance of synchronous generator connected to infinite bus under constant power and variable excitation and V and Inverted V curves of a synchronous motor.	2	L4
	Optional Experiments		
11	Polarity Test on Transformers and Load test on single phase induction motor	2	L4
12	Determination of parameters of equivalent circuit of a 3-phase Induction Motor	2	L4

TEACHING LEARNING PROCESS: Chalk and Talk, Hands – on Laboratory Experiments

Note 1: Laboratory report should be submitted to the subject faculty every week and evaluation will be done on the same week only

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1 Choose proper testing method to study the performance of transformers
CO2 Explain the characteristics of induction machines and study their performance
CO3 Apply the basic concept for parallel operation of AC machines
CO4 Analyse the voltage regulation of synchronous generator by various methods
CO5 Evaluate the performance of electrical machines by suitable tests.

REFERENCE BOOKS

1. Electrical Machines, D.P. Kothari I.J.Nagrath, McGraw-Hill Education, 4th Edition,2010.
2. Electrical Technology – AC & DC Machines, B.L. Theraja, S Chand and Company, 2013.
3. Principles Electrical Engineering and Electronics, V.K Mehata, Rohit Mehta, S Chand and Company, 2nd edition, 2015.
4. M.V Bhakshi, "Transformer and Induction Machine", Technical Publisher

Web Links.

1. https://www.svec.education/courses/eee-course-material-lab-manuals/
2. http://rmkcet.ac.in/eee-machines-lab.php/
3. https://www.slideshare.net/KamiWijaya/2-electrical-machines-lab
4. https://www.slideshare.net/sai55chaitanya/electrical-machines-2-lab-manual/

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				2				3	2			3		1
CO2	3				3				3	2			3		1
CO3	3				2				3	2			3		1
CO4	3				2				3	2			3		1
CO5	3				2				3	2			3		1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**ELECTRICAL AND ELECTRONIC MEASUREMENTS AND INSTRUMENTS**						
Course Code	**EET306A**						
Category	**Engineering Science Course (ESC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**40**	**03**
CIE Marks**: 40 + 5(A) + 5(GA)**	SEE Marks**: 50**		Total Max. marks**:100**		Duration of SEE**: 03 Hours**		

COURSE OBJECTIVE:

1. Understand the errors encountered in measuring instruments.
2. Derive the balance conditions in AC and DC bridges for the measurement L, C, R and dissipation factor etc.
3. To analyse the working of analogue and digital measuring instruments, and determine the necessary conditions for working of instrument transformers.
4. To analyse the working principles of signal generators used in the laboratories.
5. To distinguish and describe various transducers and display devices used in instrumentation.

COURSE CONTENT:

UNIT I	**8 hours**
Measurement of Power, Energy, Power factor and Frequency: Dynamometer wattmeter construction and working principle UPF and LPF wattmeters. Measurements of real and reactive power in 3 phase circuits. Induction type energy meter construction and operation. Construction and operation of single-phase and three phase dynamometer type power factor meter. Weston frequency meter and phase sequence indicator.	
UNIT II	**8 hours**
a) Measurement Errors: Definition of error, Gross errors and systematic errors, Absolute and relative errors, Accuracy, Precision, Resolution and Significant figures. **b) Digital Instruments:** Introduction, digital voltmeters (DVM) of ramp type, successive approximation principles, resolution and sensitivity, general specifications, Digital Multimeters. ADC and DAC. Digital frequency meters.	
UNIT III	**8 hours**
Bridges: Wheatstone's bridge, Kelvin Bridge; AC bridges - Capacitance Comparison Bridge, Maxwell's bridge, Wein's bridge, Schering bridge, D'sautys bridge, Wagner's earth connection, examples.	
UNIT IV	**8 hours**
a) Measuring Instruments (AC and DC): Introduction, ammeter, voltmeter, Multi-range voltmeter, extending voltmeter range. AC voltmeter using Rectifiers – Half wave and full wave, Peak responding and True RMS voltmeters, ammeters, multimeters. **b) Instrument Transformers:** Construction and theory of instrument transformers, ratio and phase angle errors of C.T. and P.T. including derivation and Numerical problems.	
UNIT V	**8 hours**
a) Signal Generators and Analyzers: Introduction, Fixed and variable AF oscillator, standard signal generator, laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator.	

b) Display Devices: Digital display system, classification of display, Display devices, LEDs, LCD, Analog and Digital storage oscilloscope.
TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animatio videos

COURSE OUTCOMES: On completion of the course, student should be able to:
CO1: Understand the working of various instruments used for measurement of electrical parameters.
CO2: Classify various errors present in measuring instruments.
CO3: Measure resistance, inductance and capacitance using bridges.
CO4: Analyse the working of different digital instruments.
CO5: Comprehend different types of digital devices, signal generators and analyzers, their construction and operation.

TEXT BOOKS

1. Electrical and electronic Measurements and Instrumentation, A.K. Sawhney, 10th Edition, Dhanpat Rai and Co, 2015.
2. Electrical and Electronic Measurements and Instruments, R K Rajput 3rd edition, S Chand, 2013.

REFERENCE BOOKS

1. A Course in Electronics and Electrical Measurements and Instrumentation, J. B. Gupta, 13th edition, Katson Books, 2008.
2. Electronic Instrumentation and Measurements, David A Bell, 2nd Edition, PHI, 2006.
3. Modern electronic instrumentation and measuring techniques, Cooper D & A D Helfrick, PHI, 1998.

ONLINE RESOURCES

1. https://www.academia.edu/8140873/A_K_Sawhney_A_course_in_Electrical_and_Electronic_Measurements_and_Instrumentation
2. https://www.pdfdrive.com/an-introduction-to-electrical-instrumentation-and-measurement-systems-a-guide-to-the-use-selection-and-limitations-of-electrical-instruments-and-measurement-systems-e158029348.html

SCHEME FOR EXAMINATIONS

(i) The question paper will have ten full questions carrying equal marks.
(ii) Each full question will be for 20 marks.
(iii) There will be two full questions from each module.
(iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
(v) The students have to answer five full questions, selecting one full question from each module.

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO11	3	2				1	1			1			2		1
CO2	3	2				1	1			1			2		1
CO3	3	2				1	1			1			2		1
CO4	3	2				1	1			1			2		1
CO5	3	2				1	1			1			2		1
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**OPERATING SYSTEMS**						
Course Code	**EET306B**						
Category	**Engineering Science (ESC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	**00**	**03**	**00**	**03**	**40**	**03**
CIE Marks**: 40 + 5(A) + 5(GA)**	SEE Marks**: 50**		Total Max. marks**:100**		Duration of SEE**: 03 Hours**		

COURSE OBJECTIVE:

1. Understand about the computer organizations.
2. Understand its subsidiary systems, the concept of system management with various process controls methods.
3. Explain the need of synchronization.
4. Need to overcome the deadlocks.
5. Familiarize the use of various memory and accessibility in the operating system operations.

COURSE CONTENT:

UNIT I **08 hours** **Introduction to Operating System, System Structures:** What Operating System Do; Computer System Organization; Computer System Architecture; Operating System Structure; Operating System Operations; Process Management; Memory Management; Storage Management; Protection and Security; Distributed System; Special Purpose Systems; Computing Environments. **Operating System Services:** User - Operating System Interface; System Calls; Types of System Calls; Virtual Machines.
UNIT II **08 hours** **Process Management:** Process Concept; Process Scheduling; Operations On Processes; Inter-Process Communication. **Multi-Threaded Programming:** Overview; Multithreading Models; Thread Libraries; Threading Issues. Process Scheduling: Basic Concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-Processor Scheduling; Thread Scheduling.
UNIT III **08 hours** **Process Synchronization:** Synchronization: The Critical Section Problem; Peterson's Solution; Synchronization Hardware; Semaphores; Classical Problems of Synchronization; Monitors. **Deadlocks:** Deadlocks: System Model; Deadlock Characterization; Methods For Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance;
UNIT IV **08 hours** **Memory Management:** Memory Management Strategies: Background; Swapping; Contiguous Memory Allocation; Paging; Structure of Page Table; Segmentation. Virtual Memory Management: Background; Demand Paging; Copy-On-Write; Page Replacement; Allocation of Frames; Thrashing. **File System, Implementation of File System:** File System: File Concept; Access Methods; Directory Structure; File System Mounting; Protection. Implementing File System: File System Structure; File System Implementation;
UNIT V **08 hours** **Secondary Storage Structures, Protection:** Mass Storage Structures; Disk Structure; Disk Attachment; Disk Scheduling; Disk Management; Swap Space Management. **Protection:** Goals Of Protection, Principles Of Protection, Domain Of Protection, Access Matrix,

Implementation Of Access Matrix.

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, vid

Course Outcome: At the end of the course students will be able to -

CO1: Understand the basic operations and the phenomena involved in operating of operating systems.

CO2: Explain the working of various processes and the concept of multi-tasking.

CO3: Apply the synchronization requirements and handle deadlocks.

CO4: Analyze the allocation of the memory and file system management.

CO5: Justify the need of secondary memory and protection of OS.

TEXT BOOKS:

1. Operating System Principles. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley, 8th Edition, 2009.

REFERENCE BOOKS:

1. Operating Systems: A Concept Based Approach. D.M Dhamdhere, TMH, 2nd Edition, 2006.
2. Operating Systems. P.C.P. Bhatt, PHI, 2nd Edition, 2008.
3. Operating Systems. Harvey M Deital, Pearson Education, 3rd Edition.

Web Links

1. https://www.geeksforgeeks.org/what-is-an-operating-system/
2. https://www.javatpoint.com/operating-system

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				2								3	2	
CO2	3				2								3	2	
CO3	3				2								3	2	
CO4	3				2								3	2	
CO5	3				2								3	2	
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**BASIC ELECTRICAL LABORATORY**						
Course Code	**EEL308A**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	24	01
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

COURSE OBJECTIVE:

1. To understand and measure electrical quantities and parameters.
2. To verify the relation between line and phase quantities, measure power and power factor in Three-phase circuits.
3. To demonstrate fundamental laws of electrical engineering.
4. To determine the efficiency of single-phase transformers
5. To understand the significance of power, power factor, and control electrical Lamps from different Places.

Expt No	Syllabus Contents	No.of Hours	Blooms Taxonomy level.
	Introduction: Electrical tools, wires, types of wiring systems, working of switches, plug, and sockets and measuring instruments.	02	L1-L2
1	Measurement of Resistance using Voltmeter-Ammeter method and verification using Wheatstone bridge.	2	L1-L4
2	Measurement of voltage, current, power, and power factor and verify line and phase relationship in the three-phase star-connected circuit.	2	L1-L4
3	Verification of Kirchhoff's Laws in DC circuits	2	L1-L4
4	Comparison of domestic lamps against their power consumption.	2	L1-L4
5	Improvement of power factor in inductive circuits.	2	L1-L4
6	Control of electrical Lamp from one, two and three points.	2	L1-L4
7	Load test on a single-phase transformer.	2	L1-L4
8	OCC of DC shunt generator.	2	L1-L4
9	Single phase domestic lighting wiring	2	L1-L4
10	Rigging of Extension box and soldering in electrical circuits.	2	L1-L4
	Optional Experiments		
11	Servicing of Electrical gadgets -1 Iron box, oven, Maxi, oven etc	2	L1-L4
12	Location of fault in domestic appliance	2	L1-L4

Course Outcomes:

CO1: Verify basic laws of electrical circuits.

CO2: Understand the power consumption of different types of lamps and control of lamps from different points.

CO3: Determine the impedance of an electrical circuit and power consumption by a 3-phase load.

CO4: calculate the power consumption of single phase wiring circuit and evaluate the performance of

single-phase transformers.

CO5: conduction of soldering and rigging of extension box.

References.

1. Dr. Eranna Dr. S. Vasudevamurthy, "Department manual.

Web Links.

1. http://vlab.amrita.edu/?sub=1&brch=75&sim=217&cnt=1/
2. http://vlab.amrita.edu/?sub=1&brch=75&sim=322&cnt=1

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2			1		1	1	1		1	2	2	2
CO2	3	3	2			1		1	1	1		1	2	2	2
CO3	3	3	2			1		1	1	1		1	2	2	2
CO4	3	3	2			1		1	1	1		1	2	2	2
CO5	3	3	2			1		1	1	1		1	2	2	2
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**INTEGRATED CIRCUIT LABORATORY**						
Course Code	**EEL308B**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	**00**	**02**	**00**	**02**	**26**	**01**
CIE Marks: **50**	SEE Marks: **50**		Total Max. mark: **100**		Duration of SEE**: 02 Hours**		

COURSE OBJECTIVE:

1. Explain working of multivibrator circuit
2. Understand working of Schmitt Trigger circuit.
3. Explanation of sequential circuits.
4. Understand and analyse pulse width modulation circuits.
5. Apply the concept of 555-timer in daily life application.

COURSE CONTENT:

Sl. No	Laboratory Component	No. of hours	BTL
01.	**Schmitt trigger**: Design and realize circuit using an op-amp for desired upper and lower triggering points.	02	L1-L4
02.	Comparator Circuits Design and verify the operation of op-amp voltage comparator circuit and zero crossing circuits.	02	L1-L4
03.	Realization of One / Two bit comparator & study of 7485 magnitude comparator.	02	L1-L4
04.	Realization of BCD to Excess-3 code conversion and vice versa.	02	L1-L4
05.	Verification of registers: Shift left, Shift right, SIPO,SISO, PISO, PIPO operations using IC 7495.	02	L1-L4
06.	Construct Astable and Monostable Multivibrator circuit using IC-555 Timer.	02	L1-L4
07.	Generate Pulse Width Modulator (PWM) signal using IC-555 Timer.	02	L1-L4
08.	Construct and test Running LED circuit using IC-555 Timer.	02	L1-L4
09.	Construct water level indicator using IC-555 Timer.	02	L1-L4
10.	Construct and design Pulse Position Modulation using IC-555 Timer.	02	L1-L4
	Optional Experiments		
11	Realization of Priority encoder	02	L1-L4

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES: On completion of the course, student should be able to:
CO1: Analysis of multivibrator circuit.
CO2: Design of sequential timer circuit.
CO3: Analysis of pulse width modulation circuit.
CO4: Analysis of Schmitt trigger circuit.
CO5: Examine the application of 555 timer.

Text Books:

1. David A Bell, "Operational amplifiers and linear ICs", Third Edition, Oxford University Press, 2010

2. B.Somanathan Nair, "Linear Integrated Circuits - Analysis, Design and Applications", First Edition, Wiley India, 2009

Reference Text Books.

1. S. Salivahanan, V S KanchanaBhaaskaran, "Linear Integrated Circuits", Second Edition, McGraw Hill, 2015
2. Stanley William D, "Operational amplifiers with Linear Integrated Circuits", Fourth Edition Pearson Education, 2002
3. Ramakanth A Gayakwad, "Operational amplifiers and linear ICs", Fourth Edition, PHI, 2009

MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3					2			2	2	2
CO2	3	3	2	2	3					2			2	2	2
CO3	3	3	2	2	3					2			2	2	2
CO4	3	3	2	2	3					2			2	2	2
CO5	3	3	2	2	3					2			2	2	2
Strength of correlation: Low-1, Medium- 2, High-3															