B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - III

ENGINEERING MATHEMATICS –III (Core Subject)

Subject Code	15MAT31	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

Credits - 04

Course objectives:

Module-1	**Teaching Hours**
	10
Revised Bloom's Taxonomy Level	

Module-2	
	10
Revised Bloom's Taxonomy Level	

Module-3	
	10
Revised Bloom's Taxonomy Level	

15MAT31 ENGINEERING MATHEMATICS –III (Core Subject) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)	
Module-4	**Teaching Hours**
	10
Revised Bloom's Taxonomy Level	
Module-5	
	10
Revised Bloom's Taxonomy Level	
Course outcomes: At the end of the course the student will be able to:	
Graduate Attributes (As per NBA)	
Question paper pattern:	
Text/Reference Books	

1	Title	Authors	Publisher	Edition Year
2				
3				
4				
5				
6				

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - III

ELECTRIC CIRCUIT ANALYSIS (Core Subject)

Subject Code	15EE32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

Credits - 04

Course objectives:

- To familiarize the basic laws, theorems and the methods of analysing electrical circuits.
- To explain the concept of coupling in electric circuits and resonance.
- To familiarize the analysis of three-phase circuits
- To analyze the transient response of circuits with dc and sinusoidal ac input
- To impart basic knowledge on network analysis using Laplace transforms.

Module-1		**Teaching Hours**
Basic Concepts: Active and passive elements, Concept of ideal and practical sources. Source transformation and Source shifting, Concept of Super Mesh and Super node analysis. Analysis of networks by (i) Network reduction method including star – delta transformation (ii) Mesh and Node voltage methods for ac and dc circuits with independent and dependent sources. Equilibrium equations using KCL and KVL, Duality. **Resonant Circuits:** Analysis of simple series RLC and parallel RLC circuits under resonances. Resonant frequency, Bandwidth and Quality factor at resonance. Practical RL-RC circuits.■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-2		
Network Theorems: Analysis of networks with and without dependent ac and dc sources by Thevenin's and Norton's theorems. Analysis of ac and dc circuits for maximum power transfer to resistive and complex loads. Application of Millman's theorem and Super Position theorem to multisource networks. Reciprocity theorem and its application. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3		
Transient Analysis: Review of ordinary linear nonhomogeneous first and second order differential equations with constant coefficients. Transient analysis of dc circuits by classical method for unit step input only. Behaviour of circuit elements under switching action ($t = 0$ and $t = \infty$). Evaluation of initial conditions. ■		**10**
Revised Bloom's Taxonomy Level	L_2 – Understanding, L_3 – Applying, L_4 – Analysing, L_5 – Evaluating.	
Module-4		
Laplace Transformation: Laplace transformation (LT), LT of Impulse, Step, Ramp, Sinusoidal signals and shifted functions. Waveform synthesis. Initial and Final value theorems. Laplace Transform of network and time domain solution for RL, RC and RLC networks for ac and dc excitations. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

CHOICE BASED CREDIT SYSTEM (CBCS)

Module-5	**Teaching Hours**
Unbalanced Three phase systems: Analysis of three phase systems, calculation of real and reactive powers. **Two Port networks:** Definition, Open circuit impedance, Short circuit admittance and Transmission parameters and their evaluation for simple circuits. Network functions of one port and two port networks, Properties of poles and zeros of network functions. **Complex Wave analysis:** Analysis of simple circuits with non-sinusoidal excitation. ■	**10**
Revised Bloom's Taxonomy Level L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

Course outcomes:

At the end of the course the student will be able to:

- Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits.
- Identify, formulate, and solve engineering problems in the area circuits and systems.
- Analyze the solution and infer the authenticity of it.

Graduate Attributes (As per NBA)

Engineering Knowledge
Problem analysis

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text/Reference Books

1	Engineering Circuit Analysis	William H Hayt et al	Mc Graw Hill	8th Edition,2014
2	Engineering Circuit Analysis	J David Irwin et al	Wiley India	10th Edition,2014
3	Fundamentals of Electric Circuits	Charles K Alexander Matthew N O Sadiku	Mc Graw Hill	5th Edition,2013
4	Network Analysis	M.E. Vanvalkenburg	Pearson	3rd Edition,2014
5	Electric Circuits	Mahmood Nahvi	Mc Graw Hill	5th Edition,2009
6	Introduction to Electric Circuits	Richard C Dorf and James A Svoboda	Wiley	9th Edition,2015
7	Circuit Analysis; Theory and Practice	Allan H Robbins Wilhelm C Miller	Cengage	5th Edition,2013

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - III

TRANSFORMERS AND GENERATORS (Core Subject)

Subject Code	15EE33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

Credits - 04

Course objectives:

- To understand the concepts of transformers and their analysis.
- To suggest a suitable three phase transformer connection for a particular operation.
- To understand the concepts of generator and to evaluate their performance.
- To explain the requirement for the parallel operation of transformers and synchronous generators.

Module-1	**Teaching Hours**
Single phase Transformers: Review of Magnetically coupled circuit, Principle of operation, Constructional details of shell type and core type single-phase transformers, EMF equation, Losses and commercial efficiency, Conditions for maximum efficiency (No question shall be set from the review portion). Salient features of ideal transformer, Operation of practical transformer under no - load and on - load with phasor diagrams. Equivalent circuit, Open circuit and Short circuit tests, Calculation of equivalent circuit parameters and predetermination of efficiency- commercial and all-day. Voltage regulation and its significance. **Three-phase Transformers:** Introduction, Constructional features of three-phase transformers. Choice between single unit three-phase transformer and a bank of three single-phase transformers. Transformer connection for three phase operation – Star/Star, Delta/Delta, Star/Delta, Zigzag/star and V/V, Choice of connection. Phase conversion - Scott connection for three-phase to two-phase conversion. Labelling of three-phase transformer terminals, Vector groups. Equivalent circuit of three phase transformers. ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-2	
Parallel Operation of Transformers: Necessity of Parallel operation, Conditions for parallel operation – Single phase and three phase, Load sharing in case of similar and dissimilar transformers. **Auto transformers and Tap changing transformers:** Introduction to auto transformer - copper economy, Equivalent circuit, Three phase auto transformer connection and voltage regulation. Voltage regulation by tap changing – off circuit and on load. **Tertiary winding Transformers:** Necessity of tertiary winding, Equivalent circuit and voltage regulation, Tertiary winding in star/star transformers, Rating of tertiary winding.■	**10**
Revised Bloom's Taxonomy Level: L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3	
Transformers (continuation): Cause and effects of harmonics, Current inrush in transformers, Noise in transformers. Objects of testing transformers, Polarity test, Sumpner's test. **Direct current Generator –** Review of construction, Types, Armature windings, Relation between no load and terminal voltage (No question shall be set from the review portion). Armature reaction, Commutation and associated problems, No load and full load characteristics.	**10**

15EE33 TRANSFORMERS AND GENERATORS (Core Subject) (continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Module-3 (continued)		**Teaching Hours**
Synchronous generators- Review of construction and operation of salient & non-salient pole synchronous generators (No question shall be set from the review portion). Armature windings, Winding factors, Emf equation. Harmonics – causes, Reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit.■		
Revised Bloom's Taxonomy Level	L_2 – Understanding, L_3 – Applying, L_4 – Analysing, L_5 – Evaluating.	
Module-4		
Synchronous generators (continuation): Generator load characteristic. Voltage regulation, Excitation control for constant terminal voltage. Generator input and output. Parallel operation of generators and load sharing. Synchronous generator on infinite bus-bars – General load diagram, O – curves and V – curves. Power angle characteristic and synchronizing power. **Synchronous generators (continuation):** Effects of saliency, Two-reaction theory, Direct and Quadrature reactance, Power angle diagram, Reluctance power, Slip test. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-5		
Synchronous generators (continuation): Open circuit and short circuit characteristics, Assessment of reactance- Short Circuit Ratio, Synchronous reactance, Adjusted synchronous reactance and Potier reactance. Voltage regulation by EMF, MMF, ZPF and ASA methods. **Performance of synchronous generators:** Capability curve for large turbo generators and salient pole generators. Starting, Synchronizing and control. Hunting and dampers. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

Course outcomes:

At the end of the course the student will be able to:

- Explain the construction and operation and performance of transformers.
- Explain different connections for the three phase operations, their advantages and applications.
- Explain the construction and operation of Synchronous machines and evaluate the regulation of synchronous machines by different methods.
- Analyze the operation of the synchronous machine connected to infinite machine.

Graduate Attributes (As per NBA)

Engineering Knowledge
Problem analysis

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.■

15EE33 TRANSFORMERS AND GENERATORS (Core Subject) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Text/Reference Books				
1	Electric Machines	D. P. Kothari, I. J. Nagrath	Mc Graw Hill	4th Edition, 2011
2	Performance and Design of A.C. Machines	M. G. Say	CBS Publishers	3rd Edition, 2002
3	Principles of Electric Machines and power Electronics	P.C.Sen	Wiley	2nd Edition, 2013
4	Electric Machines	Mulukuntla S.Sarma, at el	Cengage Learning	1st Edition, 2009
5	Electrical Machines, Drives and Power systems	Theodore Wildi	Pearson	6th Edition, 2014
6	Electrical Machines	M.V. Deshpande	PHI Learning	1st Edition, 2013
7	Electrical Machines	Abhijit Chakrabarti et al	Mc Graw Hill	1st Edition, 2015
8	A Textbook of Electrical Machines	K.R.Siddapura D.B.Raval	Vikas Publishing House Pvt Ltd	1st Edition, 2014
9	Theory of Alternating Current Machines	Alexander Langsdorf	Mc Graw Hill	2nd Edition, 2001

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
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SEMESTER - III

ANALOG ELECTRONIC CIRCUITS (Core Subject)

Subject Code	15EE34	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

Credits - 04

Course objectives:

- Provide the knowledge for the analysis of transistor circuits.
- Develop skills to design the basic electronic circuits like amplifiers and oscillators.
- Highlight the importance of FET and MOSFET.

Module-1	**Teaching Hours**
Diode Circuits: Review of diodes as rectifiers (No question shall be set from review portion). Diode clipping and clamping circuits. **Transistor biasing and stabilization**: Operating point, Analysis and design of fixed bias circuit, Self-bias circuit, Emitter stabilized bias circuit, Voltage divider bias circuit, Stability factor of different biasing circuits. Problems. **Transistor switching circuits:** Transistor switching circuits, PNP transistors, Thermal compensation techniques. ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying.	
Module-2	
Transistor at low frequencies: BJT transistor modelling, CE fixed bias configuration, voltage divider bias, Emitter follower, CB configuration, Collector feedback configuration, analysis using h – parameter model, Relation between h – parameters model of CE, CC and CB modes, Millers theorem and its dual. **Transistor frequency response:** General frequency considerations, Low frequency response, Miller effect capacitance, High frequency response, Multistage frequency effects. ■	**10**
Revised Bloom's Taxonomy Level: L_2 – Understanding, L_3 – Applying, L_4 – Analysing, L_5 – Evaluating.	
Module-3	
Multistage amplifiers: Cascade and cascode connections, Darlington circuits, Analysis and design. **Feedback amplifiers:** Feedback concept, Different types, Practical feedback circuits, Analysis and design of feedback circuits. ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-4	
Power amplifiers: Amplifier types, Analysis and design of different power amplifiers, Distortion in power amplifiers. **Oscillators:** Principle of operation, Analysis and derivation of frequency of oscillation of phase shift oscillator, Wien bridge oscillator, RF and crystal oscillator and frequency stability. ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

15EE34 ANALOG ELECTRONIC CIRCUITS (Core Subject) (continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Module-5	**Teaching Hours**
FETs: Construction, Working and characteristics of JFET and MOSFET. Biasing of JFET and MOSFET, Analysis and design JFET (Only common source configuration with fixed bias) and MOSFET amplifiers. ■	**10**
Revised Bloom's Taxonomy Level L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

Course outcomes:
At the end of the course the student will be able to:

- Utilize the characteristics of transistor for different applications.
- Design and analyze biasing circuits for transistor.
- Design, analyze and test transistor circuitry as amplifiers and oscillators.

Graduate Attributes (As per NBA)
Engineering Knowledge
Problem Analysis
Ethics

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.■

Text/Reference Books

1	Electronic Devices and Circuit Theory	Robert L Boylestad Louis Nashelsky	Pearson	11th Edition, 2015
2	Integrated Electronics, Analysis and Digital Circuits and Systems	Jacob Millman et al	Mc Graw Hill	2nd Edition, 2009
3	Electronic Devices and Circuits	David A Bell	Oxford University Press	5th Edition, 2008
4	Microelectronics Circuits Analysis and Design	Muhammad Rashid	Cengage Learning	2nd Edition, 2014
5	A Text Book of Electrical Technology, Electronic Devices and Circuits	B.L. Theraja, A.K. Theraja,	S. Chand	Reprint, 2013
6	Electronic Devices and Circuits	Anil K. Maini Vasha Agarval	Wiley	1st Edition, 2009
7	Electronic Devices and Circuits	S.Salivahanan N.Suresh	Mc Graw Hill	3rd Edition, 2013
8	Fundamentals of Analog Circuits	Thomas L Floyd	Pearson	2nd Edition, 2012

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - III

DIGITAL SYSTEM DESIGN (Core Subject)

Subject Code	15EE35	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

Credits - 04

Course objectives:

- To impart the knowledge of combinational circuit design.
- To impart the knowledge of Sequential circuit design.
- To provide the basic knowledge about VHDL & its use.

Module-1	**Teaching Hours**
Principles of combinational logic: Review of Boolean Algebra. Definition of combinational, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables. Incompletely specified functions (Don't care terms). Simplifying max - term equations. Quine -McClusky minimization technique, Quine - McClusky using don't care terms, Reduced Prime Implicant tables, Map entered variables. ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying.	
Module-2	
Analysis and design of Combinational Logic: General approach, Decoders-BCD decoders, Encoders. Digital multiplexers-using multiplexers as Boolean function generators. Adders and Subtractors-Cascading full adders, Look ahead carry, Binary comparators. Design methods of building blocks of combinational logics.■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3	
Sequential Circuits: Basic Bistable element, Latches, SR latch, Application of SR latch, A Switch debouncer. The SR latch, The gated SR latch. The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The master-slave SR Flip-Flops, The master-slave JK Flip-Flop, Edge Triggered Flip-flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop. Characteristic equations, Registers, Counters-Binary Ripple Counter, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-N counters using clocked JK Flip-Flops Design of a Synchronous Mod-N counter using clocked D, T, or SR Flip-Flops. ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-4	
Sequential Design: Introduction, Mealy and Moore models, State machine notation, synchronous sequential circuit analysis and design. Construction of state Diagrams, Counters Design. ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

15EE35 DIGITAL SYSTEM DESIGN (Core Subject) (continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Module-5	**Teaching Hours**
HDL: Introduction, A brief history of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, Simulation and synthesis, Brief comparison of VHDL and Verilog. **Data-Flow Descriptions**: Highlights of Data flow descriptions, Structure of data-flow description, Data type-vectors. ■	**10**
Revised Bloom's Taxonomy Level L_1 – Remembering, L_2 – Understanding, L_3 – Applying.	

Course outcomes:
At the end of the course the student will be able to:
- Design and analyze combinational & sequential circuits
- Design circuits like adder, sub tractor, code converter etc.
- Understand counters and sequence generators.

Graduate Attributes (As per NBA)
Engineering Knowledge
Problem Analysis
Ethics

Question paper pattern:
- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.■

Text/Reference Books

1	Digital Logic Applications and Design	John M Yarbrough	Cengage Learning	2011
2	Digital Principles and Design	Donald D Givone	McGraw Hill Education	1st Edition,
3	Logic and computer design Fundamentals	M. Morries Mano and Charles Kime	Pearson Learning	4th Edition, 2014
4	Fundamentals of logic design	Charles H Roth, JR and Larry L. Kinney	Cengage Learning	6th Edition,
5	Fundamentals of Digital Circuits	A. Anand Kumar	PHI	3rd Edition,
6	Digital Logic Design and VHDL	A.A.Phadke S.M.Deokar	Wiley India	1st Edition,
7	Digital Circuits and Design	D.P.Kothari J.S.Dhillon	Pearson	First Print
8	HDL Programming (VHDL and Verilog)	Nazeih M. Botros	Cengage Learning	1st Edition,
9	Circuit Design and Simulation with VHDL	Volnei A Pedroni	PHI	2nd Edition,

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SEMESTER - III

ELECTRICAL AND ELECTRONIC MEASUREMENTS (Foundation Course)

Subject Code	15EE36	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

Credits - 04

Course objectives:

- To understand the concept of units and dimensions.
- To measure resistance, inductance, capacitance by use of different bridges.
- To study the construction and working of various meters used for measurement.
- To have the working knowledge of electronic instruments and display devices.

Module-1	**Teaching Hours**
Units and Dimensions: Review of fundamental and derived units. SI units (No question shall be set from the review portion). Dimensional equations, problems. **Measurement of Resistance:** Wheatstone's bridge, Sensitivity, Limitations. Kelvin's double bridge. Earth resistance measurement by fall of potential method and by using Megger. **Measurement of Inductance and Capacitance:** Sources and detectors, Maxwell's inductance bridge, Maxwell's inductance and capacitance bridge, Hay's bridge, Anderson's bridge, Desauty's bridge, Schering bridge. Shielding of bridges. Problems. ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying.	
Module-2	
Measurement of Power, Energy, Power factor and Frequency: Review of Dynamometer wattmeter construction and operation (No question shall be set from the review portions), Torque expression, Errors and minimization, UPF and LPF wattmeters. Measurements of real and reactive power in 3 phase circuits. Review of Induction type energy meter construction and operation (No question shall be set from the review portions)]. Errors, adjustments and calibration of single and three phase energy meters, Problems. Construction and operation of single-phase and three phase dynamometer type power factor meter. Weston frequency meter and phase sequence indicator. ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3	
Extension of Instrument Ranges: Desirable features of ammeters and voltmeters. Shunts and multipliers. Construction and theory of instrument transformers, Desirable characterises, Errors of CT and PT. Turns compensation, Illustrative examples, Silsbee's method of testing CT. **Magnetic measurements:** Introduction, Measurement of flux/ flux density, Magnetising force and leakage factor. Hopkinson permeameter. Measurement of iron loss by wattmeter method. A brief discussion on measurement of air gap flux and field strength.■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

15EE36 ELECTRICAL AND ELECTRONIC MEASUREMENTS (Foundation Course) (continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Module-4		**Teaching Hours**
Electronic and digital Instruments: Introduction. Essentials of electronic instruments, Advantages of electronic instruments. True rms reading voltmeter. Electronic multimeters. Digital voltmeters (DVM) - Ramp type DVM, Integrating type DVM, Continuous – balance DVM and Successive - approximation DVM. Q meter. Principle of working of electronic energy meter (block diagram treatment), Extra features offered by present day meters and their significance in billing.■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	
Module-5		
Display Devices: Introduction, Character formats, Segment displays, Dot matrix displays, Bar graph displays. Cathode ray tubes, Light emitting diodes, Liquid crystal displays, Nixes, Incandescent, Fluorescent, Liquid vapour and Visual displays. Display multiplexing and zero suppression. **Recording Devices:** Introduction, Strip chart recorders, Galvanometer recorders, Null balance recorders, Potentiometer type recorders, Bridge type recorders, LVDT type recorders, Circular chart and X – Y recorders. Magnetic tape recorders, Direct recording, Frequency modulation recording, Pulse duration modulation recording, Digital tape recording, Ultraviolet recorders. Biomedical recorders, Electro Cardio Graph (ECG), Electroencephalograph, Electromyograph9. Noise in reproduction. ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding.	

Course outcomes:
At the end of the course the student will be able to:

- Explain the importance of units and dimensions.
- Measure resistance, inductance and capacitance by different methods.
- Explain the working of various meters used for measurement of power and energy.
- Explain the working of different electronic instruments and display devices.

Graduate Attributes (As per NBA)
Engineering Knowledge

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.■

15EE36 ELECTRICAL AND ELECTRONIC MEASUREMENTS (Foundation Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Text/Reference Books				
1	Electrical and electronic Measurements and Instrumentation	A.K. Sawhney	Dhanpat Rai and Co	10th Edition
2	A Course in Electronics and Electrical Measurements and Instrumentation	J. B. Gupta	Katson Books	2013 Edition
3	Electrical and electronic Measurements and Instrumentation	Er.R.K. Rajput	S Chand	5th Edition 2012
4	Electrical Measuring Instruments and Measurements	S.C. Bhargava	BS Publications	2013
5	Modern Electronic Instrumentation and Measuring Techniques	Cooper D and A.D. Heifrick	Pearson	First Edition 2015
6	Electronic Instrumentation and Measurements	David A Bell	Oxford University	3rd Edition 2013
7	Electronic Instrumentation	H.S.Kalsi	Mc Graw Hill	3rd Edition 2010

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - III

ELECTRICAL MACHINES LABORATORY - 1

Subject Code	15EEL37	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80

Credits - 02

Course objectives:

- Conducting of different tests on transformers and synchronous machine and evaluation of their performance.
- Verify the parallel operation of two single phase transformers of different KVA rating.
- Study the connection of single phase transformers for three phase operation and phase conversion.
- Study of synchronous generator connected to infinite bus.

Sl. NO	Experiments
1	Open Circuit and Short circuit tests on single phase step up or step down transformer and predetermination of (i) Efficiency and regulation (ii) Calculation of parameters of equivalent circuit.
2	Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.
3	Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load sharing and analytical verification given the Short circuit test data.
4	Polarity test and connection of 3 single-phase transformers in star – delta, delta – delta and V – V (open delta) and determination of efficiency and regulation under balanced resistive load.
5	Scott connection with balanced and unbalanced loads
6	Separation of hysteresis and eddy current losses in single phase transformer.
7	No load and load characteristics of DC shunt generator.
8	Voltage regulation of an alternator by EMF and MMF methods.
9	Voltage regulation of an alternator by ZPF method.
10	Slip test – Measurement of direct and quadrature axis reactance and predetermination of regulation of salient pole synchronous machines.
11	Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa.
12	Power angle curve of synchronous generator.

Revised Bloom's Taxonomy Level	L_3 – Applying, L_4 – Analysing, L_5 – Evaluating, L_6 – Creating

Course outcomes:

At the end of the course the student will be able to:

- Conduct different tests on transformers and synchronous generators and evaluate their performance.
- Connect and operate two single phase transformers of different KVA rating in parallel.
- Connect single phase transformers for three phase operation and phase conversion.
- Assess the performance of synchronous generator connected to infinite bus.

15EEL37 ELECTRICAL MACHINES LABORATORY – 1 (continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Graduate Attributes (As per NBA)

Engineering Knowledge
Problem Analysis
Individual and Team work
Communication

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.■

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - III

ELECTRONICS LABORATORY

Subject Code	15EEL38	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80

Credits - 02

Course objectives:

- To design and test half wave and full wave rectifier circuits
- To design and test different amplifier and oscillator circuits using BJT
- To study the simplification of Boolean expressions using logic gates
- To realize different Adders and Subtractors circuits
- To design and test counters and sequence generators.

Sl. No	Experiments
1	Design and Testing of Full wave – centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency.
2	Testing of diode clipping and Clamping circuits
3	Frequency response of single stage BJT and FET RC coupled amplifier and determination of half power points, bandwidth, input and output impedances.
4	Design and testing of BJT - RC phase shift oscillator for given frequency of oscillation.
5	Testing for the performance of BJT - crystal RC phase shift oscillator
6	Testing of a transformer less Class – B push pull power Amplifier and determination of its conversion efficiency.
7	Simplification, realization of Boolean expressions using logic gates/Universal gates.
8	Realization of half/Full adder and Half/Full Subtractors using logic gates.
9	Realization of parallel adder/Subtractors using 7483 chip- BCD to Excess-3 code conversion & Vice –Versa, Binary to Gray code conversion and vice versa.
10	Design and testing Ring counter/Johnson counter.
11	Design and testing of Sequence generator.
12	Realization of 3 bit counters as a sequential circuit and MOD – N counter design using 7490, 74192, 74193.
Revised Bloom's Taxonomy Level	L_3 – Applying, L_4 – Analysing, L_5 – Evaluating, L_6 – Creating

Course outcomes:

At the end of the course the student will be able to:

- Design and test different diode circuits.
- Design and test amplifier and oscillator circuits and analyse their performance.
- Use universal gates and ICs for code conversion and arithmetic operations.
- Design and verify on of different counters.

15EEL38 ELECTRONICS LABORATORY (continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Graduate Attributes (As per NBA)
Engineering Knowledge
Problem Analysis
Individual and Team work
Communication

Conduct of Practical Examination:
1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.■

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