Basaveshwar Engineering College (Autonomous)

[TEQIP Lead Institute, Govt. Aided Institution, AICTE Recognized, Affiliated to VTU Belgaum]

Bagalkot-587103, Karnataka, India.

Department of Electrical and Electronics Engineering

Scheme of Teaching & Evaluation and detailed Syllabus
for B.E Electrical and Electronics Engineering for batch admitted in 2020-21
(based on Joint Board Meeting held on 04.06.2018 and 09-05-2020)

Semester-3 **CAY 2021-22 (175 Credits 2020-21 admitted batch)**

Sl.	Sub Code	Subject	C	Hrs/ Week			Exam Marks		
				L	T	P	CIE	SEE	Total
01	UMA335C	Computational Methods for Electrical Science	3	3	0	0	50	50	100
02	UEE351C	Analog and Digital Electronics	4	4	0	0	50	50	100
03	UEE352C	Network Analysis	4	3	2	0	50	50	100
04	UEE353C	Electrical and Electronic Measurements	4	4	0	0	50	50	100
05	UEE354C	Transformers and Induction Machines	4	4	0	0	50	50	100
06	UEE355L	Transformers and Induction Machines Laboratory	1	0	0	2	50	50	100
07	UEE356L	Electrical and Electronic Measurements Laboratory	1	0	0	2	50	50	100
08	UEE357L	Network Analysis Laboratory	1	0	0	2	50	50	100
09	UMA330M	Bridge Course Mathematics-I*	0	3	0	0	50	50	100
10	UBT133M	Environmental Studies**	0	2	0	0	50	50	100
Total			22	23	02	06	500	500	1100

*Bridge Course Mathematics-I	:	is a mandatory subject only for students admitted to 3rd Semester through lateral entry scheme (Diploma quota). Passing the subject is compulsory, however marks will not be considered for awarding grade/class. A PP/NP grade will be awarded for passing/not passing the subject.
**Environmental Studies	:	is amandatory subject for lateral entry students. Question Paper will be of Objective type. Students have to pass the subject compulsorily, however marks will not be considered for awarding Grade / Class / Rank.

Legend for Scheme	L	Lecturer	T	Tutorial	P	Practical	M	Mandatory
Legend in Subject	C	Core	E	Elective	C	Credits		

Question paper pattern for Theory SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than 4 sub divisions.
3. Any five full questions are to be answered choosing at least one from each unit

Laboratory Assessments for SEE:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE Performance and journal write-up: Marks for each experiment = 30 marks / No. of proposed experiments. One Practical test for 20 marks, (5 write up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE: 25% write up, 50% conduction, calculation, results etc., 25% viva-voce

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ANALOG AND DIGITAL ELECTRONICS	
Subject Code: UEE351C	**Credits: 04**
Contact Hours: 04 (4L-0T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes

At the end of this course,

1. Student shall be able to analyze and explain different types of clipping, clamping and full wave rectifier circuits, and drive expressions for efficiency and ripple factors.
2. Students shall be able to explain different types of biasing circuits, single stage and multistage amplifier, analyze hybrid model and derive h - Parameters.
3. Student shall be able to explain JFET & MOSFET construction and characteristics and drive important relation
4. Student shall be able to simplify boolean algebra equations by using K. map and Quine Mcclusky and MEV techniques.
5. Student shall be able to design combinational circuits like Code converters adders, comparators, decoders, mux etc.
6. Student shall be able to design Flip-Flop, sequential circuit Registers and Counters.

Unit-I
Diode Circuits: L-08 Hrs Introduction, clipping circuits, Clipping at two independent levels, Clamping Circuits, Comparators, Full wave rectifier with C filter **Transistor Biasing** : L-**05 Hrs** Introduction, Operating point, DC load line, Bias stability, voltage divider bias, Derivation of stability factors, Bias compensation.
Unit-II
BJT Low Frequency Analysis : L-04 Hrs Introduction, two port devices. Hybrid model, transistor hybrid model. h - Parameters, Analysis of transistor amplifier circuit using h- parameters (CE amplifier only) **Multistage Amplifiers& Power Amplifier : L-04 Hrs** Introduction, Classification of Amplifiers, , Frequency response of R-C coupled amplifier, Class A large signals amplifier, Transformer coupled power amplifier, Class B (Push pull) amplifiers **Field Effect Transistor: L-05 Hrs** Introduction, construction & characteristics of JFETs, transfer characteristics, Important relationships, Depletion &Enhancement type MOSFETs
Unit-III
Number system & Combinational Logic : L-05 Hrs Number system Definition of combinational logic, canonical forms, Karnaugh maps - 3

and 4 variables, incompletely specified functions (Don't Care terms), simplifying minterm and maxterm equations

Minimization Techniques: L-**05 Hrs**

Quine- McClusky minimization technique, Quine- McClusky using Don't Care terms, Map entered variables

Analysis and Design of Combinational Logic : L-**03 Hrs**

Adders and subtractors, Cascading full adders, look ahead carry adders, binary comparators, Codes &Code converter.

Unit-IV

Analysis and Design of Combinational Logic : L-**05 Hrs**

Decoders -BCD Decoders, encoders. Digital multiplexers, multiplexers as Boolean function generators.

Sequential Circuits 1 : L-04 Hrs

Basic bistable element, latches, SR latch, Application of SR latch, gated D latch, Master - Slave SR flip - flops (pulse-triggered flip-flops). Master slave JK flip -flop. Conversion of flip-flop from one type to another

Sequential Circuits 2 : L-**04 Hrs**

Characteristic equations, registers, counters - binary ripple counters, synchronous binary counters, counter based on shift registers, design of synchronous counters, design of synchronous mod-6 counter using clocked D, T, JK and SR flip- flops

Reference Books:

1. Boylestead and Nashelesky, "Electronic Devices and Circuit theory" 11th edition, Pearson, 2013.
2. Jacob Millman and Christos C. Halkias, "Integrated Electronics", TMH, 2010.
3. Albert Malvino and David J Bates, "Electronic Principles", 8th edition, TMH, 2016.
4. David A. Bell, "Electronic Devices and Circuits", 5th edition, Oxford University Press, 2008.
5. S.Samuel, Mahadevaswamy and V. Nattarasu, "Electronic Circuits", 2nd edition, Sanguine Technical Publishers, 2012.
6. John M Yarbrough, "Digital Logic Application and Design", Cengage Learning India Pvt, Ltd, 2006.
7. Donald D Givone, "Digital Principles and Design", Tata McGraw Hill, 2003.

NETWORK ANALYSIS	
Subject Code: UEE352C	**Credits: 04**
Contact Hours: 05 (3L-2T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Students shall be able to **list** different types of electric circuits and active & passive elements and **recall** the statements of network theorems
2. Students shall be able to **demonstrate** source transformation, star-delta conversion, mesh & node analysis, network topology concepts and Laplace transforms in electric circuits
3. Students shall be able to **solve** eclectic circuits by applying network theorems and Laplace transforms
4. Students shall be able to **analyze** behavior of R, L & C elements in the electric circuits, their frequency response and determine resonance related parameters
5. Students shall be able to **determine** and **establish** the relation between the various parameters in electric circuits
6. Students shall be able to **build** expressions for mesh currents and node voltages by employing the network topology for solving large power system networks.

Lecture –Theory/Derivations 3 Credits (13x3=39 Hrs)	Lecture Hours	Tutorials –Numerical 1 Credit (13x2=26 Hrs)	Tutorial Hours
UNIT-I (10 Hrs)		**UNIT-I (06 Hrs)**	
Mesh and Node Analysis: Practical source transformation, network reduction using star delta transformation, Loop and node analysis with linearly dependent and independent source for DC and AC networks. Concept of super node and super mesh.	**05**	• Transformation of practical current and voltage sources to obtain single equivalent source • Determination of equivalent resistance using star-delta transformation • Assessment of current and voltage by mesh and node analysis for DC and AC circuits • Identification and solving Super node and Super mesh	**04**
Network Topology: Graph of network, concept of tree and co-tree, incidence matrix, Tie-set & cut-set schedules, Formulation of equilibrium	**05**	• Drawing the graphs, tree and co-tree of electrical circuits • Writing incidence matrix, tie	**02**

equations in matrix form, solution of resistive network, Principles of duality.		set and cut set matrix for circuits • Developing the equilibrium equation for mesh and node analysis in power system networks • Drawing the dual networks of electrical circuits and writing the integro-differential equations	
UNIT-II (10 Hrs)		**UNIT-II (08 Hrs)**	
Network Theorems-I: Superposition, Reciprocity, and Millman's theorems.	**05**	• Application of Superposition theorem to assess the response in electrical circuits in multisource networks • Applications of Reciprocity theorem • Assessment of equivalent voltage sources using Millman's theorem multisource networks	**04**
Network Theorems-II: Thevenin's, Norton's and Maximum power transfer theorems	**05**	• Obtaining Thevenin's and Norton's equivalent circuit of electrical networks • 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	**04**
UNIT-III (09 Hrs)		**UNIT-III (06 Hrs)**	
Resonant Circuits: Series and parallel resonance, frequency-response of series and parallel circuits, Bandwidth, Q-factor	**04**	• Identifying the resonant frequency for different circuits • Assessment of bandwidth of resonant circuit • Evaluation of Quality factor and significance • Identifying the circuit	**02**

		elements for resonance to occur at given frequency • Identification of cut off frequencies under different conditions of the circuit	
Transient behaviour and initial conditions: Behaviour of circuit element under switching condition and their representation, evaluation of initial and final conditions in RL, RC, and RLC circuits for AC and DC excitation	**05**	• Identification of initial and final conditions in the electrical circuits • Determination of transient behaviour of current and voltage in resistor, capacitor and inductor	**04**
UNIT-IV (10 Hrs)		**UNIT-IV (06 Hrs)**	
Laplace Transformations and Applications: Step, Ramp and Impulse functions and their Laplace transformation, Waveform synthesis and Laplace transformation initial value theorem and final value theorem, transformed network and their solution.	**05**	• Assessment of Laplace transform of Impulse, Step, Ramp, Sinusoidal signals and shifted functions • Application of initial value and final value theorem for the assessment of initial and final conditions of the circuit elements • Laplace Transform of network and time domain solution for RL, RC and RLC networks for ac and dc excitations	**04**
Two port network parameters: Short Circuit admittance parameters, open circuit impedance parameters, transmission parameters, hybrid parameters, relationship between parameters sets.	**05**	• Identification of various circuit parameters of the two port networks	**02**

Reference Books:

1. Hayt, Kemmerly and Durbin, “Engineering Circuit Analysis", 7th edition, TMH, 2007.
2. M.E.VanValkenburg, "Network analysis", 3rd Edition, PHI, 2002.
3. Roy Chowdhary, "Network and Systems", New age International Publications, 2nd Edition 2013.
4. Joseph Edminister & M. Nahvi, “Electric Circuits", 6th Edition, TMH, 2014.

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ELECTRICAL AND ELECTRONICS MEASUREMENTS	
Subject Code: UEE353C	**Credits: 04**
Contact Hours: 04 (4L-0T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Students shall be able to **list & define** various parameters and features of different types of electrical & electronic measuring instruments/devices, sensors & transducers.
2. Students shall be able to **explain** the operation of different types of electrical & electronic measuring instruments/devices, sensors, transducer and their related components.
3. Students shall be able to **experiment with or make use** of different types of electrical & electronic measuring instruments/devices, sensors & transducers.
4. Students shall be able **compare and contrast** the features of different types of electrical & electronic measuring instruments/devices, sensors & transducers.
5. Students shall be able **evaluate/calculate** various parameters related to different types of electrical & electronic measuring instruments/devices, sensors & transducers.
6. Students shall be able **discuss/choose/test** different types of electrical & electronic measuring instruments/devices, sensors & transducers.

UNIT - I	
Measurement of Resistance, Inductance and Capacitance	**13**
Measurement of medium resistance: Wheatstone bridge - Sensitivity of WS bridge, Galvanometer current, Limitations; Measurement of low resistance: Different Methods of measuring low resistance, Kelvin's Double bridge; Earth Resistance Measurement – Fall of potential method; AC Bridges: General equilibrium equations of AC bridges; Measurement of Self Inductance – Types of bridges for measurement of self inductance, Maxwell's Inductance bridge, Maxwell's Inductance Capacitance Bridge, Anderson's bridge; Measurement of Capacitance: Types of bridges for measurement of capacitance, De Sauty's bridge, Schering Bridge; Errors in bridge circuits, Sources and Detectors.	
UNIT – II	
Measuring Instruments	**08**
Introduction; Types of Instruments, Errors in ammeters and Voltmeters; Permanent Magnet Moving Coil Instrument(PMMC) – Torque equation, Errors in PMMC instruments, Advantages and Disadvantages; Moving Iron Instruments(MI) – Torque equation, Classification of MI instruments, Errors in MI instruments, Advantages and Disadvantages; Electrodynamometer Type Instruments – Torque equation, Advantages and Disadvantages; Thermocouple Instruments – Principle of operation, Construction, Advantages and Disadvantages.	
Measurement of Power and Related Parameters	**05**
Dynamometer Type Wattmeter, Low Power Factor Wattmeter; Induction Type Single Phase Energy meter – Construction, Theory, Error adjustments, Calibration; Dynamometer Type Single Phase Power Factor meter – Construction and Operation; Weston Frequency meter.	
UNIT – III	
Electronic Instruments	**05**
Introduction; Principle of Electronic Energy meter; True RMS reading Voltmeter; Electronic Multimeter; Digital Voltmeter(DVM) ; Classification of DVM- Ramp type DVM,	
Extension of Instrument ranges	**08**
Introduction; Shunts and Multipliers for AC Ammeter and Voltmeter respectively; Instrument Transformers: Advantages of Instrument Transformers, Ratios of Instrument Transformers, ratio Correction Factor, Burden on Instrument Transformer; Current Transformer(CT) – Theory of CT,	

Errors in CT's, Design features if CT's; Potential Transformer(PT) – Differences between CT and PT, Theory of PT.	
UNIT - IV	
Sensors and transducers	
Definition and meaning of sensors and transducers, Difference between sensors and transducers, Classification (Types) of transducers: Mechanical/Electrical, Active/Passive, Analog/Digital, Modulating/Self balancing, Examples and advantages of electrical transducers. Resistive transducers: Potentiometers, RTD, Thermistor, Magneto-resistor (Principle, construction, working and application for each type). Capacitive transducers: Absolute and differential type, applications. Inductive transducers: Synchronous, Linear variable differential transformer (LVDT) ((Principle, construction, working and application). Self generating (Active) transducers: Piezoelectric, Pyroelectric, Thermocouple (Principle, construction, working and application for each type). Sensor/transducer based instrumentation system: Generalized block diagram representation, Typical examples related to electrical field.	**13**

Reference Books:

1. A. K. Sawhney, "Electrical & Electronic Measurements and Instrumentation", 19th edition, Dhanpat Rai & Son's, New Delhi, 2011.
2. Cooper D and A. D. Helfrick, "Modern Electronic Instrumentation and Measurement Techniques", PHI.
3. Ian R. Sinclair, "Sensors and Transducers", 3rd Edition, Newnes Publication.
4. Golding & Widdies, Pitman, "Electrical Measurements and Measuring Instruments", 5th edition, D.R & Son's, New Delhi.
5. John P Beately, "Principles of Measurement Systems", 3rd edition, Pearson Education, 2006.
6. Ramon P. Areny, John G. Webster, "Sensors and Signal Conditioning", 2nd Edition, Wiley India Private Ltd.

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Transformer and Induction Machines	
Subject Code: UEE354C	**Credits: 04**
Contact Hours: 04 (4L-0T-0P)	**Assessment: CIE 50 and SEE 50**

UNIT-I	
Single Phase Transformer	**13**
Transformer construction and types, Principle of operation, emf equation, concept of ideal transformer, no-load and on-load analysis of ideal and practical transformer. Phasor diagrams, Development of equivalent circuit diagram, Calculation of equivalent circuit parameters by OC and SC tests, Transformer ratings and per unit(p.u.) scaling, Types of losses, efficiency, all day efficiency, voltage regulation, polarity test and Sumpner's test	
UNIT-II	
Three Phase Transformer	**07**
Types, three phase transformer connections: star-star, star-delta, delta-star, delta-delta, open delta. Choice of connections: bank of single phase transformers for three phase operations. Scott connection for three phase operations, scott connection for three phase to two phase conversation. Labeling of three phase transformer terminals, phase shift between primary and secondary and vector groups, Harmonics in transformer, Suppression of harmonics by tertiary winding	
Parallel operation of Transformer	**03**
Need for parallel operation, conditions to be satisfied for parallel operation and load sharing, Parallel operation of three phase transformer	
Auto Transformer	**03**
Construction, working principle, saving of copper, equivalent circuit and applications	
UNIT-III	
Three Phase Induction Machine	**13**
Construction, types-squirrel cage and slip ring motors. Principle of operation, production of rotating magnetic field, slip, rotor induced emf and it's frequency, power losses in an induction motor, equivalent circuit, torque equation, torque-slip characteristics-motoring generating and breaking modes, starting torque, maximum torque, effect of rotor resistances on torque slip -characteristics, power output, no load and blocked rotor test-evaluation of equivalent circuit parameters, circle diagram and obtain it's performance, double cage and deep bar motors, Cogging and crawling	
UNIT –IV	
Starting and Speed Control of Three Phase Induction Motors	**08**
Need for starter, DOL, star delta, autotransformer and rotor resistance starters, Calculation of starting torque Voltage control, frequency and rotor resistance control	
Single Phase Induction Motors	**05**
Construction, double field revolving theory and principle of operation, equivalent circuit starting of single phase motors: Resistance split phase, capacitor start and capacitor run motors, shaded pole motors	

Course Outcomes:

- Students will be able to explain the principle and construction of transformer and their phasor diagram.
- Students will be able to draw the equivalent circuit of transformer and calculate the parameters using OC and SC test.
- Students will be able to explain the necessary of autotransformer and parallel operation of transformer and their application.
- Students will be able to connect three phase transformer and compute different values.

- Students will be able to state how torque is produced and torque varies with speed for induction motor and compute various electrical and mechanical qualities by no-load and blocked rotor test and circle diagram.
- Students Shall be able to explain starting methods and speed control of single phase and three phase IM and select proper motors for different applications.

References Books:

1. I. J. Nagarath and D.P Kothari, "Electrical Machines" TMI Publications, 4th - Edition 2012.
2. Ashaq Hussian, "Electrical Machines", Dhanapatrai and Co. 2nd - Edition 2007.
3. P.S.Bhimra, "Electrical Machinery", Khanna Publishers, New Delhi, 7th - Edition 2008-2011.
4. Smarjit Ghosh "Electrical Machines" Pearson, 3rd - Edition 2011.
5. P.S.Bhimra, "Generalized Theory of Electrical Machine", Khanna Publishers, New Delhi, 5th - Edition 2008
6. Alexander Longsdorf, "Theory of alternating current", TMH-Publications 1999

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Transformer and Induction Machines Laboratory	
Subject Code: UEE355L	**Credits: 01**
Contact Hours: 02 (0L-0T-2P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Predetermination of the efficiency and other parameters.
2. Controlling methodologies of the machines.
3. Selection of machines for specific application.
4. To study specific characteristic of transformer and its operation.
5. To study specific characteristic of induction motor and its operation.
6. Starting and speed control of induction motor.

List of Experiments:

1. Open circuit and short circuit test on single phase transformer and pre-determination of efficiency, regulation for different loads at power factors. Calculations of equivalent circuit parameters of a given transformer.
2. Sumpner's test.
3. Parallel operation of two single phase transformers (dissimilar ratings)
4. Connections of three single phase transformers: star-star, star-delta, delta-delta and delta-star.
5. Scott Connection. To convert 3-phase to 2-phase supply
6. Load test on three phase induction motor and performance evaluation, (torque-speed, BHP-efficiency, slip BHP, etc).
7. No-load and blocked rotor test on three phase induction motor to calculate parameters of equivalent circuit diagram and performance evaluation.
8. No-load and blocked rotor test on three phase induction motor to draw the circle diagram and hence the performance evaluation of given motor.
9. Speed control of three phase slip ring induction motor by rotor resistance.
10. Load test on single phase induction motor and performance evaluation (torque-speed, BHP- efficiency, slip -BHP, etc)

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Electrical and Electronics Measurement Laboratory	
Subject Code: UEE356L	**Credits: 01**
Contact Hours: 02 (0L-0T-2P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Student shall be able to use measuring devices and sensors.
2. Student shall be able to analyze electrical circuits from the reading and results obtained from various circuits.
3. Student shall be able to interpret the analysis results obtained and drive inference for the given circuits/systems.

List of Experiments:

1. Measurement of low resistance using Kelvin's double bridge.
2. Measurements of inductance using Maxwell's L-C bridge and determination of Q factor.
3. Measurements of capacitance using De-sauty's bridge and determination of dissipation factor.
4. Adjustment and calibration of l-Φ Energy meter.
5. Measurement of power in a balanced 3-phase circuit using two wattmeter's for star and delta connected loads.
6. Evaluation of transfer characteristics of Resistance Temperature Detector (RTD) using RTD module.
7. Evaluation of transfer characteristics of Light Dependent Resistor (LDR) using LDR module.
8. Evaluation of transfer characteristics of Semiconductor Temperature Sensor using LM35 sensor module/unit.
9. Evaluation of transfer characteristics of Linear Variable Differential Transformer using LVDT module.

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Network Analysis Laboratory	
Subject Code: UEE357L	**Credits: 01**
Contact Hours: 02 (0L-0T-2P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Student shall be able to identify and use the voltage & current sources and other passive elements of electrical networks
2. Student shall be able to verify the electric network theorems and analyze the behavior of circuit elements
3. Student shall be able to interpret the analytical calculations with experiments results of the circuit analysis

List of Experiments:

4. Determination of equivalent resistance in complex electric circuits with star and delta conversions
5. Determination of Average value, rms value, Form factor, Peak factor of sinusoidal wave and square wave
6. Verification of source transformation and source shifting
7. Verification of Kirchhoff's voltage and Current law (AC and DC)
8. Verification of mesh analysis (With all possible combinations of Voltage and Current sources including a supermesh, AC and DC)
9. Verification of node analysis (With all possible combinations of Voltage and Current sources including a supernode, AC and DC)
10. Verification of super position theorem
11. Verification of reciprocity theorem
12. Verification of maximum power transfer theorem with both resistive and impedance loads
13. Verification of Thevenin's, Norton's and Milliman's theorem
14. Determination of frequency response for series resonance circuits
15. Determination of frequency response for parallel resonance circuits
16. Determination of transient response of current in RL and RC circuits with step voltage input
17. Determination of two port network parameters Short Circuit admittance, parameters, open circuit impedance parameters, transmission parameters and hybrid parameters

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Semester-4 **CAY 2021-22 (175 Credits 2020-21 admitted batch)**

Sl.	Sub Code	Subject	C	Hrs/ Week			Exam Marks		
				L	T	P	CIE	SEE	Total
01	UMA435C	Statistical Methods for Electrical Science	3	3	0	0	50	50	100
02	UEE451C	Signals and Systems	4	3	2	0	50	50	100
03	UEE452C	Power Electronics	4	4	0	0	50	50	100
04	UEE453C	Operational Amplifiers and Linear IC's	4	4	0	0	50	50	100
05	UEE454C	DC Machines and Synchronous Machines	4	4	0	0	50	50	100
06	UEE456L	Power Electronics Laboratory	1	0	0	2	50	50	100
07	UEE457L	DC Machines and Synchronous Machines Laboratory	1	0	0	2	50	50	100
08	UEE458L	Linear IC's Laboratory	1	0	0	2	50	50	100
09	UMA430M	Bridge Course Mathematics-II*	0	3	0	0	50	50	100
10	UHS001N	Fundamentals of Quantitative Aptitude & Soft Skills	1	2	0	0	50	50	100
11	UHS226M	Constitution of India**	0	2	0	0	50	50	100
12	UHS488C	Saamskrutika Kannada***	1	2	0	0	50	50	50
		OR							
13	UHS489C	Balake Kannada***	1	2	0	0	50	50	50
Total			24	27	02	06	600	600	1150

*Bridge Course Mathematics –II	:	is a mandatory subject only for students admitted to 4th Semester through lateral entry scheme (Diploma quota). Passing the subject is compulsory, however marks will not be considered for awarding grade /class. A PP/NP grade will be awarded for passing/not passing the subject.
**Constitution of India	:	is a mandatory subject for lateral entry students. Question Paper will be of Objective type. Students have to pass the subject compulsorily, however marks will not be considered for awarding Grade / Class /Rank.
***Saamskrutika Kannada ***Balake Kannada	:	Is for students who speak read and write kannada Is for non-kannada speaking reading and writing

Legend for Scheme	L	Lecturer	T	Tutorial	P	Practical	M	Mandatory
Legend in Subject code	C	Core	E	Elective	C	Credits		

Question paper pattern for Theory SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than 4 sub divisions.
3. Any five full questions are to be answered choosing at least one from each unit

Laboratory Assessments for SEE:

4. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
5. Allocation of 50 marks for CIE Performance and journal write-up: Marks for each experiment = 30 marks / No. of proposed experiments. One Practical test for 20 marks, (5 write up, 10 conduction, calculation, results etc., 5 viva-voce).
6. Allocation of 50 marks for SEE: 25% write up, 50% conduction, calculation, results etc., 25% viva-voce

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Signal and Systems	
Subject Code: UEE451C	**Credits: 04**
Contact Hours: 05 (3L-2T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Students shall be able to classify different types of signals and systems.
2. Students shall be able to list and define different types of elementary signals and systems.
3. Students shall be able to derive the properties of signals and systems, convolution, Fourier series, Fourier transform and Z transform.
4. Students shall be able to solve convolution sum and integral, CTFS and DTFS.
5. Students shall be able to decide the stability of system in the Z domain for different types of systems.
6. Students shall be able to construct the continuous time and discrete time system using direct form-I and canonical form.

Lecture –Theory/Derivations 3 Credits (13x3=39 Hrs)	**Lecture Hours**	**Tutorials –Numerical 1 Credit (13x2=26 Hrs)**	**Tutorial Hours**
Unit -I (10 Hrs)		**Unit -I (07 Hrs)**	
Introduction: Definitions of signals and systems, classification of signals, basic operations on signals, Elementary signals, and systems viewed as interconnections of operations, properties of systems.	**10**	• Numerical on • Numerical on systems and properties of systems • Numerical on system viewed interconnection	**07**
Unit -II (10 Hrs)		**Unit -II (07Hrs)**	
Time-domain representation for LTI systems: Convolution, impulse response representation, properties impulse response representation, block diagram representations.	**10**	• Numerical on convolution of continuous and discrete time systems • Numerical on properties of systems • Numerical on block diagram representation on both continuous and discrete system	**07**
Unit -III (09 Hrs)		**Unit -III (07Hrs)**	

Fourier Analysis of periodic and aperiodic signals: Introduction, Properties of continuous-time Fourier series (excluding derivation of defining equations for CTFS), Fourier representation of discrete-time periodic signals, properties of discrete-time Fourier series (DTFS).	**09**	• Numerical on DTFT • Numerical on DTFS • Numerical on CTFS	**07**
Unit -IV (10 Hrs)		**Unit -IV (05 Hrs)**	
Z-Transforms: Introduction, Z transform, properties of ROC, properties of the Z - transform, inversion of Z -transform, Long division method, Partial fraction expansion method, Transfer function, causality and stability,	**10**	• Numerical on Z transform and properties of Z transform • Numerical on LTI system in Z transform	**05**

Reference Books:

1. Simon Haykin and Bary Vam Veen, "Signals and Systems," John Wiely and Sons, 2nd Edition 2014.
2. H P HSU, "Signals and Systems," Schaums Outline, TMH, 2nd Edition 2011.
3. Michel J Roberts, "Signals and Systems-Analysis of signals through linear systems" TMH, 2003.
4. Alan V Oppenheim, Alan S.Will sky and S.hamid Nawab, "Signals and Systems," Pearson Education, Indian Reprint, 2nd Edition 2013.

Basaveshwar Engineering College (Autonomous)
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Department of Electrical and Electronics Engineering

Power Electronics	
Subject Code: UEE452C	**Credits: 04**
Contact Hours: 04 (4L-0T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:
Students able to

1. Recall, list and define the various semiconductor switches employed in power electronics circuits
2. Students able to describe the operation and switching characteristics of switches and operation of various power converters.
3. Derive the expressions of performance parameters for various power converters connected to R and R L loads
4. Analyze power converter circuits and its behavior and resolve the output parameters connected to R and R-L loads.
5. Design various components for choppers, commutation circuits and snubber elements of switching elements
6. Assess the impact of source and load inductance on operation of power converter and summarize the impact in industrial application.

UNIT-I	
Introduction:	**02**
Introduction to power electronics, block diagram of power electronic converter system, applications of power electronics. Types of power electronic circuits and their peripheral effects.	
Power Transistors:	**06**
Introduction to Power BJT's, MOSFETs and IGBT's – static characteristics, switching characteristics, switching limits, di/dt and dv/dt protection, cooling, heat sinks and snubber circuits.	
Thyristors	**05**
Introduction, static characteristics, two transistor model. Switching characteristics, di/dt and dv/dt protection.	
UNIT-II	
Controlled Rectifiers:	**13**
Introduction. Classification of rectifiers, principle of phase controlled converter operation. Single- phase half wave, semi-converters and full converters and problems. Three-phase half wave, semi converters and full converters with R, R-L, R-C and RLE load. Performance evaluation of Rectifier, Effects of Load and Source Inductances.	
UNIT-III	
Commutation Techniques:	**05**
Introduction. Natural commutation, forced commutation: self commutation, impulse commutation, resonant pulse commutation and complementary commutation.	
DC –DC Converter	

Introduction. Principle Operation of dc-dc converter, Buck and Boost converter, Control Strategies: constant frequency, Variable Frequency, Four quadrant operation of dc-dc converter. Derivation of duty cycle of buck and boost converter for continuous mode of operation, Introduction for discontinues mode of operations	**08**
UNIT-IV	
Inverters:	
Introduction. Types of inverters, performance parameters, principle of operation of half bridge and full bridge inverters with R and R-L load. Three phase inverter configuration to operate with 120 and 180 degree modes. Voltage control of single-phase inverters – single pulse width modulation, multiple pulse width modulation and sinusoidal pulse width modulation and Current source inverters.	**08**
AC Voltage Controllers: Introduction. Principle of ON-OFF control and phase control. Single-phase half wave and full wave AC voltage controllers with resistive and inductive loads.	**05**

Reference Books:

1. M.H.Rashid “Power Electronics”, 3rd - Edition, P.H.I./Pearson, New Delhi, 2002.
2. Mohan, Undeland, Robbins” Power Electronics” Wiley Edition 2003
3. P.S.Bimbra, “Power Electronics”**,** IV- edition, Khanna Publishers, 2009.
4. G.K. Dubey, S.R. Dorodla, A. Joshi and R.M.K. Sinha, “Thyristorised Power Controllers”, New Age International Publishers, 2005.
5. M.D. Singh and Khanchandani K.B., “Power Electronics**”,** 2nd - Edition Khanna Publisher, 2007.

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Operational Amplifiers and Linear IC's	
Subject Code: UEE453C	**Credits: 04**
Contact Hours: 04 (4L-0T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes

At the end of this course,

1. Student should be able to explain the characteristics of Op-Amp.
2. Student should be distinguish the operational function of the amplifier.
3. Student should be able to explain about the AC amplifier.
4. Student should be able to define the frequency response of op-amps.
5. Student should be able to design the application of op-amp.
6. Student should be able to evaluate the various types of the filters.

Unit-I

Op-Amps: L-05 Hours

Block diagram and characteristics of 741 Op-amp, Op-amp as an inverting and non- inverting amplifier, voltage follower, adder, subtractor, integrator and differentiator.

Op-Amps as AC Amplifier: L -08 Hours

Capacitor coupled voltage follower, high Z_{in} capacitor coupled voltage follower, capacitor coupled non- inverting amplifier, high Zin capacitor coupled non - inverting amplifier, capacitor coupled inverting amplifier, setting the upper cut - off frequency, capacitor coupled difference amplifier and use of single polarity supply.

Unit-II

Op-Amps Frequency Response and Compensation: L-08 Hours

Op-amp circuit stability, frequency and phase response, frequency compensating methods, manufacture's recommended compensation, op-amp circuit band width, slew rate effects, stray capacitance effects, load capacitance effects, Z_{in} mod compensation and circuit stability precautions.

Signal Processing circuits: L-05 Hours

Precision half wave & full wave rectifiers, limiting circuits, clamping circuits, peak detectors, sample and hold circuits.

Unit-III

Op-amp Nonlinear circuits: L-06 Hours

Op-amps in switching circuits, zero crossing detectors, inverting Schmitt trigger circuit, non inverting Schmitt circuit. Astable multivibrator and mono-stable multivibrator using 555 timer.

Signal Generator: L-07 Hours

Triangular/Rectangular wave generator, waveform generator design, phase shift oscillator, oscillator amplitude stabilization, Wein bridge oscillator, signal generators output controls.

Unit-IV

Active filters: L- 09 Hours

First and second order high pass and low pass filters, band stop and band pass filters.

D.C Voltage Regulators: L-04 Hours

Voltage regulators basics, voltage follower regulator, adjustable output regulator, LM217 and LM237 integrated circuit voltage regulators

References:

1. David A. Bell, "Operational Amplifier and Linear ICS", 3rd edition, Oxford, 2012.
2. Ramakanth A. Gayakwad, "Operational Amplifier and Linear ICS", 4th edition, PHI, 2016.
3. R.F. Coughlin & F.F. Driscoll, "Operational Amplifier and Linear ICS", 6th edition, PHI, 2015.
4. Bruce Carter and Ron Mancini, "OP AMPS for everyone", 4th edition, Elsevier, 2013.

Dc Machines and Synchronous Machines	
Subject Code: UEE454C	**Credits: 04**
Contact Hours: 04 (4L-0T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Student shall be able to explain the principle operation construction and classification of both AC and DC machines
2. Students shall be able to explain the performance operation of both AC and DC machines
3. Students shall be able to identify the machines for different operations/applications by using operating characteristics of machines
4. Students shall be able to calculate different parameters like losses and efficiency by conducting different tests on different machines and gives the conclusion
5. Students shall be able to solve the numerical and compare the results
6. Students shall be able to select the machines for different field applications and identify the significance of parallel operation

UNIT - I	
DC Generator:	**08**
Constructional features, emf equation, types of excitation, types of dc generator, no load and load characteristics, armature reaction, calculation of demagnetizing and cross magnetizing AT/pole, compensating winding, commutation, inter poles, application of dc generators.	
DC Motors:	**05**
Principle of Operation, types, torque equation, characteristics and application of D.C. motors, starters.	
UNIT - II	
Speed control of DC Motor:	**05**
Flux and armature control, Ward Leonard method. Electrical braking of DC motors.	
Testing of D.C Motors:	**08**
Losses in DC. Machine, Efficiency, direct load test on DC machine, Swinburne's test, Hopkinson's test, retardation test, Field's test on DC. Series motors.	
UNIT – III	
Synchronous Machines:	**13**
Construction of salient and non-salient pole synchronous Machines, Advantages of stationary armature, emf equation for generator, effect of distribution and chorded coils, effects of harmonics on emf generated of poly-phase armature windings, phasor diagram of a Synchronous generator with cylindrical rotor, calculation of voltage regulation by EMF, MMF, ZPF, and ASA methods. Phasor diagram and regulation of a salient pole synchronous generator, slip test.	
UNIT – IV	
Parallel Operations Of Generators:	**05**

Parallel operation and stability, operation on infinite bus, operating characteristics, power flow equations of Alternators.	
Synchronous Motors:	**08**
Principle of operation, methods of starting, phasor diagram, effect of changing excitation, two reaction model, V and inverted V curves of synchronous machines, hunting in synchronous machines, effect of damper windings, synchronous condensers.	

Reference Books:

1. I J Nagarath and DP Kothari, "Electrical machines", 4th - Edition, TMH, New Delhi.
2. B . L .Thereeja Electrical technology val -II
3. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai Publications, 2nd Edition, 2014.
4. M. G. Say, Performance and design of AC machines, CBS publishers.
5. P.S. Bhimra, "Electrical machinery", Khanna publishers. 7th Edition 2008.
6. Alexander Lngsdorf, "Theory of alternating current machines", TMH, 2nd Edition 2008

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Power Electronics Laboratory	
Subject Code: UEE456L	**Credits: 01**
Contact Hours: 02 (0L-0T-2P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Students shall be able to explain the basic operation of various power semiconductor devices and passive components.
2. Students shall be able to apply power electronic circuits for different loads.
3. Students shall be able to demonstrate the ability to apply what they have learned theoretically in the field of Power electronics

List of Experiments:

1. Static characteristic of SCR
2. Static and Switching characteristic of IGBT and MOSFET.
3. Static characteristic of TRIAC.
4. Study of SCR firing circuit(R,RC, UJT).
5. Single Phase half wave controlled rectifier with R and RL load.
6. Single phase half controlled bridge rectifier with R and RL load.
7. Single phase fully controlled bridge rectifier with R and RL load.
8. Speed control of a separately excited D.C. motor using an IGBT an MOSFET chopper.
9. Study of SCR commutation circuit
10. Half wave and Full wave bridge Inverter for R and RL load

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DC Machine and Synchronous Machines Laboratory	
Subject Code: UEE457L	**Credits: 01**
Contact Hours: 02 (0L-0T-2P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Students shall be able to identify the related experiment and do the necessary connections for the defined experiment
2. Students shall be able to conduct necessary task on the machines (AC/DC) to note down the related data.
3. Students shall be able to calculate the necessary parameters for the data obtained from the experiments and analyze the related characteristics

List of Experiments:

1. OCC characteristics of D.C. Shunt generator.
2. Load characteristics of a D.C. generator.
3. Load test on a DC motor- determination of speed-torque and BHP-efficiency characteristics
4. Speed control of DC motor by armature voltage control and flux control.
5. Swinburne's test.
6. Ward Leonard method of speed control of D.C. motor.
7. Hopkinson's Test.
8. Fields test on series motors.
9. Voltage regulation of alternator by EMF, MMF, method.
10. Voltage regulation of alternator by ZPF method.
11. Synchronization of Alternator with infinite bus.
12. V and Inverted V curves of a synchronous motor

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Linear Integrated Circuits Laboratory	
Subject Code: UEE458L	**Credits: 01**
Contact Hours: 02 (0L-0T-2P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Students shall be able to design Op-Amp circuits and analyze simple applications of above circuits.
2. Students shall be able to design Filter circuits and understand the principles of timers and oscillators.
3. Students shall be able to design and analyze rectifier circuits.

List of Experiments:

1. Study of Op-Amp as

a. Inverting and non inverting amplifier

b. Integrator and differentiator.

2. Study of Op-Amp as

a. Voltage follower

b. Adder and substractor

3. Study of Op-Amp as zero crossing detector

4. Study of Op-Amp as Schmitt trigger

5. Study of Op-Amp as triangular and rectangular wave generator.

6. Design and testing of Op-Amp based RC phase shift oscillator.

7. Design and testing of Op-Amp based RC Wein bridge oscillator.

8. Study of rectifiers using Op-Amp.

9. Design and testing of filters of the first and second order using Op-Amp.

10. Study of Astable multivibrator using Op-Amp.

11. Study of Astable multivibrator using 555 timer