Undergraduate Degree Courses in Engineering & Technology

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)

General, Course structure & Theme
&
Semester-wise credit distribution

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 2 Hours Practical (Lab)/week	0.5 credits 1 credit

B. Structure of Undergraduate Engineering program:

S. No.	Category	Suggested Breakup of Credits (Total 160)
1.	Basic Science Courses (BSC)	20
2.	Engineering Science Courses (ESC)	30
3.	Humanities, Social Science and Management Courses (HSMC)	10
4.	Professional Core Courses (PCC)	60
5.	Professional Elective Courses (PEC)	18
6.	Open Elective Courses (OEC)	14
7.	Seminar	2
8.	Project	10
9.	Internships in industry	8
10.	Mandatory Courses (MC)	NC
	Total Credits	172

C. Course code and definition:

Course code	**Definitions**
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses

**Minor variation is allowed as per need of the respective disciplines.*

B.E II Year (Semester-III) Electrical Engineering
Course Structure & Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Contact Hours			Sessional Marks			End Semester Marks			Credits
				L	T	P	CT	TA	Total	TE	PE	Total	
1	BSC	BSC-301	Mathematics III	3	1	0	30	10	40	60	-	100	**4**
2	PCC	BEE-301	Network Analysis and Synthesis	3	1	0	30	10	40	60	-	100	**4**
3	PCC	BEE-302	Electrical Machines - I	3	1	0	30	10	40	60	-	100	**3**
4	PCC	BEE-303	Solid state Devices and Circuits	3	0	0	30	10	40	60	-	100	**3**
5	ESC	BEC-301	Digital Electronics	3	0	0	30	10	40	60	-	100	**3**
6	MC	MC-302	Human Values and Professional Ethics	2	0	0	30	10	40	60	-	100	**0**
7	ESC	BEC-351	Digital Electronics Lab	0	0	2	20	20	40	-	60	100	**1**
8	PCC	BEE-351	Electrical Machines Lab - I	0	0	2	20	20	40	-	60	100	**1**
9	PCC	BEE-352	Solid state Devices and Circuits Lab	0	0	2	20	20	40	-	60	100	**1**
10	Project/Internship	BEE-353	Mini-project/ Internship Assessment	0	0	0	-	-	100	-	-	100	**2**
			Total	**17**	**3**	**6**	**240**	**120**	**460**	**360**	**180**	**1000**	**22**

B.E II Year (Semester-IV) Electrical Engineering
Course Structure & Evaluation Scheme

Sr. No.	Category	Course Code	Course Title	Contact Hours			Sessional			End semester Exam			Credit
				L	T	P	CT	TA	Total	TE	PE	Total	
1	PCC	BEE401	Electrical Measurements & Instruments	3	1	0	30	10	40	60	-	100	4
2	ESC	BEC404	Linear Integrated circuits	3	0	0	30	10	40	60	-	100	3
3	PCC	BEE402	Electrical Machines- II	3	1	0	30	10	40	60	-	100	4
4	PCC	BEE403	Electromagnetic Theory	3	1	0	30	10	40	60	-	100	4
5	ESC	BCS402	Data Structures and Algorithms	3	0	0	30	10	40	60	-	100	3
6	MC	MC401	Environment and Ecology	2	0	0	30	10	40	60	-	100	0
7	PCC	BEE451	Measurements & Instrumentation Lab	0	0	2	20	20	40	-	60	100	1
8	ESC	BEC454	Linear Integrated Circuits Lab	0	0	2	20	20	40	-	60	100	1
9	PCC	BEE452	Electrical Machines Lab-II	0	0	2	20	20	40	-	60	100	1
10	ESC	BCS452	Data Structures and Algorithms Lab	0	0	2	20	20	40	-	60	100	1
			Total	**17**	**3**	**8**	**260**	**140**	**400**	**360**	**240**	**1000**	**22**

BCS-301 MATHEMATICS-III (L-T-P-C: 3-1-0-4)
III SEMESTER (ECE, CSE, EE, ME, CE)

L T P C
3 1 0 4

Course Details:

Unit – I:

Fourier Transform : (9 Hours)

Fourier integral, conditions of convergence, Fourier sine and cosine integrals, complex form, applications, Inversion formula for Fourier transform, operational properties. Discrete and Fast Fourier transform. Applications of Fourier transform to solve boundary value problems.

Unit- II:

Functions of a Complex Variable and Conformal mapping: (10 Hours)

Limit, Continuity, Differentiability and Analyticity of functions of a complex variable, Cauchy-Riemann equations, Harmonic functions, Complex functions as mappings, Linear Transformation, Inverse transformation, Bilinear Transformations, Conformal Mapping & applications.

Unit- III:

Integration of Complex Functions: (10 Hours)

Contour integrals and evaluations, Cauchy's Theorem, Cauchy's Integral Formulae, Liouville's theorem, Convergence of power series, Taylor series, Laurent series, Zeros and Singularities of a complex function, Residues and Residue theorem, Evaluation of definite and improper integrals.

Unit- IV:

Curve- Fitting & Probability: (8 Hours)

Curve-fitting: method of least- squares, Normal equations, Normal equation in case of straight line, Fitting a straight line, Polynomial, non-linear and exponential curves, Change of origin.

Probability: Basics of probability, random variables, Expectation, Baye's theorem and probability distributions, Binomial, Poisson and Normal distributions.

Unit- V:

Statistical Methods: (8 Hours)

Sampling Theory, Parameters of Statistics, Tests of hypothesis and significance, z-test, t-test, $\chi 2$- **test ,**Goodness of fit test**,** Time series analysis, Index numbers, Quality control chart and acceptance sampling, Introduction to design of experiments, Forecasting models.

Books Recommended:

1.R.K. Jain & S.R.K. Iyengar; Advanced Engineering Mathematics, Narosa Publishing House, 2002.
2.Erwin Kreyszig; Advanced Engineering Mathematics, John Wiley & Sons, 1962.
3.R.V. Churchill and J.L. Brown, Complex Variables and Applications, McGraw Hill, 1990.
4.B.S.Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
5.J.H. Mathews and R.W. Howell, Complex analysis for Mathematics and Engineering, 3rd Ed. Narosa, 1998.

BEE-301 NETWORK ANALYSIS AND SYNTHESIS (L-T-P-C: 3-1-0-4)

Unit – I: Graph Theory (8 Hours)

Graph of a network, Definitions, Tree, Co tree, Link, basic loop and basic cut set, Incidence matrix, Cut set matrix, Tie set matrix, Node and Mesh Analysis with dependent current and voltage sources. Mutual coupled circuits, Dot Convention in coupled circuits

Unit – II: Network Theorems - Applications to AC Networks (8 hours)

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Compensation theorem, Concept of duality and dual networks

Unit – III: Network Transient and steady state analysis (10 Hours)

Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response, Evaluation of time response both through classical and Laplace methods

Unit – IV Network Functions (8 Hours)

Concept of complex frequency, Transform impedances network functions of one port and two port networks, Concept of poles and zeros, Properties of driving point and transfer functions.

Two Port Networks- Characterization of LTI two port networks; Z, Y, ABCD, A'B'C'D', g and h parameters, Reciprocity and symmetry, Inter-relationships between the parameters, Interconnections of two port networks, Ladder and Lattice networks: T & Π representation

Unit – V Network Synthesis (6 Hours)

Positive real function; definition and properties, Properties of LC, RC and RL driving point functions, Synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms

Text Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall of India
2. Alexander, Sadiku, "Fundamentals of Electric Circuits", McGraw Hill
3. D. Roy Choudhary, "Networks and Systems", Wiley Eastern Ltd.
4. C. L. Wadhwa, "Network Analysis and Synthesis", New Age International Publishers
5. A. Chakrabarti, "Circuit Theory", Dhanpat Rai & Co.

Reference Books:

1. Hayt, Kimmerly, Durbin, "Engineering Circuit Analysis", McGraw Hill
2. Donald E. Scott, "An Introduction to Circuit analysis: A System Approach", McGraw Hill
3. M. E. Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd.
4. T. S. K. V. Iyer, "Circuit Theory", Tata McGraw Hill 5. Joseph A. Edminister, " Theory & Problems of Electric Circuits", McGraw Hill

BEE-302 ELECTRICAL MACHINES-I (L-T-P-C: 3-0-0-3)

Unit – I: Electro-Mechanical Energy Conversion (6 Hours)

Faraday's law and Lenz's law - time varying and rotational induced emfs – Energy balance, energy and coenergy – force and torque – singly and doubly excited systems – reluctance and mutual torques.

Unit – II: Basic Concepts in Electrical Machines (9 Hours)

Construction – Principle of operation - Windings: D.C Machine armature winding (lap and wave connection), field winding – MMF pattern of armature winding and field winding – Magnetic fields in rotating machinery - EMF and torque equations – losses in machines – armature reaction – commutation – Interpoles and compensating windings

Unit – III: DC machine - motoring and generation (9 Hours)

Armature circuit equation for motoring and generation – methods of excitation, equivalent circuits and characteristics of generators and motors – testing and efficiency – starting - speed control, Ward-Leonard control - braking, Permanent Magnet DC Machines

Unit – IV: Transformers (8 Hours)

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test
Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers

Unit – V: Special Purpose Transformers (8 Hours)

Autotransformers - construction, principle, applications and comparison with two winding transformer, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers, Instrument Transformers. Harmonics and switching transients in transformers, effect of transformer connections, inrush current, cooling of transformers

Text / References

1. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
2. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
3. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
4. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
5. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

BEE-303 SOLID STATE DEVICES AND CIRCUITS (L-T-P-C: 3-0-0-3)

Unit – I: PN junction Devices (7 Hours)

PN junction diode – structure, operation and V-I characteristic – current equation – drift current density and diffusion current density – diffusion and transient capacitance – Zener breakdown – zener reverse characteristic – zener as regulator; Optoelectronic devices - LED, LCD and LASER

Unit – II: BJT circuits (8 Hours)

Structure and I-V characteristics of a BJT; BJT as a switch, BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

Unit – III: MOSFET circuits (8 Hours)

MOSFET structure and I-V characteristics; MOSFET as a switch, MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

Unit – IV: Feed-back amplifiers and oscillators (9 Hours)

Principles of feedback in amplifiers advantages of negative feedback, Classification of feedback, voltage series, and voltage shunt, current series, Current – shunt effect of feedback on input and output impedance, Gain, stability, noise, distortion and band width Barkhausen criterion for sinusoidal oscillators. Phase shift oscillator. Wein-bridge oscillator, Hartley oscillator, Colpitts oscillator, crystal oscillator, frequency stability

Unit – V: Power Amplifiers (9 Hours)

Classification of Output stages A/B/AB, single-ended and Push-Pull Configuration, Power dissipation and Output Power conversion efficiencies, complimentary-symmetry Power Amplifier. Power BJTs, MOS Power Transistors, Temperature effects
Tuned Amplifiers:, Tuned Voltage Amplifier, single and double tuned amplifiers, Class-C Amplifier, RF Amplifiers.

Text/References:

1. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.
2. David A. Bell, Electronic devices and circuits, Prentice Hall of India, 2004.
3. Rashid, Microelectronic circuits, Thomson publications, 1999
4. J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.
5. Boylstad & Neshlshky/Electronics Devices & Circuits/PHI
6. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.

BEE-305 DIGITAL ELECTRONICS (L-T-P-C: 3-0-0-3)

Unit I : Digital Fundamentals (8 Hours)
Number Systems – Decimal, Binary, Octal, Hexadecimal, 1,,s and 2,,s complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.

Unit II : Combinational Logic Design (8 Hours)
Design Examples: Arithmetic Circuits, BCD - to – 7 segment decoder, Code converters. Adders and their use as subtractor, look ahead carry, Digital Comparator, Parity generators/checkers, Multiplexers and their use in combinational logic designs, multiplexer , De-multiplexers and their use in combinational logic designs, Decoders, demultiplexer.

Unit III : Sequential Logic Design (9 Hours)
1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip-flops, Conversion of flip flops, Application of Flip flops: Registers, Shift registers, Counters, Sequence Generators, ripple counters, up/down counters, synchronous counters. Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation

Unit IV : Digital Logic Families (8 Hours)
Classification of logic families, Characteristics of digital ICs-Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements. TTL logic. Operation of TTL NAND gate, active pull up, wired AND, open collector output. Tri-State logic. CMOS logic – CMOS inverter, NAND, NOR gates, wired logic , open drain output. Interfacing CMOS and TTL. Comparison table of Characteristics of TTL, CMOS, ECL, RTL, I2L, DCTL.

Unit V : Programmable Logic Devices and Semiconductor Memories (7 Hours)
Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, Designing combinational circuits using PLDs. General Architecture of FPGA and CPLD Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM,ROM,EPROM, EEPROM, NVRAM, SRAM,DRAM.

TextBooks:

1. R.P. Jain , "Modern digital electronics" , 3rd edition , 12threprint Tata McGraw Hill Publication, 2007.
2. M. Morris Mano, "Digital Logic and Computer Design" 4th edition, Prentice Hall of India, 2013.

Reference:

1. Anand Kumar, "Fundamentals of digital circuits" 1st edition, Prentice Hall of India, 2001
2.Tokheim, H. Roger L. /"Digital Electronics Principles & Application"/ Tata McGraw-Hill / 6th Ed.
3. NPTEL video lectures on Digital Circuits.

MC 302/MC 402 Human Values and Professional Ethics (L-T-P-C: 2-0-0-0)

UNIT-1 Introduction (4 Hours)

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations.

UNIT-2 Understanding Harmony in the Human Being (4 Hours)

Understanding Harmony in the Human Being - Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT-3 Understanding Harmony in the Family and Society (4 Hours)

Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti (Mutual Happiness); Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and disrespect; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society.

UNIT-4 Understanding Harmony in the Nature and Existence (4 Hours)

Whole existence as Co-existence Understanding the harmony in the Nature, Interconnectivity and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT-5 Holistic Understanding of Harmony (4 Hours)

Implications of the Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco friendly production systems, technologies and management models. Improving quality of work life at work place.

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

References:

1. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
2. R. Subramanian,2017, Professional Ethics,
3. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
4. A N Tripathy, 2003, Human Values, New Age International Publishers.
5. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
6. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
7. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
8. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
9. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

BEE-401 ELECTRICAL MEASUREMENT AND INSTRUMENTS L-T-P-C: 3-0-0-3

Unit – I: Introduction to Measurement (8 Hours)

Measurement system, Methods of measurement, Classification of instrument systems, Characteristics of instruments, Unit, Dimensions, Standards, Scientific notations
Introduction to Error, Errors in Measurement & Measurement standards, Gross error, Systematic error, Absolute error, Relative error, Accuracy, Precision, Resolution, Measurement error combination

Unit – II: Transducers (8 Hours)

Transducers, Definition, Types of transducers, Selection of transducers, Advantages of transducers, Applications of transducers, Characteristics, Factors affecting the choice of transducers, Strain gauges, Resistance thermometer, Thermistors, Thermocouples, Linear variable differential transformer, Inductive transducers, Capacitive transducers, Piezoelectric transducers.

Unit – III: Measuring Instruments (8 Hours)

Electronic digital multimeter, Digital frequency meter system, Galvanometer, Voltmeter, Ammeter, Ohm meter, Energy meter, Q-meter

Measurement of Resistance: Resistance measurement, Measurement of low, medium and high resistances, Wheatstone bridge.

Measurement of Inductance And Capacitance: AC bridges for inductance measurement, AC bridges for capacitance measurement, Applications of bridges in measurement system.

Unit – IV: Display Devices (8 Hours)

Cathode Ray Oscilloscope (CRO): Circuit (Block diagram), Cathode Ray Tube (CRT) & its components, Applications of CRO in measurement, Measurement of voltage, frequency and phase by CRO, Types of CRO, Digital Storage Oscilloscope (DSO), Applications of Digital Storage Oscilloscope

Special Devices: Spectrum Analyzer, Logic Analyzer, Digital Multimeter as a standard instrument, Data Loggers, Digital Read Out Systems, Digital Input-Output devices.

Unit – V: Telemetry and Data Acquisition Systems (8 Hours)

Introduction to telemetry, Telemetry types, Landline telemetry, Radio telemetry, Telemetry applications. Introduction to Data acquisition systems, Data acquisition systems types, Analog Data acquisition systems and Digital Data acquisition systems, Data acquisition systems applications.

Text / Reference Books

1. A. K. Sawhney, “Advanced Measurements & Instrumentation”, Dhanpat Rai & Sons
2. Rajendra Prasad, “Electronic Measurement and Instrumentation Khanna Publisher
3. M.M.S. Anand, “Electronic Instruments and Instrumentation Technology” PHI Learning.
4. W. D. Cooper and A.P. Beltried, “Electronics Instrumentation and Measurement Techniques” Prentice Hall International
5. David A. Bell, “Electronic Instrumentation and Measurements”, Oxford University Press.
6. Oliver and Cage, “Electronic Measurements and Instrumentation”, Tata McGraw Hill Publication.
7. Alan S. Morris, “Measurement and Instrumentation Principles”, Elsevier (Butterworth Heinmann).

BEE-402 LINEAR INTEGRATED CIRCUITS L T P C 3 1 0 4

Unit I : OP-AMP Basics (9 Hours)

Introduction, , Differential Amplifier configurations, DC & AC analysis of all Differential amplifier configurations, Swamping resister, Constant current Bias, Current Mirror Circuits, Level Translator. Block diagram of OP-AMP. Op-amp internal circuit, Basic information of Op-amp, Op-amp charachteristics**,** Voltage series and voltage shunt feedback amplifier and its effect on Ri, Ro, bandwidth and voltage gain.

Unit II : Linear & Non-linear Applications of OP-AMP (9 Hours)

Inverting and Non-inverting amplifier, voltage follower. Summing, averaging, scaling amplifier, difference amplifier, Ideal integrator, practical integrator with frequency response, Ideal differentiator, practical differentiator with frequency response, Instrumentation amplifiers. Comparator, Schmitt trigger, clippers and clampers, voltage limiters, Square wave generator, triangular wave generator, peak detectors, sample and hold circuits.

Unit III : Filters & Oscillators (9 Hours)

Types of filter (LP,HP,BP, and Notch), first order & second order low-pass & High-pass filter. Oscillators principle, types and frequency stability, design of phase shift, wein bridge, Quadrature, voltage controlled oscillators.

Unit IV : Voltage Regulator & Converters (9 Hours)

Transistorized series-pass Regulator, overload short circuit protection, fixed & adjustable voltage regulators (LM317, 723 regulators), SMPS V-F, I-V and V-I converter, DAC: types of DAC, Weighted resister, R-2R ladder. ADC: types of ADC, Flash type, counter type, successive approximation resister.

Unit V : Signal generators and wave shaping circuits (9 Hours)

IC Timer-555, internal structure, pin diagram, monostable and astable operation. 565 Phase locked loop PLL, Block diagram of PLL and its function, VCO, Phase detector, applications of PLL, ICL 8038 function generator IC, isolation amplifiers, opto coupler, opto electronic ICs.

TEXT BOOKS:

1. Ramakant A.Gayakwad, Op-amps and Linear Integrated Circuits, IV edition, Pearson Education, 2009 / PHI.
2. D. Roy Choudhery, Sheil B. Jain, Linear Integrated Circuits, second edition, New Age publishers, 2010.

REFERENCES:

1. Robert F Coughlin, Fredrick, F. Driscold, Opamp and linear ICs, Pearson education, 4th edition, 2002.
2. David A Bell, Opamp and linear ICs, second edition, Prentice hall of India,1997.
   David L Terrel, Opamps – design, applications and trouble shooting, Elsevier 2007.

BEE-307 ELECTRICAL MACHINES – II (L-T-P-C: 3-1-0-4)

UNIT-I Synchronous Generator (8 Hours)

Constructional details – Types of rotors –winding factors- emf equation – Synchronous reactance – Armature reaction – Phasor diagrams of non-salient pole synchronous generator connected to infinite bus–Synchronizing and parallel operation – Synchronizing torque -Change of excitation and mechanical input- Voltage regulation – EMF, MMF, ZPF and A.S.A methods – steady state power-angle characteristics– Two reaction theory –slip test -short circuit transients – Capability Curves

UNIT II Synchronous Motor (8 Hours)

Principle of operation – Torque equation – Operation on infinite bus bars – V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.

UNIT III Three Phase Induction Motor (8 Hours)

Constructional details – Types of rotors –- Principle of operation – Slip –cogging and crawling- Equivalent circuit – Torque-Slip characteristics – Condition for maximum torque – Losses and efficiency – Load test – No load and blocked rotor tests – Circle diagram – Separation of losses – Double cage induction motors –Induction generators – Synchronous induction motor. Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star-delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control – Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking.

UNIT IV Single Phase Induction Motors (8 Hours)

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor

UNIT V Special Machines (8 Hours)

Linear induction motorRepulsion motor – Hysteresis motor – AC series motor – introduction to magnetic levitation systems – permanent magnet brushless DC motors - switched reluctance motors - Servo motors- Stepper motors

Text/References:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
5. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
6. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

BEE-308 ELECTROMAGNETIC THEORY (L-T-P-C: 3-1-0-4)

Unit 1: Review of Vector Calculus (8 Hours)
Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus-differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another

Unit 2: Static Electric Field (8 Hours)
Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications, Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations, Electric dipole, Electrostatic Energy and Energy density
Conductors, Dielectrics and Capacitance Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance Capacitance of a two wire line

Unit 3: Static Magnetic Fields (8 Hours)
Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.
Magnetic Forces, Materials and Inductance (6 Hours) Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

Unit 4: Time Varying Fields and Maxwell's Equations (8 Hours)
Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces, Boundary Conditions

Unit 5: Electromagnetic Waves (8 Hours)
Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.

Text / References:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.
3. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
4. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
5. G.W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
   W.J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
6. W.J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
7. E.G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
8. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.

BEE-308 DATA STRUCTURES AND ALGORITHMS (L-T-P-C: 3-0-0-3)

Unit 1 (8 Hours)

Introduction: Basic concepts and notations, Mathematical background, Revision of arrays and pointers, Recursion and implementation of Recursion, Time and Space Complexity, Asymptotic notations: Big Oh, Big Theta and Big Omega, Time-Space trade-off.

Searching: linear search and binary search techniques.

Unit 2 (8 Hours)

Stacks and Queues: Sequential representation of stacks and queues, Primitive Stack operations: Push & Pop, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression,conversion of infix to postfix.

Lists: List representation techniques, Dynamics Storage allocation, Representation of stacks and queues using linked list, Operations on a Linked List: Insertion, Deletion, Traversal, Introduction to Doubly linked list, introduction to circularly linked list.

Unit 3 (8 Hours)

Sorting Algorithms and hashing: Insertion sort, Bubble sort, Quick sort, Merge sort, Heap sort, Shell sort, Time and Space complexity of sorting algorithms, hashing.

Unit 4 (8 Hours)

Trees: Definition and basic concepts, Linked tree **r**epresentations, Binary tree traversal algorithms,(Preorder, Inorder, Postorder), Binary search tree, Insertion and Deletion in Binary search tree, Multiway search trees, B trees, B+ tree and their applications.

Unit 5 (8 Hours)

Graphs: Introduction to Graphs, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Graph Traversal: Depth First Search and Breadth First Search, Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm.

Text Books and References:

1. Y. Langsam, M.J. Augenstein and A.M. Tenenbaum, Data Structure Using C and C++. Second Edition, Prentice Hall of India, 1997.
2. Seymour Lipschutz, Data Structures , Schaum's Outlines, Tata McGraw Hill , New Delhi, 2006
3. Lafore – Data structure & Algorithms in java, (BPB Publication)
4. Sartaj Sahni – Data structure, Algorithms & application in C++ (McGraw Hill)

MC 301/ MC 401 ENVIRONMENT AND ECOLOGY (L-T-P-C: 2-0-0-0)

UNIT-I: Nature of Environment Introduction to Environmental Science (5 Hours)

Definition and scope and need for public awareness Ecosystems Concept, structure and functions, restoration of damaged ecosystems Biodiversity – Definition, description at national and global level, threats and conservation Natural Resources - Renewable and non-renewable and their equitable use for sustainability, Material cycles – carbon, nitrogen and sulphur cycle. Conventional and Non-conventional Energy Sources – fossil fuel-based, hydroelectric, wind, -nuclear and solar energy, biomass, biodiesel, hydrogen as an alternative fuel

UNIT-II: Impact of Human Activity on Environment (5 Hours)

Human Population and Environment – Population growth, population explosion and migration; Impact of farming, housing, mining, transportation and industrial growth Social Issues Related to Environment– Sustainable development, urban problems (related to water and energy conservation and waste management), resettlement and rehabilitation Environmental ethics

UNIT-III: Environmental Changes and Human Health Environmental Pollution **(5 Hours)**

Definition, causes and effects, control measures for water, air, soil, marine, land, noise, thermal pollution, Climate change– Greenhouse effect and global warming, acid rain, ozone layer formation and depletion Impact on human health – water and air borne diseases, diseases induced by residual impurities in drinking water (fluoride and arsenic); Toxic wastes and carcinogens; Nuclear hazards

UNIT- IV: Environmental Protection **(5 Hours)**

Environmental Protection through Assessment and Education Indicators and Impact Assessment – Bio-indicators, Natural disasters and disaster management, Impact assessment through inventorying and monitoring Environmental Protection– Role of individuals, organizations and government in pollution control Laws, Conventions and Treaties–National legislation, issues in the enforcement of environmental legislation, initiatives by non- governmental organizations, global efforts in environmental protection Environmental education–women and value education Recommended

Textbook: Environmental Studies, J Krishnawamy , R J Ranjit Daniels, Wiley India. **Recommended Reference Books:**

1. Environmental Science, Bernard J. Nebel, Richard T. Right, 9780132854467, Prentice Hall Professional 1993.
2. Environment and Ecology, R K Khandal, 978-81-265-4277-2, Wiley India.
3. Environmental Science, 8th Ed ISV, Botkin and Keller, 9788126534142, Wiley India.
4. Environmental Studies, R Rajagopalan, 978-0195673937, Oxford University Press
5. Textbook of Environmental Science and Technology, M.Anjireddy, BS Publications
6. Environmental Studies, Soli. J Arceivala, Shyam, R Asolekar, 9781259006050, McGrawHill India, 2012.
7. Environmental Studies, D.L. Manjunath, 9788131709122 Pearson Education India, 2007
8. Textbook of Environment Ecology, Singh, Acme Learning
9. Perspective in Environmental Studies, Kaushik, New Age International
10. Environmental Studies, B. Joseph, 2nd Ed, 978-0070648134, Tata McGraw Hill

BEC-351 **Digital Electronics Lab** **(L-T-P-C: 0-0-2-1)**

(Any 10 of the given experiments are to be conducted)

List of experiments

1.To study about logic gate and verify their Truth table.

2.To design and implement half adder and full adder.

3.To design and implement half subtractor and full subtractor

4.To design and implement 8:1 MUX.

5.To design and implement 1:8 DEMUX.

6.To design and implement Encoder.

7.To design and implement Decoder.

8.To design and implement R-S flip flop and J K flip flop

9.To design and implement D & T flip flop

10.To design and implement Master -Slave flip flop

11.To design and implement SISO AND SIPO.

12.To design and implement PISO and PIPO.

13.To design and implement DECAD counter

BEE-351 **Electrical Machines Lab –I** **(L-T-P-C: 0-0-2-1)**

(Any 10 of the given experiments are to be conducted)

List of Experiments:

1. Determination of circuit parameters and loss in single phase transformer by OC test
2. Determination of circuit parameters in single phase transformer by SC test
3. Measurement of efficiency ad Voltage Regulation of transformer
4. Magnetization characteristic of DC shunt generator
5. Load Test on DC shunt generator
6. Load Test on DC series generator
7. Load Test on DC compound generator
8. Speed control of dc shunt motor by field control method
9. Speed control of dc shunt motor by armature control method
10. Hopkinson's test on DC shunt machines
11. Characteristics of DC shunt generator using digital simulation
12. Load test on DC shunt generator using digital simulation
13. Speed control techniques of DC motor using programmable logic controller and Lab VIEW

BEE-352 SOLID-STATE DEVICE & CIRCUIT LAB (L-T-P-C: 0-0-2-1)

(Any 10 of the given experiments are to be conducted)

List of Experiments:

1. Study of Lab Equipment and Components: CRO, Multimeter, and Function Generator, Power supply- Active, Passive Components and Bread Board.

2. P-N Junction diode: Characteristics of PN Junction diode - Static and dynamic resistance measurement from graph.

3. Applications of PN Junction diode: Half & Full wave rectifier- Measurement of Vrms, Vdc, and ripple factor.

4. Characteristics of Zener diode: V-I characteristics of Zener diode, Graphical measurement of forward and reverse resistance.

5. Application of Zener diode: Zener diode as voltage regulator. Measurement of percentage regulation by varying load resistor.

6. Characteristic of BJT: BJT in CE configuration- Graphical measurement of h-parameters from input and output characteristics. Measurement of Av, AI, Ro and Ri of CE amplifier with potential divider biasing.

7. Field Effect Transistors: Single stage Common source FET amplifier –plot of gain in dB Vs frequency, Measurement of, bandwidth, input impedance, maximum signal handling capacity (MSHC) of an amplifier.

10. Oscillators: Sinusoidal Oscillators

    a. Wein bridge oscillator

    b. phase shift oscillator.

11. Simulation of Amplifier circuits studied in the lab using any available simulation software.

BEE-451 MEASUREMENTS AND INSTRUMENS LAB (L-T-P-C: 0-0-2-1)

(Any 10 of the given experiments are to be conducted)

List of Experiments:

1. Study & observe the characteristics of Load Cell Sensor.
2. Study & observe the characteristics of LVDT.
3. Study & observe the characteristics of RTD Sensor.
4. Study & observe the characteristics of NTC Temperature Sensor.
5. Study & observe the characteristics of Temperature LM35 Sensor.
6. Study & observe the characteristics of Photovoltaic Cell.
7. Study & observe the characteristics of Photoconductive Cell.
8. Study & observe the characteristics of Photo Transistor.
9. Study & observe the characteristics of Photo Diode.
10. Study & observe the characteristics of Strain Gauge Sensor.
11. Study & observe the characteristics of IR Sensor.
12. Study & observe the characteristics of Ultrasonic Sensor.
13. Study & observe the characteristics of Smoke Sensor.
14. Study & observe the application of FPGA Trainer Kit.

BEC-454 LINEAR INTEGRATED CIRCUITS LAB (L-T-P-C: 0-0-2-1)

(Any 10 of the given experiments are to be conducted)

List of Experiments:

1. To design and implement an inverting amplifier circuit.
2. To design and implement a non-inverting amplifier circuit.
3. To design and implement a voltage follower circuit.
4. To design and implement a summing amplifier circuit.
5. To design and implement a difference amplifier circuit
6. To design and implement a Differentiator circuit
7. To design and implement an integrator circuit
8. To design and implement an Instrumentation Amplifier circuit
9. To design and implement Precision Rectifier circuit implement
10. To design and implement RC oscillator.
11. To design and implement LC oscillator.
12. To implement monostable, bistable, astable multivibrators using Opamp 741.
13. To implement Phase Locked Loop.
14. To implement Frequency Multiplier.
15. To implement A/D Converters & D/A Converters.
16. To implement Second Order Active Filter- High Pass & Low Pass Realization.

BEE-452 ELECTRICAL MACHINES LAB –II (L-T-P-C: 0-0-2-1)

(Any 10 of the given experiments are to be conducted)

List of Experiments:

1. No Load and Blocked Rotor Test on a 3- ϕ Induction Motor
2. Equivalent Circuit of a Single-Phase Induction Motor
3. Brake Test on 3- ϕ Squirrel Cage Induction Motor
4. Starting of Slip Ring Induction Motor by Rotor Resistance Method
5. Star-Delta Starter
6. Determination of X_d And X_q of Salient Pole Synchronous Motor
7. V' and 'Inverted V' Curves of Synchronous Motor
8. Voltage Regulation of Alternator by synchronous Impedance Method
9. Sumpner's Test on a Transformer
10. Scott Connection of Transformers
11. Parallel Operation of Transformers
12. Separation of Hysteresis and Eddy Current Losses in a Transformer
13. Brushless DC Motor – Load Characteristics and speed control
14. Single phase Induction motor

BCS-452 DATA STRUCTURES AND ALGORITHMS (L-T-P-C: 0-0-2-1)

(Any 10 of the given experiments are to be conducted)

List of Experiments:

Write Program in C / C++ for following:

1. To implement stack using array
2. To implement queue using array
3. To implement circular queue using array
4. To implement various operations on linked list:

   (a)insert (b)delete (c) display
5. To implement stack using linked list
6. To implement queue using linked list
7. To implement linear search
8. To implement binary search
9. To implement bubble sort
10. To implement insertion sort
11. To implement merge sort
12. To implement quick sort
13. Program to find the factorial of a number using recursion
14. To implement Heap sort
15. Implementation of graph menu driven program