B. TECH. ELECTRCAL ENGINEERING

Total Contact Hours = 30 **Total Marks = 900** **Total Credits = 25**

SEMESTER 3rd		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMAT0- 301	Mathematics-III	3	1	0	40	60	100	4
BELE1-301	Transformers	3	1	0	40	60	100	4
BELE1-302	Network Analysis and Synthesis	3	1	0	40	60	100	4
BELE1-303	Electronic Devices & Circuits	3	1	0	40	60	100	4
BELE1-304	Electrical Measurement & Instrumentation	3	1	0	40	60	100	4
BELE1-305	Measurement & Instrumentation Lab.	0	0	2	60	40	100	1
BELE1-306	Electronic Devices & Circuit Lab.	0	0	2	60	40	100	1
BELE1-307	Training#	0	0	4	60	40	100	2
BSOS0-F91	Soft Skill -I	0	0	2	60	40	100	1
Total		**15**	**5**	**10**	**440**	**460**	**900**	**25**

#Workshop training will be imparted in the institution at the end of 2nd semester for four-week duration

(Minimum 36 hrs. per week) industrial tour will also from the part of this training.

Total Contact Hours = 28 **Total Marks = 900** **Total Credits = 24**

SEMESTER 4th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BELE1- 408	DC Machines	3	1	0	40	60	100	4
BELE1- 409	Digital Electronics	3	1	0	40	60	100	4
BELE1- 410	Electrical Engineering Materials	3	1	0	40	60	100	4
BELE1- 411	Linear Control System	3	1	0	40	60	100	4
BELE1- 412	Electromagnetic Field Theory	3	1	0	40	60	100	4
BELE1- 413	Electrical Machine - I Lab.	0	0	2	60	40	100	1
BELE1-414	Control System Lab.	0	0	2	60	40	100	1
BELE1-415	Digital Electronics Lab.	0	0	2	60	40	100	1
BSOS0- F92	Soft Skills - II	0	0	2	60	40	100	1
Total		**15**	**5**	**8**	**440**	**460**	**900**	**24**

After 4th semester, student will go for 6 Weeks Institutional / Industrial Training in which he/she should cover complete knowledge of at least one of the following software: MATLAB/LabVIEW/C/C++/Automation/AutoCAD (Electrical)/Data Analysis using Excel.

Total Contact Hours = 28 **Total Marks = 900** **Total Credits = 23**

SEMESTER 5th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BEEE1- 516	Asynchronous Machines	3	1	0	40	60	100	4
BEEE1- 517	Power Electronics & Drives	3	1	0	40	60	100	4
BEEE1- 518	Generation and Economics of Electric Power	3	1	0	40	60	100	4
BEEE1-519	Power Electronics Lab.	0	0	2	60	40	100	1
BEEE1-520	Electrical Machines-II Lab.	0	0	2	60	40	100	1
BELE1-521	Industrial Training#	0	0	4	60	40	100	2
BSOS0-F93	Soft Skills-III	0	0	2	60	40	100	1
Department Elective – I (Select any one)		3	0	0	40	60	100	3
BEEE1-556	Power Plant Engineering							
BEEE1-557	Signals and Systems							
BEEE1-558	Microprocessors and Microcontroller							
BEEE1-559	Instrumentation Engineering							
Open Elective – I		3	0	0	40	60	100	3
Total		**15**	**3**	**10**	**440**	**460**	**900**	**23**

#Industrial training to be imparted at the end of 4th semester for six weeks

Total Contact Hours = 23 **Total Marks = 800** **Total Credits = 20**

SEMESTER 6th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BELE1- 622	Synchronous Machines	3	1	0	40	60	100	4
BELE1- 623	Power System-I (Transmission and Distribution)	3	1	0	40	60	100	4
BELE1- 624	Electrical: Estimation & Costing Lab.	0	0	2	60	40	100	1
BELE1- 625	Programming in MATLAB	0	0	2	60	40	100	1
BSOS0-F94	Soft Skills-IV	0	0	2	60	40	100	1
Department Elective – II		3	0	0	40	60	100	3
BELE1-660	Electrical Power Utilization							
BELE1-661	Energy Auditing & Management							
BELE1-662	Substation Equipment & Design							
BELE1-663	Digital Control System							
Department Elective – III		3	0	0	40	60	100	3
BELE1-664	Energy Efficient Machines							
BELE1-665	Virtual Instrumentation							
BELE1-666	Flexible AC Transmission System Devices							
BELE1-667	Non-conventional Energy Sources							
Open Elective – II		3	0	0	40	60	100	3
Total		**15**	**2**	**6**	**380**	**420**	**800**	**20**

Students will undergo 8 weeks industrial training after end semester examinations of sixth semester and present a seminar along with submission of report in 7th semester

Total Contact Hours = 22 Total Marks = 800 Total Credits = 21

SEMESTER 7th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BELE1- 726	Non-linear and Digital Control System	3	1	0	40	60	100	4
BELE1- 727	Power System-II (Switchgear and Protection)	3	1	0	40	60	100	4
BELE1- 728	Minor Project*	0	0	4	60	40	100	2
BELE1- 729	Software Lab.	0	0	2	60	40	100	1
BELE1-730	Power System-II Lab.	0	0	2	60	40	100	1
BELE1-731	Industrial Training#	0	0	0	60	40	100	3
Department Elective – IV		3	0	0	40	60	100	3
BELE1-768	Industrial Automation							
BELE1-769	System Engineering and Reliability							
BELE1-770	Digital Signal Processing							
BELE1-771	EHVAC Transmission							
Open Elective – III		3	0	0	40	60	100	3
Total		**12**	**2**	**08**	**400**	**400**	**800**	**21**

***** *In this semester, the candidate shall submit a Minor Project (Hardware/Software) based on area of interest in consultation with his/her supervisor. Student has to deliver the seminar associated with the same work. The same work of minor project can be extended to Major Project in the next semester.*

 # Industrial training to be imparted at the end of 6th semester for eight weeks

Total Contact Hours = 24 Total Marks = 500 Total Credits = 17

SEMESTER 8th		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BELE1- 832	Power System Analysis and Design	3	1	0	40	60	100	4
BELE1- 833	High Voltage Engineering	3	0	0	40	60	100	3
BELE1- 834	Major Project	0	0	12	60	40	100	6
BELE1-835	Power System Analysis and Design Lab.	0	0	2	60	40	100	1
Department Elective – IV		3	0	0	40	60	100	3
BEEE1-872	Electrical Machine Design							
BEEE1-873	HVDC Transmission							
BEEE1-874	Fuzzy Logic Systems							
BEEE1-875	Neural Networks							
Total		**9**	**1**	**14**	**240**	**260**	**500**	**17**

Total Credits

Semester	Credits
I	25
II	25
III	25
IV	24
V	23
VI	20
VII	21
VIII	17
Total	**180**

MATHEMATICS-III

Subject Code: BMAT0-F91 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I (13 Hrs.)

Fourier Series: Periodic function, Fourier Seies, Dirichlet's conditions, Fourier series for even and odd functions, Change of interval, Half range Fourier series, Other forms of Fourier series.

Fourier Transforms: Dirichlet's conditions, Fourier integral formula (without proof), Fourier transform, Inverse Theorem for Fourier transform, Fourier sine and cosine transforms and their inversion formulae. Properties of Fourier transform, Convolution theorem of Fourier transforms, Parseval's identity.

UNIT-II (10 Hrs.)

Laplace Transforms: Laplace transforms of various standard functions (Exponential, Algebraic, Sine, Cosine), Properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function,

Application of Laplace Transforms: Solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

UNIT-III (12 Hrs.)

Partial Differential Equations: Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Classification of partial differential equation.

Applications of PDEs: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation in Cartesian Coordinates, solution by the method of separation of variables.

UNIT-IV (10 Hrs.)

Functions of Complex Variable: Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic

functions; Conformal Mapping: Definition, standard transformations, translation, rotation, inversion, bilinear. Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues(Integration Of type $\int_0^{2\pi} F(Cos\theta, Sin\theta)d\theta,\ \ \int_{-\infty}^{\infty} \frac{f(x)}{F(X)}dx)$

Recommended Books:

1. E. Kreyszing, 'Advanced Engineering Mathematics', 8th Edn., John Wiley, New Delhi.
2. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publishers, New Delhi.
3. Ian N. Sneedon, 'Elements of Partial Differential Equations', McGraw- Hill, Singapore, **1957**.
4. Peter. V. O'Nil, 'Advanced Engineering Mathematics', Wadsworth Publishing Company.
5. H.C. Taneja, 'Engineering Mathematics', Volume-I & II, I.K. Publisher.

TRANSFORMERS

Subject Code: BELE1-301 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives

1. To aware the students about the basics of Transformer.
2. To provide basic concepts of different types of transformer connections and their applications.
3. To impart knowledge of single phase transformer, auto transformer and three phase transformer.
4. To impart knowledge about analysis of different transformer connections.

Course Outcomes

1. Students will be having skills to analyse transformer connections.
2. Knowledge of different types of transformer operations and applications.

UNIT-I (12 Hrs.)

Single Phase Transformer: Construction, working principle of operation, E.M.F. equation, phasor diagram under loaded and unloaded condition, rating of transformers, losses in transformer, transformer testing, open and short circuit tests, back to back test, voltage regulation and efficiency, condition for maximum efficiency, equivalent circuit, ideal Transformer, parallel operation of single phase transformers, applications of transformers.

UNIT-II (11 Hrs.)

Auto-Transformer: Construction, working principle of operation, phasor diagram, saving of conductor material, comparison of auto transformer and two winding transformer, advantages, disadvantages and applications, equivalent circuit.

UNIT-III (12 Hrs.)

Three Phase Transformer: Three winding transformer, construction of three phase transformer, three phase transformer connections: Star-star connection, delta-delta connection, delta-star connection, star-delta connection, phasor groups, three phase to two phase and six phase conversion, scott connection- three phase to two phase conversion, phase shifting from primary to secondary windings, Parallel operations of three phase transformers, harmonics and excitation phenomenon, inrush current phenomenon.

UNIT-IV (10 Hrs.)

Transformer Materials: Different types of insulting materials for transformer core, winding, insulation, need for bushings, various cooling techniques, effect of temperature on the performance of transformer.

Recommended Books

1. P.S. Bhimbra, 'Electrical Machinery', Khanna Publishers, Delhi, **2004**
2. A.E. Fitzgerald, C. Kingsley and S.D. Umans, 'Electric Machinery', TMH, **2002.**
3. A.S. Langsdorf, 'Theory of AC Machinery', Tata McGraw Hill, **1955.**
4. Ashfaq Hussian, 'Electrical Machines', Dhanpat Rai and Company, **2002**.
5. S.J. Chapman, 'Electrical Machinery Fundamentals', McGraw Hill, New York, **1991.**

NETWORK ANALYSIS AND SYNTHESIS

Subject Code: BELE1-302 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives

1. To aware the students about the basics of networks.
2. To provide them basic concepts of different types of network theorems and their applications.
3. To impart knowledge about different circuits, analysing and synthesizing the circuits.

Course Outcomes

1. Students will be having skills to design, analyse and synthesize the circuits.
2. Knowledge of mathematical forms such as Laplace transforms and designing of filters circuits.

UNIT-I (10 Hrs.)

Circuits Concepts: Independent and dependent sources, Standard test signals: Step, ramp, impulse, and doublet. Mesh and nodal analysis. Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, Millman's, Tellegen's and Reciprocity.

UNIT-II (11 Hrs.)

Time and Frequency Domain Analysis: Representation of basic circuits in terms of generalized frequency and their response, Laplace transform, transient and steady response, transfer function, poles and zeros, pole zero diagram, time domain behaviors from poles and zeros, Convolution Theorem.

UNIT-III (12 Hrs.)

Network Synthesis: Network functions, Impedance and admittance function, Transfer functions. Network function for two port network, Sinusoidal network in terms of poles and zeros, Real liability condition for impedance synthesis of RL, LCand RC circuits, network synthesis techniques for 2-terminal network, foster and cauer forms.

UNIT-IV (12 Hrs.)

Filters Synthesis: Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T-section, π-section, terminating half section, pass bands and stop bands, Design of Constant-K, m-derived filters, Composite filters.

Recommended Books

1. Bird John, 'Electrical Circuit Theory and Technology', Newnes, **2003.**
2. Abhijit Chakraborty, 'Circuit Theory', Dhanpat Rai, **2001.**
3. D. Roy Chaudhury, 'Networks and Synthesis', New Age International.
4. T.S.K. VIyer, 'Circuit Theory', Tata McGraw Hill, **2006.**
5. Mohan, Sudhakar Sham, 'Circuits and Networks Analysis and Synthesis', TMH, **2005.**
6. Van Valkenberg, 'Network Analysis and Synthesis', PHI Course, **2009.**

ELECTRONICS DEVICES AND CIRCUITS

Subject Code: BELE1-303 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives

1. To aware the students about basic electronic components.
2. To update the knowledge about amplification circuits to amplify the signal.
3. Various types of circuits to generate signals.

4. How electronic components are specified and selected for industrial applications.

Course Outcomes

1. The students could have skills about the basic electronic circuits, their operational characteristics and their applications.
2. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

UNIT-I (10 Hrs.)

Introduction: Introduction to semiconductors theory, P type and N-Type semiconductors, different types of diodes, Drift current, diffusion current. Rectifiers.

UNIT-II (11 Hrs.)

Bipolar Junction Transistor: Working action of NPN and PNP. CE, CB and CC configurations, Current components, Concept of D.C. and A.C. load line and operating point, Q point selection, bias stability, various biasing circuits- fixed bias, collector to base bias, emitter bias, voltage divider, Stability factors.

UNIT-III (12 Hrs.)

Power Amplifiers: Classifications according to mode of operation and driving output, Class A direct coupled with resistive load, operation of class- B power amplifier, Push-Pull Amplifiers, Concept of feedback in amplifiers: Positive and negative feedback, effect of negative feedback.

Oscillators: Principle of operation of different oscillator circuits-RC Phase shift, Wien Bridge, Hartley Bridge, Colpits and Crystal oscillators.

UNIT-IV (12 Hrs.)

Field Effect Transistors: FET construction and working, P-channel and N-channel JFETs. Comparison with BJT, Characteristics of JFET, JFET parameters- AC drain resistance, trans-conductance, amplification factor, dc drain resistance. Construction, working and characteristics of MOSFET. Comparison of BJT, JFET and MOSFET.

Recommended Books

1. Boylstad and Nashelsky, 'Electronic Devices and Circuits', Prentice Hall, **2010.**
2. Millman and Halkias, 'Integrated Electronics', McGraw Hill, **2001.**
3. Malvino, 'Electronic Principles', McGraw Hill, **2007.**
4. V.K. Mehta, 'Principles of Electronics', S. Chand, **2006.**
5. Donald L. Shilling and Charles Belowl, 'Electronic Circuits', TMH, **2009.**

ELECTRICAL MEASUREMENT & INSTRUMENTATION

Subject Code: BELE1-304 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives

1. To aware the students about the basics of measurements and instrumentation systems.
2. To impart knowledge about different instruments for electrical measurements.
3. To provide them basic concepts of different types of sensors and transducers.

Course Outcomes

1. The students will be having skills to design, analyse and instruments.
2. To gain the skill knowledge of bridges and CRO operations.

UNIT-I (12 Hrs.)

Measuring Instruments: Introduction to measuring techniques, necessity of measurements, block diagram of measurement system, types of instruments, classification of standards, fundamental and derived units. Instrument characteristics; accuracy, precision, repeatability

and sensitivity. Different types of errors in measurement. Principle of operation and constructional features; D'Arsonval galvanometer, Moving Coil PMMC and Moving Iron instrument (Repulsion and Attraction type), Electrodynamics instruments.

UNIT-II (11 Hrs.)

Measurement of Resistance: Low, Medium and High resistance measurement using Kelvin Double Bridge, Ammeter-Voltmeter method, Wheat Stone Bridge, Loss of Charge and Megger.

Measurement of Inductance and Capacitance: Maxwell Inductance, Hay's, Anderson and Schering Bridges, Measurement of frequency by Wein bridge method.

UNIT-III (11 Hrs.)

Oscilloscope: Basic principle and construction of Analog CRO, sweep modes, applications in measurement of voltage, frequency (Lissajous pattern), Introduction to Dual Trace Oscilloscope, Digital Storage Oscilloscope, sampling oscilloscope. Comparison between analog and digital oscilloscope.

UNIT-IV (11 Hrs.)

Transducers: Transducer and its classifications, basic requirements of Transducer/Sensors. Displacement Transducers: LVDT, RVDT and Piezo Electric. Resistance Thermometer, Thermistors, Thermocouples and Strain Gauge Transducer: Basic principle of operation of Resistance strain gauge.

Recommended Books

1. H. Cooper, 'Modern Electronic Instrumentation and Measurement Techniques', PHI, **1990.**
2. A.K. Sawhney, Electronic Instrumentation and Measurement', Dhanpat Rai & Sons, **2011.**
3. Jones and Chin, 'Electronic Instruments and Measurement', **2010**.
4. J. Toppin, 'Theory of Errors', Wessely Publishing, **2000.**

MEASUREMENT AND INSTRUMENTATION LAB.

Subject Code: BELE1-305 **L T P C**
0 0 2 1

Course Objectives

1. To understand the working principal and construction of the measuring instruments and recorders.
2. To measure various electrical parameters using meters and transducers.
3. To calibrate the measuring devices such as meters and transducers.

Course Outcomes

1. The students could have skills about the basic measurement circuits.
2. Ability to use the techniques and skills to operate CRO.

EXPERIMENTS

1. Study of principle of operation of various types of electromechanical measuring instruments.
2. To measure high value of DC current and voltage using shunt and multiplier.
3. To measure low resistance using wheat stone bridge.
4. To measure active and reactive power in 3-phase balanced load by one wattmeter
5. method.

6. To measure the active power in 3-phase balanced and unbalanced load by two wattmeter method and observe the effect of power factor variation on wattmeter readings.
7. To study and calibrate single phase energy meter.
8. Measurement of resistance using Kelvin's Bridge.
9. Measurement of self-inductance using Anderson's Bridge.
10. Measurement of capacitance using Schering Bridge.
11. Plotting of Hysteresis loop for a magnetic material using flux meter.
12. Measurement of frequency using Wein's Bridge.
13. To study the connections and use of Current and Potential transformers and to find out ratio error.
14. Determination of frequency and phase angle using CRO.
15. Measurement of unknown voltage using potentiometer.
16. To find 'Q' of an inductance coil and verify its value using Q-meter.

Note: At least ten experiments should be performed in semester.

ELECTRONICS DEVICES AND CIRCUIT LAB.

Subject Code: BELE1-306 **L T P C**
0 0 2 1

Course Objectives
1. To understand the characteristics of various semiconductor devices.
2. To understand identification and selection of various electronic components.

Course Outcomes
1. Ability to understand all types of electronics devices and circuits.
2. Ability to analyse and interpret data.

EXPERIMENTS
1. To analyse the response of Zener diode as regulator
2. To analyse the response of half wave, full wave and Bridge rectifiers.
3. To plot the input and output characteristics of CE configuration.
4. To plot the input and output characteristics of CB configuration.
5. To examine the characteristics of a Class-A amplifier.
6. To examine the characteristics of Class-B amplifier.
7. To analyse the characteristics of Class-B push-pull amplifier.
8. To analyse the characteristics of complementary symmetry amplifier.
9. To discuss the response of RC phase shift oscillator and determine frequency of oscillation.
10. To discuss the response of Hartley oscillator and determine frequency of oscillation.
11. To analyse the response of Colpitt's oscillator and determine frequency of oscillation.
12. To analyse the response of Wien Bridge oscillator and determine frequency of oscillation.
13. To study the characteristics and response of crystal oscillator.
14. To plot the characteristics of FET.
15. To plot the characteristics of MOSFET.

Note: At least ten experiments should be performed in semester.

DC MACHINES

Subject Code: BELE1-408 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives

- To understand the basic concepts of D.C machines.
- To introduce different techniques of speed control of DC machines.
- To study different types of testing methods.

Course Outcomes

- To understand all basic concepts of DC motors and generators.
- To understand operation and control of DC machines.

UNIT-I (12 Hrs.)

General Concepts of DC Machines: Principles and construction: generator action, motor action, commutator, commutation, interpolar and compensating windings, brushes, armature core, armature windings, winding pitch, commutator pitch, commutator segments, armature reaction: de-magnetizing and cross magnetizing effects.

UNIT-II (11 Hrs.)

DC Generators: Operation, emf equation, effect of speed upon voltage and flux, types of DC generators. Characteristics of series, shunt and compound generators, voltage regulation, Condition for maximum efficiency, applications.

UNIT-III (10 Hrs)

DC Motors: Operation, concept of back emf, torque equation, power developed, Characteristics of DC motors (series, shunt and compound), effect of saturation and applications.

UNIT-IV (12 Hrs.)

Starters, Speed Control and Testing: Speed control of DC motors, Ward-Leonard control (Voltage control), various starting techniques for DC motors: Three-point starter, four-point starter, Electric breakings of DC shunt and series motors, Testing of DC machines: Brake test, Swinburne's test, Hopkinson's test, Retardation test, Field's test.

Recommended Books

1. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers.
2. P.K Mukherjee and S. Chakravorty, 'Electrical Machines', Dhanpat Rai, **2004.**
3. I.J. Nagrath and D.P. Kothari, 'Electric Machines', Tata McGraw Hill, **2004.**
4. Fitzgerald Kingsley, and Stephen Umans, 'Electric Machinery', McGraw Hill, **2002.**
5. J.B. Gupta, 'Theory and Performance of Electrical Machinery', S.K. Kataria and Sons.
6. B.L. Theraja and A.K. Theraja, 'A Text Book of Electrical Technology', S. Chand.

DIGITAL ELECTRONICS

Subject Code: BELE1-409 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives

1. To provide knowledge about basics of digital electronics.
2. To impart knowledge about designing of digital circuits.
3. Students will use schematics and symbolic algebra to represent digital gates inthe creation of solutions to design problems.

Course Outcomes

1. An ability to understand all types of combinational and sequential digital circuits and their designing.
2. Students will have skills to simplify a digital design problem as part of the systematic approach to solving a problem.

UNIT-I (12 Hrs.)

Number System and Binary Code: Introduction, Binary, decimal, Octal, hexadecimal, BCD number system, Signed and unsigned numbers, binary operations: Addition, Subtraction. Multiplication and division. Subtractions using 1's and 2's compliment. ASCII code. Excess 3 codes and Gray code. Logic gates: OR, AND, NOT, NOR, NAND, Ex-OR gates, Basic theorems of Boolean algebra, sum of products and product of sums. Minimisation using theorems, minimisation using K-map up to 4 variables.

UNIT-II (10 Hrs.)

Combinational logic circuits: Combinational circuit design, multiplexer, demultiplexer, encoders, decoders, adders, subtractors, code converters, parity checkers, BCD display drive, magnitude comparators.

UNIT-III (11 Hrs.)

Sequential circuits: Flip Flop fundamentals, different flip flop configurations: SR, JK, D, T. Edge triggered and clocked flip flops, Registers: Types of Registers, series and parallel shift: circuit diagram, timing wave form and operations. Counters: synchronous and asynchronous, Johnson counter.

UNIT-IV (12 Hrs.)

D/A and A/D Converters: Introduction, Weighted register D/A converter, binary ladder D/A converter, D/A accuracy and resolution, parallel A/D converter, Counter type A/D converter, Successive approximation A/D converter, Single and dual slope A/D converter, A/D accuracy and resolution.

Recommended Books

1. D.P. Kothari and J.S. Dhillon, 'Digital Circuits and Design', Pearson, **2015.**
2. R.P. Jain, 'Modern Digital Electronics', TMH, **2011.**
3. Malvino and Leach, 'Digital Principles and Applications', TMH, **1991.**
4. Fletcher, 'An Engg. Approach to Digital Design', PHI, Indian Ed., **2011.**

ELECTRICAL ENGINEERING MATERIALS

Subject Code: BELE1-410 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives

1. To provide knowledge about basics of electrical engineering materials.
2. Students will obtain skills of application of materials in daily life.

Course Outcomes

1. An ability to understand all types of magnetic and conducting materials.
2. To understand the various properties of electrical engineering materials.

UNIT-I (10 Hrs.)

Elementary Materials Science Concepts: Bonding and types of solids and its defects, resistivity, factors affecting resistivity, temperature dependence of resistivity, Skin Effect, Hall Effect.

UNIT-II (12 Hrs.)

Dielectric Properties of Insulators in Static and Alternating Field: Dielectric constant of gases, molecules and solids, internal field in solids and liquids, Properties of ferro-electric materials, polarization, types of polarizations, polarizability: atomic and molecular, frequency dependence of electronic and ionic polarizability, piezoelectricity and dielectric losses.

UNIT-III (12 Hrs.)

Magnetic Properties and Superconductivity: Magnetization of matter, magnetic material classification, ferromagnetic origin, Curie-Weiss law, soft and hard magnetic materials, Superconductivity and its origin, critical temperature, critical magnetic field, zero resistance and Meissner Effect, Type-I and Type-II superconductors, applications of superconductors.

UNIT- IV (11 Hrs.)

Conductivity of Metals: Drift velocity, relaxation time of electrons, collision time and mean free path, electron scattering and resistivity of metals.

Semiconductor Materials: Classification of semiconductors, semiconductor conductivity, temperature dependence, Carrier density and energy gap, fermi level, applications of semiconductors in electrical engineering.

Recommended Books

1. S.P. Seth, 'A Course in Electrical Engineering Materials', Dhanpat Rai and Sons, **2001.**
2. Electrical Engineering Materials, T.T.T.I, Madras, **1998.**
3. K.B. Raina and S.K. Bhattacharya, 'Electrical Engineering Materials', S.K. Kataria and Sons, **2004.**
4. P.K. Palanisamy, 'Material Science for Electrical Engineering', Scitech Pub. (India) Pvt. Ltd., Chennai, **2011.**

LINEAR CONTROL SYSTEM

Subject Code: BELE1-411 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

Course Objectives

1. To obtained transfer functions for electrical circuits, translational/rotational mechanical systems and electromechanical systems.
2. To learn basic goals of control systems in terms of transient/steady state time response behaviour.
3. To update the knowledge about control components.

Course Outcomes

1. The students will have skills to model the control systems.
2. Ability to analyse the stability of designed systems.

UNIT-I (10 Hrs.)

Introductory Concepts: Plant, Systems, Servomechanism, regulating systems, Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, Block diagrams, some illustrative examples.

UNIT-II (12 Hrs.)

Modeling: Force voltage analogy, force current analogy, Transfer function, Block diagram reduction technique, signal flow graphs and Mason's gain formula, characteristics equation.

Time Domain Analysis: Transient response of the first and second order systems, Time domain specifications, Steady state error and coefficients, Absolute and relative stability, Routh-Hurwitz Criterion.

UNIT-III (12 Hrs.)

Stability Analysis: Root locus technique, sketch of the root locus plot, Frequency domain analysis: Closed loop frequency response, bode plots, relative stability using bode plot. Frequency response specifications, relation between time and frequency response for second order systems. Nyquist criterion for stability.

UNIT-IV (11 Hrs.)

State Space Analysis: State space representations, transfer function from state model, state transition matrix, controllability, observability. Control components: Error detectors-potentiometers and synchros, servo motors, A.C. and D.C. techno generators, Magnetic amplifiers.

Recommended Books

1. Dorf Richard and Bishop Robert, 'Modern Control System', Addison-Wesley, Pearson, **2009.**
2. K. Ogata, 'Modern Control Engineering', Prentice Hall, **2011.**
3. B.C. Kuo, 'Automatic Control System', Prentice Hall, **1999.**
4. I.J. Nagrath and M. Gopal, 'Control System Engineering', Wiley Eastern Ltd, **1997.**
5. B.S. Manke, 'Linear Control Systems', **2002.**

ELECTROMAGNETIC FIELD THEORY

Subject Code: BELE1-412 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

Course Objectives

1. To provide the knowledge about the time varying fields and Maxwell's equations.
2. To provide knowledge about the propagation of electromagnetic wave along different mediums.
3. Study of physical concept and all the important fundamental parameters of waveguides.

Course Outcomes

1. The students will learn the concepts of electromagnetic field theory and fundamental field equations.
2. The students will have skills to identify, formulates and solves engineering problems related to electromagnetic fields.

UNIT-I (11 Hrs.)

Review of Electrostatic and Magnetostatic Fields: Review of vector algebra, Review of Cartesian, Cylindrical and spherical coordinate systems, Introduction to del operator, Use of del operator as gradient, divergence, curl. Introduction to coulomb's law, Gaussian law. Laplace's and Poission's equation in various coordinate systems. Introduction to Ampere's law, Magnetic vector potential.

UNIT-II (11 Hrs.)

Time Varying Fields and Maxwell's Equations: Equation of continuity, Inconsistency of Ampere's law for time varying fields, Concept of displacement current, Maxwell's equation in integral and differential form (for static fields, time varying fields, free space, good conductors, harmonically varying fields), Poynting theorem.

UNIT-III (12 Hrs.)

Uniform Plane Waves: Introduction, Uniform plane wave propagation, Wave equations: Wave equations for free space, Wave equations for conductors. Transverse nature of uniform plane waves, Reflection of electromagnetic waves by perfect conductor and perfect

dielectric, wave impedance and propagation constant, depth of penetration, surface impedance.

UNIT-IV (11 Hrs.)

Wave Guides: Introduction, simple waveguides between two infinite and parallel conducting plates, Transverse Electric (TE) Waves or H-Waves, Transverse magnetic (TM) Waves or E-Waves, Characteristics of TE and TM waves, Transverse Electromagnetic (TEM) waves and its characteristics.

Recommended Books

1. Jordan and Balmain, 'Electromagnetic Wave', PHI and Radiation System, **2010.**
2. Kraus, 'Electromagnetics', T.M.H. **2003.**
3. W.H. Hayt and J.A. Buck, 'Problem and Solutions in Electromagnetics', Tata McGraw Hill, **1999.**
4. W.H. Hayt, 'Engineering Electromagnetic', Tata McGraw Hill, **2012**.

ELECTRICAL MACHINE-I LAB.

Subject Code: BELE1-413 **L T P C**
0 0 2 1

Course Objectives

1. To understand the characteristics of D.C. Machines.
2. To understand speed control methods and testing methods.
3. To study universal motor.

Course Outcomes

1. To acquire skills to operate all types of dc machines.
2. Ability to analyse the speed control and efficiency of DC machine.

EXPERIMENTS

1. To study various components/cut-section of DC machines.
2. To perform starting techniques of various DC machines.
3. To obtain torque and speed characteristics of a D.C. Shunt motors.
4. To obtain external characteristics of a D.C. shunt generators.
5. To obtain external characteristics of a D.C. series generators.
6. To obtain external characteristics of DC compound generators.
7. Speed control of a dc shunt motor by varying armature circuit and field circuit methods.
8. To obtain performance characteristics of universal motor.
9. To perform Swinburne's Test.
10. To perform Hopkinson's Test.
11. To perform the Brake Load Test.
12. To calculate the power rating of DC machines.
13. To determine losses and efficiency of DC machines.

Note: At least ten experiments should be performed in semester.

CONTROL SYSTEM LAB.

Subject Code: BELE1-414 **L T P C**
0 0 2 1

Course Objectives

1. To understand the basics concepts of MATLAB software.

2. To introduce variety of control system strategies.
3. To comment about the stability of designed systems.

Course Outcomes

1. To acquire skills to understand all types of control components
2. Ability to analyse the stability of control systems

EXPERIMENTS

1. Familiarization with MATLAB control system toolbox, MATLAB Simulink toolbox and PSPICE.
2. Determination of step response for first order and second order system with unity feedback and their display on CRO. Calculation and verification of time constant, peak overshoot, setting time etc. from the response.
3. Simulation of step response and impulseresponsefortype-0, type-1and type-2 systems with unity feedback using MATLAB and PSPICE.
4. Determination of Root Locus, Bode-Plot, Nyquist Plot using MATLAB-Control system toolbox for 2nd order system. Determination of different control system performance indices from the plots.
5. Experimental determination of approximate transfer function from Bode plot.
6. Evaluation of steady state error, settling time, percentage peak overshoot, gain margin, phase margin, with addition of lead compensator and by compensator in forward path transfer function for unity feedback control system using PSPICE.
7. Design of a second order linear time invariant control system and study of system response with unit step input.
8. To study the characteristics of potentiometers and to use 2-potentiometers as an error detector in a control system.
9. To study the synchro Transmitter-Receiver set and to use it as an error detector.
10. To study the Speed-Torque characteristics of an AC Servo Motor and to explore its applications.
11. To study the Speed-Torque characteristics of a DC Servo Motor and explore its applications.
12. To study various electro-mechanical transducers i.e. resistive, capacitive and inductive transducers.
13. To study the speed control of an A.C. Servo Motor using a closed loop and an open loop system.
14. To study the operation of a position sensor and study the conversion of position in to corresponding voltage

Note: At least ten experiments should be performed in semester.

DIGITAL ELECTRONICS LAB.

Subject Code: BELE1-415 **L T P C**
0 0 2 1

Course Objectives

1. To give students a practical knowledge about all types of digital circuits.
2. To give students a working knowledge to connect digital circuits and verify their truth tables.
3. To give students knowledge of different combinational and sequential circuits.

Course Outcomes

1. Anabilitytotestandverifyworkingandtruthtablesofcombinationalandsequentialcircuits.
2. To give knowledge of various logic families.

EXPERIMENTS

1. To Study Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates and realization of OR, AND, NOT and XOR functions using universal gates.
2. To design Half Adder using Logic gates on bread board.
3. To design Full Adder using Logic gates on bread board.
4. To design Half Subtractor using Logic gates on bread board.
5. To design Full Subtractor using Logic gates on bread board.
6. To design 4-Bit Binary-to-Gray Code Converter on bread board.
7. To design 4-Bit Gray-to-Binary Code Converter on bread board.
8. To study and design 4-Bit magnitude comparator using logic gates on bread board.
9. Design and verification of Truth-table of multiplexer.
10. Realization of Half adder and Full adder using MUX.
11. Design and verification of Truth-table of Demultiplexer.
12. Realization of half subtractor and full subtractor using DEMUX.
13. To study and verify Truth-table of RS, JK, D, JK Master Slave Flip Flops.
14. To design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
15. To Study different shift registers: SIPO, SISO, PIPO, and PISO.
16. To Study digital logic families.

Note: At least ten experiments should be performed in semester.