Semester III [Second year]

Sr. No	Course Code	Course Title	Hours per week			Marks			Credits
			L	T	P	Int	Ext	Total	
1.	BELES1-301	Electrical Circuit Analysis	3	1	0	40	60	100	4
2.	BELES1-302	Analog Electronic Circuits	3	0	0	40	60	100	3
3.	BELES1-303	Analog Electronic Circuit Lab	0	0	2	60	40	100	1
4.	BELES1-304	Electrical Machine – I	3	1	0	40	60	100	4
5.	BELES1-305	Electrical Machine Lab-I	0	0	2	60	40	100	1
6.	BELES1-306	Electromagnetic Fields	3	1	0	40	60	100	4
7.	BELES1-307	Institutional Training	0	0	--	60	40	100	2
8.	BMECE0-001	Engineering Mechanics	3	1	0	40	60	100	4
9.	BMNCC0-002	Environment Science	2	0	0	--	--	--	0
		Total	**17**	**4**	**4**	**380**	**420**	**800**	**23**

#Workshop training will be imparted in the institution at the end of 2nd semester for four weeks duration (Minimum 30 hours Per week). Industrial tour will also form a part of this training.

Semester IV [Second year]

Sr. No	Course Code	Course Title	Hours per week			Marks			Credits
			L	T	P	Int.	Ext	Total	
1.	BELES1-401	Digital Electronics	3	0	0	40	60	100	3
2.	BELES1-402	Digital Electronics Lab	0	0	2	60	40	100	1
3.	BELES1-403	Electrical Machines – II	3	1	0	40	60	100	4
4.	BELES1-404	Electrical Machines–II Lab	0	0	2	60	40	100	1
5.	BELES1-405	Power Electronics	3	0	0	40	60	100	3
6.	BELES1-406	Power Electronics Lab	0	0	2	60	40	100	1
7.	BELES1-407	Signals and Systems	3	1	0	40	60	100	4
8.	BMATH3-301	Mathematics-III (Probability & Statistics)	3	1	0	40	60	100	4
9.	BMNCC0-001	Constitution of India	2	0	0	--	--	--	0
		Total	17	3	6	380	420	800	21

#After 4th semester, student will go for 6-Week Institutional/Industrial Training in which he/she should cover at least one of the software; such as: MATLAB/LabVIEW/C/C++/Automation/AutoCAD (Electrical)/Data Analysis using Excel or the upcoming advanced software which may be useful for Electrical Engineering.

ELECTRICAL CIRCUIT ANALYSIS

Sub Code: BELES1-301	L	T	P	C	Duration: 60 Hrs.
	3	1	0	4	

UNIT 1

Network Theorems **(14 Hours)**

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of Duality and dual networks.

UNIT 2

Solution of First and Second Order Networks **(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.

UNIT 3

Sinusoidal Steady State Analysis **(12 Hours)**

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

UNIT 4

Electrical Circuit Analysis using Laplace Transforms **(12 Hours)**

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances.

UNIT 5

Two Port Network and Network Functions **(12 Hours)**

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Text / References:

1. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.
2. D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 1998.

3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
6. Mohan, Sudhakar Sham, 'Circuits and Networks Analysis and Synthesis', TMH, 2005.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1) Apply network theorems for the analysis of electrical circuits.
2) Obtain the transient and steady-state response of electrical circuits.
3) Analyse circuits in the sinusoidal steady-state (single-phase and three-phase).
4) Analyse two port circuit behaviour.

ANALOG ELECTRONIC CIRCUITS

Sub Code: BELES1-302	L	T	P	C	Duration: 45 Hrs.
	3	0	0	3	

UNIT 1

Diode Circuits **(5 Hours)**

Introduction to Semiconductors and their classifications, P-N junction diode, I-V characteristics of a PN diode, PN diode as half-wave and full-wave rectifiers, Clamping and clipping device, Zener diode, Zener diode as voltage regulator.

BJT Circuits **(10 Hours)**

Bipolar Junction Transistor (BJT) and its operation, Various BJT configurations and I-V characteristics, Biasing techniques and bias stability, BJT as a switch, BJT as an amplifier: Small-signal model,Current mirror; Common-emitter, Common-base and Common-collector amplifiers; Small signal equivalent circuits, High-frequency equivalent circuits.

UNIT 2

Field Effect Transistor Circuits **(8 Hours)**

Field Effect Transistor and its operation, various configurations and I-V characteristics, Biasing techniques, FET as a switch and as an amplifier, MOS capacitor, C-V characteristics.

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 3

Operational Amplifiers **(10 Hours)**

Differential amplifier; Basic structure and principle of operation, Ideal op-amp, Non-idealities in an op-amp such as; Output offset voltage, Input bias current, Input offset current, Slew rate, Gain bandwidth product, calculation of differential gain, common mode gain, CMRR and ICMR, OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation.

UNIT 4

Applications of OP-AMP **(12 Hours)**

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, Integrator and Differentiator, Summing amplifier, Differential amplifier, Instrumentation amplifier,Active filters: Low pass, high pass, band pass and band stop, design guidelines, Voltage regulator, Oscillators (Wein bridge and phase shift).

Hysteresis comparator, Zero crossing detector, Schmitt trigger and its applications, Square-wave and triangular-wave generators, Precision rectifier, Peak detector, Monoshot vibrator.

Text/References:

1. A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
5. P. R. Gray, R. G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons, 2001.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the characteristics of transistors.
2. Design and analyse various rectifier and amplifier circuits.
3. Design sinusoidal and non-sinusoidal oscillators.
4. Understand the functioning of OP-AMP and design OP-AMP based circuits.

ANALOG ELECTRONIC CIRCUITS LAB

Sub Code: BELES1-303	L	T	P	C
	0	0	2	1

EXPERIMENTS

1. To draw V-I characteristics of PN junction diode.
2. To draw V-I characteristics of Zener diode.
3. To analyse the response of Zener diode as regulator.
4. To study the response of clamping and clipping circuits.
5. To analyse the response of half wave, full wave and Bridge rectifiers.
6. To study and compare various biasing techniques for transistors.
7. To plot the input and output characteristics of CE configuration.
8. To plot the input and output characteristics of CB configuration.
9. To plot the input and output characteristics of CC configuration.
10. To plot the characteristics of JFET.
11. To plot the characteristics of MOSFET.
12. To discuss the response of RC phase shift oscillator and determine frequency of oscillation.
13. To analyse the response of Wien Bridge oscillator and determine frequency of oscillation.
14. Study of OP-AMP as inverting amplifier.
15. Use OP-AMP as a differentiator.
16. Use of OP-AMP as an integrator circuit.
17. OP-AMP as square wave/triangular wave generator.

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

ELECTRICAL MACHINES – I

Sub Code: BELES1-304	L	T	P	C	Duration: 60 Hrs.
	3	1	0	4	

UNIT 1

Magnetic Fields and Magnetic Circuits **(14 Hours)**

Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air

Influence of highly permeable materials on the magnetic flux lines, B-H curve of magnetic materials; flux-linkage v/s current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit.

UNIT 2

DC Machines **(14 Hours)**

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil.

Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

UNIT 3

DC machine - Motoring and Generation **(14 Hours)**

Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series.
Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed, V-I characteristics and Torque-speed characteristics of separately excited, shunt and series motors.
Speed control through armature voltage, Losses, Load testing and back-to-back testing of DC machines

UNIT 4

Transformers **(18 Hours)**

Single-phase transformers - Principle, construction and operation of, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses

Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers,

Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current,

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. Cooling of transformers.

Text / References:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concepts of magnetic circuits.
2. Understand the operation of D.C. machines.
3. Analyse the differences in operation of different D.C. machine configurations.
4. Analyse single phase and three phase transformers circuits.

ELECTRICAL MACHINES LAB - I

Sub Code: BELES1-305	L	T	P	C
	0	0	2	1

EXPERIMENTS

1. To study three point and four point starters of D.C. shunt motor.
2. To obtain torque and speed characteristics of different types of D.C. motors.
3. To obtain external characteristics of D.C. shunt generators.
4. To obtain external characteristics of D.C. series generators.
5. Speed control of a D.C. shunt motor by varying armature circuit and field circuit methods.
6. To calculate the power rating of D.C. machines.
7. To determine losses and efficiency of various types of D.C. machines.
8. To check the transformation ratio and polarity of single phase transformer.
9. To perform open and short circuit test onsingle phase transformer and to determine its efficiency
10. To perform load test on a single phase transformer and to determine voltage regulation.
11. To perform parallel operation on single phase transformers.

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

Course Objectives

1. To understand the characteristics of D.C. Machines.
2. To understand speed control methods and testing methods.
3. To determine efficiency and voltage regulation of transformers.

Course Outcomes

1. To acquire skills to operate all types of D.C. machines.
2. Ability to analyse the speed control methods and efficiency of DC machines.
3. To be able to compute efficiency and voltage regulation of transformers.

ELECTROMAGNETIC FIELDS

Sub Code: BELES1-306	L	T	P	C	Duration: 60 Hrs.
	3	1	0	4	

UNIT 1

Review of Vector Calculus **(12 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 **(10 Hours)**

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, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

UNIT 3

Static Magnetic Fields **(6 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 **(8 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 **(6 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.

Electromagnetic Waves **(10 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. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
5. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

NOTE: This course shall have Lectures and Tutorials. Most of the students find it difficult to visualize electric and magnetic fields. Instructors may demonstrate various simulation tools to visualize electric and magnetic fields in practical devices like transformers, transmission lines and machines.

Course Outcomes:

At the end of the course, students will demonstrate the ability

1. To understand the basic laws of electromagnetism.
2. To obtain the electric and magnetic fields for simple configurations under static conditions.
3. To analyse time varying electric and magnetic fields.
4. To understand Maxwell's equation in different forms and different media.
5. To understand the propagation of EM waves.

ENGINEERING MECHANICS

Subject Code: BMECE0-001 **L T P C** **Duration: 60 Hrs.**
3 1 0 4

Course Objectives:

1. The concepts of friction in screw jack & inclined plane.
2. To draw shear force and bending moment diagrams by analytical method
3. To find forces in simple trusses by using joints and section methods
4. The concepts related to torsions and mechanics of fluids.

UNIT-I

Introduction to Engineering Mechanics **(14 Hours)**

Force Systems, Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its

Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.

UNIT-II

Friction **(13 Hours)**

Types of Friction, Limiting Friction, Angle of Repose, Coefficient of Friction, Laws of Friction, Static & dynamic Friction, Screw Jack, Minimum force required to drag a body on rough horizontal plane, body tending to move upwards on an inclined plane, body moving down the plane.

UNIT-III

Centroid, Centre of gravity and Moments **(21 Hours)**

Centroid of composite sections, Parallel & perpendicular axes theorem, Moment of area, Moment of inertia of standard sections and composite sections, mass moment of inertia of cylinder cone sphere, and Polar moment of inertia, Shear force and bending moment diagram, simple trusses, Method of joints, Method of section

UNIT-IV

Kinematics of Particles **(12 Hours)**

Rectilinear motion, plane curvilinear motion-rectangular coordinates, normal and tangential component, Kinetics of Particles: Equation of motion, rectilinear motion and curvilinear motion, work energy equation, conservation of energy, impulse and momentum, conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact.

Expected Outcomes:

After going through these contents the student shall be able to solve the simple problems related to:

1. Kinematics of particles,
2. Co-planar and concurrent forces,
3. Solids mechanics,
4. Moment of inertia and centre of gravity
5. Role of friction in screw Jack and inclined planes.

Recommended Books:

1. Theory of machines by V.P Singh Dhanpat rai& Co
2. Jindal U.C Engineering Mechanics Part-I, Galgotia Publications
3. Sadhu Singh, 'Strength of Materials', Khanna Publishers
4. Dr. Kirpal Singh, 'Mechanics of Materials', Standard Publishers
5. E.P.Popov, 'Mechanics of Materials', Pearson Education
6. K.L. Kumar, 'Engineering Fluid Mechanics', S. Chand
7. P.N. Chandramouli, 'Engineering Mechanics', PHI

ENVIRONMENTAL SCIENCES

(Mandatory Non-Credited course)

Sub. Code-BMNCC0-002	L	T	P	C
	2	0	0	0

Course Objectives:

1. To identify global environmental problems arising due to various engineering/industrial and technological activities and the science behind these problems.
2. To realize the importance of eco-system and bio-diversity for maintaining ecological balance.
3. To identify the major pollutants and abatement devices for environmental management and sustainable development.
4. To estimate the current world population scenario and thus calculating the economic growth, energy requirement and demand.
5. To understand the conceptual process related with the various climatologically associated problems and their plausible solutions.

UNIT-I

The Multi-disciplinary Nature of Environmental Studies: Definition, scope and importance, Need for public awareness.

Natural Resources: Renewable and Non-renewable Resources: Natural resources and associated problems.

Forest Resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food Resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land Resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT-II

Environmental Pollution: Definition**,** causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies,
Disaster management: floods, earthquake, cyclone and landslides.

UNIT-III

Social Issues and the Environment: From unsustainable to sustainable development**, Urban Problems:** related to Energy**,** Water conservation, Rain water harvesting, Watershed management**,** Resettlement and rehabilitation of people; its problems and concerns, Wasteland reclamation, Consumerism and waste products, Case studies.
Environmental Ethics: Issues and possible solutions**,** Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and Holocaust, Case studies.
Protection Acts: Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife protection Act, Forest conservation Act, Issues involved in enforcement of environmental legislation

UNIT-IV

Human Population and the Environment: Population growth, Variation among nations**,** Population explosion – Family Welfare Programmes**,** Environment and human health**,** Human rights**,** Value education**,** HIV/AIDS**,** Women and child welfare**,** Role of information technology in environment and human health**,** Case studies.

Environmental Science related activities:

We as human being are not an entity separate from the environment around us. Rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethoses. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students on the above issues through following two types of activities.

(a) Awareness Activities:

i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste.
ii) Slogan making event
iii) Poster making event
iv) Cycle rally
v) Lectures from experts.

(b) Actual Activities:

i) Plantation
ii) Gifting a tree to see its full growth
iii) Cleanliness drive
iv) Drive for segregation of waste
v) To live with some big environmentalist for a week or so to understand his work
vi) To work in kitchen garden for mess
vii) To know about the different varieties of plants
viii) Shutting down the fans and ACs of the campus for an hour or so

DIGITAL ELECTRONICS

Sub Code: BELES1-401	L	T	P	C	Duration: 45 Hrs.
	3	0	0	3	

UNIT 1

Fundamentals of Digital Systems and Logic families **(10 Hours)**

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates

Number systems-binary, signed binary, octal and hexadecimal number, binaryarithmetic,one's and two's complements arithmetic, codes, error detecting and correctingcodes.

UNIT 2

Combinational digitalcircuits **(10 Hours)**

Standard representation for logic functions, Simplification of logic functions using K-map, Minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders,

Adders, Subtractors, BCD arithmetic, Carry look ahead adder, Serial adder, Arithmetic and Logic unit (ALU), elementary ALU design, popular MSI chips.

Digital comparator, Parity checker/generator, Code converters, Priority encoders, Decoders/drivers for display devices.

UNIT 3

Sequential Circuits and Systems **(10 Hours)**

Flip-flops and Registers: A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J- K, D and T flip-flops, Applications of flip-flops, Shift registers, Applications of shift registers, Serial to parallel converter, Parallel to serial converter.

Counters: Ring counter, Sequence generator, Ripple(Asynchronous) counters, Synchronous counters, Counters design using flipflops, special counter IC's, Asynchronous sequential counters, applications of counters.

UNIT 4

Semiconductor memories and Programmable logic devices **(6 Hours)**

Memory organization and operation, Expanding memory size, Classification and characteristics of memories, Sequential memory, Read only memory (ROM), Read and write memory(RAM), Content addressable memory (CAM), Charge de-coupled device memory (CCD),

Commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, Complex programmable logic devices (CPLDS), Field programmable gate array (FPGA).

Analog-to-Digital (A/D) and Digital-to-Analog (D/A) Converters (9 Hours)

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/Aconverter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit,

Analog to digital converters: quantization and encoding, Parallel comparator A/Dconverter, Successive approximation A/D converter, Counting A/D converter, Dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, Example of A/D converter ICs.

Text/References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
4. Malvino and Leach, “Digital Principles and Applications”, TMH, 4th Ed.1991

CourseOutcomes:

At the end of this course, students will demonstrate the ability to

1. Understand working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
4. Be able to use PLDs to implement the given logical problem.

DIGITAL ELECTRONICS LAB

Sub Code: BELES1-402	L	T	P	C
	0	0	2	1

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.

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

Course Objectives

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

ELECTRICAL MACHINES –II

Sub Code: BELES1-403	L	T	P	C	Duration: 60 Hrs.
	3	1	0	4	

UNIT 1

Fundamentals of AC Machine Windings **(12 Hours)**

Physical arrangement of windings in stator and cylindrical rotor; Slots for windings; Single-turn coil - active portion and overhang; Full-pitch coils, Concentrated winding, Distributed winding, Winding axis, 3D visualization of the above winding types.

Air-gap MMF distribution with fixed current through winding, Concentrated and distributed winding, Sinusoidally distributed winding, Winding distribution factor.

UNIT 2

Pulsating and Revolving Magnetic Fields **(12 Hours)**

Constant magnetic field, Magnetic field produced by a single winding - fixed current and alternating current, Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), Revolving magnetic field.

UNIT 3

Three-phase Induction Machines **(12 Hours)**

Construction, Types (squirrel cage and slip-ring), Torque-slip characteristics, Starting and maximum torque. Equivalent circuit. Phasor diagram, Losses and efficiency.

Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors.

Generator operation. Self-excitation. Doubly-fed induction machines.

Single-phase Induction Motors **(8 Hours)**

Constructional features, Double revolving field theory, Equivalent circuit, Determination of parameters. Split-phase, Starting methods and applications.

UNIT 4

Synchronous Machines **(16 Hours)**

Constructional features, Cylindrical rotor synchronous machine - Generated EMF, Equivalent circuit and phasor diagram, Armature reaction, Synchronous impedance, Voltage regulation. Operating characteristics of synchronous machines, V-curves.

Salient pole machine - Two reaction theory, Analysis of phasor diagram, Power angle characteristics. Parallel operation of alternators - Synchronization and Load division.

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.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concepts of rotating magnetic fields.
2. Understand the operation of ac machines.
3. Analyse performance characteristics of ac machines.

ELECTRICAL MACHINES LAB – II

Sub Code: BELES1-404	L	T	P	C
	0	0	2	1

EXPERIMENTS

1. To perform load-test on three-phase induction motor and to plot speed-torque characteristics.
2. To perform no-load and blocked rotor test on three-phase induction motor to obtain equivalent circuit parameters and to draw circle diagram.
3. To study the speed control of three-phase induction motor by Kramer's method.
4. To study the speed control of three-phase induction motor by cascading of two induction motors.
5. To study star- delta starters and
   a) To draw electrical connection diagram.
   b) To start the three-phase induction motor using it.
   c) To reverse the direction of three-phase induction motor.
6. To start a three-phase slip ring induction motor by inserting different levels of resistance in the rotor circuits and to plot speed- torque characteristics.
7. To perform no-load and blocked rotor test on single-phase induction motor and to determine the parameters of equivalent circuit.
8. To perform load test on single-phase induction motor and plot speed-torque characteristics.
9. To perform no load and short circuit test on three-phase alternator and draw open and short circuit characteristics.
10. To find voltage regulation of an alternator by zero power factor (ZPF) method.
11. To study effect of variation of field current upon the stator current and power factor of synchronous motor running at no load and draw V and inverted V curves of motor.
12. To synchronise two 3-phase alternators using dark lamp method, and two-bright & one dark lamp method.
13. To start a synchronous motor using appropriate method.

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

Course Objectives:

1. To plot speed-torque characteristics of three-phase and single-phase induction motors.
2. To obtain equivalent circuit parameters of three-phase and single-phase induction motors.
3. To study speed control of induction motors using different techniques.
4. To plot characteristics of a three-phase alternator and a synchronous motor.
5. To synchronise two 3-phase alternators by different methods

Course Outcomes:

Students will be able to

1. Obtain equivalent circuit parameters of single-phase and three- phase Induction motors.
2. Control speed of Induction motors by different methods.
3. Draw open and short circuit characteristics of three-phase alternator and V and inverted V curves of synchronous motor.
4. Find out voltage regulation of an alternator by different tests.
5. Synchronise two or more 3-phase alternators.

POWER ELECTRONICS

Sub Code: BELES1-405	L	T	P	C	Duration: 45 Hrs.
	3	0	0	3	

UNIT 1

Power Switching Devices **(12 Hours)**

Power Diode, MOSFET, Insulated gate bipolar transistor(IGBT): V-I characteristics, Gate drive circuits for MOSFET and IGBT.

Thyristor family: Introduction, Silicon controlled rectifier (SCR), Static and dynamic Characteristics,Turn-on methods, Firing circuits for thyristors, Commutation circuits for thyristors.

Uni-junction transistor (UJT): Construction, V-I characteristics and use in firing circuits

UNIT 2

Thyristor Rectifiers (AC – DC converters) **(10 Hours)**

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load;

Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

UNIT 3

Choppers (DC-DC converters) **(6 Hours)**

Elementary chopper with an active switch and diode, Duty ratio and average voltage, Buck converter: analysis and waveforms at steady state, duty ratio control of output voltage, Boost converter: analysis and waveforms at steady state, duty ratio and average output voltage.

AC Voltage Controllers and Cycloconverters (AC - AC converters) **(5 Hours)**

Single phase AC voltage controllers using thyristors, phase control and integral cycle control, Single phase cyclo-converters, applications.

UNIT 4

Voltage Source Inverters (DC – AC converters) (12 Hours)

Single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and uni-polar sinusoidal modulation, modulation index and output voltage.

Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation.

Text/References:

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.
5. Bimbhra P.S., Power Electronics, Khanna Publishers, 2004.
6. P. C. Sen,Power Electronics, Tata McGraw-Hill Company Limited, New Delhi, 1992.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the differences between signal level and power level devices.
2. Analyse controlled rectifier circuits.
3. Analyse the operation of DC-DC choppers.
4. Analyse the operation of voltage source inverters.

POWER ELECTRONICS LAB

Sub Code: BELES1-406	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

EXPERIMENTS

1. To obtain V-I characteristics of SCR and measure latching and holding currents.
2. To plot V-I Characteristics of UJT.
3. To obtain triggering pulses for SCR by using UJT as relaxation oscillator.
4. To obtain triggering wave forms for SCR using R and RC firing circuits.
5. To obtain output voltage waveforms of single phase half wave controlled rectifier for R-L load.
6. To obtain output voltage wave forms for single phase full-wave controlled rectifiers with resistive and inductive loads.

7. To simulate three phase bridge rectifier and draw load voltage and load current waveform for resistive and inductive loads.
8. To study different types of chopper circuits and obtain waveforms for at least one of them.
9. To simulate single phase inverter using different modulation techniques and obtain load voltage and load current waveforms for different types of loads.
10. To simulate single phase full wave ac voltage controller and draw load voltage and load current waveforms for inductive load.
11. To study single phase cycloconverter.
12. To study speed control of induction motor using thyristor.
13. To study speed control of DC motor using thyristor.

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

Recommended Books

1. K.R. Varmah, K. John Ginnes, Abraham Chikku, 'Power Electronics, Design, Testing and Simulation, Laboratory Manual', 1st Edn., CBS Publishers & Distributors Pvt. Ltd., **2017**.
2. O.P. Arora, 'Power Electronics Laboratory, Theory, Practice and Organization', Narosa Publishing House, **2007.**

Course Objectives:

1. To obtain the characteristics of SCR and UJT and to obtain triggering pulses for them.
2. To verify the performance of various converter circuits by measuring the currents and voltages at different points in the circuit and to display their waveforms.
3. To control speed of motors by using thyristors.

Course Outcomes:

1. Students will be able to verify the characteristics of SCR and UJT and triggering pulses for them.
2. They will be able to visualize and analyse the performance of various converter circuits.
3. They will be able to control the speed of motors using thyristors.

SIGNALS & SYSTEMS

Sub Code: BELES1-407	L	T	P	C	Duration: 60 Hrs.
	3	1	0	4	

UNIT 1

Introduction to Signals and Systems **(14 Hours)**

Signals and systemsin electrical engineering and science, Signal properties: Periodicity, absolute integrability, determinism and stochastic character.

Some special signals of importance: Unit step, Unit impulse, Sinusoid, Complex exponential, Special time-limited signals; Continuous and discrete time signals, Continuous and discrete amplitude signals.

System properties: Linearity, additivity and homogeneity, Shift-invariance, causality, stability, realizability, Examples.

UNIT 2

Continuous and Discrete-time Linear Time invariant (LTI) systems (14 Hours)

Impulse response and step response, Convolution, Input-output behaviour with aperiodic convergent inputs, Cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations.

UNIT 3

Fourier and Z- Transforms (20 Hours)

Fourier series representation of periodic signals, Waveform symmetries, Calculation of Fourier coefficients. Fourier Transform, Convolution/multiplication and their effect in the frequency domain, Magnitude and phase response, Fourier domain duality.

The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT), Parseval's Theorem, The Z-Transform for discrete time signals and systems, System functions, Poles and zeros of systems and sequences, Z-domain analysis.

UNIT 4

Sampling and Reconstruction (12 Hours)

The Sampling Theorem and its implications. Spectra of sampled signals, Reconstruction: ideal interpolator, zero-order hold, first-order hold, Aliasing and its effects.

Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Text/References:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, “Signals and systems”, Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithms, and Applications”, Pearson, 2006.
3. H. P. Hsu, “Signals and systems”, Schaum’s series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, “Signals and Systems”, John Wiley and Sons, 2007.
5. A. V. Oppenheim and R. W. Schafer, “Discrete-Time Signal Processing”, Prentice Hall, 2009.
6. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
7. B. P. Lathi, “Linear Systems and Signals”, Oxford University Press, 2009.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concepts of continuous time and discrete time systems.
2. Analyse systems in complex frequency domain.
3. Understand sampling theorem and its implications.

MATHEMATICS - III
(Probability and Statistics)

Sub Code: BMATH3-301	L	T	P	C	Duration: 60 Hrs.
	3	1	0	4	

UNIT 1

Basic Probability **(18 Hours)**

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

UNIT 2

Continuous Probability Distributions **(6 Hours)**

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Bivariate Distributions **(6 Hours)**

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

UNIT 3

Basic Statistics **(12 Hours)**

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

UNIT 4

Applied Statistics **(13 Hours)**

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Small Samples **(5 Hours)**

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Text / References:

1) E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 2006.

2) P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
3) S. Ross, "A First Course in Probability", Pearson Education India, 2002.
4) W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 1968.
5) N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.
6) B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
7) T. Veerarajan, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.

CONSTITUTION OF INDIA

Subject Code: BMNCC0-001	L	T	P	C	Duration: 24 Hrs.
	2	0	0	0	

Course Contents:

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of Constitution of India.
4. Scheme of the fundamental rights.
5. The scheme of the fundamental Duties and its legal status.
6. The directive Principles of State Policy – its importance and implementation.
7. Federal structure and distribution of legislative and financial powers between the Union and the States.
8. Parliamentary Form of Government in India – The constitution powers and the status of the president of India.
9. Amendment of the constitutional Powers and Procedure.
10. The historical perspectives of the constitutional amendments in India.
11. Emergency Provisions: National emergency, President Rule, Financial Emergency.
12. Local Self Government – Constitutional Scheme in India.
13. Scheme of the Fundamental Right to Equality.
14. Scheme of the Fundamental Right to certain Freedom under Article 19.
15. Scope of the Right to Life and Personal Liberty under Article 21.