JECRC™ UNIVERSITY

BUILD YOUR WORLD

School of Engineering

Syllabi and Course Structure

B. Tech. (Electrical Engineering) (2018-2022)

Academic Programme

July 2018

Abbreviation: F=Foundation, G=General, C=Core, ID=Interdisciplinary, S=Specialization, A = Audit

B. Tech. (EE) Program Educational Objective (PEO's):
A graduate of the Electrical Engineering Program should:

PEO- I
Students should be in position to solve the real time problems related to Electrical machine, power system and its relevant equipments depending upon the present day demand based on effectiveness innovation.

PEO- II
Students should be capable enough to formulate the design problem based on the customize demand of the country and citizen.
PEO- III
Students should be in position to demonstrate the skill set developed related to field of electrical engineering.
PEO- IV

After learning the basic skills through the B. Tech. Electrical engineering course, student should have spark and intention to learn and explore more on its favorite field of interest.

Program Outcome (PO's)

A graduate of the Electrical Engineering Program will demonstrate:

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome:

PSO 1: Able to apply the knowledge gained during the course of the program from Mathematics, Basic Computing, and Basic Sciences in general and all electrical courses in particular to identify, formulate and solve real life problems faced in industries and/or during research work.

PSO 2: Able to provide socially acceptable technical solutions to complex electrical engineering problems with the application of modern and appropriate techniques for sustainable development.

PSO 3: Able to apply the knowledge of ethical and management principles required to work in a team as well as to lead an industry.

EE-Semester III

S. No.	Course Code	Course Title	L	T	P	Contact hrs./wk.	Credits	Type
1	BEL004B	Network Analysis and Synthesis	3	1	0	4	4	C
2	BEL002B	Electrical Machines I	3	1	0	4	4	C
3	BEL057A	Electromagnetic Field Theory	3	1	0	4	4	C
4	BEL058A	Analog Electronics	3	0	0	3	3	C
5	BAS003C	Advanced Engineering Mathematics	4	0	0	4	4	S
6	BEL059A	Electrical Power Generation	3	0	0	3	3	C
7	BEL005A	Basic Programming and Simulation Lab	0	0	2	2	2	C
8	BEL060A	Analog Electronics Lab	0	0	2	2	2	C
9	BEL007A	Electrical Machines Lab I	0	0	2	2	2	C
10	BHS003A	Professional Skills-Aptitude-III	2	0	0	2	0	Audit
		TOTAL	**24**	**0**	**6**	**30**	**28**	

Note: It is mandatory to pass Audit course.

EE - Semester IV

S. No.	Course Code	Course Title	L	T	P	Contact hrs./wk	Credits	Type
1	BEL009B	Power Electronics	3	1	0	4	4	C
2	BEL010B	Electrical Machines II	3	1	0	4	4	C
3	BEL061A	Digital Electronics	3	0	0	3	3	ID
4	BEL062A	Transmission and Distribution Systems	3	0	0	3	3	C
5	BAS004C	Computer Aided Numerical Methods	3	0	0	3	3	ID
6	BEL003B	Measurements and Instruments	3	0	0	3	3	C
7	BEL 006A	Measurements and Instruments Lab	0	0	2	2	2	C
8	BEL 011A	Power Electronics Lab	0	0	2	2	2	C
9	BEL 012A	Electrical Machines Lab II	0	0	2	2	2	C
10	BEL063A	Computer Aided Numerical Methods Lab	0	0	2	2	2	ID
11	BHS004A	Professional Skills- Advanced Aptitude-IV	2	0	0	2	0	Audit
		TOTAL	**20**	**2**	**8**	**30**	**28**	

Note: It is mandatory to pass Audit course.

EE - Semester V

S. No.	Course Code	Course Title	L	T	P	Contact hrs./wk.	Credits	Type
1	BEL013A	Control Systems	3	0	0	3	3	C
2	BCO003A	Object Oriented Programming with C^{++}	2	0	0	2	2	ID
3	BEE020A	Microprocessor and Microcontroller System	3	0	0	3	3	ID
4	BEL045B	Advanced Power Electronics	3	0	0	3	3	S
5	BEL018B	Switchgear and Relaying	3	0	0	3	3	C
6	BEL072A	Electrical Machine Design	2	0	0	2	2	S
7	BEE013A	Signal & Systems	3	0	0	3	3	ID
8		Open Elective I	3	0	0	3	3	ID
9	BEL015A	Control Systems Lab	0	0	2	2	2	C
10	BCO004A	Object Oriented Programming Lab	0	0	2	2	2	ID
11	BEE022A	Microprocessor and Microcontrollers System Lab	0	0	2	2	2	ID
12	BEL016A	Power Systems Lab I	0	0	2	2	2	C
		TOTAL	**22**	**0**	**8**	**30**	**30**	

EE-Semester VI

S. No.	Course Code	Course Title	L	T	P	Contact hrs./wk.	Credits	Type
1	BEL041B	Power System Stability	3	0	0	3	3	S
2	BEL024B	Electric Drives	3	0	0	3	3	S
3	BEL074B	Power System Analysis	3	1	0	4	4	C
4	BCO002A	Data Structures and Algorithms	3	0	0	3	3	ID
5		Program Elective I	3	0	0	3	3	S
6		Program Elective II	3	0	0	3	3	S
7		Open Elective II	3	0	0	3	3	ID
8	BEL025A	Electric Drives Lab	0	0	2	2	2	S
9	BCO005A	Data Structures and Algorithms Lab	0	0	2	2	2	ID
10	BEL027A	Power Systems Lab II	0	0	2	2	2	C
11	BHS006A	Professional Skills-Technical-VI	2	0	0	2	0	Audit
		TOTAL	**24**	**0**	**6**	**30**	**28**	

Note: It is mandatory to pass Audit course.

Program Elective-I and II (Any Two from followings)					
1	BEL033B	Advanced Control Systems	4	BEL064A	Special Electrical Machines
2	BEL022B	Programmable Logic Controllers and SCADA	5	BEL065A	Electrical Materials
3	BEL017B	Power System Reliability	6	BEL066A	Safety, Repair and Maintenance of Electrical Equipments

EE-Semester VII

S. No.	Course Code	Course Title	L	T	P	Contact hrs./wk.	Credits	Type
1	BEL034B	High Voltage Engineering	3	0	0	3	3	S
2	BEL040B	EHV AC/DC Transmission	3	0	0	3	3	S
3	BEL067A	Power System Economics	3	0	0	3	3	S
4	BEL021A	Energy Auditing	3	0	0	3	3	S
5		Program Elective III	3	0	0	3	3	S
6		Program Elective IV	3	0	0	3	3	S
7		Open Elective III	3	0	0	3	3	ID
8	BEL073A	CAD of Electrical Machines	0	0	2	2	2	S
9	BEL038A	Advanced Simulation Lab	0	0	2	2	2	S
10	BEL039A	Project Work	0	0	4	4	4	C
11	BEL050A	Seminar	0	0	1	1	1	S
		TOTAL	**21**	**2**	**7**	**30**	**30**	

Program Elective- III and IV (Any Two from followings)					
1	BEL068A	Recent Trends in Electric Power Generation	5	BEL043A	Excitation of Synchronous Machines and their Control
2	BEL037A	Power System Security and Smart Grid	6	BEL029A	FACTS (Flexible AC Transmission Systems)
3	BEL036A	Utilization of Electrical Energy and Electric Traction	7	BEL070A	Power System Instrumentation
4	BEL069A	Basics of Soft Computing			

EE-Semester VIII

S. No.	Course Code	Course Title	L	T	P	Contact hrs./wk.	Credits	Type
1	BEL046A	Industrial Project and Dissertation	0	0	28	28	28	C
		TOTAL	**0**	**0**	**28**	**28**	**28**	

OPEN ELECTIVE SUBJECTS OFFERED BY DEPARTMENT OF ELECTRICAL ENGINEERING

S. No.	Course No.	Course Title	Hrs/Wk L: T: P	Credits	Semester
1	BEL075A	Energy Studies	3: 0: 0	3	V
2	BEL051A	Knowledge Management	3: 0: 0	3	V
3	BEL022A	Programmable Logic Controllers and SCADA	3: 0: 0	3	V
4	BEL021A	Energy Auditing	3: 0: 0	3	VI
5	BEL030A	Indian Electricity Standards and their Applications	3: 0: 0	3	VI
6	BEL071A	Industrial Safety	3: 0: 0	3	VII
7	BEL035A	Non Conventional Energy Sources and Applications	3: 0: 0	3	VII
8	BEL069A	Basics of Soft Computing	3: 0: 0	3	VII

School of Engineering
B.Tech (Common to all)– Semester I/II
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BES005B: Basic Electrical Engineering

OBJECTIVE:
The objective of this course is to provide the students with an introductory treatment of the field of Electrical Engineering.

Unit 1: DC Circuit & Theorems – Ohm's law, KCL & KVL, Voltage & Current Sources, Star-Delta and Delta-Star transformations, Nodal & Mesh Analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem (only independent sources).

Unit 2: Single Phase Circuits - Definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and phasor representation of alternating quantities; Analysis with phasor diagrams of R, L, C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, series, parallel and series- parallel circuits.

Unit 3: Three Phase AC Circuits: Necessity and Advantages of three phase systems, Generation of three phase power, definition of Phase sequence, balanced supply and balanced load; Relationship between line and phase values of balanced star and delta connections.

Unit 4: Transformers - Principle of operation and construction of single phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation

Unit 5: Rotating Electrical Machines – Construction & Working principle of DC machine as a generator and a motor; EMF equation of DC generator; torque equation of DC motor. Back EMF of DC Motor. Induction Motors – Construction & Working principle of single phase induction motor, Applications of dc machines and single phase motors.

Course Outcome (CO):
CO1. To understand and analyze basic electrical circuits
CO2. To connect the electrical circuits with various components and calculate desired outputs.
CO3. To understand working and applications of different electrical machines (AC and DC).
CO4. To identify the type of electrical machine used for that particular application.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H				L			H				M		H	
CO2				M		H			H		M				M
CO3		M	H				H			M			M		
CO4	H				H			M			M			H	

H = Highly Related, M = Medium, L = Low

Text Books:

1. Nagsarkar and Sukhija, Basic Electrical Engineering,Oxford Uni. Press.
2. Abhijeet Chakrabarti, Sudipta Debnath and Chandan Kumar Chanda "Basic Electrical Engineering" Mc Graw Hill Education.

Reference Book:

1. Nagrath I.J. and D. P. Kothari (2001), Basic Electrical Engineering, TMH
2. Kulshreshtha DC (2009), Basic Electrical Engineering, Tata McGraw Hill
3. Rajendra Prasad (2009), Fundamentals of Electrical Engineering, Prentice Hall, India
4. Hughes, E. 2005), Electrical Technology. Pearson
5. BL Theraja, A textbook of electrical technology, Vol- II, S.Chand & Co. LTD.

School of Engineering
B. Tech. (Common to all) – Semester I/II
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines
BES008B: Basic Electrical Engineering Lab

OBJECTIVE: To provide exposure to the students with hands on experience on various basic engineering practices in Electrical Engineering.

List of experiments (Perform any 10).

1. Familiarization with (a) Electrical Symbols (b) Electrical Abbreviations (c) Electrical Tools
2. Familiarization with (a) Various Electrical Components (b) Electrical Measuring Instruments
3. To study the various Electrical Lamps Viz. Halogen Lamps, Fluorescent Tube & CFL, Sodium Vapour lamp, Neon Lamps, Incandescent Lamps and LED bulbs & Tubes
4. To make house wiring for a lamp operated from two different positions (or two way switching).
5. To make house wiring including Earthling for 1- Phase Energy meter, MCB, Ceiling Fan, Tube light, 3 Pin Plug & Socket.
6. To verify transformation ratio by measuring primary and secondary side voltages of single phase transformer
7. To measure current and voltage of primary and secondary side of 3-phase transformer for different tapings.
8. To study the construction & working of Ceiling fan
9. To run the single phase induction motor at varying speeds by using autotransformer.
10. To run the 3-pahse phase induction motor at varying speeds by using 3-phase auto transformer.
11. (a) To measure Power in 3-phase load by one-wattmeter method.
    (b) To measure Power in 3-phase load by three-wattmeter method.
12. To measure Power and Power factor in 3-phase load by two-wattmeter method.

OUTCOMES:

CO1. Students can now become familiar with various electrical symbols, abbreviations, tools and measuring instruments and practically connect the electrical circuits.
CO2. The ability to conduct testing and experimental procedures on different types of electrical machines.
CO3. The ability to select a suitable measuring instrument for measuring electrical and non electrical quantities for a given application. They will now be in position to learn different testing procedure of transformers and induction motors.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M			H		H			M			H		
CO2			H			M		H				H		M	
CO3	H			M					M		H				H

H = Highly Related, M = Medium, L = Low

School of Engineering
B. Tech. in Electrical Engineering – Semester III
Contact Hrs per week (L-T-P): 3-1-0

Course Outlines
BEL004B- Network Analysis and Synthesis

OBJECTIVES: In this course one can understand

- Various laws and equations with respect to electric and magnetic fields.
- In its second part one can learn various network theorems and transient response under different excitation.

Unit-1: **Introduction**: Introduction to circuit elements and their characteristics. Resonance, selectivity & Q-factor in ac circuits. **Graph Theory:** Graph for given network, classification of graph and sub graphs, incidence, tie set and cut set matrices, terminology used in Network Graph, properties of tree in a graph, variable solution of network using graph theory and matrix from the concept of network function.

Unit-2: **Network Theorems:** Thevenis's, Norton's, Superposition, Reciprocity, Compensation, Millman's theorem Tellegen's, Maximum power transfer and Miller`s theorems in DC & AC Circuits (for dependent sources).

Unit-3: **Transient Analysis of Networks:** Network elements, Transient response of R-L, R-C, R-L-C for DC and sinusoidal excitation,Response of networks to step, ramp, impulse, pulse and sinusoidal inputs. Time domain analysis of circuits; Shifting theorem, initial and final value theorems.

Unit-4: **Two-Port Network:** Introduction, different parameters and relationship between different parameters, inter-connections of two port networks, open circuit and short-circuit impedances and ABCD constants, image impedance, image parameters.\

Unit-5: **Network Synthesis:** Hurwitz polynomial, positive real functions, reactive networks. Separation property for reactive networks. The four-reactance function forms, specification for reactance function. Foster form of reactance networks; Cauer form of reactance networks. Synthesis of R-L and R-C networks in Foster and Cauer forms.

OUTCOMES:

CO1. Students can now apply the knowledge to solve different networks involving electric and/or magnetic field.
CO2. Also with the knowledge of different circuit theorem one can calculate the drop or power consumed/supplied by the load or source etc.
CO3. Calculate parameters of various two port power or communication networks.
CO4. Determine driving point and transfer functions of various networks, their poles and zeros and also their time response.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H		H	M		H		H		M		M		
CO2	M		M			H		M		H		H		H	
CO3			H	M		M	M			H	H				H
CO4	M	M			H			M	H			M	M		

H = Highly Related, M = Medium; L = Low

TEXT BOOKS:

1. M S Sukhija, T K Nagsarkar "Circuits & Networks: Analysis, Design and Synthesis" Oxford University Press.
2. Engineering Circuit Analysis by W. H. Hayt and J.E. Kemmerly, "*McGraw Hill*".

RECOMMENDED BOOKS:

1. A Course in Electrical Circuit Analysis by Soni and Gupta, "*Dhanpat Rai & Sons*".
2. Modern Network Synthesis by M. E. Van Vallkenburg, "*Wiley Eastern*".
3. Electronic devices and Circuit theory by R.L. Boylestad and L. Nashelesky, *"PHI"*

School of Engineering
B.Tech. in Electrical Engineering – Semester III
Contact Hrs per week (L-T-P): 3-1-0

Course Outlines
BEL002B- Electrical Machines I

OBJECTIVES:

- The working principles of electrical machines using the concepts of electromechanical energy conversion principles.
- Derive expressions for generated voltage and torque developed in various Electrical Machines.

Unit 1: **Electromechanical Energy Conversion:** Conservation of energy, physical phenomenon involved in conversion, energy balance, energy stored in magnetic field.

Unit 2: **Transformers:** Principle, construction with cooling methods and operation of single phase transformers, phasor diagram, equivalent circuit, voltage regulation, losses and efficiency. Open and short circuit tests, Polarity test, Sumpner's test, Separation of hysteresis and eddy current losses. **Autotransformers**: Construction, Principle, Applications and Comparison with two winding transformer.

Unit 3: **Three Phase Transformer:** Construction, various types of connection and their comparative features. Parallel operation of single phase and three phase transformers. Phase conversion-Scott connections, three phase to six phase conversion. Tap changing Transformers-No load and on load tap changing of transformers. Excitation phenomenon in transformers, Harmonics in single phase and three phase transformers, Suppression of harmonics.

Unit 4: **DC Machines-I:**Working principle, construction and methods of excitation. Armature Winding- Detailed study of simple lap and wave windings. emf equation, torque equation and classifications of DC Machines. Armature reaction, effect of brush shift and compensating winding. Commutation: Causes of bad commutation, Methods of improvement.

Unit 5: **DC Machine-II:** Characteristics of DC shunt, series and compound generators and motors, applications of various DC machines. Starting of DC motors: three point and four point starters. Losses and efficiency, speed control of DC shunt and series motors. Direct and regenerative methods to test DC motors.

OUTCOMES:

CO1. Apply the knowledge about the machines in the field
CO2. Students can now apply the knowledge of transformer and DC machines in testing them for the study of speed control, efficiency calculation and their various characteristics.
CO3. can used Modern tools for control.
CO4. machine based problems can be solved.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H		M		M		H	H	M			H	H
CO2		H		H		H		H				M	M		
CO3	H		M		M		L			H			M		H
CO4		M		M		M		M	H		L	M		M	

H = Highly Related, M = Medium, L = Low

Text Books:

1. PS Bimbhra, "Electrical Machinery", Khanna Publishers.
2. I.J. Nagrath and D.P. Kothari, "Electric Machines", Tata McGraw Hill, Fifth edition.

Reference Books:

1. George Mcphersion ,"An Introduction to Electrical Machines and Transformers", John Wiley and Sons, NY
2. BL Theraja, A textbook of electrical technology, Volume- II, S.Chand and Company. LTD.
3. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Sixth edition, Tata McGraw Hill Books Company, 2003.
4. MG Say, Theory, Performance and Design of AC Machines, CBS Publishers.
5. Clayton. A.E., "Performance and Design of Direct Current Machines" UBS Publishers.
6. Irving L. and Kosow, "Electric Machinery and Transformers", PHI

School of Engineering
B.Tech. in Electrical Engineering – Semester III
Contact Hrs per week (L-T-P): 3-1-0

Course Outlines
BEL057A- Electromagnetic Field Theory

OBJECTIVES: In this course one can understand

- Various laws and equations with respect to electric and magnetic fields.

Unit 1: **Vector Analysis:** Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient, Divergence and curl, Green's Stoke's and Helmholz theorems

*Unit-2:***Electrostatic Fields:** Coulomb's law, electric field intensity from point charges, Electric field due to continuous field distribution of charges, gauss's law, electric displacement and displacement density, potential functions, potential field of a charge, Laplace's and Poisson's equation, capacitance and electrostatic energy.

*Unit-3:***Magnetostatics:**Magnetic field vector: Magnetic field intensity, flux density & magnetization, Bio-Savart's law, Ampere's law, Magnetic scalar and vector potential, self & mutual inductance. Energy stored in magnetic field, Boundary conditions, Analogy between electric and magnetic field, Field mapping and concept of field cells

*Unit-4:***Time Varying Fields:** Faraday's law, Displacement currents and equation of continuity. Maxwell's equations, Uniform plane wave in free space, dielectrics and conductors, skin effect sinusoidal time variations, reflections, refraction & polarization of UPW, standing wave ratio. Pointing vector and power considerations

*Unit-5:***Transmission Lines:** The high-frequency circuit. LCR ladder model. The transmission Line equation. Solution for loss-less lines. Wave velocity and wave impedance. Reflection and Transmission coefficients at junctions.

OUTCOMES:

CO1. To differentiate different types of coordinate systems and use them for solving the problems of electromagnetic field theory.
CO2. To describe static electric and magnetic fields, their behavior in different media, associated laws, boundary conditions and electromagnetic potentials.
CO3. To apply numerical methods for the estimation of electromagnetic field quantities.
CO4. To calculate capacitances, inductances and to solve the Laplace and Poisson's equations for electric potential.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H		H	M		H		H		M		M		
CO2	M		M			H		M		H		H		H	
CO3			H	M		M	M			H	H				M
CO4	M	M			H			M	H			M		H	

H = Highly Related, M = Medium, L = Low

TEXT BOOKS:

1. Electromagnetics - William H. Hayt, Jr. Fifth Edition. TMH.1999.
2. Electro-Magnetics. Krauss J.DF; Mc Graw Hill.

REFERENCE BOOKS:

1. Electro-magnetic Waves and Radiating System: Jordan & Balmain, PHI.
2. Electromagnetic field theory: PV Gupta

School of Engineering

B.Tech. in Electrical Engineering – Semester III

Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL058A- Analog Electronics

OBJECTIVES

To analyze electric networks and circuits.

Knowledge of linear and large signal models of MOS and BJTs, and ability to use these models in basic amplifier circuits.

Unit-1: **Diodes**: Open-circuited p-n junction and space charge region. The biased p-n junction, volt-ampere characteristics, cutin voltage and effect of temperature on V-I characteristics. Minority carrier density distribution in (i) a forward biased junction and (ii) a reverse biased junction, diode capacitances, junction diode switching times and characteristics.Applications of diodes in rectifier, clipping, clamping circuits and voltage multipliers

Unit-2: **Transistors:** P-N-P and N-P-N transistors, transistor current components, common base (CB) and common emitter (CE) configurations: input & output characteristics, current Gains: alpha & beta, transistor operating regions: active region, saturation region and cutoff region, common collector configuration.

Unit-3: **Field Effect Transistors:** Construction, working, V-I characteristics and transfer characteristics of JFET. MOSFET: Enhancement type and depletion type: construction, working, V-I characteristics, and transfer characteristics. DC analysis of FETs. FET as a voltage variable resistor. FET small signal models. FET as a switch.

Unit-4: **OP-AMP:** Operational amplifier: inverting and non-inverting modes. Characteristics of ideal op-amp. Offset voltage and currents. Basic op-amp applications. Differential Amplifier and common mode rejection ratio. Differential DC amplifier and stable ac coupled amplifier. Integrator and differentiator. Analog computation, comparators, sample and hold circuits, logarithmic & antilog Amplifiers and Analog multipliersActive filters: Low pass, high pass, band pass and band stop, design guidelines.

*Unit-5:***Oscillators:**Classification of oscillators and Criterion for oscillation. RC-phase shift, Hartley, Colpitts, tuned collector, Wein Bridge and crystal oscillators. Astable, monostable and bistable multivibrators. Schmitt trigger

OUTCOMES:

CO1. To understand and analyze the different biasing techniques used in BJTs and FETs.
CO2. To analyze and design filters, analog to digital and digital to analog Converters, Comparators, adders, subtractors, Integrators and differentiators using OPAMP.
CO3. To understand the effect of positive feedback and to analyze and design Oscillators using BJTS, FETs and OPAMPs.
CO4. To develop the skill to build, and troubleshoot Analog circuits.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H			M				H		M		H	
CO2		H			M		M		H				M		
CO3	H	M				H					M		M		
CO4			H	M				M				M			H

H = Highly Related, M = Medium, L = Low

Text Books:

1. Integrated Electronics J. Millman and Halkias McGraw Hill.
2. Microelectronic Circuits-“Adel S. Sedra, Kenneth Carless Smith” Oxford.

Reference Books:

1. Introduction to Operational Amplifier theory and applications, J.V. Wait, L.P. Huelsman and GA Korn,McGraw Hill, 1992. 4 .
2. Analysis and Design of Analog Integrated Circuits, Paul R.Gray \& Robert G.Meyer, John Wiley, 3rd Edition. 3 .Op-amps and Linear Integrated Circuits-”Ramakant A. Gayakwad ” Prentice Hall.

School of Engineering
B. Tech. in Electrical Engineering – Semester III
Contact Hrs per week (L-T-P): 4-0-0

Course Outlines
BAS003C - Advanced Engineering Mathematics

OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

Unit 1: Vectors covering, laws of vector algebra, operations- dot, cross, triple products; Vector function – limits, continuity and derivatives, geometric interpretation; Gradient, divergence and curl formulae.

Unit 2: Complex Analysis including limits and continuity, derivatives; Analytic Functions; Cauchy Riemann Equations; Integrals, Cauchy theorem and Cauchy integral formulae; Taylor's series, Singular points and poles, Residues, Residue Theorem.

Unit 3: Evaluation of definite integrals, Conformal mapping, *The complex inverse formula*, the Bromwich contour, the use of Residue theorem in finding Laplace transforms; A sufficient condition for the integral around T to approach zero; The case of infinitely many singularities.

Unit 4: Mathematical Statistics, Sample space, Events, Random Variables; Definitions of probability, conditional Probability, expectation and higher order moments, distributions, examples of (discrete and continuous).

Unit 5: Normal, Poisson, Binomial distributions. Characteristic functions (mean and standard deviation); *Correlation and Regression*, Curve Fitting (Linear, Parabolic and Exponential).

OUTCOMES:

CO1. The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.
CO2. Expand important mathematical functions in power series and their applications.
CO3. Understand the theory of functions of several variables and its applications .
CO4. Express real life problems into mathematical models using differential equations and analyse their solutions.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	H	H			M			H			H		L
CO2	M			H	M	H					M			M	
CO3		M			M		L		H			H	M		H
CO4	L	L				L		M			L			M	

H = Highly Related, M = Medium, L = Low

Text Books:

1. Advance Engineering Mathematics by Erwin Kreyszig, Wiley India.

Reference Book:

1. Advance Engineering Mathematics by H. K Das, S.Chand.
2. Higher Engineering Mathematics by B.V Ramana, MGH.

School of Engineering
B.Tech. in Electrical Engineering – Semester III
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL059A- Electrical Power Generation

Unit-1: **Conventional Energy Generation Methods-I:** (i) Thermal Power plants: Basic schemes and working principle. (ii) Gas Power Plants: open cycle and closed cycle gas turbine plants, combined gas & steam plants-basic schemes.

Unit-2: **Conventional Energy Generation Methods**-II (i) Hydro Power Plants: Classification of hydroelectric plants. Basic schemes of hydroelectric and pumped storage plants. (ii) Nuclear Power Plants: Nuclear fission and Nuclear fusion. Fissile and fertile materials. Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor. Efficiencies of various power plants.

Unit-3: **Non Conventional Energy Generation:** Geothermal power plants, Electricity from biomass, Direct energy conversion systems, Thermo-Electric conversion system, Fuel Cells, Magneto HydroDynamic system.

Unit-4: **Load Curves**: Types of load, chronological load curve, load duration curve, energy load curve and mass curve. Maximum demand, demand factor, load factor, diversity factor, capacity factor and utilization. **Power factor improvement**: Causes and effects of low power factor and advantages of power factor improvement. Power factor improvement using shunt capacitors and synchronous condensers.

Unit-5: **Tariffs:** Objectives of tariffs. General tariff form. Flat demand rate, straight meter rate, block meter rate. Two part tariff, power factor dependent tariffs, three-part tariff. Spot (time differentiated) pricing. **Selection of Power Plants:** Comparative study of thermal, hydro, nuclear and gas power plants. Base load and peak load plants. Size and types of generating units, types of reserve and size of plant. Selection and location of power plants.

OUTCOMES:

CO1. Have the knowledge of various types of conventional power plants and their working, different equipments and instruments used for trouble free operation and maintenance.
CO2. Various types of storage batteries and their field of applications.
CO3. Know about various types of lamps their working principle, construction, field of application.
CO4. Design the Fuel Cells & MHDS for various applications.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M	H		L						L	M		L
CO2		M			H		L		M	H			M		
CO3				H				H			L			H	
CO4	M	M			H					M	M		L	M	

H = Highly Related, M = Medium, L = Low

TEXT BOOKS

1. A Course in Electrical power by Soni, Gupta, Bhatnagar.
2. Elements of Electrical Power Station Design by M.V.Deshpande.

RECOMMENDED BOOKS

1. Power station Engineering and Economics by Strotzky and Uopat

School of Engineering
B.Tech. in Electrical Engineering – Semester III
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines
BEL005A Basic Programming and Simulation Lab

OBJECTIVES:

- To expose the students to learn programming and simulation on MATLAB / Sci Lab software.

List of experiments (Perform any 10):

1. Introduction to simulation software for e.g. MATLAB, Sci Lab, including its installation, applications, opening of software, extensions used for programming and simulation, storage of file in hard disk, heaviness of file, saving and running the files, role of different colours reflected in programs, error identification and rectification etc.
2. To learn and calculate the results using different mathematical functions in command window.
3. Write a program to calculate the area of triangle and rectangle using definite input values in the program made in editor window.
4. Write a program to calculate the area of triangle and rectangle using input values from command window.
5. Write a program using the knowledge of DC machine in such a manner that there is graphical output plotting between two parameters of DC machine (for e.g. speed control of DC machine), thereby learning graphic window functions.
6. Write a program to calculate the efficiency of the transformer using the knowledge of open circuit and short circuit test.
7. Simulate using MATLAB software to learn the application of different mathematical blocks.
8. Simulate using MATLAB software to learn the application of different control system blocks.
9. Simulate using MATLAB software to learn the application of different measurement blocks.
10. Simulate half wave rectifier (uncontrolled) using MATLAB software with R Load.
11. Simulate half wave rectifier (controlled) using MATLAB software with R Load.
12. Simulate half wave rectifier (uncontrolled) using MATLAB software with RL Load.
13. Simulate half wave rectifier (controlled) using MATLAB software with RL Load.
14. Simulate half wave rectifier (uncontrolled) using MATLAB software with RLC Load.
15. Simulate half wave rectifier (controlled) using MATLAB software with RLC Load.

Course Outcome (CO):

CO1. Students can now use programming skills to get output on any mathematical objective function.

CO2. Students can also simulate the electric circuit by connecting different components and tools available in different block sets.
CO3. To develop their own program to solve their own problems and use this program to solve similar problems later on.
CO4. Students will get the knowledge about simulink models of the different electrical systems.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H		M		H		M	L		M	H		M
CO2		H		M	M	H		H			H			M	
CO3	H		M	H			M			H		M			H
CO4		H			M	M		H	L		M		M	M	

H = Highly Related, M = Medium, L = Low

School of Engineering
B.Tech. in Electrical Engineering – Semester III
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines
BEE060A Analog Electronics Lab

List of experiments (Perform any 10):

1. Design a voltage amplifier using BJT in common emitter mode and
   (a) Plot I/P vs. O/P voltage and calculate voltage gain.
   (b) Draw gain-frequency response and determine band width.
2. Design a voltage amplifier using BJT in common base mode and
   (a) Plot I/P vs. O/P voltage and calculate voltage gain.
   (b) Draw gain-frequency response and determine band width.
3. Design a voltage amplifier using BJT in common collector mode and
   (a) Plot I/P vs. O/P voltage and calculate voltage gain.
   (b) Draw gain-frequency response and determine band width.
4. Design voltage series feedback amplifier using BJT / FET. Plot I/P vs. O/P voltage graph.
5. Design a class B Push-pull amplifier.
6. Design and verify adder and subtractor circuit using OP-AMP(IC-741).
7. Design and verify differentiator and integrator circuit using OP-AMP(IC-741).
8. Design the square wave oscillator using OP-AMP (IC-741). Find frequency of oscillation.
9. Design of RC phase shift oscillator. Find frequency of oscillation.
10. Design of Wien bridge oscillator. Find frequency of oscillation.
11. Design of Hartley oscillator. Find frequency of oscillation.
12. Design of Colpitts oscillator. Find frequency of oscillation.
13. Design of band pass and band stop filter using OP-AMP(IC-741). Draw frequency response. Find lower cut-off frequency (F_L) and higher cut-off frequency (F_H).
14. Design and verify 4 bit analog to digital converter.
15. Design and verify 4 bit digital to analog converter.

Course Outcome (CO):

CO1. Understand the characteristics of diodes and transistors
CO2. Design and analyze various rectifier and amplifier circuits
CO3. Design sinusoidal and non-sinusoidal oscillators
CO4. Understand the functioning of OP-AMP and design OP-AMP based circuits.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H			M				M			L	M		L
CO2	H		M				M			L					M
CO3	M					M			L		M			M	
CO4			L					M		M		H	L	M	

H = Highly Related, M = Medium, L = Low

School of Engineering

B.Tech. in Electrical Engineering – Semester III

Contact Hrs per week (L-T-P): 0-0-2

Course Outlines

BEL007A- Electrical Machines Lab I

OBJECTIVES:

- To expose the students to the operation of DC machines and transformers and give them experimental skill.

List of experiments (Perform any 10):

1. Speed control of D.C. shunt motor by (a) Field current control method & plot the curve for speed vs field current. (b) Armature voltage control method & plot the curve for speed vs armature voltage.
2. Speed control of a D.C. Motor by Ward Leonard method and to plot the curve for speed vs applied armature voltage.
3. To determine the efficiency of D.C. Shunt motor by loss summation (Swinburne's) method.
4. To determine the efficiency of two identical D.C. Machine by Hopkinson's regenerative test.
5. To perform O.C. and S.C. test on a 1-phase transformer and to determine the parameters of its equivalent circuit its voltage regulation and efficiency.
6. To perform back-to-back test on two identical 1-phase transformers and find their efficiency & parameters of the equivalent circuit.
7. To perform parallel operation of two 1-phase transformers and determine their load sharing.
8. To determine the efficiency and voltage regulation of a single-phase transformer by direct loading.
9. To perform OC & SC test on a 3-phase transformer & find its efficiency and parameters of its equivalent circuit.
10. To perform parallel operation of two 3-phase transformers and determine their load sharing.
11. To study the performance of 3-phase transformer for its various connections, i.e. star/star star/delta, delta/star and delta/delta and find the magnitude of 3rd harmonic current.

Course Outcome (CO):

CO1. Students can now analyze the efficiency and characteristics of different electrical machines.
CO2. Students will develop the ability to perform different testing methods of transformer and DC Machines.
CO3. Students will get the knowledge of various parts of a transformer and DC Machines.
CO4. Students Will able to design and solve experimental problem of DC Machines and transformers.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		L			M			M		L		M		L
CO2		M		M			M	M		L		M		H	
CO3				L		H	H		H		M		M	H	
CO4	M	L	L		H					H		H			M

H = Highly Related, M = Medium, L = Low

School of Engineering
B.Tech. in Electrical Engineering – Semester IV
Contact Hrs per week (L-T-P): 3-1-0

Course Outlines
BEL009B- Power Electronics

OBJECTIVES:

- To be familiar with the working, characteristics and applications of different power electronic devices.

Unit 1: **Power Semiconductor Devices**: Construction, Principle of operation, Characteristics and Switching behaviour of various solid-state devices i.e. Power Diodes, SCR, TRIAC, DIAC, GTO, Power MOSFET, IGBT, MCT and Power BJT.

Unit 2: **Silicon Control Rectifier***:* Two-transistor analogy of SCR, triggering circuits of SCR: R, RC, UJT relaxation oscillators& its gate characteristics, SCR ratings & Protection of SCR: Protection against over voltage, over current, dv/dt, di/dt, Gate protection. Methods of SCR Commutation, Series & Parallel operation of SCR.

Unit 3: **Phase Control Rectifiers**: Single phase half, full and semi converters with R, Rl & RLE load and their performance parameters. Power factor improvement-Extinction angle control, symmetrical angle control, pulse width modulation control and sinusoidal pulse width modulation control.

Unit 4: **Three Phase Rectifiers:** Three phase half wave, full wave and half wave controlled rectifiers and their performance parameters. Effect of source impedance on the performance of single phase and three phase controlled rectifiers. Single-phase and three phase Dual Converter.

Unit 5: **Choppers:** Introduction of choppers, principle of operation of choppers, classification of choppers (Type A chopper, Type B chopper, Type C chopper and Type D chopper,) and applications of choppers.

OUTCOMES:

CO1. Articulate the basics of power electronic devices
CO2. Students can now apply the knowledge of working of different power electronic devices to control electrical and electronic systems.
CO3. Ability to express communication methods.
CO4. Ability to express characteristics of SCR, BJT, MOSFET and IGBT.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			M	H	L		H		M			H		M	L
CO2	L			M		M		H		H	M		H		
CO3		M				L	L		H		M	M		L	M
CO4		L			H			M		M			H		

H = Highly Related, M = Medium, L = Low

Text Books:

1. PS Bhimbra. “Power Electronics”, Khanna Publishers.
2. M.H. Rashid,“Power Electronics: Circuits, Devices & Applications”, Prentice Hall of India Ltd.

Reference Book:

1. AK Gupta and LP Singh, “Power Electronics”, Dhanpat Rai Publishing Co.
2. Rama Reddy, “Fundamental of Power Electronics”, Narosa Publishing.
3. MD Singh and KB Khanchandani, “Power Electronics” TMH Edition.
4. G.K. Dubey and C.R. Kasarbada “Power Electronics and Drives”, Tata McGraw-Hill

School of Engineering
B. Tech. in Electrical Engineering – Semester IV
Contact Hrs per week (L-T-P): 3-1-0

Course Outlines
BEL010B- Electrical Machines II

OBJECTIVES:

- To study the working principles of electrical machines using the concepts of electromechanical energy conversion principles.
- Derive expressions for generated voltage and torque developed in various AC Machines.

Unit 1: **Basic concepts of AC Electrical Machines:** Introduction, Idea of rotating magnetic field, mmf of concentrated Coil, mmf of distributed winding ,Winding factors, Generated emf.

Unit 2: **Induction Machines:** Principle of Operation Construction: cage and wound rotors, Equivalent circuit, Performance analysis, Torque-slip characteristics, Testing-Running light and blocked rotor test, load test, Effect of rotor resistance, Deep bar and double cage induction motor, Starting- Starting methods of squirrel cage and wound rotor induction motor, Speed Control- Various methods of speed control of squirrel cage and wound rotor induction motor, Effects of space harmonics, application.

Unit 3: **Single phase Induction Motors:** Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split phase starting methods and applications.

Unit 4: **Synchronous Generator:** Introduction, Construction, advantages of rotating field, types of rotors, emf equation, excitation systems, equivalent circuit and their phasor diagrams, voltage regulation, synchronous impedance method, mmf method. Zero power factor method, two reaction theory of salient pole rotor, phasor diagram, power developed and power angle characteristics of salient pole machine, determination of Xd and Xq, synchronization, synchronizing power and torque, parallel operation application.

Unit 5: **Synchronous Motors:** Introduction, construction, principal of operation, starting of synchronous motor, equivalent circuit and phasor diagrams, power and torque, performance calculation, speed torque characteristics, power factor control-effect of change of excitation. V-curve and inverted V-curve, synchronous condenser and reactors, synchronous phase modifiers, hunting-causes and remedies, applications, synchronous motor application.

OUTCOMES:

CO1. Students can now apply the knowledge of AC machines in testing them for the study of speed control, efficiency calculation and their various characteristics.
CO2. Can design and develop new machines
CO3. Design the machines for environmental friendly
CO4. Can used Modern tools for control

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			M		L		L		M			H	H	L	L
CO2	L			H		H		H		H	M				
CO3		M		H		M	L		H		M	M		M	H
CO4		L			H			M		M			H		

H = Highly Related, M = Medium; L = Low

Text Books:

1. PS Bhimbra, "Electrical Machinery", Khanna Publishers.
2. Ashfaq Husain : Electric Machines ,Dhanpat Rai & Co.(Pvt) Ltd , 2nd Edition 2006

Reference Book:

1. Nagrath and Kothari," Electric Machines" TMH
2. BL Theraja, A textbook of electrical technology, Vol-II, S.Chand & Co. LTD.
3. Fitzgerald and Kingsley, "Electric Machinery" McGraw Hill
4. Alexander S. Langsdorf, "AC Machines", Tata McGraw Hill.
5. MG Say, "Theory Performance and Design of AC Machines" CBS Publisher

School of Engineering
B.Tech. in Electrical Engineering – Semester IV
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL061A-Digital Electronics

OBJECTIVES:

- To familiarize the students with different codes of used in digital Electronics and their applications.

Unit 1: **Number Systems & Codes**: Basics of number systems, Binary representation, Codes and their conversions: BCD, Octal, Hexadecimal, ASCII, EBDIC, Gray, Signed binary number representation with 1's and 2's complement methods, Binary arithmetic

Unit 2: **Boolean Algebra & Combinational Circuits**: Boolean algebra, logic gates & circuits representation, Minimization of Boolean Functions by Karnaugh-map method & Quine McCluskey methods. Combinational circuits- adder, substractor, encoder, decoder, comparator, multiplexer, de-multiplexer, parity generator, etc

Unit 3: **Sequential Circuits**: Flip-flops, Bi-stable circuits: RS, JK, D, T, Master/Slave Flip-flop, race around condition, latches, synchronous and asynchronous counters up and down counters, shift registers, state Table & state transition diagram

Unit 4: **A/D and D/A Converters**- D/A converter, accuracy, resolution and precision, variable resistor network, binary ladder, A/D converter, accuracy and resolution, simultaneous conversion, counter method, continuous A/D converter, dual slope, successive approximation method.

Unit 5: **Different Logic families**- TTL, ECL, MOS and CMOS, their operation and specifications. Memory Systems: RAM, ROM, EPROM, EEROM

OUTCOMES:

CO1. Students can now apply the knowledge of digital circuits and its components to make different digitally feasible Projects.
CO2. Realize logic circuits.
CO3. Encode, decode, multiplex and de-multiplex the data.
CO4. Reduce the combinational circuits using K-map and Boolean algebra.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H	L		H		M			M	L	H		
CO2	M	L		H		H	H			L				M	
CO3		M			H	M			L		L	H		H	L
CO4		L	H				L		M	M		L	M		

H = Highly Related, M = Medium; L = Low

Text Books:

1. Jain R.P, "Modern Digital Electronics", Third edition, Tata Mc Graw Hill, 2003
2. Floyd T.L., "Digital Fundamentals ", Prentice Hall, 9th edition, 2006

Reference Book:

1. Anil K. Mani: Digital Electronics-Principles and Integrated Circuits, Wiley-India, 200
2. Digital Integrated Electronics- H.Taub & D.Shilling, Mc Graw Hill.
3. Givone—Digital Principles & Design, TMH
4. Leach & Malvino—Digital Principles & Application, 5th Edition, TMH

School of Engineering
B.Tech. in Electrical Engineering – Semester IV
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL062A-Transmission and Distribution Systems

OBJECTIVE:

- To make the students understand the concepts of generation, transmission and distribution of power.

Unit 1: **Distribution Systems**- DC 2–wire & 3–wire systems, AC single phase, 3 ph & 4-wire systems, Distribution Systems: primary and secondary distribution systems, concentrated and uniformly distributed loads on distributors fed at one and both ends, ring distribution, sub-mains and tapered mains, voltage drop and power loss calculations, voltage regulators.

Unit 2: **Neutral Grounding:** Necessity of neutral grounding, Effectively Grounded System, Ungrounded System, Methods of Neutral Grounding: Resonant Grounding, Generator Neutral Breaker, Grounding Practices, Earthing transformer. **Insulators:** Pin, shackle, suspension, post and strain insulators. Voltage distribution across an insulator string, grading and methods of improving string efficiency.

Unit 3: **Overhead Transmission Lines-** Types of Conductors, Line parameters; calculation of inductance and capacitance of single and double circuit transmission lines, three phase lines with stranded and bundle conductors, Generalized ABCD constants &performance of short, medium and long lines, Regulation and efficiency of long lines, Ferranti effect ,Surge impedance loading

Unit 4: **Mechanical Design of Transmission Lines**- Conductor material and types of conductor. Conductor arrangements and spacing. Calculation of sag and tension, supports at different levels, effect of wind and ice loading, stringing chart and sag template. Conductor vibrations and vibration dampers.

Unit 5: **Underground Cables :**Insulation, insulating materials, Extra high voltage cables, grading of cables, insulation resistance, Capacitance of a single core and three core cables, Overhead lines versus underground cables, types of cables, Dielectric loss, heating of cables.

Course Outcome (CO):

CO1. Students can able to understand with various factors which can affect power generation.
CO2. Students now know able to identify the performance of Transmission & distribution network used.
CO3. To identify the efficiency of distribution & Transmission lines as well as its efficiency under various operating conditions.
CO4. To understand Mechanical design of Transmission & distribution depending upon the requirement.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	H		L			H					M	H		H
CO2			H		M	L		L	M		M				M
CO3	L		L		H	H	M		H	L	H	L	M	L	
CO4		M		M				L		H				M	

H = Highly Related, M = Medium, L = Low

Text books:

1. Wadhwa, C.L., "Electric Power Systems", Second Edition, Wiley Eastern Limited
2. Nagrath, I.J. and Kothari, D.P., "Power System Engineering", TMH.

Reference Books:

1. Grainger John, J. and Stevenson, Jr. W.D., "Power System Analysis", McGraw Hill,
2. Harder Edwin, I., "Fundamentals of Energy Production", John Wiley and Sons
3. Deshpande, M.V., "Elements of Electric Power Station Design", A.H. Wheeler and Co. Allahabad
4. BR Gupta, "Power System Analysis and Design", S. Chand.

School of Engineering
B.Tech. in Electrical Engineering – Semester IV
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BAS004C Computer Aided Numerical Methods

OBJECTIVES:

- Numerical methods are that branch that deals with the approximate solution formations of various mathematical models.

Unit-1: Approximation in numerical computation, Truncation and rounding errors; Interpolation: Lagrange's Interpolation, Newton forward & backward differences Interpolation, Newton divided difference.

Unit- 2: Numerical Integration: Trapezoidal, Rule, Simson's 1/3 Rule, Weddle' Rule; Numerical Solution of a system of linear equation ; Gauss elimination method, Matrix Inversion, LU Factorization method, Gauss Jacobi method, Gauss Seidel method

Unit- 3: Algebraic Equation: Bisection method, Secant method, Regular- Falsi method, Solution of polynomial and transcendental equations by Newton- Raphson method.

Unit- 4: Numerical solution of ordinary differential equation: Taylor's series method, Euler's method, 4th order Runge - Kutta method, and Predictor-Corrector method.

Unit 5: Introduction to Finite Element Method for solving field problems. Stress and Equilibrium. Boundary conditions. Strain — Displacement relations. Stress — strain relations for 2-D and 3-D Elastic problems.

OUTCOMES:

CO1. After completing this course the student must demonstrate the knowledge and ability to solve these mathematical models by - analytical, graphical, or approximations.
CO2. Be familiar with numerical integration and differentiation
CO3. Be familiar with numerical solution of ordinary differential equations
CO4. Be familiar with calculation and interpretation of errors in numerical methods,

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H			M	L			H	M				M	L
CO2		L			L		M	H		H	M	M	H		
CO3	M		L	H		H			M					L	M
CO4			M	L			H	L			H	H	H		

H = Highly Related, M = Medium; L = Low

Text Books:

1. Numerical Methods (Problems and Solution) by Jain, Iyengar , & Jain
2. Numerical Analysis – Rao G.S., New Age International

Reference Books:

1. Numerical Analysis & Algorithms, Pradeep Niyogi, TMH, 1st ed.
2. Numerical Mathematical Analysis by J.B.Scarborough
3. Balagurusamy: Numerical Methods
4. Numerical Methods (Problems and Solution) by Jain, Iyengar , & Jain
5. Numerical Methods In Computer Applications – P.U.Wayse. EPH
6. Numerical Solutions of Differential Equations – Jain M.K.,New Age
7. Numerical Analysis – Rao G.S.,New Age International
8. Discrete Mathematical Structures – Rao G.S., New Age International
9. Foundations of Discrete Mathematics – Joshi K.D., New Age International

School of Engineering
B.Tech. in Electrical Engineering – Semester IV
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL003B- Measurements and Instruments

OBJECTIVES:

- To introduce the students to the standards which are available for measurement of different physical quantities.
- To introduce the students to the instruments which are available for measurement of different physical quantities.

Unit 1: **Units, Standards and Errors**: Absolute standards (International, Primary, and Secondary Standards), True Value, Errors (Gross, Systematic, Random); Static Characteristic of Instruments (Accuracy, Precision, Sensitivity, Resolution and threshold). **Measuring Instruments:** Moving coil, moving iron, electrodynamic and induction instruments-construction, operation, torque equation and errors.

Unit 2: **Instrument transformer:** Construction and operation of current transformer, potential transformer and CVT; Testing of CTs and PTs. Applications of CTs and PTs for the measurement of current, voltage, power and energy.**Energy Meter:**Applications of instruments for measurement of current, voltage, single-phase power and singlephase energy. Testing and calibration of single-phase energy meter by phantom loading.

Unit 3: **Potentiometers:** Construction, operation and standardization of DC potentiometers– slide wire and Crompton potentiometers. Use of potentiometer for measurement of resistance and voltmeter and ammeter calibrations. **Power Factor And Frequency Meters**: Construction, operation, principle, Torque equation, Advantages and disadvantages of Single phase power factor meters (Electrodynamic and Moving Iron types) and Frequency meters (Electrical Resonance Type).

Unit 4: **Resistance Measurement**: Introduction, sensitivity and limitations of Wheatstone bridge; Kelvin's double bridge method, Difficulties in high resistance measurements, Measurement of high resistance by direct deflection, loss of charge method, Megohm bridge and Megger.

Unit 5: **AC Bridges**: General balance equation; circuit diagram, Phasor diagram, Advantages, disadvantages and applications of Maxwell's bridge, Hays bridge & Anderson bridge for self inductance, Heaviside's bridge for mutual inductance, De-Sauty's bridge for capacipance measurement, Wien's bridges for frequency measurement and Schering bridge. .

Course Outcome (CO):

CO1. Students can now select different instruments (based on type, range and accuracy) to measure different physical quantities.
CO2. Understand the measurement standards and analyse the measurement errors.
CO3. Also they can compare different instruments to ascertain which is best for a particular condition and requirement.
CO4. Suggest the kind of instruments and instrumentation schemes suitable for typical measurements.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	**Program Outcome**												**Program Specific Outcome**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H			M			H	M		M			M	H
CO2	M		H	M		M	H			H		M	H		
CO3		M			H			M		H				M	
CO4	H		H			M	L		M		H	L	M		H

H = Highly Related, M = Medium, L = Low

Text Books:

1. A.K. Sawhney, “Electrical and Electronic Measurement and Instrument”, Dhanpat Rai and Sons

Reference Books:

1. Rajendra Prasad, “Electrical Measurement and Measuring Instrument” Khanna Publications.
2. EW Golding and F.C. Widdis, “Electrical Measurement and Measuring Instrument”, AH Wheeler and Co. India.
3. Forest K. Harries,“Electrical Measurement”,Willey Eastern Pvt. Ltd. India .
4. M.B. Stout ,“Basic Electrical Measurement” Prentice hall of India.
5. W.D. Cooper,” Electronic Instrument & Measurement Technique“Prentice Hall International.

School of Engineering
B.Tech. in Electrical Engineering – Semester III
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines
BEL006A- Measurements and Instruments Lab

OBJECTIVES:

- To introduce the basic functional elements of instrumentation and to learn the comparison between various measurements techniques and display devices.

List of Experiments (Perform any 10):

1. To perform the working of CRO and to learn to take readings of frequency, unknown voltage etc using divisions method and using plotting paper method.
2. To perform the working of a) Megger to calculate unknown high resistance, b) Tong-tester to calculate unknown and c) pf meter to calculate unknown pf.
3. To perform the working of single phase energy meter and take readings at unknown load.
4. To measure power and power factor by three voltmeter method.
5. To measure power and power factor by three ammeter method.
6. To calibrate an ammeter using DC slide wire potentiometer.
7. To calibrate a voltmeter using Crompton potentiometer.
8. To measure low resistance by Crompton potentiometer.
9. To measure Low resistance by Kelvin's double bridge.
10. To measure earth resistance using fall of potential method.
11. To measure resistance using Wheatstone bridge.
12. To measure inductance by Maxwell’s bridge.
13. To measure unknown inductance by Hay’s bridge.
14. To measure self-inductance using Anderson's bridge.
15. To measure capacitance using De Sauty Bridge.
16. To measure frequency using Wien’s bridge.
17. To measure frequency using vibrating reed type frequency meter.

Course Outcome (CO):

CO1: Students can now use the above instruments to measure unknown quantity or verify the given known physical quantity.
CO2: Students should be able to know performance of various electrical circuits, ac bridges, instruments, measurement procedures.
CO3: Students can use different measuring instruments and their practical aspects including accuracy and calibration of these instruments.
CO4: Students are able to understand the measurement techniques used for industrial purpose.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H	M		H		M		H		M		M		M
CO2	H			M		H		H		H		M		H	
CO3		M	H		H		H		M		L		H		
CO4	H			H		M		H		L		H		M	L

H = Highly Related, M = Medium, L = Low

School of Engineering
B.Tech. in Electrical Engineering – Semester IV
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines
BEL011A Power Electronics Lab

OBJECTIVES:

- To enable the students to verify the behavior of power electronics devices based on experimentation.

List of Experiments (Perform any 10):

1. To perform the comparison of following power electronics devices regarding ratings, performance characteristics and applications: Power Diode, Power Transistor, Thyristor, DIAC, TRIAC, GTO, MOSFET, MCT and SIT.
2. To plot V-I characteristics of SCR and measure forward breakdown voltage, latching and holding currents.
3. To plot the V-I characteristics of TRIAC and DIAC.
4. To draw output characteristics of MOSFET and IGBT.
5. To draw transfer characteristics of MOSFET and IGBT.
6. To draw UJT static emitter characteristics and study the variation in peak point and valley point.
7. To test firing circuits for SCR-R, RC and UJT firing circuits.
8. To test three phase diode bridge rectifier with R and RL loads.
9. To obtain waveforms of single-phase half wave controlled rectifier with and without Filters and also find the variation of output voltage with respect to firing angle.
10. To obtain waveforms of single-phase half controlled bridge rectifier with R and RL loads. To test the effect of freewheeling diode.
11. To obtain waveforms of single-phase full controlled bridge converter with R and RL loads.
12. To perform the rectification and inversion operations on single-phase full controlled bridge converter with R and RL loads with and without a freewheeling diode.
13. To control the speed of a DC motor using single-phase half controlled bridge rectifier and full controlled bridge rectifier and plot armature voltage versus speed characteristics.
14. To perform the forced commutation circuits of SCR.
15. To perform the experiment on protection circuits of SCR: (i) d*v*/dt (ii) d*i*/dt (iii) Over voltage (iv) Over current.
16. To perform the firing circuit of SCR using ramp-comparator scheme.
17. To perform the firing circuit of SCR using cosine-wave scheme.
18. To perform the firing circuit of SCR using Op-amps and Gates.
19. To perform the digital firing circuit of SCR.

Course Outcomes (CO):

CO1. Students can now compare the effect of different power electronic devices on the basis of their applications and performance characteristics.
CO2. To implement the phase controlled switching using DIAC and TRIAC.
CO3. To realize different type of triggering circuits for particular applications.
CO4. Students will able to understand the basics of different power electronic devices for industrial applications.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			H				M		H		L	H	L	
CO2			L		H	L	M				H		M		H
CO3	M	H		M		M		L	H	M	M	M		M	
CO4		L	H		M		H		M						M

H = Highly Related, M = Medium, L = Low

School of Engineering
B.Tech. in Electrical Engineering – Semester IV
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines
BEL012A- Electrical Machines Lab II

OBJECTIVES:

- To expose the students to the operation of transformers, synchronous machines and induction motors and give them experimental skill.

List of experiments (Perform any 10):

1. Separation of transformer core losses and to determine the hystersis and eddy current losses at rated voltage and frequency.
2. To plot the O.C.C. & S.C.C. of an alternator and to determine its regulation by synchronous impedance method.
3. To synchronize an alternator across the infinite bus (RSEB) & summarize the effects of variation of excitation on load sharing.
4. To plot the V-curve for a synchronous motor for different values of loads.
5. To perform sumpner's back-to- back test on 3 phase transformers, find its efficiency & parameters for its equivalent circuits.
6. To perform the heat run test on a delta/delta connected 3-phase transformer and determine the parameters for its equivalent circuit.
7. To perform no load and blocked rotor test on a 3 phase induction motor and to determine the parameters of its equivalent circuits. Draw the circle diagram and compute the following (i) Max. Torque (ii) Current (iii) slip (iv) p.f. (v) Efficiency.
8. To perform the load test on a 3-phase induction motor and determine its performance characteristics (a) Speed vs load curve (b) p.f. vs load curve (c) Efficiency vs load curve (d) Speed vs torque curve
9. Determination of losses and efficiency of an alternator.
10. To find X_d and X_q of a salient pole synchronous machine by slip test.

Course Outcomes (CO):

CO1. Students can now analyze the efficiency and characteristics of different electrical machines.
CO2. To understand the constructional details of various machines.
CO3. To compare the obtained characteristics with the theoretical one.
CO4. To understand various method of speed control of motors.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L		M	H		L			H	M				M	L
CO2			L		H		M	H		H	M	M	H		
CO3	H	L		M		H			M					L	M
CO4		M			M		H	L			H	H	H		

H = Highly Related, M = Medium; L = Low

School of Engineering
B.Tech. in Electrical Engineering – Semester IV
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines
BEL063A- Computer Aided Numerical Method Lab

List of Experiments (Perform any 10):

1. To deduce error involved in polynomial equation.
2. To Find out the root of the Algebraic and Transcendental equations using Bisection method.
3. To Find out the root of the Algebraic and Transcendental equations using Regula-Falsi method.
4. To Find out the root of the Algebraic and Transcendental equations using Newton-Raphson method.
5. To Find out the root of the Algebraic and Transcendental equations using Iterative method.
6. To implement Numerical Integration using Trapezoidal rule.
7. To implement Numerical Integration using Simpson 1/3 rule.
8. To implement Numerical Integration Simpson 3/8 rule.
9. To implement Newton‟s Forward Interpolation formula.
10. To implement Newton‟s Backward Interpolation formula.
11. To implement Gauss Forward Interpolation formula.
12. To implement Gauss Backward Interpolation formula.
13. To implement Bessel‟s Interpolation formula.
14. To implement Sterling‟s Interpolation formula.
15. To implement Newton‟s Divided Difference formula.
16. To implement Langrange‟s Interpolation formula.
17. To implement Numerical Differentiations.
18. To implement Least Square Method for curve fitting.

Course Outcomes (CO):

CO1. Students can now analyze the algebraic and transcendental equations with different method.
CO2. To understand the gauss interpolation formula.
CO3. To implement Numerical Integration techniques.
CO4. To compare among different numerical techniques.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			M		M				M		L	M		
CO2				M			L				L			H	
CO3		H				L		M				M	M		L
CO4			M		H					M	L				M

H = Highly Related, M = Medium; L = Low

School of Engineering
B.Tech. in Electrical Engineering – Semester V
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL013A Control Systems

OBJECTIVE:

- The objective of any design problem is a statement of what the final system is to achieve, and this applies to control system design as well.
- This course deals with techniques to meet out above objective.

Unit 1: **Introduction to Control Systems**- Concept of control, control system terminology, classification of Control Systems. Mathematical Models of Systems- Differential equations of physical systems, transfer function of linear systems, block diagram models, signal flow graph.

Unit2: **Time Response Analysis-** Time response analysis - First Order Systems – Impulse, Ramp and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation.

*UNIT 3:***Frequency Response Analysis-** Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol‟s Chart - Use of Nichol‟s Chart in Control System Analysis. Series, Parallel, series-parallel Compensators - Lead, Lag, and Lead Lag Compensators.

*UNIT 4:***Stability Analysis-** Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability.

Unit5: **State Variable Models**- State variables of a dynamic system, state equation, transfer function from the state equation and vice-versa. Ackerman's formula, limitations of state variable feedback.Introduction to P/I/D and ON-OFF control actions.

Course Outcome (CO):

CO1. Students can able to understand control circuits with various components and get desired outputs.
CO2. Students now know the working and applications different control feedback & its performance.
CO3. To identify the stability conditions of control circuits used for that particular application.
CO4. To design any control controller depending upon the requirement.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H			M	L			H	M				M	L
CO2		L			L		M	H		H	M	M	H		
CO3	M		L	H		H			M					L	M
CO4			M	L			H	L			H	H	H		

H = Highly Related, M = Medium; L = Low

Text books:

1. I.J Nagrath and M.Gopal, “Control System Engg”, TMH
2. BS Manke, “Linear control systems”, Khanna Publishers.

Reference Books:

1 M.Gopal, “Control Systems: Principles and Design”, TMH
2 BC Kuo, “Automatic Control System”, PHI
3 Ogata, “Control System Engg”, PHI
4 RC Dorf and RH Bishop, “Modern Control Systems”, Addison-Wesley Publishers

School of Engineering
B.Tech. in Electrical Engineering – Semester V
Contact Hrs per week (L-T-P): 2-0-0

Course Outlines
BCO003A Object Oriented Programming with C++

OBJECTIVE:

- To perform object oriented programming solution and develop solutions to problems demonstrating usage of control structure, modularity, classes, I/O and the scope of the class members
- To demonstrate adeptness of object oriented programming in developing solution to problems demonstrating usage of data abstraction, encapsulation and inheritance
- To demonstrate ability to implement one or more patterns involving dynamic binding and utilization of polymorphism in the solution of problems
- To learn syntax and features of exception handling

Unit 1: C++ Overview, C++ Characteristics, Object-Oriented Terminology, Polymorphism, encapsulation ,inheritance, Object-Oriented Paradigm, Abstract Data Types, I/O Services, Standard Template Library, Standards Compliance, Functions and Variables. Declaration and Definition

Unit 2: Variables: Dynamic Creation and Derived Data, Arrays and Strings in C++,Classes in C++, Defining Classes in C++, Classes and Encapsulation, Member Functions, Instantiating and Using Classes. Friend function ,Inline function

Unit 3: Using Constructors, Multiple Constructors and Initialization Lists, Using Destructors to Destroy Instances, Using Destructors to Destroy Instances, Operator Overloading: operator overloading of unary and binary operator, Function Overloading, Working with Overloaded Operator Methods, Initialization and Assignment, Initialization vs. Assignment.

Unit 4: Constant and Static Class Members, Inheritance, Overview of Inheritance, Defining Base and Derived Classes, Single, Multiple, multilevel, hybrid hierarchical inheritance. Constructor and Destructor Calls in inheritance, virtual function, virtual base class,

Unit 5: Input and Output in C++ Programs, Standard Streams, Manipulators, Unformatted Input and Output. Working with files.

Course Outcome (CO):

CO1. Understand object-oriented programming features in C++,

CO2. Apply these features to program design and implementation,

CO3. Understand object-oriented concepts and how they are supported by C++,

CO4. Gain some practical experience of C++.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			M				M			M		M		H
CO2		M			L				M			M		M	
CO3	H			L			M				H		M		
CO4		M			M				L			M		H	L

H = Highly Related, M = Medium; L = Low

Text Books:

1. Let Us C: Bala Guruswamy, TATA McGraw Hill.
2. Programming with C, C++: Yashwant Kanetkar

Reference Books:

1. C++: The Complete Reference.
2. The C++ Programming Language: Bjarne Stroustrup

School of Engineering
B.Tech. in Electrical Engineering – Semester V
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEE020A Microprocessor and Microcontroller System

OBJECTIVE:

- The course emphasizes on basic structure, programming and advancement in the field of microprocessor and microcontrollers.

Unit 1: Evolution of microprocessors, technological trends in microprocessordevelopment. The Intel family tree. CISC Versus RISC. Applications of Microprocessors. 8086 Block diagram; description of data registers, address registers,pointer and index registers, PSW, Queue, BIU and EU. 8086 Pin diagram descriptions. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module. Instruction formats, addressing modes.

Unit 2: Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions, process control instructions; Assembler directives. Writing assembly Language programs for logical processing, arithmetic processing, timing delays; loops, data conversions. Writing procedures, Data tables, modular programming, Macros.

Unit 3:8086 Interrupt types and interrupt vector table. DOS interrupt INT 21 h functions. INT 10h and INT 16h functions. Intel 8086 bus cycles, instruction queue, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode, reset operation, wait state, halt state, hold state, lock operation, interrupt processing. Address decoding techniques.

Unit 4: Intel's 8255 description, 8255 different modes operation and interfacing with 8086. Interfacing ADC(0808/0809),DAC-(0808) using 8255. Wave form generation. Intel's 8251 description and operation. Intel's 8259. DMA operation. Intel's 8237. Intel's 8279. Intel's 8253. Introduction to i3,i5,i7 processors.

Unit 5:8051 microcontroller pin diagram, Block diagram, Flag, RAM configuration, Register Banks, addressing modes, instruction set, 8051 programming and interfacing.

Course Outcome (CO):

CO1. Students will be able to verify assembly-language instructions which are used in microprocessor, cache memories, and parallel execution
CO2. Students now know able to understand the parts of a computer and the workings of each part buses and memories.
CO3. To distinguish and analyze the properties of Microprocessors & Microcontroller.
CO4. To understand illustrate how the different peripherals (8255, 8253 etc.) are interfaced with Microprocessor

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H			M	L			H	M				M	L
CO2		L			L		M	H		H	M	M	H		
CO3	M		L	H		H			M					L	M
CO4			M	L			H	L			H	H	H		

H = Highly Related, M = Medium; L = Low

Text Books:

1. Douglas Hall Microprocessors Interfacing, Tata McGraw Hill, 1991.
2. The 8051 Microcontroller and Embedded systems by Muhammad Ali Mazidi Pearson Education Asia.

Reference Books:

1. Computer Organization and Design, The hardware and software interface by D. A. Patterson and J H Hennessy, Morgan Kaufman Publishers.
2. The 8051 Microcontroller Architecture, programming and Applications by Kenneth Ayala, Penram International.

School of Engineering
B.Tech. in Electrical Engineering – Semester V
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL045B-Advanced Power Electronics

*Unit 1:***Inverters:**Principle of Operation, Single-phase bridge inverters. Three phase bridge Inverters: 180 and 120 degree of conduction. VSI and CSI. Voltage control of Single Phase and Three Phase Inverters, Harmonic analysis, harmonic reduction techniques, Pulse width modulation techniques.

*Unit-2:***Resonant Pulse Inverter:** Series resonant inverter with unidirectional switches, parallel resonant inverter, class E resonant inverter, L-type and M-type ZCS resonant converter, ZVS resonant converter.

*Unit-3:***AC Voltage Controllers**: **Regulators:** Principle of On-Off Control, Principle of Phase control, Single Phase Bi-directional Controllers with Resistive Loads, Single Phase Controllers with Inductive Loads, Three Phase full wave AC controllers, AC Voltage Controller with PWM Control. **Cyclo-converters:** Basic principle of operation, single phase to single phase, three-phase to three-phase and three-phase to single phase cyclo-converters. Output equation, Control circuit.

*Unit-4:***Non-isolated DC-DC Converters:** Buck, Boost, Buck-boost, Cuk and SEPIC converters – operations in CCM and DCM, non-idealities. Isolated DC-DC Converters: Flyback, Forward and Push-pull topologies.

*Unit-5***Power Supplies:** Switched Mode DC Power Supplies, fly-back converter, forward converter, half and full bridge converter, resonant DC power supplies, bi-directional power supplies. Resonant AC power supplies, bidirectional AC power supplies. Multistage conversions, Control Circuits: Voltage Mode Control, Current Mode Control

Course Outcome (CO):

CO1. Students can now apply the knowledge of these converters to make different power electronic models and applications.
CO2. Students can be known the current state-of-the-art technological development and application of these converters.
CO3. Realize advanced power electronic circuits for particular application.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M			H			H	L	H				M
CO2	M	H		M	H	M			H				H	M	
CO3		M		H			H	M			H	H		H	
CO4			H		M		L	M		M		M	M		H

H = Highly Related, M = Medium, L = Low

References:

1. R. Erickson and D. Maksimovic, " Fundamentals of Power Electronics," 2nd Edition 2001, Springer International Edition.
2. Ned Mohan, Tore M, Undelnad, William P, Robbins (3 Edition), " Power Electronics: Converters, Applications and Design," Wiley 2002.
3. Philip T Krein: Elements of Power Electronics; published by Oxford University Press.
4. M H Rashid, Power Electronics - Circuits, Devices and Applications; PHI, New Delhi.
5. L. Umanad, Power Electronics - Essentials and Applications; Wiley India Pvt. Ltd

School of Engineering
B.Tech. in Electrical Engineering – Semester V
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL018B- Switchgear and Relaying

OBJECTIVE:

- This course helps in understanding the principle and working of protective schemes, equipments used and various faults in the power system.

Unit 1: **Relays**: Introduction, basic requirements, operating principles and characteristics of electromagnetic type over-current, differential, impedance and admittance relays. Detail of protection against abnormal conditions for alternators, transformers, feeders transmission lines, and bus-bars. Carrier current protection for long lines.

Unit 2: **Circuit Breakers-** Introduction, functions of a circuit breaker, contacts separation and arc phenomenon, theory of arc formation and its extinction, recovery voltage, re-striking voltage, interruption of capacitive and inductive currents, resistance switching, double frequency transients, circuit breaker ratings, clearing time, reclosing time.

Unit 3: **Classification of circuit breakers:** Classification of circuit breakers, detailed principle, working, advantages and disadvantages of oil, air-blast, vacuum and SF_6 circuit breakers.

Unit 4: **Static Relays**: Introduction, comparison with electromagnetic relays, working of instantaneous, definite time, inverse time and directional over current relays, introduction to digital relays.

Unit 5: **Sub-Stations**: Types of sub-stations, sub-station equipments and outdoor yard layout, types of bus-bars, key diagrams and bus-bar arrangements. Fuse: Definition and its types, construction of HRC fuse. Lightening Arrestors and isolators.

Course Outcome (CO):

CO1. Students will be able to identify the main components and features of a protection scheme . .
CO2. Students now know able to understand fault clearing phenomena under abnormal conditions in different type of circuit breakers
CO3. To analyze the acquire skill to design the feasible protection systems needed for each main part of a power system
CO4. To illustrate apply conventional and numerical relays to the protection of rotating machines, busbars, transformers, transmission lines and distribution network.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H			M	L			H	M				M	L
CO2		L			L		M	H		H	M	M	H		
CO3	M		L	H		H			M					L	M
CO4			M	L			H	L			H	H	H		

H = Highly Related, M = Medium; L = Low

Text Books:

1. Badriram and DN Vishwakarma, “Power System Protection and Switchgear”, TMH
2. Ravindra P Singh, “Switchgear and Power System Protection”, PHI Learning

Reference Books:

1. CL Wadhwa, “Electric Power Systems”, Wiley Eastern Limited.
2. IJ Nagrath and DP Kothari,”Power System Engineering” Tata McGraw-Hill.
3. Sunil S. Rao, “Switchgear, Protection and Power Systems”, Khanna Publishers.
4. JBGUPTA: Switchgear protection. Kataria Publications, New Delhi.

(c)

School of Engineering

B.Tech. in Electrical Engineering – Semester V

Contact Hrs per week (L-T-P): 2-0-0

Course Outlines

BEL072A-Electrical Machines Design

Objectives:

To provide sound knowledge about constructional details and design of various electrical machines.

UNIT 1: **INTRODUCTION:** Major considerations in Electrical Machine Design – Insulating Materials – Space factor –Choice of Specific Electrical and Magnetic loadings - Thermal considerations - Heat flow –Temperature rise - Rating of machines – Standard specifications.

UNIT 2: **DC MACHINES:** Output Equations – Main Dimensions - Magnetic circuit calculations – Carter's Coefficient – Net length of Iron –Real & Apparent flux densities – Selection of number of poles – Design of Armature –Design of commutator and brushes – performance prediction using design values.

UNIT 3: **TRANSFORMERS:** Output Equations – Main Dimensions - KVA output for single and three phase transformers –Window space factor – Overall dimensions – Operating characteristics – Regulation – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.

UNIT 4: **INDUCTION MOTORS**: Output equation of Induction motor – Main dimensions – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor — Magnetic leakage calculations – Leakage reactance of poly-phase machines-Magnetizing current - Short circuit current – Circle diagram - Operating characteristics.

OUTCOMES:

CO1. To design armature and field systems for D.C. machines.
CO2. To design core, yoke, windings and cooling systems of transformers.
CO3. To design stator and rotor of induction machines.
CO4. Students will now be able to design an electrical machine for specified output.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H		H		M	H			H		M		M	
CO2	M		H		H			M	M		M		H		H
CO3			M		L		H		H			H		M	
CO4	H	H		\H		M		H		H	L		M		M

H = Highly Related, M = Medium, L = Low

TEXT BOOKS:

1. Sawhney, A. K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.
2. Sen, S. K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

REFERENCES BOOKS:

1. A. Shanmugasundaram, G. Gangadharan, R. Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint 2007.

School of Engineering
B.Tech. in Electrical Engineering – Semester V
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEE013A -SIGNALS AND SYSTEMS

Objectives:

1. To develop an understanding of the fundamental tools and concepts used in the analysis of signals and the analysis and design of linear shift-invariant systems.
2. To develop an understanding of their application in a broad range of areas, including electronics & electrical networks, telecommunications, signal-processing and automatic control.

Unit 1: Signals: Definition, types of signals and their representations: continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random, one-dimensional/multi-dimensional; commonly used signals: unit impulse, unit step, unit ramp, exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals.

Systems: Definition, types of systems: linear and non-linear, time invariant and time varying, Deterministic and Stochastic, Casual and non causal, Analog and Discrete/Digital, memory and memoryless.

Unit 2: Linear Time-Invariant Systems: Introduction, Continuous –time and Discrete-Time LTI Systems ,The Convolution Integral, Properties of the Convolution Integral, The Convolution sum, Properties of the Convolution sum, Properties of Linear Time-Invariant Systems, Relationship between LTI system properties and the Impulse response.System representation through differential equations and difference equations.

Unit 3: Fourier Analysis for Continuous-Time Signals and Systems: Introduction, The Response of Continuous-Time LTI Systems to Complex Exponentials, Representation of Periodic Signals: The Continuous-Time Fourier Series, Properties of Continuous-Time Fourier Series, Approximation of Periodic Signals Using Fourier Series and the Convergence of Fourier Series. Representation of Aperiodic Signals : The Continuous -Time Fourier Transform, Properties of the Continuous –Time Fourier Transform.
Fourier Analysis for Discrete-Time Signals and Systems: Introduction, Properties of Discrete Fourier series, Fourier Transform and Properties of Discrete Fourier Transform.

Unit 4: The Laplace-Trasform: Introduction, The Laplace-Transform, The Region of Convergence for the Laplace-Transform, Properties of Laplace-Transform, Inverse Laplace-Transform, Application & Characteristics of LTI System Using Laplace- Transform.

Unit 5: The Z-Transform: Introduction, The Z-Transform, The Region of Convergence for the Z-Transform, Properties of Z-Transform, The Inverse z-Transform, Application & Characteristics of LTI System Using Z Transform.
Sampling: Introduction, Representation of a Continuous- Time Signal by Its Samples , The Sampling Theorem, Reconstruction of a signal from its Samples, The Effect of Under sampling : Aliasing.

OUTCOMES:

CO1. Analyze different types of signals
CO2. Represent continuous and discrete systems in time and frequency domain using different transforms
CO3. Investigate whether the system is stable
CO4. Sampling and reconstruction of a signal

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			M	H			M		M		L	H	L	M	
CO2		H			M	M			H			L		H	
CO3	M				L		H		H			H	H	L	
CO4	M		L	L	H			M		M					M

H = Highly Related, M = Medium, L = Low

Text Book:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.

Reference Books:

1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
2. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
3. Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition: c1999.
4. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
5. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
6. I. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.

School of Engineering

B.Tech. in Electrical Engineering – Semester V

Contact Hrs per week (L-T-P): 0-0-2

Course Outlines

BEL015A- Control Systems Lab

OBJECTIVE:

- To learn the different order systems in controls circuits, plotting different steady state and transient responses.
- Study the frequency response of different damping networks.

List of Experiments (Perform any 10):

1 Introduction to MATLAB Computing Control Software for programming and simulation.
2 Defining Systems in TF, ZPK form.
(a) Plot step response of a given TF and system in state-space. Take different values of damping ratio and ω_n natural undamped frequency. (b) Plot ramp response.
3 For a given 2^{nd} order system plot step response and obtain time response specification.
4 To design 1^{st} order R- C circuits and observe its response with the following inputs and trace the curve. (a) Step (b) Ramp (c) Impulse
5 To design 2^{nd} order electrical network and study its transient response for step input and following cases. (a) Under damped system (b) Over damped System. (c) Critically damped system.
6 To Study the frequency response of following compensating Networks, plot the graph and final out corner frequencies. (a) Lag Network (b) Lead Network (c) Lag-lead Network.
7 To draw characteristics of AC servomotor.
8 To perform experiment on Potentiometer error detector.
9 Check for the stability of a given closed loop system.
10 Plot bode plot for a 2^{nd} order system and find GM and PM.
11 Error detector characteristics and control applications of the following. (i) LVDT (ii) Potentiometer.
12 Performance analysis of thermal system and design using PID/Relay control.
13 To obtain the position control performance of DC Servo Motor.
14 Comparisons of different Control Action (P/I/D/Relay) on Industrial Process (Pneumatic/ Simulated System.)

Course Outcome (CO):

CO1. Students can able to understand control circuits with various components and get desired outputs.
CO2. Students now know the working and applications different control feedback & its performance.
CO3. To identify the stability conditions of control circuits used for that particular application.
CO4. To design any control controller depending upon the requirement.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H			M	L			H	M				M	L
CO2		L			L		M	H		H	M	M	H		
CO3	M		L	H		H			M					L	M
CO4			M	L			H	L			H	H	H		

H = Highly Related, M = Medium; L = Low

School of Engineering
B.Tech. in Electrical Engineering – Semester V
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines
BCO004A - Object Oriented Programming Lab

List of Experiments:

1.a) Study of Unix/Linux general purpose utility command list: man,who,cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown.

b) Study of *vi* editor.

c) Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system.

d) Study of Unix/Linux file system (tree structure).

e) Study of .bashrc, /etc/bashrc and Environment variables.

2. Write a C program that makes a copy of a file using standard I/O, and system calls

3. Write a C program to emulate the UNIX ls –l command.

4. Write a C program that illustrates how to execute two commands concurrently with a command pipe. Ex: - ls –l | sort

5. Write a C program that illustrates two processes communicating using shared memory

6. Write a C program to simulate producer and consumer problem using semaphores

7. Write C program to create a thread using pthreads library and let it run its function.

8. Write a C program to illustrate concurrent execution of threads using pthreads library.

Extra Programs

1. Write a shell script that accepts a file name, starting and ending numbers as arguments and displays all the lines between the given line numbers.

2. Write a shell script that displays a list of all files in the current directory to which the user has read, write and execute permissions.

Course Outcome (CO):

CO1. Understand object-oriented programming features in C++,
CO2. Apply these features to program design and implementation,
CO3. Understand object-oriented concepts and how they are supported by C++,
CO4. Gain some practical experience of C++.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			M				M			M		M		H
CO2		M			L				M			M		M	
CO3	H			L			M				H		M		
CO4		M			M				L			M		H	L

H = Highly Related, M = Medium; L = Low

School of Engineering
B.Tech. in Electrical Engineering – Semester V
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines

BEE022A: Microprocessor and Microcontroller System Lab

OBJECTIVE:
To understand the internal organization of INTEL 8086 Microprocessors, 8051 microcontroller and Assembly Language Programs using the instruction sets of processors and to study the interfacing of the processor with various peripheral devices.

List of Experiments (Perform any 10):

1. a) Write a program using Microprocessor 8086 to add two 8 bits numbers.
   b) Write a program using Microprocessor 8086 to subtract two 8 bits numbers.
   c) Write a program using Microprocessor 8086 to add two 16 bits numbers.
   d) Write a program using Microprocessor 8086 to add ten 16 bits numbers with carry.
2. (a) Write an assembly language program to find whether the given number is even or odd.
   (b) Write an assembly language program to find the number of even and odd numbers from given series of 16 bit numbers.
   (c) Write an assembly language program to find the number of 1's in a given number.
   (d) Write an assembly language program to find whether the given number has even parity or odd parity.
3. (a) Write an assembly language program to find the largest number from an array of 16 bit numbers.
   (b) Write an assembly language program to find the smallest number from an array of 16 bit numbers.
   (c) Write an assembly language program to arrange the given array of 16 bit numbers in ascending order.
   (d) Write an assembly language program to arrange the given array of 16 bit numbers in descending order.
4. (a) Write an assembly language program to find the number of +ve and -ve numbers from given series of 16 bit numbers.
   (b) Write an assembly language program to perform 1 byte BCD addition
   (c) Write an assembly language program to perform addition, subtraction, Multiplication and Division of given operands. Perform BCD addition and subtraction.
   (d) Write an assembly language program to move 16 bytes from the offset 0200H to 0300H.
5. (a) Write an assembly language program to find whether the given byte is present in the string or not.
   (b) Write an assembly language program to compare two given strings.
   (c) Write an assembly language program to find square of the given number.

(d) Write an assembly language program to find square of the given array of 16 bit number.

6. (a) Display a message " very large scale integration"
   (b) Write an assembly language program to convert BCD number 0 to 9 to their 7 segment codes, using look up table.
   (c) Write an ALP for (i) addition and (ii) Multiplication of two 3x3 Matrices.
7. a) Write a program to calculate squares of BCD number 0 to 9 and store then sequentially from 2000H offset onward in the current data segment. The number and their square are in BCD format. Write a subroutine for the calculation of square of number.
   b) Write a program to change a sequence of 16 two byte number from ascending to descending order and store them in same data segment.
8. a) Write a program to generate a delay of 100ms using an 8086 system that runs on 10MHz frequency.
   (b) Write a program to generate delay of 1Minutes.
9. (a) Write a program in 8051
   (i) to clear the accumulator and add 3 to accumulator 10 times.
   (ii) to load accumulator with the value 55H and complement the accumulator 700Times.
   (b) Write a program to toggle all the bits of port1. put a time delay in between each issuing of data to port 1.
10. (a) Write a program to generate a delay of 1µsec. assuming that crystal frequency is 11.05 MHz.
    (b) Write a program in 8051 to perform the following
    (i) Keep monitoring the port P2.2 bit until it becomes high
    (ii) When it becomes high write a value 45H to port 0 send a high to low pulse to P3.3.
11. (a) Write a program to get X value from P1 and send X^2 to P2 continuously.
    (b) Assume P1 is I/P port and connected to a temperature sensor. Write a program to read the temperature and test it for the value 75. according to test result place the temperature value into the registers indicated by the following
    If T = 75 then A = 75
    If T < 75 then R1 = T
    If T > 75 then R2 = T
12. (a) Write a program to find number of 1's in given number.
    (b) Write a program tfor conversion of packed BCD to ASCII
13. Write a program to Interface 7-segment LED displays to a microprocessor and displaying a real-time clock.
14. Write a program for the implementation of a traffic signal controller.
15. Write a program for implementation of a programmable frequency synthesizer using timers.
16. Write a program to interfacing ADC & DAC -capturing a waveform from signal generator and CRO display.
17. Write a program to interfacing a stepper motor to a 8051 microcontroller.

Course Outcomes (CO):

CO1. Students will be able to verify assembly-language programme using Microprocessor 8086 applicable for various arithmetic operation.
CO2. Students now know able to understand Interface 7-segment LED displays to a microprocessor
CO3. To distinguish and analyze the properties of Microprocessors & Microcontroller to interfacing ADC & DAC.
CO4. To understand illustrate how the different peripherals (8255, 8253 etc.) are interfaced with Microprocessor

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M		H		L	M		H	M				M	L
CO2			L		M			H		H	M	M	H		
CO3	M			M	H		H		M					L	M
CO4		M	H			M		L			H	H	H		

H = Highly Related, M = Medium; L = Low

School of Engineering
B.Tech. in Electrical Engineering – Semester V
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines
BEL016A- Power Systems Lab I

OBJECTIVE:

The power system laboratory is responsible for getting the line parameters and other power system quantities using hardware, panels and simulated results.

List of Experiments (Perform any 10):

1 To perform various test on transmission line hardware / software model, to determine the ABCD parameters.
2 To perform various test on transmission line hardware / software model, to determine the surge impedance load.
3 To perform various test on transmission line hardware / software model, to determine the efficiency at various load.
4 Write a program in MATLAB to calculate sending end voltage and regulation in a short transmission line.
5 Write a program in MATLAB to apply Kelvin's law to determine the economic cross-section of the conductor of over head transmission line.
6 To measure (PPS and NPS) sequence components of supply voltages by segregating networks and verify graphically using hardware / software.
7 To determine negative and zero sequence reactance's of an alternator using software programming tool such as MATLAB.
8 To test the given AC energy meter by phantom loading at (i). Unity power factor (ii). 0.8 power factor lagging (iii). 0.8 power factor leading.
9 To find the string efficiency (i). Without the guard ring (ii). With guard ring using hardware or software programming tool such as MATLAB.
10 To study the negative phase sequence protection scheme on testing kit or using software programming tool such as MATLAB.
11 To find the zero sequence impedance of a given three phase transformer using software programming tool such as MATLAB.
12 Write a MATLAB program for sag calculation with supports at same level.
13 Write a MATLAB program for sag calculation with supports at different level.
14 Write a MATLAB program for sag calculation with supports at same level considering the ice and wind load (given the wind velocity in km/hr).

Course Outcome (CO):

CO1. Students can able to will be able to verify the principle of protective schemes and various faults in the power system using MATLAB.
CO2. Students now know able to perform various testing on transmission line hardware / software model, to determine the efficiency at various load using MATLAB.
CO3. To identify the string efficiency using guard ring using hardware or software programming tool such as MATLAB. .
CO4. To understand phase sequence protection scheme on testing kit or using software programming tool such as MATLAB.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H			M	L			H	M				M	L
CO2		M			L		M	H		H	M	M	H		
CO3	M		M	H		H			M					L	M
CO4			H	L			H	L			H	H	H		

H = Highly Related, M = Medium L = Low

School of Engineering
B.Tech. in Electrical Engineering – Semester VI
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL041B- Power Systems Stability

OBJECTIVE:

- This course helps in modeling of synchronous machine. It also gives information regarding various stabilities methods.

Unit :1 **Modelling of synchronous machines:** Modeling of cylindrical rotor salient pole synchronous machines, flux linkage equations, voltage equations, Park's transformation, various inductances and time constraints of synchronous machines, vector diagrams for steady state and transient conditions, power angle curves.

Unit-2: **Power Angle equations and curves:** Power angle equations and power angle curves under steady state, and transient conditions. Rotor dynamics and swing equation (solution of swing equation not included), synchronizing power coefficient. **Machine Systems:** Steady state stability of single machine connected to an infinite bus by the method of small oscillations. Two machine systems. Coherent and non-coherent machines.

Unit3: **Equal Area Criterion:** Equal area criterion and its application to transient stability studies under basic disturbances: Sudden loss of one parallel line, sudden change in mechanical input and reclosure, critical clearing angle and critical clearing time.

Unit :4 S**tudy of various stability methods:** Solution of Swing equation by step by step method.Euler's Method and Runga-Kutta Method, Application of Computers in the study of transient stability using these methods. Methods of improving steady state and transient stability.

Unit:5 **Voltage Stability:** Introduction, Comparison of angel and voltage stability, Reactive power flow and Voltage collapser, Mathematical formulation of voltage stability problems, Voltage stability analysis, prevention of voltage collapse.

OUTCOMES:

CO1. Students can get the design and modeling methodologies of synchronous machines.
CO2. Students will now be able to compare different stabilities methods to find the best for a particular situation.
CO3. Students will able to solve numerical problems for power system stability assessment.
CO4. To perform stability analysis and stability criteria of multi machine systems.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			H			H				L	H				M
CO2	M		H	M	L				H			H	M	M	
CO3	M	M			H	M	H	M	H		H			H	
CO4		H		L			L	M		M		M	M		H

H = Highly Related, M = Medium, L = Low

Text book:

1. P. Kundur, “Power System Stability and Control”, Mc Graw Hill.

Reference Books:

1. P.S.R. Murty, “Operation and control in Power Systems” B.S. Publications.
2. J. Wood and B.F. Wollenburg,“ Power Generation, Operation and Control “ John Wiley
3. CL Wadhwa, Electrical power system. New Age international publishers.

School of Engineering
B.Tech. in Electrical Engineering – Semester VI
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL024B- Electric Drives

OBJECTIVE:

- This course helps in explaining the design, function, operation and control of all major components of a typical electric vehicle power train / drives (AC and DC both).

Unit 1: **Introduction**- Classifications of Electric Drives, components of electric drives, advantages of electric drives, Review of characteristics and speed control of DC and AC motors. Dynamics of Electric Drives:- Fundamental torque equation, speed-torque conventions and multi-quadrant operation, equivalent values of drive parameters, components of load torques, nature and classification of load torques, calculation of time and energy-loss in transient operations, criteria for steady state stability, load equalization.

Unit2: **Rectifier Control of DC Drives**- Controlled rectifier circuits, 1-phase fully controlled rectifier-fed separately excited DC motor, 1-phase half-controlled rectifier-fed separately excited DC motor, 3-phase fully controlled rectifier-fed separately excited DC motor, multi quadrant operation of fully-controlled rectifier-fed DC motor.

Unit 3: **Chopper Control of DC Drives**- Principle of operation and control techniques, motoring operation of separately excited and series excited motors, multi quadrant control of chopper-fed motors.

Unit4: **Induction Motor (IM) Drives**:- 3-phase AC voltage controller-fed IM drive, voltage source inverter (VSI) and current source inverter (CSI) variable frequency drives, comparison of VSI and CSI drives, cyclo-converter-fed IM drive, static rotor resistance control of 3-phase slipring IM Synchronous Motor Drives- VSI drive, CSI drive, CSI drive with load commutation, cyclo-converter drive.

Unit 5: **Braking methods**- Various methods of braking DC and AC motors, regenerative braking of DC motors during chopper control, static Scherbius drive, commutatorless Kramer drive. Introduction to Microprocessor Control of Electric Drives.

COURSE OUTCOMES:

CO1: Students will now be able to describe the structure of electric drive systems and their role in various applications.
CO2: Students will able to use power electronics devices as controllers for different drives.
CO3: Ability is developed to understand the relation between torque, speed and braking system of motor and beyond conventional methods some efficient methods will understand.
CO4: Develop an ability to differentiate between current source and voltage source converters.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			H			H	H		H		M		H		H
CO2	M	M		M	M			H		L		H		H	
CO3		H	M		H	M		M	L	M	M		M		
CO4	H			M			M					L		M	L

H = Highly Related, M = Medium; L = Low

Text Books:

1. GK Dubey, “Fundamentals of Electrical Drives” Narosa Publishing House, 1995.

Reference Books:

1. V. Subrahmanyam, “ Electric Drives: Concepts and Applications”, TMH 1994.
2. GK Dubey, “ Power Semiconductor Controlled Drives, Prentice Hall.
3. EL- Sharkawi & A Mohamad “Fundamental of Electric Drive”, Vikas Pub. House
4. SK Pillai, “A First course on Electrical Drives” Wiley Eastern Ltd.

School of Engineering
B.Tech. in Electrical Engineering – Semester VI
Contact Hrs per week (L-T-P): 3-1-0

Course Outlines

BEL074A- Power Systems Analysis

OBJECTIVE:

- This course helps in formulating a single line, impedance and reactance diagram of power system network with the help of per unit system which helps in calculating the power system components during faulty and healthy conditions.
- It also gives information about load flow studies.

Unit 1: **Representation of Power System Components**- Synchronous machines, Transformers, Transmission lines, one line diagram, Impedance and reactance diagram, per unit. **Symmetrical Fault Analysis:** Transient on a transmission line, calculation of 3-phase short circuit current and reactance of synchronous machine on no-load and load condition, Equivalent circuits of synchronous machine under sub transient, transient and steady state conditions, Analysis of three-phase faults.

Unit 2: **Symmetrical components**- Symmetrical components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks of synchronous machine, transformer and transmission line, Construction of sequence network of power system.

Unit3: **Unsymmetrical faults**-Analysis of single line to ground fault, line-to-line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance.

Unit 4: **Impedance Model:** Bus admittance and impedance matrices, Direct determination of Z bus. Modification of an exciting bus. Analysis of an unsymmetrical faults using bus impedance matrix method.

Unit 5: **Load Flow**- Introduction, bus classifications, development of load flow equations, load flow solution using Gauss Siedel and Newton Raphson method, approximation to N-R method, decoupled and fast decoupled method. Comparison of load flow methods.

OUTCOMES:

CO1. Students will now be able to design different power system network using different representations.
CO2. Understand the various power system components.
CO3. Students shall learn how to analyze power system performance during fault
CO4. Also they can select as to which load flow method is suited for which condition.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L			H	M		M			M		M	H		
CO2		L	M			H		M	M			L		L	M
CO3	M			H			M			L	M				H
CO4	M		L				M			L	H	M	M	L	

H = Highly Related, M = Medium L = Low

Text Books:

1. T.K Nagsarkar and M.S. Sukhija, "Power System Analysis" Oxford University Press,2007
2. BR Gupta, "Power System Analysis and Design", S.Chand.

Reference Books:

1. CL Wadhwa, "Electrical Power System", New Age International.
2. W.D. Stevenson, Jr. "Elements of Power System Analysis", McGraw Hill.
3. L. P. Singh; "Advanced Power System Analysis and Dynamics", New Age International
4. Hadi Sadat; "Power System Analysis", Tata McGraw Hill.
5. Stagg and El-Abiad, "Computer Methods in Power System Analysis" Tata Mc Graw Hill
6. Kothari and Nagrath, "Modern Power System Analysis" Tata McGraw Hill.

School of Engineering
B.Tech. in Electrical Engineering – Semester VI
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BCO002A - Data Structures And Algorithms

OBJECTIVE:

- To study various data structure concepts like Stacks, Queues, Linked List, Trees and Files
- To overview the applications of data structures.
- To be familiar with utilization of data structure techniques in problem solving.

Unit -1: Introduction: Notions of data type, abstract data type and data structures. Importance of algorithms and data structures in programming. Notion of Complexity covering time complexity, space complexity, Worst case complexity & Average case complexity. BigOh Notation, Omega notation, Theta notation. Examples of simple algorithms and illustration of their complexity.

Sorting- Bubble sort, selection sort, insertion sort, Quick sort; Heap sort; Merge sort; Analysis of the sorting methods. Selecting the top k elements. Lower bound on sorting.

Unit-2: Stack ADT, Infix Notation, Prefix Notation and Postfix Notation. Evaluation of Postfix Expression, conversion of Infix to Prefix and Postfix Iteration and Recursion- Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Tradeoffs between iteration and recursion.

Unit3: List ADT. Implementation of lists using arrays and pointers. Stack ADT. Queue ADT. Implementation of stacks and queues. Dictionaries, Hash tables: open tables and closed tables. Searching technique- Binary search and linear search, link list- single link list, double link list, Insertion and deletion in link list.

Unit-4: Binary Trees- Definition and traversals: preorder, post order, in order. Common types and properties of binary trees. Binary search trees: insertion and deletion in binary search tree worst case analysis and average case analysis. AVL trees. Priority Queues -Binary heaps: insert and delete min operations and analysis.

Unit-5: Graph: Basic definitions, Directed Graphs- Data structures for graph representation. Shortest path algorithms: Dijkstra (greedy algorithm) and Operations on graph, Worshall's algorithm , Depth first search and Breadth-first search. Directed acyclic graphs. Undirected Graphs, Minimal spanning trees and algorithms (Prims and Kruskal) and implementation. Application to the travelling salesman problem.

OUTCOMES:

CO1. Show the understanding of various data structure concepts like Stacks, Queues, Linked List, Trees and Files
CO2. Understand the applications of data structures.
CO3. Understand with utilization of data structure techniques in problem solving.
CO4. Use comprehensive knowledge of data structures and algorithm with asymptotic analysis of algorithm.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M			L	M				L		M	M			M
CO2	M		L			M				H			L	M	
CO3			H					M		M		M			H
CO4		H					M					M	M		L

H = Highly Related, M = Medium, L = Low

Text Books:

1. Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman and John E. Hopcroft , Addison-Wesley Series (1983)

Reference Books:

1. T.H. Cormen, C.E. Leiserson, and R.L. Rivest. Introduction to Algorithms.The MIT Press and
2. McGraw-Hill Book Company, Cambridge, Massacusetts, 1990 (Available in Indian Edition).
3. Steven S. Skiena. The Algorithm Design Manual.Springer, Second Edition, 2008.
4. Data Structures and Algorithm Analysis in Java (3rd Edition) by Mark Allen Weiss, Addison Wesley(2011).

School of Engineering
B.Tech. in Electrical Engineering – Semester VI
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL033B - Advanced Control Systems

OBJECTIVE:

- This subject provides an introduction to modern control theory with a particular focus on state-space analysis of continuous system, analysis of discrete system and stability concerns of control system.

Unit 1: **State Space Analysis:** State Space Representation, Solution of State Equation, State Transition Matrix, Canonical Forms –Controllable Canonical Form, Observable Canonical Form, Jordan Canonical Form.

Unit 2: **Controllability and Observability:** Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability form Jordancanonical form and other canonical forms.

Unit 3: **Analysis of Discrete System**: Discrete system and discrete time signals, state variable model and transfer function model of discrete system, conversion of state variable model to transfer function model and vice-versa, modelling of sample hold circuit, solution of state difference equations, steady state accuracy, stability on the z-plane and Jury stability criterion, bilinear transformation

Unit 4: **Stability:** Lyapunov's stability theorems for continuous and discrete systems, methods for generating Lyapunov function for continuous and discrete system, Popov's criterion.

Unit 5: **Optimal Control:** Introduction - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti's equation – Application examples and modal reference adaptive control systems.

Course Outcomes (CO):

CO1. Student should be able to apply fundamental state-space techniques in the analysis and design of linear feedback control systems, as they arise in a variety of contexts.
CO2. Students can now formulate and control of engineering problems in terms of optimizing an objective function subject to different constraints.
CO3. Use software tools to simulate and design the linear control systems.
CO4. To enhance an ability to non-linear system on the phase plane & its application.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H				M		H		M	H		M		M	
CO2		M	H	M		M		M	H		M		H		M
CO3		H		M	H							H		H	
CO4	M		M	\		M	H	H		L	H		L		H

H = Highly Related, M = Medium, L = Low

Text Books:

1. M.Gopal, "Digital Control and State variable Methods", Tata Mc Graw Hill.

Reference Books:

1. D. Landau, "Adaptive Control", Marcel Dekker Inc.
2. S.Rajasekaran and G.A.VjayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Alogorithms: Synthesis and Applications" Prentice Hall of India
3. Donald E. Kiv, "Optimal Control Theory: An Introduction" Prentice Hall
4. B.C. Kuo, "Digital Control Systems" Sounders College Publishing
5. CH Houpis and G.B.Lamont, "Digital Control Systems: Theory, Hardware, Software", MGH
6. Ajit K.Madal, "Introduction to Control Engineering: Modelling, Analysis and Design" New Age International.

School of Engineering

B.Tech. in Electrical Engineering – Semester VI

Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL022A- Programmable Logic Controllers and SCADA

OBJECTIVE:

- This course helps in understanding the various instructions, components and programming of PLC and features and applications of SCADA systems.

Unit 1: **Programmable Logic Introduction:** programmable Logic structures Programmable Logic Arrays (PLAs), Programmable Array Logic (PALs), Programmable Gate Arrays (PGAs), Field Programmable Gate Arrays (FPGAs) Sequential network design with Programmable Logic Devices (PLDs) Design of sequential networks using ROMs and PLAs Traffic light controller using PAL.

Unit 2: **Programmable Logic Controllers**: (PLCs) Introduction Parts of PLC Principles of operation PLC sizes PLC hardware components I/O section Analog I/O section Analog I/O Units, digital I/O Units CPU Processor memory Unit Programming devices Diagnostics of PLCs with Computers.

Unit 3: **PLC programming**: Simple instructions Programming EXAMINE ON and EXAMINE OFF instructions Electromagnetic control relays Motor starters Manually operated switches Mechanically operated and Proximity switches Output control devices Latching relays PLC ladder diagram Converting simple relay ladder diagram in to PLC relay ladder diagram.

Unit 4: **Timer instructions& Application**: ON DELAY timer and OFF DELAY timer counter instructions Up/Down counters Timer and Counter applications program control instructions Data manipulating instructions math instructions. Simple materials handling applications Automatic control of warehouse door Automatic lubricating oil supplier Conveyor belt motor control Automatic car washing machine Bottle label detection Process control application, PID control of continuous processes.

Unit 5: **SCADA**: Introduction to Supervisory Control and Data Acquisition, SCADA Functional requirements and Components, General features, Functions and Applications, Benefits, Configurations of SCADA, RTU (Remote Terminal Units) Connections, Power Systems SCADA and SCADA in Power System Automation.

Course Outcomes (CO):

CO1: Students will able to understand the complex networks and perform different experiments.
CO2: Get the knowledge about timer instruments.
CO3: Students will able to understand new information and techniques for SCADA / PLC project.
CO4: Students will able to do projects on PLC/SCADA.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M		M				H		M		H		M
CO2		H		H		H	M	H		H		M		M	
CO3	H		L	M	H		M		M		M	L	H		H
CO4		M				M		L		H				M	

H = Highly Related, M = Medium; L = Low

TextBooks:

1. William I. Fletcher, An Engineering Approach to Digital Design, PHI Ltd., ND (1999).

Reference Books:

1. Chareles H. Roth, Jr, Fundamentals of Logic Design, 4th Ed., Jaico Pub. House (1999).
2. Siemens, PLC Handbook.
3. Frank D. Petruzella, Programmable Logic Controllers, McGraw- Hill (1989).
4. Wood, AJ & Wollenberg, BF, Power Generation Operation & Control, 2nd Ed. John Wiley.

School of Engineering
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Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL017B:Power System Reliability

OBJECTIVE:

- This course covers power system planning, operation and management issues as well as reliability in a regulated and deregulated environment.

Unit 1: **System Reliability**: Introduction, definition of reliability, failure, probability, concepts, power quality variation, reliability measurements, power supply quality survey, Reliability aids, and recent development.

Unit 2: **Reliability Concepts**: Measure of reliability rules for combining probabilities, Mathematical expectation. Distributions, reliability theory series and parallel systems, Markov processes.Static generating capacity reliability.

Unit 3: **Outage Reliability**: Loss of load probability methods, loss of energy probability method. Load forecast, System Design and planning, Strategies for generation, Transmission and Distribution networks. Transmission system reliability evaluation-Average interruption rate method.The frequency and duration method.

Unit 4: **Interconnected System Reliability**: Generating capacity reliability evaluation introduction. The loss of load approach, reliability evaluation in two and more than two interconnected systems, Interconnection benefits.

Unit 5: **Load Forecasting**: Necessity short-term forecasting by preliminary analysis control, medium term forecasting by field survey method, and long-time forecasting by statistical method. Regression analysis.Analysis of time series.Factors in power system loading.

Course Outcome (CO):

CO1. Students will be able to the student shall be able to model and analyse electric power systems with respect to reliability of supply. .
CO2. Students now know able to understand Measure of reliability rules for combining probabilities & reliability theory.
CO3. To analyze the reliability condition in case of Outage i.e Loss of load , Generation.
CO4. To illustrate how the interconnected systems are interfaced under reliability condition.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H			M	L			H	M				M	L
CO2		L			L		M	H		H	M	M	H		
CO3	M		L	H		H			M					L	M
CO4			M	L			H	L			H	H	H		

H = Highly Related, M = Medium L = Low

Text Books:

1. A.S. Pabla-Electric power distribution. (Text Book).
2. Roy Billinton and Ronald N.Allan-Reliability Evaluation of Power System volume-I

Reference Books:

1. Roy Billinton and Ronald N.Allan-Reliability Evaluation of Power System volume-II
2. J Endreny- Reliability Modelling in Electric Power System.

School of Engineering
B.Tech. in Electrical Engineering – Semester VI
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL064A-Special Electrical Machines

OBJECTIVES:

- The objective of this course is to get knowledge regarding principle, working and application of special motors viz. Brushless DC motors, Universal motors etc.

Unit 1: **AC Series Motors**: Construction, Principle of operation, Phase diagrams and Characteristics of Single phase and Three Phase AC Series motors, Simple and compensated motors, Universal motors and their Applications.

Unit 2: **Single Phase Synchronous Motors:** Reluctance Motors: Construction, principle of operation, Torque-Speed Characteristic production, modes of operation & its drive circuits, Hysteresis motors: Constructions, Operation, Torque-speed Characteristic, Applications.

Unit 3: **Special Motors-I**: Stepper motors :Construction, Operation, Types : Variable Reluctance Type, Permanent Magnet Type, Hybrid Type and its application, Permanent magnet DC motors : Construction, Operation, application, Concept of Brushless DC motor.

Unit 4 **Special Motors -II:** Servo Motors: DC Servomotors, AC Servomotors: Two Phase AC Servomotors, Three Phase AC Servomotors, Constructions, Torque-speed Characteristics, Controlling and Applications.

Unit 5: **Special Motors –III**: Schrage Motor: Constructions, Principle of operation, Speed and Power factor control, Applications, Linear Induction Motors: Construction, principle of operation, linear force and applications.

OUTCOMES:

CO1. Students can now apply the knowledge of these machines to make different power electronic models and applications.
CO2. Understand the construction and performance characteristics of electrical machines.
CO3. Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines
CO4. Understand the principles of electrical machine design and carry out a basic design of an ac machine.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			H	M				M	H			L		M	
CO2	M			L		M		H		M		M	H	L	
CO3		L	M						M		L			H	
CO4	L			M			H					H			M

H = Highly Related, M = Medium L = Low

Text Books:

1. P.S. Bimbhra: Generalized Theory of Electrical Machines, Khanna Pub. 1997.
2. D.P. Kothari and I.J. Nagarath: Electric Machines: Tata McGraw-Hill Pub., Third Edn, 2004.
3. Ashfaq Husain : Electric Machines ,Dhanpat Rai & Co.(Pvt) Ltd , 2nd Edition 2006

Reference Books:

1. A.E. Fitzgerald, Charles Kingsley and Stepen D. Umans: Electric Machinery, Tata McGraw-Hill Pub, Sixth Edition, 2002.
2. P.S. Kenjo and S. Nagamori: Permanent Magnet DC motors, Clarendon Press, Oxford, 1985.
3. J.B. Gupta: Theory and Performance of Electrical Machines, S. K. Kataria & Sons, Fourteenth Edn, 2006.
4. Jacob, Michael Power Electronics: Principles and Application, Vikas Pub. House

School of Engineering
B.Tech. in Electrical Engineering – Semester VI
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL065A-Electrical Materials

Unit1: **Conductors Classification:** High conductivity, high resistivity materials, fundamental requirements of high conductivity materials and high resistivity materials, mobility of electron in metals, commonly used high conducting materials, copper, aluminum, bronze brass, properties, characteristics, constantan, platinum, nichrome, properties, characteristics and applications, materials used for contacts.

Unit 2: **Semi-Conductors**: General concepts, energy bands, types of semiconductors, Fermi Dirac distribution, intrinsic Semi-conductors, extrinsic Semi-conductors, hall effect, drift, mobility, diffusion in Semiconductors, Semi-conductors and their applications, superconductors.

Unit 3: **Dielectrics And Insulators** Properties of gaseous, liquid and solid dielectric, dielectric as a field medium, electric conduction in gaseous, liquid and solid dielectric, breakdown in dielectric materials, mechanical and electrical properties of dielectric materials, effect of temperature on dielectric materials, polarization, loss angle and dielectric loss, petroleum based insulating oils, transformer oil, capacitor oils, properties, solid electrical insulating materials, fibrous, paperboards, yarns, cloth tapes, sleeving wood, impregnation, plastics, filling and bounding materials, fibrous, film, mica, rubber, mica based materials, ceramic materials.

Unit 4: **Magnetic Materials** Soft and hard magnetic materials, diamagnetic, paramagnetic and ferromagnetic materials, electric steel, sheet steel, cold rolled grain oriented silicon steel, hot rolled grain oriented silicon steel, hot rolled silicon steel sheet, hystersis loop, hystersis loss, magnetic susceptibility, coercive force, curie temperature, magneto-striction.

Unit 5: **Optical Materials:** Properties of Solids Photo emission, photo emission materials, electro luminescence junction diode, photo emitters, photo transistor, photo resistors, injunction lasers, optical properties of semiconductors, application of photo sensitive materials (CRT, Tube light, photo panels etc.).

Course Outcomes (CO):

CO1. Students will now be able to use the properties and behavior of different materials.
CO2. Apply the knowledge about the Electrical Engineering Materials to use them more effectively.
CO3. Become familiar with the dielectric behavior in static as well as varying field and polarization mechanisms.
CO4. Fulfill the demand of the industry about the analysis and construction of Electrical Engineering Materials.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	H			M	L			H	M				M	L
CO2		L			L		M	H		H	M	M	H		
CO3	M		L	H		H			M					L	M
CO4			M	L			H	L			H	H	H		

H = Highly Related, M = Medium; L = Low

Text Books:

1. “Electrical Engineering Materials”, Dekker, PHI Pbs.
2. “Electrical Engineering Materials”, Indulkar, S. Chand

Reference Books:

1. “Electrical Engineering Materials”, Tareev
2. “Electrical Engineering Materials”, Yu. Koritsky.
3. “Electrical Engineering Materials”, R K.Rajput, Laxmi Pbs.

School of Engineering
B.Tech. in Electrical Engineering – Semester VI
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL066A: Safety, Repair and Maintenance Of Electrical Equipments

OBJECTIVES:

- The objective is to familiarize the students with the evolution in time of the maintenance strategies, the classification of strategies maintenance by the criterion of fault occurrence and also the current trend through passing from time-based preventive maintenance (especially time criterion) to condition-based maintenance.

Unit-1: **Electrical Safety*:*** Electric Shock-Introduction, its effect, Precaution, cure, Electric Safety-Introduction, classification, safety precaution for indoor and outdoor installation, fast aid practice.

Unit-2: Maintenance of DC batteries: Classification of dc batteries, initial charging, battery capacity, efficiency of lead-acid battery, methods of recharging, common fault & remedies, Maintenance Checklist, battery charging equipment and SCR controller.

Unit-3: Maintenance of Transformer: Introduction, transformer failure, condition monitoring, Transformer maintenance, breakdown voltage test of transformer oil, partial discharge detection, drying out of the transformer, filtration& dehydration of transformer oil. Preventive maintenance for transformer, reactor, potential transformer, current transformer

Unit-4: Maintenance of Electric Motors: Introduction, faults in electric motors, periodical checks, Maintenance test, installation test of electric motor, visual inspection of machine, insulation resistance measurement of the winding.

Unit-5:Earthing: Equipments to be connected to earth, selection of earthing conductor, definitions, factors affecting the value of earth electrode resistance, methods of reducing earth resistance, precaution to be taken while installing earth conductor, Preventive maintenance schedule for bus bar, lightening arrestor, jumpers, transmission lines, earth switches, circuit breaker.

Course Outcomes (CO):

CO1. Students will now be able to about Electrical Safety.
CO2. Become familiar with the Maintenance of DC batteries.
CO3. Become familiar with the Maintenance of Electric Motors.
CO4. Become familiar with the different Earthing.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H		L			M		L			L	L		
CO2			M		L	M		H			H			M	
CO3	M			L			M			H		H		M	
CO4	H	M			M			L	M		L		L		H

H = Highly Related, M = Medium; L = Low

TEXT BOOK:

1. Electrical Workshop: Safety, Commissioning and Maintenance by R.P. Singh, I.K International Publishers

REFERENCES:

1. “Testing, Commissioning, Operation and Maintenance of Electrical Equipments” S. Rao Khanna Publishers.

School of Engineering
B.Tech. in Electrical Engineering – Semester VI
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines
BEL025A- Electric Drives Lab

OBJECTIVE:

- This course helps in practically explaining the design, function, operation and control of all major components of a typical electric vehicle power train / drives (AC and DC both).

List of Experiments (Perform any 10):

1. Perform the speed control of separately excited DC motor by varying armature voltage using single-phase fully controlled bridge converter.
2. Perform the speed control of separately excited DC motor by varying armature voltage using single phase half controlled bridge converter.
3. Perform the speed control of self excited DC motor by varying armature voltage using single-phase fully controlled bridge converter.
4. Perform the speed control of self excited DC motor by varying armature voltage using single phase half controlled bridge converter.
5. Perform the speed control of separately excited DC motor using GTO.
6. Perform the speed control of separately excited DC motor using single phase dual converter (Static Ward-Leonard Control)
7. Perform the speed control of separately excited dc motor using MOSFET/IGBT chopper.
8. Perform the speed control of fan using DIAC or TRIAC.
9. Perform the speed control of separately excited DC generator using MOSFET/IGBT chopper.
10. Perform the closed loop control of separately excited DC motor.
11. Perform the speed control of single phase induction motor using single phase AC voltage controller.
12. Perform the speed control of three phase induction motor using three phase AC voltage controller
13. Perform the speed control of three phase induction motor using three phase current source inverter
14. Perform the speed control of three phase induction motor using three phase voltage source inverter

Course Outcomes (CO):

CO1: Students will able to control the speed of DC drives using different power electronic controllers.
CO2: Students will able to control the speed of AC drives using different power electronic controllers.
CO3: Students will able to operate the drives in all four quadrants.
CO4: Students will understand the structure of controllers and their on-off methodology.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H			H		H		H		H		H		M
CO2	M		M			H		H		H		M		H	
CO3		M	M	M	H	M	H		L	L	M			L	M
CO4	M			M				M				H	M		

H = Highly Related, M = Medium; L = Low

School of Engineering

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Contact Hrs per week (L-T-P): 0-0-2

Course Outlines

BCO005A: Data Structure And Algorithms Lab

List of Experiments (Perform any 10):

1.Write a program to implement following searching algorithms using array data structure
- 1.1 Matrix Addition and Subtraction
- 1.2 Matrix Multiplication and Transpose

2.Write a program to implement following searching algorithms using array data structure
- 2.1. Linear Search
- 2.2. Binary Search

3. Write a program to implement following searching algorithms using array data structure
- 3.1. Insertion Sort
- 3.2 Bubble Sort

4. Write a program to implement following searching algorithms using array data structure
- 4.1. Selection Sort
- 4.2 Quick Sort

5. Write a program to implement following operations on stack using array data structure.
- 5.1 Traversing
- 5.2 Push
- 5.3 POP

6. Write a program to implement following examples of recursion
- 6.1 Fibonacci Series
- 6.2 Factorial Function
- 6.3 Tower of Hanoi

7. Write a program to implement Merge Sort.

8. Write a program to implement following operations on Queue using array data structure.
- 8.1 Insertion 8.2 Deletion 8.3 Traversing

9. Write a program to implement Postfix evaluation.

10. Write a program to implement Infix to Postfix Notation.

11. Write a program to implement following operations on Link List data structure.
- 11.1 Insertion at beginning
- 11.2 Insertion at last
- 11.3 Insertion at any location

12. Write a program to implement following operations on Link List data structure.
- 12.1 Deletion at beginning
- 12.2 Deletion at last
- 12.3 Deletion at any location

13. Write a program to implement Doubly Link List
- 13.1 Insertion 13.2 Traversing

14. Write a program to implement Breadth First Search Algorithm.

15. Write a program to implement Depth First Search Algorithm.

Course Outcomes (CO):

CO1. Show the understanding of various data structure concepts like Stacks, Queues, Linked List, Trees and Files
CO2. Understand the applications of data structures.
CO3. Understand with utilization of data structure techniques in problem solving.
CO4. Use comprehensive knowledge of data structures and algorithm with asymptotic analysis of algorithm.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M			L	M				L		M	M			M
CO2	M		L			M				H			L	M	
CO3			H					M		M		M			H
CO4		H					M					M	M		L

H = Highly Related, M = Medium, L = Low

School of Engineering
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Contact Hrs per week (L-T-P): 0-0-2

Course Outlines
BEL027A- Power Systems Lab II

OBJECTIVE:

- This course helps in formulating a reactance diagram of power system network with the help of per unit system and to calculate different types of faults.

List of Experiments (Perform any 10):

1. To determine direct and sub transient axis reactance (X_d) of a salient pole alternator using hardware/panel/model or simulate using MATLAB.
2. To determine quadrature axis reactance (X_q) of a salient pole alternator using hardware/panel/model or simulate using MATLAB.
3. To determine negative and zero sequence reactance of an alternator.
4. To determine fault current for L-G faults at the terminals of an alternator at very low excitation using hardware/panel or simulate using MATLAB.
5. To determine fault current for L-L faults at the terminals of an alternator at very low excitation using hardware/panel or simulate using MATLAB.
6. To determine fault current for L-L-G faults at the terminals of an alternator at very low excitation using hardware/panel or simulate using MATLAB.
7. To determine fault current for L-L-L faults at the terminals of an alternator at very low excitation using hardware/panel or simulate using MATLAB.
8. To study the IDMT over current relay and determine the time current characteristics using electrical panels.
9. To study percentage differential relay, Impedance, MHO and Reactance type distance relays using electrical panels.
10. To determine location of fault in a cable using cable fault locator.
11. To study Ferranti effect and voltage distribution in HV long transmission line using transmission line model or using programming or simulation tool of MATLAB/similar software.
12. To obtain steady state, transient and sub-transient short circuit currents in an alternator using programming or simulation tool of MATLAB/similar software.
13. To obtain formation of Y-bus and perform load flow analysis using Gauss-Siedel method using programming or simulation tool of MATLAB/similar software.
14. To perform symmetrical and unsymmetrical fault analysis in a power system using programming or simulation tool of MATLAB/similar software.
15. Write a program for a load flow solution in a power system problem using Gauss Siedel method.
16. Write a program for a load flow solution in a power system problem using Newton Raphson method.
17. Write a program for a load flow solution in a power system problem using Fast decoupled method.

Course Outcomes (CO):

CO1. Students will now be able to practically verify the different fault calculations and different load flow solution methods.
CO2. Simulate and calculate the transmission line parameters for various network configurations.
CO3. Study of steady-state stability limit of a transmission line.
CO4. To study the effects of various line loading and line lengths on power system parameters.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H	H		H		M		M	M		M		H
CO2		H			M		H		H			M		M	
CO3			M	M	M			H		H			H		H
CO4	H	M				L	M		H		H	L		L	

H = Highly Related, M = Medium, L = Low

School of Engineering
B.Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL034B – High Voltage Engineering

OBJECTIVES:

- Introduction to conduction and breakdown of solids, liquids and gases.
- It also gives information regarding process and application with respect to generation of high (AC and DC) voltages.

Unit 1: **Conduction and Breakdown in Gases, Liquid and Solid Dielectrics:** Ionization process in gases, Townsend's current growth equation. Townsend's First and Second ionisation coefficients. Townsend criterion for breakdown. Streamer theory of breakdown. Paschen's law of gases. different types of breakdown in liquids and different types of breakdown in solids.

Unit 2: **Generation of High Voltages and Currents**: Generation of high DC, AC, impulse voltage and impulse currents. Tripping and control of impulse generators; Measurement of High Voltages and Currents: Measurement of high DC, AC (Power frequency and high frequency) voltages, various types of potential dividers, generating voltmeter, peak reading AC voltmeter, Digital peak voltmeter, electrostatic voltmeter. Sphere gap method, factors influencing the spark voltage of sphere gaps.

Unit 3: **Measurement of High Voltages and High Currents** -High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

Unit 4: **High Voltage Testing of Electrical Apparatus**: Testing of insulators, bushings, circuit breakers power capacitors and power transformers.

Unit 5: **Over voltage Phenomenon and Insulation Co-ordination**: Theory of physics of lightning flashes and strokes. Insulation co-ordination, volt-time and circuit time characteristics. Horn gap, single diverters, ground wires, surge absorbers.

Course Outcomes (CO):

CO1. To learn the fundamental concept of electric breakdown in liquids, gases, and solids.
CO2. To become familiar with non-destructive test techniques in high voltage engineering.
CO3. Student should be able to select a particular dielectric for circuit breakers and other insulation requirement in the machine.
CO4. Students know how ill effects of over voltages and lightening strokes can be averted by suitably installing the required equipments.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H		H		H		H	M			M	H		
CO2	M		M		M		H				M			M	H
CO3	H	H			H				L	M		H	M	H	
CO4			M	\H		M	H	H		H	H				H

H = Highly Related, M = Medium, L = Low

Text Books:

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering, TMH.

Reference Books:

1. CL. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.
2. E. Kuffel and W. S. Zacngal, High Voltage Engineering", Pergamon Press.
3. M.P Chaurasia , "High Voltage Engineering", Khanna Publishers
4. R. S. Jha, "High Voltage Engineering", Dhanpat Rai and sons
5. M. Khalifa, " High Voltage Engineering Theory and Practice", Marcel Dekker.

School of Engineering
B.Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P):3-0-0

Course Outlines

BEL040B - EHV AC/DC Transmission

OBJECTIVE:

- This course explains the need and application of EHV AC and DC transmission, load frequency control (and its methods) and voltage control.

Unit 1: **EHV AC Transmission:** Advantages of EHV transmission lines, power handling capacity and surge impedance loading. Problems of EHV transmission, **Bundled Conductors**: geometric mean radius of bundle, properties of bundle conductors. Electrostatic fields of EHV lines and their effects, corona effects: Corona loss, audio and radio noise.

Unit2: **Load Frequency Control:** Introduction to control of active and reactive power flow, turbine speed governing system. Speed governing characteristic of generating unit and load sharing between parallel operating generators.

Unit3: **Method of Load Frequency Control:** Flat frequency, flat tie line and tie line load bias control. Automatic generation control. Load frequency control with generation rate constraints. Speed Governor dead band and its effect on AGC. Decentralized control.

Unit4: **Voltage Control:** No load receiving end voltage and reactive power generation. Methods of voltage control. Synchronous phase modifier, shunt capacitors and reactors, saturable reactors, Thyistorised static VAR compensators- TCR, FC-TCR and TSC- TCR.

Unit5: **HVDC Transmission:** Types of DC links, advantages and disadvantages of HVDC transmission. Basic scheme and equipment of converter station.Ground return. Basic principles of DC link control and basic converter control characteristics. Application of HVDC transmission.

Course Outcomes (CO):

CO1. Students will now be able to compare EHV AC and DC transmission and its applications.
CO2. They will also be in position to realizing the problems and precautions associated with EHV transmission.
CO3. Students will get the awareness about different FACTS devices with their utilizations.
CO4. To know the applications of HVDC transmission system in real world.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M			L			H	L	H				M
CO2	M		H	M	L				H				H	M	
CO3		M			H		H	M			H	H		H	
CO4		H	M	L		M	L	M		M		M	M		H

H = Highly Related, M = Medium, L = Low

Text Books:

1. R.D. Begamudre- EHV AC Transmission Engineering.
2. K.R. Padiyar- HVDC Power Transmission System

Reference Books:

1. J.J Grainger and W.D. Stevenson-Power system analysis.
2. B.R Gupta-Generation of Electrical Engineering.

School of Engineering
B.Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL067A-Power System Economics

OBJECTIVES:

- To learn to optimized allocation of generating unit to a load centre and controlling of real and reactive power of generator.

Unit 1: **Cost of Power Generation:** Power Generation Cost - Thermal, Hydro & Nuclear; Significance of load factor, diversity factor, demand factor, Connected Load , Maximum Demand , load duration Curve, Base Load & Peak Load ,Selection of number & size of Generator units

Unit 2: **Economic load Dispatch:** System constraints, Heat rate and incremental rate curves of thermal generating units, Economic Load Dispatch neglecting Losses, Optimum Load dispatch including Transmission loss, Exact Transmission Loss Formula, Modified Co-ordination Equations, Automatic Load dispatching

Unit 3: **Economic Scheduling of Hydroelectric Plants:** Introduction to Hydrothermal Scheduling, Problem Formulation, Optimal Power Flow, Multi-objective Optimal Power Flow

Unit 4: **Unit Commitment:** Optimal unit commitment, Constraints in unit commitment, spinning reserve, Unit commitment solutions methods

Unit 5: **Tariff :** Purpose of Tariff, Block rate Tariff , Flat rate, Two part, Three part tariffs, Subsidization and cross subsidization, Availability tariff of generation companies, Pool tariff of transmission companies.

OUTCOMES:

CO1. Students can now know how the control the flow of power to the load centres takes place using turbine governing system and hence load frequency control.
CO2. Calculate and study the outcome of simple electricity markets.
CO3. Critically analyze transmission and distribution investment/pricing practices
CO4. Determine optimal investment strategies for simple transmission and generation expansion problems.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		L			H			H		M		M			M
CO2	M	M		H			L		M		M		L		H
CO3														M	
CO4			L		M	M					M	H	M		

H = Highly Related, M = Medium, L = Low

Text books:

1. C. L. Wadhwa “Electrical Power Systems”, 6th Edition, New Age International
2. D. P. Kothari, I.J. Nagrath,“Modern Power System Analysis”4th Edition,TMH

Reference Books:

1. B R.Gupta: “Power system Analysis and Design”, S.Chand.
2. S Sivanagaraju, G Sreenivasan, “Power System Operation & Control” 1st ed., Pearson Pub.

School of Engineering
B.Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL021A- Energy Auditing

OBJECTIVE:

- This course helps in understanding the components and process involved in energy auditing.

Unit 1: **Introduction to Audit**: Introduction to industrial energy auditing, definition of energy auditing, Objectives , Types of energy audits, Preparation, audit criteria, audit scope, Selection of audit team, Audit plan, Preparing an audit checklist.

Unit 2: **Survey**: Conducting the initial walk-through visit, Collecting energy bills and available data and information, Conducting the preliminary analysis, Analyzing energy bills, Electricity bills, Natural gas bills, Coal and fuel oil bills.

Unit 3: **Inventory and production patterns**: Electrical load inventory, Thermal energy use inventory, Energy balance, Analyzing energy use, Load profile, Scatter diagram for energy-production relationship, Interpretation of energy-production on a scatter diagram, Energy performance analysis, Energy efficiency and energy cost reduction.

Unit 4: **Analysis of data**: Electrical demand control, Cross-cutting energy-efficiency improvement options, Energy-efficiency improvement opportunities in electric motors, compressed air systems, pumping systems, fan systems, lighting system, steam systems, process heating systems, Cost-benefit analysis of energy-efficiency , Life-cycle cost analysis, Life cycle cost method, Net present value method, Internal rate of return method, Simple payback period method.

Unit 5: **Audit preparation**: Preparing an energy audit report, Post-audit activities, Create Conversion factors, Energy audit instruments, Safety considerations, Measuring electrical parameters, Temperature measurement, Flow measurements, Exhaust gas measurements, Measurement of the speed of rotating equipment.

Course Outcomes (CO):

CO1: Students will be able to understand the role of Engineers in auditing.
CO2: Students will able to understand the methods of survey and ability is developed to apply best auditing method for primary fulfillments.
CO3: Students will able to represent large data's in graphical shape to easily understand.
CO4: Students are able to analysis the large data through suitable methods and interoperate the results.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M		M			H		H		M	H		H
CO2		H		H		H		M	M		H	H		M	
CO3		M	H	H	H		H				H				H
CO4	H					M	M		L	H			H	M	

H = Highly Related, M = Medium L = Low

Text Books:

1. Energy Conservation Hand Book, Bureau of Energy Efficiency, Ministry of Power, Govt. of India.
2. Industrial Energy Audit Guidebook: Guidelines for Conducting an Energy Audit in Industrial Facilities, Ali Hasanbeigi, Lynn Price, China Energy Group, Energy Analysis Department., Environmental Energy Technologies Division.

School of Engineering
B.Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL068A: Recent Trends In Electrical Power Generation

OBJECTIVES:

- To know how various energy sources (renewable and nonrenewable) are generated and to enhance their contribution to the socio-economic development.
- Awareness of different treaties, energy scenario and Energy policy related to India.

Unit-1: Physics of Wind Power: History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

Unit-2: Wind generator topologies: Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

Unit-3: The Solar Resource: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Unit-4: Solar photovoltaic: Technologies-Amorphous, mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

Unit-5: Biomass energy: Photosynthesis process, usable forms of biomass ,biomass conversion technology, urban waste to energy conversion, biomass gasification, liquification, biomass production from waste biomass, energy scenario of biomass energy India and world.

COURSE OUTCOMES:

CO1. Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
CO2. Understand the basic physics of wind and solar power generation.
CO3. Understand the power electronic interfaces for wind and solar generation.
CO4. Understand the issues related to the grid-integration of solar and wind energy systems.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M		H			H			H		M		H
CO2		M		M		M			M	M		H		M	
CO3	H		H		H		M		L		L	H	M		
CO4		H		\H		M	H	H		H				H	H

H = Highly Related, M = Medium, L = Low

Text Books:

1. BH Khan, “Non Conventional Energy Resources” TMH.
2. G. M. Masters, “Renewable and Efficient Electric Power Systems”, John Wiley and Sons, 2004.

Reference Books:

1. Energy Conservation Hand Book, Bureau of Energy Efficiency, Ministry of Power, Govt. of India.
2. T. Ackermann, “Wind Power in Power Systems”, John Wiley and Sons Ltd., 2005.
3. S. P. Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, McGraw Hill, 1984.

School of Engineering
B.Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL037A-Power System Security and Smart Grid

OBJECTIVES:

- The objective of this course is to give knowledge about power system security, voltage stability.
- It also gives information as to how smart grid is helpful in present scenario.

Unit 1: **Power system Security**: Introduction to power system security, System state classification, Security analysis, Contingency analysis, Sensitivity factors and power system voltage stability.

Unit 2: **Voltage Stability I**: Introduction to voltage stability, Comparison of angle and voltage stability, Reactive power flow and voltage collapse, Difficulties with reactive power Flow, HVDC operation

*Unit 3:***Voltage Stability II**: Mathematical formulation of voltage stability problem, Voltage stability analysis: P-Curve, Prevention of voltage collapse, State of the art, future trends and challenges.

Unit 4: **State estimation of Power systems**: An introduction to state estimation of power systems, least squares estimation, static state estimation of power systems, Computational consideration, and External system equivalency, Treatment of bad data, Network observability and Pseudo measurements.

Unit 5: **Smart Grid**: Introduction about smart grid, Aims of the smart grid, Pathways to a smart grid, Components of a smart grid, Optimizing grid operation and application, Optimizing grid infrastructure, Information and communication technologies. New market places, users and energy efficiency, Micro grid and smart micro grid.

Course Outcomes (CO):

CO1. Student should be able to detect the contingencies associated with power system security.
CO2. Students get awareness about voltage collapse and hence how these can be prevented.
CO3. Students can able to know how optimized grid structure can be established.
CO4. Students will able to understand smart Grid properties with detailed in real life.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M				M	L				H		M		H
CO2	H		H		M			M	M	M		H		M	
CO3		L	M	H	H		M		L		L	H	M		
CO4	L			M		H		L		H				H	H

H = Highly Related, M = Medium, L = Low

Text Books:

1. Modern Power System Analysis by DP Kothari and IJ Nagrath, 4th Ed.TMH.
2. CL Wadhwa "Electrical Power Systems", 6th Edition, New Age International, 2012

Reference Books:

1. BR Gupta, "Power System Analysis and Design", S.Chand.
2. P.S.R. Murty, "Operation and control in Power Systems" B.S. Publications.
3. J. Wood and B.F. Wollenburg," Power Generation, Operation and Control " John Wiley
4. P. Kundur, "Power System Stability and Control Mc Graw Hill.
5. T.K Nagsarkar and M.S. Sukhija, "Power System Analysis" Oxford Uni. Press.

School of Engineering
B.Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL036A – Utilization of Electrical Energy and Electric Traction

OBJECTIVES:

- This course provides information regarding working and applications of different sources of illumination, electric heating and electrolytic processes.
- It also in looks the characteristics and control of DC and AC traction motors.

Unit 1: **Illumination**- Nature of light, important definitions, laws of illumination, principle of production of light- discharge through gases under pressure – incandescence/sources of light-filament lamp, halogen lamp-discharge lamp-sodium discharge lamp, high pressure mercury discharge lamp, dual lamps, fluorescent lamps, lamp efficiency, requirements of good lighting, illumination level, absence of contrasts, shadows, glare, colour rendering-lamp fittings. Lighting schemes, design of indoor and outdoor lighting system-street lighting, flood lighting, photometers.

Unit 2: **Electric Heating**- Advantages of electric heating, classification of heating methods, detailed study of resistance heating, arc heating, electron bombardment heating, induction heating and dielectric heating and their control.

Unit 3: **Electrolytic Processes**- Fundamentals of electro deposition-laws of electrolysis applications of electrolysis, electro deposition, manufacture of chemicals, anodizing, electro-polishing, electro-cleaning, electro-parting, electrometallurgy, electric supply.

Unit 4: **Train Mechanics**- Types of services, characteristics of each type of service, speed time curve, simplified speed time curve, average speed, schedule speed, factors affecting schedule speed, tractive effort for propelling a train, power of the traction motor, specific energy output, specific energy consumption, factors affecting specific energy consumption, mechanics of train movement, coefficient of adhesion, factors affecting slip.

Unit 5: **Electric Traction**- DC and AC traction motors, their characteristics Traction Motor Control: Starting and speed control of DC series motors, shunt transition, bridge transition, drum controller employing shunt transition, energy saving with series parallel starting, multiple unit control, braking of traction motors.

Course Outcomes (CO):

CO1. Student should be able to verify why a particular illumination source is chosen for lighting industrial, commercial and residential premises.
CO2. Students able know how different traction motors operate.
CO3. Students can able to understand Electrolytic Processes done in the different application.
CO4. Students can get the knowledge of controlling methods for trains.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H			H			H	H		H	H		H
CO2		H		M	H		M	H		M	M			M	
CO3	M	M	M		H				L			H			L
CO4				H		H	H	H			M		H	M	

H = Highly Related, M = Medium; L = Low

Text Books:

1. H. Partap, "Art and Science of Utilization of Electrical Energy".
2. BL Theraja Vol-III, S. Chand Publishers.

Reference Books:

1. B.R. Sharma, "Utilization of Electrical. Energy".
2. E. Openshan Taylor, "Utilization of Electric Energy", Orient Longmans.
3. N.V. Suryanarayana, "Utilization of Electric Power".
4. AT Dover, "Electric Traction", Pitman.

School of Engineering
B.Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL069A- Basics of Soft Computing

OBJECTIVES:

- To cater the knowledge of Neural Networks and Fuzzy Logic Control and use these for controlling real time systems.

Unit-1: Artificial Neural Networking-I: Structure of Human brain. Artificial Neural Networks (ANN) - Single layer and multi layer. Fundamental models of ANN-Mcculloch- Pitts, Hebbian, Delta, Boltzman, Adalin and Madalin Learning - Supervised and unsupervised, competitive learning ,Learning Rules.

Unit-2: Artificial Neural Networking-II: Perceptrons Back propagation, Hopfield networks. Radial basis function. Associative memory networks – Hetero associative memories, Auto Associative,Bi-directional associative memory. Applications of neural network in Electrical engineering including Power system control and electric drive.

Unit-3: Fuzzy Logic: Introduction, Probability vs Possibility theory, classic sets and fuzzy sets, Fuzzy set operations: intersection, union, complementary, fuzzy arithmetic's. Fuzzy Relations, fuzzy compositions: Max-Min, Max-Star, Max-Product, Max-Average composition. fuzzy logic applications.

Unit-4: Genetic Algorithms: Introduction, Procedure of genetic algorithms: genetic representations, selection, genetic operators, mutation and natural inheritance operators. Working of GA's: binary or discrete, real or continuous with applications**.**

Unit-5: Swarm Intelligent System: Introduction, Ant colony system: biological, artificial, working, probabilistic transition rules, pheromone updating, solution evaluation. Ant colony optimization. Artificial BEE colony system, Cuckoo search.
Fuzzy rule based control systems: simple fuzzy logic controllers. Introduction to Genetic Algorithm**.**

Course Outcomes (CO):

CO1. Understand importance of soft computing.
CO2. Understand different soft computing techniques like Genetic Algorithms, Fuzzy Logic, Neural Networks and their combination.
CO3. Implement algorithms based on soft computing.
CO4. Apply soft computing techniques to solve engineering or real life problems.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			M	L					H			M	H	L	
CO2	M				L		M	H		L		H			M
CO3	L		H	M		M			M		M			H	
CO4		M			H		H			M		L			H

H = Highly Related, M = Medium, L = Low

***TEXT* BOOKS:**

1. N.P. Padhy & S.P. Simon "Soft Computing with MATLAB Programming", Oxford University Press.
2. Tomthy Ross,Fuzzy Logic and Engineering Application, TMH
3. C++ Neural Networks and Fuzzy Logic by Rao & Rao.

RECOMMENDED BOOKS:

1. Neural computing Theory and Practice by P. D. Wasserman (Auza Research Inc.)
2. Neural Networks, Fuzzy Logic and Genetic Algorithm-Synthesis and Applications, Rajajsekharan and Vijayalakshmi Pai, Prentice Hall of Private Limited, New Delhi.

School *of Engineering*
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Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL043A- Excitation of Synchronous Machines and their Control

OBJECTIVES: Students will understand the principle, operation, control and characteristics of different excitation systems of synchronous machines.

Unit 1: **Excitation Systems:** Principle Controls of a generating unit. Arrangement of excitation components, voltage response-ratio. Excitation specifications. Ceiling voltage, time constant and response of excitation systems. Requirements of excitation systems: Classification of excitation systems.

Unit 2: **DC Excitation Systems:** configuration of DC excitation system with main and pilot exciters. Amplidyne and magnetic amplifier. Automatic voltage regulator with magnetic amplifier and Amplidyne. Limitation and problems of DC excitation systems. Improvement in DC excitation system.

Unit 3: **AC Shunt Excitation Systems (Static Rectifier Excitation Systems):** Static thyristor rectifier schemes. Transient Response during fault condition. Use of booster transformer. Application for shunt excitation systems.

Unit 4: **AC Separately Excitation Systems. (Alternator- Rectifier Excitation System):** Scheme of alternator-rectifier excitation system with (i) Diode rectifier and (ii) Thyristor rectifier. Comparison and Application of these schemes. Harmful effects of static excitation systems or system machine components, means of prevention.

Unit 5: **Brushless Excitation Systems:** Brush-slip ring problem. Scheme of Brushless excitation system with rotating diode. Control, protection and monitoring of Brushless excitation system. Introduction to brushless excitation system with rotating thyristors. Introduction to Superconducting Exciter.

Course Outcomes (CO):

CO1. Students can now compare different excitation systems of synchronous machines.
CO2. Students will able to design and differentiate the AC/DC excitation system.
CO3. Students can able to design and develop new machines.
CO4. Students will solve the numerical problem in real world environment.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H					L			H	L	H				M
CO2	M		H	M	L				H				H	M	
CO3		M			H		H	M			H	H		H	
CO4		H	M	L		M	L	M		M		M	M		H

H = Highly Related, M = Medium, L = Low

Text book:

1. AE Fitzgerald, Charles Kingsley, & SD Umans, Electrical Machinery, 4th Ed., MGH Pub.

Reference books:

1. MG Say, Theory, Performance and Design of AC Machines, CBS Publishers.
2. C V Jones Unified Theory of Electrical Machines, Butterworths, London 1967
3. Clayton. A.E., "Performance and Design of Direct Current Machines" UBS Publishers.

School of Engineering
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Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL029A- FACTS (Flexible AC Transmission Systems)

OBJECTIVES:

- The objective of this course is to introduce participants to the transmission challenges of modern electrical power systems.
- The course will present the basic concepts, principles and operation of fast high power electronic controllers known as Flexible AC Transmission Systems (FACTS) that enhance power system stability and effectively increase transmission capacity thus yielding significantly higher flexibility of operation.

Unit 1: **Introduction to AC transmission systems***:* Problems of AC transmission systems, power flow in parallel paths and meshed system, factors limiting loading capability, stability consideration. Power flow control of an AC transmission line. Basic types of facts controllers. Advantages of FACTS technology.

Unit2: **Static Shunt Compensators:** Mid-point and end point voltage regulation of transmission line, and stability improvement. Basic operating principle of Static Synchronous Compensators (STATCOM).Comparison between STATCOM and SVC.

Unit3: **Static Series Compensators:** Concept of series capacitive compensation, voltage and transient stabilities, power oscillation and sub synchronous oscillation damping. Introduction to thyristor switched series capacitor (TSSC), thyristor controlled series capacitor (TCSC), and static synchronous series compensator, - operation, characteristics and applications.

Unit4: **Static Voltage and Phase Angle Regulators:** (i) Voltage and phase angle regulation. Power flow control and improvement of stability by phase angle regulator. Introduction to thyristor controlled voltage and phase angle regulators (TCVR and TCPAR) (ii) Introduction to thyristor controlled braking resistor and thyristor controlled voltage limiter.

Unit5: **UPFC and IPFC:** Unified Power Flow Controller (UPFC), basic operating principles, conventional transmission control capabilities. Comparison of UPFC to series compensators and phase angle regulator. Applications of UPFC.
IPFC: Interline Power Flow Controller (IPFC), basic operating principles and characteristics. Applications of IPFC.

COURSE OUTCOMES:

CO1. Students will now know in depth the problems associated with AC transmission system which limits its loading capacity and stability.
CO2. Understand the monitoring and control of a power system.
CO3. To know the transmission challenges of modern electrical power systems.
CO4. To know how the enhance power system stability and effectively increase transmission capacity.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	H		M		H		M	H		M		M	
CO2	M			H		M		H	H		M		M		H
CO3		H	M	M	H					M		H		H	
CO4	M			\		M	H	H			L		L		H

H = Highly Related, M = Medium, L = Low

Text Books:

1. Narain G. Hingorani: Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems
2. D. P. Kothari, I. J. Nagrath: Modern Power System Analysis

Reference Books:

1. Yong-Hua Song, Allan Johns: Flexible AC Transmission Systems (FACTS).

School of Engineering
B. Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL070A-Power System Instrumentation

Unit 1: **Theory of Errors:** Accuracy and precision, systematic and random errors, limits of error, probable error and standard deviation. Gaussian error curves, combination of errors.

Unit 2: **Transducers:** Construction & Operating Characteristics of active and digital transducers, Measurement of temperature, pressure, displacement, acceleration, noise level.

Unit 3: **Signal Conditioning:** Instrumentation amplifiers, isolation amplifiers, analog multipliers, analog dividers, function generators, timers, sample and hold, optical and magnetic isolators.

Unit 4: **Measurement** of voltage, current, phase angle, frequency, active power and reactive power in power plants. Energy meters and multipart tariff meters. Basic idea of LT & HT panel's.

Unit 5: **Tap Changing transformer**, phase angle control and phase shifting transformer. Series compensation of transmission lines, location and protection of series capacitors, advantages and problems Current Transformers for measurement and protection.

Course Outcomes (CO):

CO1. To analyze the errors during measurements.
CO2. To specify the requirements in the calibration of sensors and instruments.
CO3. To design and set up measurement systems and do the studies.
CO4. To construct Instrumentation/Computer Networks.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		L		H		M			H		L	M		
CO2		H		L	M			H	M		M			M	
CO3	H					M	M			L		H	L		
CO4		M		L				M	L		M			M	H

H = Highly Related, M = Medium, L = Low

Text Books:

1 RH Cerni and L. E. Foster: Instrumentation for Engineering Measurements, JohnWiley and Sons. (1962).
2 Curtis and D. Hohnson: Process Control Instrumentation Technology, John Wiley and Sons. (2013)

Reference Books:

1. R. Morrison: Instrumentation Fundamentals and Applications, John Wiley and Sons. (1984)
2. AK. Sawhney: Advanced Measurements & Instrument ation, Dhanpat Rai & Sons. (1994)
3. EO. Decblin: Measurement System– Application & design, MGH. (1975)
4. WD. Cooper and A.P. Beltried: Electronics Instrumentation and Measurement Techniques, Prentice Hall International. (1987)
5 AS Moris: Principles of Measurement & Instrumentation, Prentice Hall, 1993.

School of Engineering
B.Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines
BEL073A- CAD of Electrical Machines

OBJECTIVE:

- This course helps in learning the tools associated with different software and hardware available in the market for computer aided design to help them solve different design issues.

Perform any 10 experiments.

Design of transformer

1 Write a program to design the rating of a single phase transformer in kVA using various physical parameters.
2 Write a program to design the out equation for voltage per turn of a single phase transformer using various physical parameters.
3 Write a program to design the ratio of iron losses to copper losses of a single phase transformer using various physical parameters.
4 Write a program to design the relation between core area and weight of iron and copper of a single phase transformer using various physical parameters.
5 Write a program to design a single phase transformer for minimum cost using various physical parameters.
6 Write a program to design a single phase transformer for minimum loss using various physical parameters.
7 Write a program to design window width of a single phase transformer for optimum output using various physical parameters.
8 Write a program for yoke design and overall dimensions of a single phase transformer for optimum output using various physical parameters.

Design of DC Machine

9 Write a program to design the output equation of a DC machine using various physical parameters.
10 Write a program to design the maximum permissible core length of a DC machine using various physical parameters.
11 Write a program to design the minimum permissible core diameter of a DC machine using various physical parameters.
12 Write a program to design the minimum number of coils required for a DC machine using various physical parameters.

Design of rotating AC Machine

13 Write a program to design the output equation of a AC machine using various physical parameters.
14 Write a program to design a 3 phase squirrel cage induction motor (calculating its main dimensions, turns per phase, number of stator slots and winding details) using various physical parameters.

Course Outcomes (CO):

CO1. To develop analytical skills for step by step solution for algorithms.
CO2. Students will now be able to make different computer aided design projects related to electrical machines.
CO3. Students will able to solve power system problems through programming.
CO4. To enhance an ability for step by step solution for algorithms the output equation of a AC machine.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M		M				H		M		H		M
CO2		H		H		H	M	H		H		M		M	
CO3	H		L	M	H		M		M		M	L	H		H
CO4		M				M		L		H				M	

H = Highly Related, M = Medium, L = Low

School of Engineering
B.Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P):0-0-2

Course Outlines
BEL038A - Advanced Simulation Lab

OBJECTIVE:

- To expose the students to learn programming and simulation on MATLAB / Sci Lab software to realize electrical and electronic circuits.

List of Experiments (Perform any 10):

1. Perform various commands of PSPICE/MATLAB/Sci Lab.
2. Determine node voltages and branch currents in a resistive network.
3. Obtain Thevenin's equivalent circuit of a resistive network.
4. Obtain Norton's equivalent circuit of a resistive network.
5. Obtain transient response of a series R-L-C circuit for step voltage and current input and for alternating square voltage waveform.
6. Obtain transient response of a parallel R-L-C circuit for step voltage and current input and for alternating square voltage waveform.
7. Obtain frequency response of a series R-L-C circuit for sinusoidal voltage input.
8. Obtain frequency response of a parallel R-L-C circuit for sinusoidal voltage input.
9. Determine line and load currents in a three phase delta circuit connected to a 3-phase balanced AC supply.
10. Determine z, y, g, h and transmission parameters of a two part network.
11. Obtain transient response of output voltage in a single phase half wave rectifier circuit using capacitance filter.
12. Obtain output characteristics of CE NPN transistor.
13. Obtain frequency response of a R-C coupled CE amplifier.
14. Obtain frequency response of an op-Amp integrator circuit.
15. Verify truth tables of NOT, AND or OR gates implemented by NAND gates by plotting their digital input and output signals.

Course Outcomes (CO):

CO1. Students can now use programming / simulation skills to get output on any electrical and electronic circuits.
CO2. Students can now programming with the help of PSPICE/MATLAB software.
CO3. To know and verify the outcomes of different electronic circuits
CO4. Students are able to simulate different power electronic circuits.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M		H			H			H		M		H
CO2		M		M		M			M	M		H		M	
CO3	H		H		H		M		L		L	H	M		
CO4		H		\H		M	H	H		H				H	H

H = Highly Related, M = Medium, L = Low

School of Engineering and Technology
B.Tech. in Electrical Engineering – Semester V
Contact Hrs per week (L-T-P):3-0-0

Course Outlines

BEL075A - Energy Studies

OBJECTIVES:

- To know how various energy sources (renewable and nonrenewable) are generated and to enhance their contribution to the socio-economic development.
- Awareness of different treaties, energy scenario and Energy policy related to India.

Unit 1:Energy Sources: Fossil fuels, Nuclear fuels, hydel, solar, wind and bio fuels in India, Energy conservation, Nuclear energy through fission and fusion processes.

***Unit 2*: Energy Conversion:** Energy conversion from source to utility, Solar, Nuclear, Geothermal, Tide and Wind Energies.

***Unit 3:* Global Energy Scenario:** Role of energy in economic development and social transformation, Overall energy demand, availability and consumption, Depletion of energy resources and its impact on economy, Non proliferation of nuclear energy. International energy policies of G-8, G-20, OPEC and European Union Countries.

***Unit 4:* Indian Energy Scenario:** Commercial and non-commercial forms of energy, Utilization pattern in the past, present and also future prediction, Sector wise energy consumption.

***Unit 5:* Energy Policy:** Energy policy issues at global level, national level and state level, Energy conservation act 2001, Electricity act 2003, Energy pricing and its impact on global variations.

COURSE OUTCOMES:

CO1. Knowing the various generation processes, energy demand and energy policy; everyone is more inclined to energy conservation and can contact different government agencies for energy projects.
CO2. To know the Energy policy issues at global level.
CO3. To know Indian Energy Scenario- Commercial and non-commercial forms of energy.
CO4. Understand the methods to handle the Energy Sources in a productive way.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			H		L	M		M		L		H	M		
CO2	H	M					L		M		M	M	M		
CO3		H	H		H			L	M					H	
CO4	H		M			M	L			M	M			M	L

H = Highly Related, M = Medium, L = Low

Text Book:

1. BH Khan, “Non Conventional Energy Resources” TMH.

Reference Books:

1. Bukhootsow, B., Energy Policy and Planning, PHI New Delhi, 2003.
2. Dr. A.N Mathur- Non Conventional resources of Energy.
3. International Energy Outlook, EIA Annual Publication, 2011.
4. Charles E. Brown, World Energy Resources, Springer Publication, New York, 2002.
5. Culp, A.W., Principles of Energy Conversion, McGraw Hill New York, 2004.

School of Engineering
B.Tech. – Semester V
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL051A: Knowledge Management

OBJECTIVE: This course mainly deals with the planning and process involved in knowledge creation and implementing management in organization.

Unit 1: **Introduction:** Definition, evolution, need, drivers, scope, approaches in Organizations, strategies in organizations, components and functions, understanding knowledge; Learning organization: five components of learning organization, knowledge sources, and documentation.

Unit 2: **Essentials of Knowledge Management**: Knowledge creation process, knowledge management techniques, systems and tools.

Unit 3: **Organizational knowledge management**: Architecture and implementation strategies, building the knowledge corporation and implementing knowledge management in organization.

Unit 4: **Knowledge management system:** Knowledge management system life cycle, managing knowledge workers, knowledge audit, and knowledge management practices in organizations, few case studies.

Unit 5: **Futuristic KM:** Knowledge Engineering, Theory of Computation, Data Structure.

Course Outcomes (CO):

CO1. One can now effectively plan a systematised approach in identifying, creating and retaining knowledge workers using modern practices.
CO2. To analyze the essentials of knowledge management.
CO3. To gain the components and functions of knowledge management.
CO4. To analyze the futuristic knowledge management.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			M	L		M			M			M	L	H	
CO2		M			H	M				M	M				H
CO3	L		M	M			H		M			L		M	
CO4		M			M			M		M		L	M	L	

H = Highly Related, M = Medium, L = Low

Text Books:

1. Knowledge Management – a resource book – A Thohothathri Raman, Excel, 2004.
2. Knowledge Management- Elias M. Awad Hasan M. Ghazri, Pearson Education.

Reference Books:

1. The KM Toolkit – Orchestrating IT, Strategy & Knowledge Platforms, Amrit Tiwana,
2. Pearson, PHI, II Edn.
3. The Fifth Discipline Field Book – Strategies & Tools for Building A learning Organization –
4. Peter Senge et al. Nicholas Brealey 1994 .
5. Knowledge Management – Sudhir Warier, Vikas publications
6. Leading with Knowledge, Madan Mohan Rao, Tata Mc-Graw Hill.

School of Engineering
B.Tech. in Electrical Engineering – Semester VI
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL030A- Indian Electricity Standards and their Applications

OBJECTIVE:
The objective of this course is to give knowledge about various standards and rules associated in power system (transmission and distribution) in India.

Unit 1: **Introduction**: Various definitions used in Indian electricity rule 1956 i.e., appointment and authority of Inspectors and officers under government, license and contents of draft license. Service lines and apparatus on consumer's premises. Cut-out on consumer's premises, Identification of earthed and earthed neutral conductors and position of switches and cut-outs, Earthed terminal on consumer's premises, Accessibility of bare conductors, Danger Notices, Handling of electric supply lines and apparatus, Cables for portable or transportable apparatus, Cables protected by bituminous materials, Street boxes, Distinction of different circuits, Accidental charge, Provisions applicable to protective equipment, Instructions for restoration of persons suffering from electric shock, Precautions to be adopted by consumers, Periodical inspection and testing of consumer's installation.

Unit 2: **General Conditions Relating To Supply And Use Of Energy:** Testing of consumer's installation, Precautions against leakage before connection, Leakage on consumer's premises, Supply and use of energy, Provisions applicable to medium, high or extra-high voltage installations, Cost of inspection and test of consumer's installation, Declared voltage of supply to consumer, Declared frequency of supply to consumer, Sealing of meters, and cut-outs, Precautions against failure of supply: Notice of failures.

*Unit 3:***Electric Supply Lines, Systems And Apparatus For Low And Medium Voltages:** Test for resistance of insulation, Connection with earth.

*Unit 4:***Electric Supply Lines, Systems And Apparatus For High And Extra-High Voltages**: Approval by Inspector, Use of energy at high and extra-high voltage, Testing, Operation and Maintenance, Metal sheathed electric supply lines, Connection with earth, General conditions as to transformation and control of energy, Supply to X-ray and high frequency installation.

*Unit 5:***Overhead Lines, Under Ground Cables And Generating Stations**: Material and strength, Maximum stresses, Clearance above ground of the lowest conductor, Clearance between conductors and trolley wires, Clearances from buildings of low and medium voltage lines and service lines, Clearances from buildings of high and extra-high voltage lines, Conductors at different voltages on same supports, Erection of or alternation to buildings, structures, flood banks and elevation of roads, Clearances, Routes, Maximum interval between supports, Conditions to apply where telecommunication lines and power lines are carried on same supports, Lines crossing or approaching each other, Service-lines from Overhead lines, Earthing, Safety and protective devices, Protection against lightning, Unused overhead lines. Additional rules for electric traction, Introduction to electric supply in mines and oil fields.

Course Outcome (CO):

CO1. To know various definitions used in Indian electricity rules
CO2. Students will now know how to get a new connection and enhancement or reduction of load, recovery of electricity charges and intervals for billing of electricity charges, disconnection, reconnection and restoration of supply of electricity.
CO3. Authority and responsibility associated with power inspectors.
CO4. Students can educate others about the safety precautions which a common man should take care of while usage of electrical appliances, cables etc. in and around their houses.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			H			H		M	H		M		M	
CO2		H	M		H		H	M			H		M		H
CO3	M		M	M		H			H	L		H		M	
CO4		H		\	M	M		H			L		M		L

H = Highly Related, M = Medium, L = Low

Text Books:

1. Indian Electricity Rules, 1956, Manak Bhavan, New Delhi.
2. Substation Design and Practice, P.S. Satnam, Dhanpat Rai and Sons

School of Engineering
B.Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEL071A- Industrial Safety

OBJECTIVE: This course will help students to know how about the safety of human beings, machineries, buildings and related properties of the industry.

Unit-1: Concepts and statutory requirements:
Introduction electrostatics, electro magnetism, stored energy, energy radiation and electromagnetic interference, Working principles of electrical equipment-Indian electricity act and rules, statutory requirements from electrical inspectorate-international standards on electrical safety -first aid-cardio pulmonary resuscitation (CPR).

Unit 2: Electrical hazard:
Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity. Energy leakage-clearances and insulation-classes of insulation-voltage classifications-excess energy- current surges-Safety in handling of war equipments-over current and short circuit current-heating effects of current-electromagnetic forces-corona effect-static electricity-definition, sources, hazardous conditions, control, electrical causes of fire and explosion-ionization, spark and arc ignition energy-national electrical safety code ANSI. Lightning, hazards, lightning arrestor, installation–earthing, specifications, earth resistance, earth pit maintenance.

UNIT 3: Protection systems
Fuse, circuit breakers and overload relays-protection against over voltage and under voltage-safe limits of amperage-voltage-safe distance from lines-capacity and protection of conductor-joints-and connections, overload and short circuit protection-no load protection-earth fault protection. insulation and continuity test-system grounding-equipment grounding-earth leakage circuit breaker (ELCB)-cable wires-maintenance of ground-ground fault circuit interrupter-use of low voltage-electrical guards-Personal protective equipment- safety in handling hand held electrical appliances tools and medical equipments.

UNIT 4: Selection, installation, operation and maintenance: Role of environment in selection-safety aspects in application-protection and interlock-self diagnostic features and fail safe concepts-lock out and work permit system-discharge rod and earthing devices- safety in the use of portable tools-cabling and cable joints-preventive maintenance.

UNIT 5: Hazardous zones: Classification of hazardous zones-intrinsically safe and explosion proof electrical apparatus-increase safe equipment-their selection for different zones-temperature classification-grouping of gases-use of barriers and isolators-equipment certifying agencies.

Course Outcomes (CO):

CO1. Student can learn electrical hazard
CO2. Student can learn protection systems for safety purpose.
CO3. Students will now know the role of environment in selection-safety aspects.
CO4. To know various hazardous zones with explosion proof electrical apparatus.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M		L		M		H		M			M		
CO2	M		M				L			H		L	H		
CO3		L	M				M		H		M			L	M
CO4			M		L				M			M		L	M

H = Highly Related, M = Medium, L = Low

TEXT BOOK:

1. Fordham Cooper, W., “Electrical Safety Engineering” Butterworth and Company, London, 1986.

REFERENCES:

1. ”Accident prevention manual for industrial operations”, N.S.C., Chicago, 1982.
2. Indian Electricity Act and Rules, Government of India.
3. Power Engineers – Handbook of TNEB, Chennai, 1989.
4. Martin Glov Electrostatic Hazards in powder handling, Research Studies Pvt.LTd., England.

School of Engineering
B.Tech. in Electrical Engineering – Semester VII
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BEL035A– Non Conventional Sources of Energy and applications

OBJECTIVE:

- This course provides information regarding working and applications of different non conventional sources of energy.

Unit 1: **Introduction**: Limitations of conventional energy sources, need and growth of alternate energy sources, basic schemes and applications of direct energy conversion.

Unit 2: **MHD Generators and Solar energy**: Basic principles and Hall Effect, generator and motor effect, different types of MHD generators, conversion effectiveness. Practical MHD generators, applications and economic aspects. Solar Energy: Photovoltaic effect, characteristics of photovoltaic cells, conversion efficiency, solar batteries and applications. Solar energy in India, solar collectors, solar furnaces and applications.

Unit 3: **Wind Energy and Thermo-electric Generators**: History of wind power, wind generators, theory of wind power, characteristics of suitable wind power sites, scope in India, advantages and limitations. Thermo-electric Generators: Seeback effect, peltier effect, Thomson effect, thermoelectric convertors, brief description of the construction of thermoelectric generators, applications and economic aspects.

Unit 4: **Fuel Cells**: Principle of action, Gibbs free energy, general description of fuel cells, types, construction, operational characteristics and applications.

Unit 5: **Miscellaneous Sources**: Geothermal system, characteristics of geothermal resources, choice of generators, electric equipment and precautions. Low head hydro plants, definition of low head hydro power, choice of site and turbines.

Course Outcomes (CO):

CO1. To identify renewable energy sources.
CO2. To understand the mechanism of solar, wind and ocean energy sources.
CO3. Student will be aware of the energy crisis gripping the world and how non conventional energy sources are helpful in meeting that demand.
CO4. Students can also now compare different sources of energy with respect to output, availability of raw material, installing and running cost etc.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M			H		L			H				M
CO2		L		M			H		M	L		H	H	L	
CO3	M		H		H		M		L		L				M
CO4		M		\	M		H	M		L		M		M	L

H = Highly Related, M = Medium, L = Low

Text Books:

1. B H. Khan, “Non Conventional Energy Resources” TMH.

Reference Books:

1. D S Chauhan, “Non Conventional Energy Resources” New Age Publication.
2. G D Rai, “Non-conventional energy sources”, Khanna Publishers.
3. HP Garg and Jai Prakash, “Solar Energy Fundamentals and Applications”, TMH

JECRC University
Department of Electrical Engineering
Minutes of BOS Meeting

Reference No. EE/2017-18/BOS

Date: 30.04.2018

Minutes of the meeting of BOS, Electrical Engineering held on 30.04.2018 in the Department of Electrical Engineering, JECRC University, Jaipur.

The following members attended the meeting.

S.No.	Name	Status
1.	Dr. Ravindra Pratap Singh (HOD)	Chairman
2.	Dr. R. A. Gupta, Prof. Dept. of Elect. Engg. MNIT, Jaipur	External Member
3.	Dr. Vivek Shrivastava, Associate Professor (RTU Kota)	External Member
4.	Dr Amit Shrivastava	Internal Member
5.	Ms. Divya Mathur	Internal Member
6.	Mr. Shashi Kant Vij	Internal Member
7.	Dr. Sandeep Gupta	Internal Member

Agenda: Finalization of curriculum of B. Tech Electrical Engineering to be effective from the session 2018-19.

Dr. RP Singh, Chairman (BOS) chaired the meeting and welcomed all the members present. He welcomed and introduced external member Prof.(Dr.) R.A. Gupta, Professor, Department of Electrical Engineering, MNIT, Jaipur and Dr. Vivek Shrivastava, Associate Professor, Department of Electrical Engineering, Rajasthan Technical University Kota. After the brief introduction, the agenda item listed below were taken up for the discussion.

1. Professional Skills- Aptitude-III in 3rd Semester, Professional Skills- Advanced Aptitude-IV in 4th Semester, and Professional Skills- Technical-VI in 6th Semester shall be part of curriculum as Audit Course. These Audit Courses are mandatory to pass for every student.
2. Advanced Engineering Mathematics in 3rd semester and Computer Added Numerical Methods (Theory and lab) in 4th semester are introduced in place of Multivariate - Analysis, Linear Algebra and Special Functions, Complex Analysis, Probability and Mathematics considering syllabus of national competitive tests as well applications in Electrical Engineering.
3. Object Oriented Programming with C^{++} (theory and lab) in 5th semester and Data Structures and Algorithms (theory and lab) in 6th semester were introduced in the place of Computer Organization and Design (theory) and Web Designing Techniques lab.

PTO

4. Electromagnetic Field Theory, Analog Electronics (theory and Lab), Digital Electronics (theory), Signal and Systems (theory) were introduced in III, IV and V semesters respectively in place of Field theory and Circuits and Electronics Devices and Systems.
5. New courses such as Computer Aided Design of Electrical Machines, Safety, Repair and Maintenance of Electrical Equipments, Basics of Soft Computing and Power System Instrumentation were introduced for Electrical Engineering students.
6. New codes were allotted to the new courses and the courses which have under gone significant changes were allotted the "B" code series of BEL.

With the above, members present unanimously agreed to put forward the schemes and course contents for approval to the Academic Council.

HoD thanked all the members present.

Dr. Ravindra Pratap Singh

Board of Studies (Department of Electrical Engineering)

Dr. Amit Shrivastava, Asso. Prof.
Member

Mr. S. K. Vij, Asst. Prof.-I
Member

Ms. Divya Mathur, Asst. Prof.-I
Member

Dr. Sandeep Gupta, Asst. Prof.-I
Member

Dr. Vivek Shrivastava
(External Member)
(Asso. Prof., Rajasthan Technical University, Kota)

Prof. (Dr.) R.A. Gupta 30.4.2018
(Prof. MNIT, Jaipur, External Member)

Dr. Ravindra Pratap Singh,
(Professor & HOD-EE, Chairman)

Counter Signature

Ram Rattan 30/4/18
Prof. Ram Rattan
(Dean, School of Engineering)