JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., Act. No. 30 of 2008)
ANANTHAPURAMU – 515 002 (A.P.) INDIA.

Course Structure for B.Tech-R15 Regulations

ELECTRICAL & ELECTRONICS ENGINEERING

B.Tech III-I Semester (EEE)

S. No.	Course Code	Subject	L	T	P	C
1.	15A02501	Electrical Measurements	3	1	-	3
2.	15A04509	Linear & Digital IC Applications	3	1	-	3
3.	15A02502	Electrical Power Transmission Systems	3	1	-	3
4.	15A02503	Power Electronics	3	1	-	3
5.	15A02504	Electrical Machines – III	3	1	-	3
6.		**MOOCS -I**	3	1	-	3
	15A04510	Digital Circuits and Systems				
	15A02505	Networks Signals and Systems				
7.	15A02506	Electrical Machines Laboratory – II	-	-	4	2
8.	15A02507	Electrical Measurements Laboratory	-	-	4	2
9.	15A99501	Audit course – Social Values & Ethics	2	0	2	0
		Total:	**20**	**6**	**10**	**22**

B.Tech III-II Semester (EEE)

S. No.	Course Code	Subject	L	T	P	C
1.	15A52601	Management Science	3	1	-	3
2.	15A02601	Power Semiconductor Drives	3	1	-	3
3.	15A02602	Power System Protection	3	1	-	3
4.	15A04601	Microprocessors & Microcontrollers	3	1	-	3
5.	15A02603	Power System Analysis	3	1	-	3
6.	15A02604 15A02605 15A02606 15A01608	**CBCC -I** 1) Neural Networks & Fuzzy Logic 2) Programmable Logic Controller & Its Applications 3) Optimization Techniques 4) Intellectual Property Rights	3	1	-	3
7.	15A04607	Microprocessors & Microcontrollers Laboratory	-		4	2
8.	15A02607	Power Electronics & Simulation Laboratory	-		4	2
9.	15A52602	Advanced English Language Communication Skills (AELCS) Laboratory (Audit Course)	-		2	-
10.	15A02608	Comprehensive Online Examination - II	-	-	-	1
		Total:	**18**	**6**	**12**	**23**

B.Tech IV-I Semester (EEE)

S. No.	Course Code	Subject	L	T	P	C
1.	15A02701	Electrical Distribution Systems	3	1	-	3
2.	15A04603	Digital Signal Processing	3	1	-	3
3.	15A02702	Power System Operation and Control	3	1	-	3
4.	15A02703	Utilization of Electrical Energy	3	1	-	3
5.	15A02704 15A02705 15A02706	**CBCC-II** a) Modern Control Theory b) Switched Mode Power Converters c) Energy Auditing & Demand Side Management	3	1	-	3
6.	15A02707	**CBCC-III** a) Smart Grid	3	1	-	3

	15A02708	b) Flexible AC Transmission Systems				
	15A02709	c) Power Quality				
7.	15A04608	Digital Signal Processing Laboratory	-		4	2
8.	15A02710	Power Systems & Simulation Laboratory	-		4	2
		Total:	**18**	**6**	**8**	**22**

B.Tech IV-II Semester (EEE)

S. No.	Course Code	Subject	L	T	P	C
1.		**MOOCS – II**	3	1	-	3
	15A02801	1. Instrumentation				
	15A02802	2.Power System Dynamics and Control				
	15A02803	3. Industrial Automation & Control				
2.		**MOOCS – III**	3	1	-	3
	15A02804	1. HVDC Transmission				
	15A04702	2. Embedded Systems				
	15A02805	3. Energy Resources & Technology				
3.	15A02806	Comprehensive Viva Voce	-	-	4	2
4.	15A02807	Technical Seminar	-	-	4	2
5.	15A02808	Project Work	-		24	12
		Total:	**6**	**2**	**32**	**22**

2 Theory + 1 Comprehensive Viva voce + 1 Technical Seminar + 1 Project work
*Either by MOOCS manner or Self study or Conventional manner

Minor Degree in EEE

S. No.	Course Code	Subject	L	T	P	C
		III B. Tech – I Semester				
1	15A02303	Control Systems Engineering	3	1	-	3
		III B. Tech – II Semester				
2	15A02402	Electrical Power Generating Systems	3	1	-	3
		IV B. Tech –I Semester				
3	15A02502	Electrical Power Transmission Systems	3	1	-	3
		IV B. Tech – II Semester				
4	15A02603	Power System Analysis	3	1	-	3
		Total	**12**	**4**	**-**	**12**

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B. Tech III-I Sem. (EEE) with values 3 1 0 3:

B. Tech III-I Sem. (EEE)

L	T	P	C
3	1	0	3

15A02501   ELECTRICAL MEASUREMENTS

Course Objectives:
The objectives of the course are to make the student learn about

- The basic principles of different types of electrical instruments for the Measurement of voltage, current, power factor, power and energy.
- The measurement of R, L, and C parameters using bridge circuits.
- The principles of magnetic measurements.
- The principle of working of CRO and its applications.
- The use of Current Transformers, Potential Transormers, and Potentiometers.

UNIT- I
MEASURING INSTRUMENTS
Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Type Instruments – Expression for the Deflecting Torque and Control Torque – Errors and Compensations, Range Extension.
Cathode Ray Oscilloscope- Cathode Ray tube-Time base generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase , Frequency, Current & Voltage- Lissajous Patterns

UNIT – II
D.C & A.C BRIDGES
Methods of Measuring Low, Medium and High Resistances – Sensitivity of Wheatstone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method. Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle - Desauty Bridge. Wien's Bridge – Schering Bridge.

UNIT – III
MEASUREMENT OF POWER AND ENERGY
Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Element Dynamometer Wattmeter, Expression for Deflecting and Control Torques. Types of P.F. Meters – Dynamometer and Moving Iron Type – 1-ph and 3-ph Meters. Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and Compensations. Three Phase Energy Meter.

UNIT –IV
INSTRUMENT TRANSFORMERS AND POTENTIOMETERS
Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – Methods for Reduction of Errors-Design Considerations.
Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer – Standardization – Measurement of unknown Resistance, Current, Voltage.
A.C. Potentiometers: Polar and Coordinate types- Standardization – Applications.

UNIT – V
MAGNETIC MEASUREMENTS
Ballistic Galvanometer – Equation of Motion – Flux Meter – Constructional Details, Comparison with Ballistic Galvanometer. Determination of B-H Loop - Methods of Reversals - Six Point Method – A.C. Testing – Iron Loss of Bar Samples.

OUTCOMES: The student should have learnt how to
- Use wattmeters, pf meters, and energy meters in a given circuit.
- Extend the range of ammeters and voltmeters
- Measure active power, reactive power, power factor, and energy in both 1-phase and 3-phase circuits
- Determine the resistance values of various ranges, L and C values using appropriate bridges.
- Analyze the different characteristic features of periodic, and aperiodic signals using CRO.
- Use CTs and PTs for measurement of very large currents and high voltages

TEXT BOOKS:
1. Electrical & Electronic Measurement & Instruments, A.K.Sawhney and Dhanpat Rai & Co. Publications, 2011, Reprint 2014.
2. Electrical Measurements and measuring Instruments 5th Edition, E.W. Golding and F.C. Widdis, Reem Publications, 5th Edition, 2011.

REFERENCE BOOKS:
1. Electronic Instrumentation, 3rd Edition, H. S. Kalsi, Tata Mcgrawhill, 2011.
2. Electrical Measurements, Buckingham and Price, Prentice Hall, 1970.
3. Electrical Measurements: Fundamentals, Concepts, Applications, Reissland, M.U., New Age International (P) Limited, 2010.

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B. Tech III-I Sem. (EEE)

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15A04509 LINEAR & DIGITAL IC APPLICATIONS

Course Objective:

- *To make the student understand the basic concepts in the design of electronic circuits using linear integrated circuits and their applications. To introduce some special function ICs.*
- *To be able to use computer-aided design tools for development of complex digital logic circuits*
- *To be able to model, simulate, verify, analyze, and synthesize with hardware description languages*
- *To be able to design and prototype with standard cell technology and programmable logic*
- *To be able to design tests for digital logic circuits, and design for testability*

Learning Outcome:

- *Upon completion of the course, students will be able to:*
- *Understand the basic building blocks of linear integrated circuits and its characteristics.*
- *Analyze the linear, non-linear and specialized applications of operational amplifiers.*
- *Understand the theory of ADC and DAC.*
- *Able to use computer-aided design tools for development of complex digital logic circuits.*
- *Able to model, simulate, verify, analyze, and synthesize with hardware description languages.*
- *Able to design and prototype with standard cell technology and programmable logic.*
- *Able to design tests for digital logic circuits, and design for testability.*

UNIT I
OP-AMP CHARACTERISTICS:
Basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics - DC and AC characteristics, 741 Op-amp and its features, modes of operation-inverting, non-inverting, differential. Basic applications of Op-amp, instrumentation amplifier, AC amplifier, V to I and I to V converters, sample & Hold circuits, multiplier and divider, Differentiator and Integrator, Comparators, Schmitt trigger, Multivibrators, Introduction to voltage regulators, features of 723 General

purpose regulator.

UNIT II
TIMERS, PHASE LOCKED LOOPS & D-A AND A-D CONVERTERS:
Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger, PLL – Introduction, block schematic, principles and description of individual blocks of 565.Basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel comparator type ADC, Counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC specifications.

UNIT III
ACTIVE FILTERS & OSCILLATORS:
Introduction, 1st order LPF, HPF filters, Band pass, Band reject and all pass filters. Oscillator types and principle of operation- RC, Wien, and quadraturetype, waveform generators- triangular, sawtooth, square wave and VCO.

UNIT IV
INTIGRATED CIRCUITS:
Classification, Chip size and circuit complexity, Classification of integrated circuits, comparison of various logic families, standard TTL NAND Gate-Analysis & characteristics, TTL open collector o/ps, Tristate TTL, MOS & CMOS open drain and tri-state outputs, CMOS transmission gate, IC interfacing-TTL driving CMOS & CMOS driving TTL.

UNIT V
COMBINATIONAL &SEQUENTIAL CIRCUITS
COMBINATIONAL: Code converters, Decoders, Demultiplexers, decoders & drives for LED & LCD display. Encoder, priority Encoder, Multiplexers & their applications, priority generators/checker circuits. Digital arithmetic circuits-parallel binary adder/subtractor circuits using 2's Complement system. Digital comparator circuits.

SEQUENTIAL: Latches, Flip-flops & their conversions. Design of synchronous counters, Decade counter, shift registers & applications, familiarities with commonly available 74XX and CMOS 40XX series of IC counters.

Text Books:
1. *Linear Integrated Circuits – D.RoyChowdhury, New Age International (p) Ltd, 2nd Edition., 2003.*
2. *Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Ed., 2005.*

Reference Books:

1. Operational Amplifiers & Linear Integrated Circuits – R.F.Coughlin & Fredric F.Driscoll, PHI.
2. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications – Denton J.Daibey, TMH.
3. Design with Operational amplifiers & Analog Integrated circuits-Sergio Franco, Mc Graw Hill, 3rd Edition , 2002.
4. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition 2005.
5. A VHDL Primer – J. Bhasker, Pearson Education/ PHI, 3rd Edition.
6. Op-amps & Linear ICs – Ramakanth A.Gayakwad, PHI, 1987.

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15A02502   ELECTRICAL POWER TRANSMISSION SYSTEMS

Course **Objectives :**

The objectives of the course are to make the student learn about

- The computation of the parameters of a Transmission line.
- Classification of transmission lines and representation by suitable equivalent circuits
- the various factors that affect the performance of Transmission lines
- The Travelling wave phenomenon on transmission lines.
- Underground cables: construction, types, and grading

UNIT- I
TRANSMISSION LINE PARAMETERS
Types of Conductors – ACSR, Bundled and Stranded Conductors- Resistance For Solid Conductors – Skin Effect- Calculation of Inductance for Single Phase and Three Phase, Single and Double Circuit Lines, Concept of GMR & GMD, Symmetrical and Asymmetrical Conductor Configuration with and without Transposition, Numerical Problems, Capacitance Calculations for Symmetrical and Asymmetrical Single and Three Phase, Single and Double Circuit Lines, Effect of Ground on Capacitance, Numerical Problems.

UNIT- II
PERFORMANCE OF TRANSMISSION LINES:
Classification of Transmission Lines - Short, Medium and Long Lines and Their Exact Equivalent Circuits- Nominal-T, Nominal-π. Mathematical Solutions to Estimate Regulation and Efficiency of All Types of Lines. Long Transmission Line-Rigorous Solution, Evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Surge Impedance and Surge Impedance Loading - Wavelengths and Velocity of Propagation – Ferranti Effect , Charging Current-Numerical Problems.

UNIT- III
MECHANICAL DESIGN OF TRANSMISSION LINES
Overhead Line Insulators: Types of Insulators, String Efficiency and Methods for Improvement, Capacitance Grading and Static Shielding.
Corona: Corona Phenomenon, Factors Affecting Corona, Critical Voltages and Power Loss, Radio Interference.

Sag and Tension Calculations: Sag and Tension Calculations with Equal and Unequal Heights of Towers, Effect of Wind and Ice on Weight of Conductor, Stringing Chart and Sag Template and Its Applications, Numerical Problems.

UNIT – IV
POWER SYSTEM TRANSIENTS & TRAVELLING WAVES
Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of Lines with Different Types of Conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

UNIT-V
CABLES
Types of Cables, Construction, Types of Insulating Materials, Calculations of Insulation Resistance and Stress in Insulation, Numerical Problems. Capacitance of Single and 3-Core Belted Cables, Numerical Problems. Grading of Cables - Capacitance Grading, Numerical Problems, Description of Inter-Sheath Grading.

Course **Outcomes:** At the end of the course the student will be able to
- Compute the transmission line parameters.
- Model a given transmission line.
- Estimate the performance of a given transmission line.
- Analyze the effect of over voltages on transmission lines.
- Explain the construction, types and grading of underground cables and analyze cable performance.

TEXT BOOKS:

1. Electrical power systems, C.L.Wadhwa, New Age International (P) Limited, 6th Edition, 2010, Reprint 2014.
2. A Text Book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakrabarti, Dhanpat Rai & Co. Pvt. Ltd., 1999.

REFERENCE BOOKS:

1. Power system Analysis 4th edition, John J Grainger and William D Stevenson, JR, Mc Graw Hill Education, 2003, Reprint 2015.
2. Power System Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill Education (India) Pvt. Ltd., 2nd Edition, 2008, 23rd Reprint 2015.
3. Electric Power Transmission System Engineering: Analysis and Design, Turan Gonen, 2nd Edition, CRC Press, Taylor & Francis group, 2009, 1st Indian Reprint 2010.

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	L	T	P	C
B. Tech III-I Sem. (EEE)	**3**	**1**	**0**	**3**

15A02503   POWER ELECTRONICS

Course **Objectives:**

The objectives of the course are to make the student learn about

- the basic power semiconductor switching devices and their principles of operation.
- the various power conversion methods, controlling and designing of power converters.
- the applications of Power electronic conversion to domestic, industrial, aerospace, commercial and utility systems etc.
- the equipment used for DC to AC, AC to DC, DC to Variable DC, and AC to Variable frequency AC conversions.

UNIT I
POWER SEMI CONDUCTOR DEVICES

Semiconductor Power Diodes, Thyristors – Silicon Controlled Rectifiers (SCR's) – TRIACs, GTOs - Characteristics and Principles of Operation and other Thyristors – Classification of Switching Devices Based on Frequency and Power Handling Capacity- BJT – Power Transistor - Power MOSFET – Power IGBT -– Basic Theory of Operation of SCR – Static Characteristics – Turn On and Turn Off Methods- Dynamic Characteristics of SCR - Two Transistor Analogy – Triggering Circuits—– Series and Parallel Connections of SCR's – Snubber Circuits – Specifications and Ratings of SCR's, BJT, IGBT.

UNIT II
PHASE CONTROLLED CONVERTERS

Phase Control Technique – Single Phase Line Commutated Converters – Mid Point and Bridge Connections – Half Controlled Converters, Fully Controlled Converters with Resistive, RL Loads and RLE Load– Derivation of Average Load Voltage and Current – Line Commutated Inverters -Active and Reactive Power Inputs to the Converters without and with Free Wheeling Diode, Effect of Source Inductance – Numerical Problems. Three Phase Line Commutated Converters – Three Pulse and Six Pulse Converters – Mid Point and Bridge Connections - Average Load Voltage with R and RL Loads – Effect of Source Inductance–Dual **Converters (Both Single Phase and Three Phase) - Waveforms –Numerical Problems.**

UNIT III
CHOPPERS AND REGULATORS
Commutation Circuits – Time Ratio Control and Current Limit Control Strategies – Step Down and Step up Choppers Derivation of Load Voltage and Currents with R, RL and RLE Loads- Step Up Chopper – Load Voltage Expression– Problems. Study of Buck, Boost and Buck-Boost regulators, buck regulator e.g. TPS54160, hysteretic buck regulator e.g.LM3475, Switching Regulator and characteristics of standard regulator ICs – TPS40200, TPS40210, TPS 7A4901, TPS7A8300

UNIT IV
INVERTERS
Inverters – Single Phase Inverter – Basic Series Inverter – Basic Parallel Capacitor Inverter Bridge Inverter – Waveforms – Simple Forced Commutation Circuits for Bridge Inverters – Single Phase Half and Full Bridge Inverters-Pulse Width Modulation Control-Harmonic Reduction Techniques-Voltage Control Techniques for Inverters – Numerical Problems, Three Phase VSI in 120^0 And 180^0 Modes of Conduction.

UNIT V
AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS
AC Voltage Controllers – Single Phase Two SCR's in Anti Parallel – With R and RL Loads – Modes of Operation of TRIAC – TRIAC with R and RL Loads – Derivation of RMS Load Voltage, Current and Power Factor Wave Forms – Firing Circuits -Numerical Problems - Thyristor Controlled Reactors; Switched Capacitor Networks.

Cyclo Converters – Single Phase Mid Point Cycloconverters with Resistive and Inductive Load (Principle of Operation only) – Bridge Configuration of Single Phase Cycloconverter (Principle of Operation only) – Waveforms

Course **Outcomes:**
After going through this course, the student acquires knowledge about:
- Basic operating principles of power semiconductor switching devices.
- the operation of power electronic converters, choppers, inverters, AC voltage controllers, and cycloconverters, and their control.
- How to apply the learnt principles and methods to practical applications.

TEXT BOOKS:
1. Power Electronics, M. D. Singh and K. B. Khanchandani, Mc Graw Hill Education (India) Pvt. Ltd., 2nd Edition, 2007, 23rd Reprint 2015.
2. Power Electronics: Circuits, Devices and Applications, Muhammad H. Rashid, Pearson, 3rd Edition, 2014, 2nd Impression 2015.

REFERENCE BOOKS:

1. Power Electronics, K. R. Varmah, Chikku Abraham, CENGAGE Learning, 1st Edition, 2016.
2. Power Electronics, P. S. Bimbhra, Khanna Publishers, 2012.
3. Power Electronics: Devices, Circuits, and Industrial Applications, V. R. Moorthi, OXFORD University Press, 1st Edition, 2005, 12th Impression 2012.

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B. Tech III-I Sem. (EEE)

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3	1	0	3

15A02504   ELECTRICAL MACHINES – III

Course **Objectives:**

The objectives of the course are to make the student learn about

- the construction and principle of working of synchronous machines
- different methods of predetermining the regulation of alternators
- the concepts and computation of load sharing among alternators in parallel.
- the performance characteristics of synchronous motors and their use as synchronous condensers for power factor improvement.
- different types of single phase motors and special motors used in house hold appliances and control systems.
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UNIT – I

SYNCHRONOUS GENERATORS

Principle and Constructional Features of Salient Pole and Round Rotor Machines – Armature Windings, Concentrated and Distributed Windings, Integral Slot and Fractional Slot Windings – Pitch, Distribution, and Winding Factors – E.M.F Equation- Harmonics in Generated E.M.F – Space and Slot Harmonics – Elimination of Harmonics- Armature Reaction – Synchronous Reactance and Impedance – Load Characteristics - Phasor Diagram.

UNIT – II

REGULATION OF SYNCHRONOUS GENERATORS

Regulation of Salient Pole Alternator – Voltage Regulation Methods – E.M.F Method- MMF Method – ZPF Method – ASA Method – Short Circuit Ratio (SCR) – Two Reaction Theory –Determination of X_d and X_q (Slip Test) – Phasor Diagrams.

UNIT –III

PARALLEL OPERATION OF SYNCHRONOUS GENERATORS

Power Flow Equation in Alternators (Cylindrical and Salient Pole Machines) – Synchronizing Power and Torque – Parallel Operation and Load Sharing – Effect of Change of Excitation and Mechanical Power Input – Synchronizing Alternators with Infinite Bus Bars – Determination of Sub-Transient, Transient and Steady State Reactances.

UNIT – IV
SYNCHRONOUS MOTORS

Theory of Operation – Phasor Diagram – Power Flow Equations in Synchronous Motors- Variation of Current and Power Factor with Excitation – V and Inverted V Curves – Synchronous Condensers – Hunting, and Methods to Eliminate Hunting – Starting Methods of Synchronous Motor – Synchronous Induction Motor - Construction, Principle of operation and control of Brushless DC motor.

UNIT – V
SINGLE PHASE AND SPECIAL MOTORS

Single Phase Induction Motors - Constructional Features – Double Revolving Field Theory- Elementary Idea of Cross Field Theory – Split Phase Motors – Capacitor Start and Run Motors – Shaded Pole Motor. Principle and Performance of A.C Series Motor - Universal Motor – Single Phase Synchronous Motors – Reluctance Motor – Hysteresis Motor – Stepper Motor.

Course **Outcomes:** At the end of the course the student will be able to

- predetermine the regulation of synchronous generators using different methods.
- Determine how several alternators running in parallel share the load on the system.
- Analyze the performance characteristics of synchronous motors.
- Make necessary calculations for power factor improvement using synchronous condenser.
- Choose specific 1-phase motor and/or special motors for a given application.

TEXT BOOKS:

1. Electrical Machinery, P.S. Bimbhra, Khanna Publishers, 7th Edition, 2011.
2. Electric Machinery Fundamentals, Stephen J Chapman, Mc Graw Hill Series in Electrical and Computer Engineering, 4th Edition, 2010, 10th Reprint 2015.

REFERENCE BOOKS:

1. Electric Machines 4th edition, D.P.Kothari and I.J. Nagrath, Mc Graw Hill Education (India) Pvt. Ltd., 4th Edition, 2010, 16th Reprint 2015.
2. Electric Machinery, A.E.Fitzgerald, C.Kingsley and S. Umans, Mc Graw Hill Education (India) Pvt. Ltd., 6th Edition, 2005.
3. Electrical Machines, S K Bhattacharya, Mc Graw Hill Education (India) Pvt. Ltd., 4th Edition, 2014, 3rd Reprint 2015.

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B. Tech III-I Sem. (EEE)

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15A04510   DIGITAL CIRCUITS AND SYSTEMS
(MOOCS-I)

Course Outcomes:

Upon completion of the course, students should possess the following skills:

- Be able to manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.
- Be able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
- Be able to design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.
- Be able to design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.

UNIT-I
Number System and Boolean Algebra And Switching Functions: Number Systems, Base Conversion Methods, Complements of Numbers, Codes- Binary Codes, Binary Coded Decimal Code and its Properties, Unit Distance Codes, Alpha Numeric Codes, Error Detecting and *Correcting* Codes. Boolean algebra: Basic Theorems and Properties, Switching Functions, Canonical and Standard Form, Algebraic Simplification of Digital Logic Gates, Properties of XOR Gates, Universal Gates, Multilevel NAND/NOR

UNIT -II:
Minimization and Design of Combinational Circuits: Introduction, The Minimization with theorem, The Karnaugh Map Method, Five and Six Variable Maps, Prime and Essential Implications, Don't Care Map Entries, Using the Maps for Simplifying, Tabular Method, Partially Specified Expressions, Multi-output Minimization, Minimization and Combinational Design, Arithmetic Circuits, Comparator, Multiplexers, Code Converters, Wired Logic, Tristate Bus System, Practical Aspects related to Combinational Logic Design, Hazards and Hazard Free Relations.

UNIT III
SEQUENTIAL CIRCUITS
Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation –Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/sub-tractor- Asynchronous Ripple or serial counter – Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters – Design of Synchronous counters: state diagram- State table –State minimization –State assignment - Excitation table and maps-Circuit implementation - Modulo–n counter, Registers
– shift registers - Universal shift registers – Shift register counters – Ring counter – Shift counters - Sequence generators.

UNIT IV
MEMORY DEVICES
Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM – EAPROM, RAM – RAM organization – Write operation – Read operation – Memory cycle - Timing wave forms – Memory decoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell – Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL

UNIT V
SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS
Synchronous Sequential Circuits: General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits
Asynchronous Sequential Circuits: Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines – Problems in Asynchronous Circuits – Design of Hazard Free Switching circuits. Design of Combinational and Sequential circuits using VERILOG

TEXT BOOKS:
1. Switching and Finite Automata Theory- Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge.
2. Digital Design- Morris Mano, PHI, 4th Edition. Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
3. S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition., Vikas Publishing House Pvt. Ltd.

REFERENCE BOOKS:
1. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed,John Wiley & Sons Inc.
2. Digital Fundamentals – A Systems Approach – Thomas L. Floyd, Pearson, 2013.
3. Digital Logic Design - Ye Brian and HoldsWorth, Elsevier
4. Fundamentals of Logic Design- Charles H. Roth, Cengage LEanring, 5th, Edition, 2004.
5. John F.Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006
6. John.M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2002.
7. William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.
8. Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003

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B. Tech III-I Sem. (EEE)

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15A02505   NETWORKS SIGNALS AND SYSTEMS
(MOOCS-I)

Course Objectives: The objectives of the course are to make the students learn about
- Basic characteristics of circuit elements
- How to compute two port parameters
- Study of graph theory and analysis of electrical networks
- Application of Laplace transforms to analyse the frequency response
- Application of Fourier transforms to electrical circuits excited by non-sinusoidal sources.

Unit – I Introduction
Network elements and sources – linearity and nonlinearity – Distributed and lumped parameters – Analysis of resistive networks

Unit – II Two port networks
Two port parameters short and open circuit – Problems – locus diagrams – Driving point immittance functions – Two element synthesis- Problems

Unit – III Introduction to signals
Types of signals – Laplace transforms – problems – Frequency response – bode plot – poles and zeros

Unit – IV – Graph Theory
Introduction – Concepts of Graph theory – image impedance and iterative impedance – Computer aided analysis of resistive networks – RLC two terminal network

Unit – V Synthesis of Network functions
Parts of Network functions – Problems – Synthesis of two port network – Fourier series – Fourier Transforms

Outcomes: After completion of Course, the student should be able to
- Given network, find the equivalent impedance by the concept of two port network
- Analyse the frequency response of electrical network using Laplace transform
- Apply concepts of Fourier series to simply the electrical network
- Synthesize the network using network functions

References:
1. Electrical circuit theory and Technology, Jhon Bird, Elsevier, 4th Edition, 2010
2. Network Analysis, M.E. Van Valkenburg, Pearson Education, 3rd Edition, 2015
3. Circuit Theory (Analysis & Synthesis), A. Charabarthi, Dhanpat Rai & Co., 6th Edition, 2008.

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15A02506   ELECTRICAL MACHINES LABORATORY – II

Course Objective:
- To experiment in detail on Transformers, Induction Motors, Alternators and Synchronous Motors, and evaluate their performance characteristics.

The following experiments are required to be conducted as compulsory experiments:
1. O.C. & S.C. Tests on Single phase Transformer.
2. Sumpner's Test on a Pair of identical Single Phase Transformers
3. Scott Connection of Transformers
4. No-Load & Blocked Rotor Tests on Three Phase Induction Motor
5. Regulation of Three –Phase Alternator by Synchronous Impedance & M.M.F. Methods
6. V and Inverted V Curves of 3 Phase Synchronous Motor.
7. Equivalent Circuit of Single Phase Induction Motor
8. Determination of Xd and Xq of Salient Pole Synchronous Machine

In addition to the above eight experiments, at least any two of the following experiments are required to be conducted:
1. Parallel Operation of Single Phase Transformers
2. Separation of Core Losses of Single Phase Transformer
3. Brake Test on Three Phase Induction Motor
4. Regulation of Three-Phase Alternator by Z.P.F. and A.S.A Methods

Course Outcomes:
- After going through this laboratory course, the student acquires sufficiently good practical knowledge about the operation, testing, and characteristics of important A.C equipment like transformers, Induction Motors, Alternators and Synchronous Motors.
- The student should also have acquired the knowledge about the fixation of the rating of transformers, induction motors and synchronous machines.

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15A02507   ELECTRICAL MEASUREMENTS LABORATORY

Course Objective: The objectives of the course are to make the students learn about:
- Calibration of various electrical measuring/recording instruments.
- Accurate determination of resistance, inductance and capacitance using D.C and A.C Bridges.
- Measurement of parameters of choke coil

The following experiments are required to be conducted as compulsory experiments:
1. Calibration of Single Phase Energy Meter using Phantom loading method with RSS meter as standard
2. Calibration of Dynamometer Power Factor Meter
3. Crompton D.C. Potentiometer – Calibration of PMMC Ammeter and PMMC Voltmeter
4. Kelvin's Double Bridge – Measurement of very low Resistance values – Determination of Tolerance.
5. Measurement of % Ratio Error and Phase Angle of Given C.T. by Comparison.
6. Schering Bridge & Anderson Bridge for measurement of Capacitance and Inductance values.
7. Measurement of 3 Phase Reactive Power with Single-Phase Wattmeter.
8. Measurement of Parameters of a Choke Coil Using 3 Voltmeter and 3 Ammeter Methods.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:
9. Optical Bench – Determination of Polar Curve, Measurement of MHCP of Filament Lamps
10. Calibration of LPF Wattmeter – by Phantom Testing
11. Measurement of 3 Phase Power with Two Watt Meter Method (Balanced & Un balanced).
12. Dielectric Oil Testing Using H.T. Testing Kit
13. LVDT and Capacitance Pickup – Characteristics and Calibration
14. Resistance Strain Gauge – Strain Measurement and Calibration
15. Transformer Turns Ratio Measurement Using A.C. Bridge.

Course Outcomes: At the end of the course, the student will be able to

- Calibrate various electrical measuring/recording instruments.
- Accurately determine the values of inductance and capacitance using a.c bridges
- Accurately determine the values of very low resistances
- Measure reactive power in 3-phase circuit using single wattmeter
- Determine ratio error and phase angle error of CT

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15A99501   SOCIAL VALUES & ETHICS (AUDIT COURSE)
(Common to all Branches)

UNIT - I

Introduction and Basic Concepts of Society: Family and Society: Concept of family, community, PRIs and other community based organizations and society, growing up in the family – dynamics and impact, Human values, Gender Justice.

Channels of Youth Moments for National Building: NSS & NCC: History, philosophy, aims & objectives; Emblems, flags, mottos, songs, badge etc.; Organizational structure, roles and responsibilities of various NSS functionaries. **Nehru Yuva Kendra (NYK):**   Activities – Socio Cultural and Sports.

UNIT – II

Activities of NSS, NCC, NYK:

Citizenship: Basic Features Constitution of India, Fundamental Rights and Fundamental Duties, Human Rights, Consumer awareness and the legal rights of the consumer, RTI.

Youth and Crime: Sociological and psychological Factors influencing youth crime, Peer Mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice

Social Harmony and National Integration: Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building.

UNIT – III

Environment Issues: Environment conservation, enrichment and Sustainability, Climate change, Waste management, Natural resource management (Rain water harvesting, energy conservation, waste land development, soil conservations and afforestation).

Health, Hygiene & Sanitation: Definition, needs and scope of health education, Food and Nutrition, Safe drinking water, Sanitation, Swachh Bharat Abhiyan.

Disaster Management: Introduction to Disaster Management, classification of disasters, Role of youth in Disaster Management. Home Nursing, First Aid.

 Civil/ Self Defense: Civil defense services, aims and objectives of civil defense, Need for self defense training – Teakwondo, Judo, karate etc.,

UNIT – IV

Gender Sensitization: Understanding Gender – Gender inequality – Role of Family, Society and State; Challenges – Declining Sex Ratio – Sexual Harassment – Domestic

Violence; Gender Equality – Initiatives of Government – Schemes, Law; Initiates of NGOs – Awareness, Movements;

UNIT - V
Physical Education : Games & Sports: Health and Recreation – Biolagical basis of Physical activity – benefiets of exercise – Physical, Psychological, Social; Physiology of Musucular Activity, Respiration, Blood Circulation**.**
Yoga: Basics of Yoga – Yoga Protocol, Postures, Asanas, Pranayama: Introduction of Kriyas, Bandhas and Mudras.

TEXT BOOKS:
1. NSS MANUAL
2. SOCIETY AND ENVIRONMENT: A.S.Chauha, Jain Brothers Publications, 6th Edition, 2006
3. INDIAN SOCIAL PROBLEM: G.R.Madan, Asian Publisher House
4. INDIAN SOCIAL PROBLEM: Ram Ahuja, Rawat Publications
5. HUMAN SOCIETY: Kingsley Davis, Macmillan
6. SOCIETY: Mac Iver D Page, Macmillan
7. SOCIOLOGY – THEMES AND PERSPECTIVES: Michael Honalambos, Oxford University Press
8. CONSTITUTION OF INDIA: D.D.Basu, Lexis Nexis Butterworth Publishers
9. National Youth Policy 2014 (available on www.yas.nic.in)
10. TOWARS A WORLD OF EQUALS: A.Suneetha, Uma Bhrugudanda, Duggirala Vasantha, Rama Melkote, Vasudha Nagraj, Asma Rasheed, Gogu Shyamala, Deepa Streenivas and Susie Tharu
11. LIGHT ON YOGA : B.K.S.Iyengar, Penguin Random House Publishers

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www.india.gov.in
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http://www.who.int/countries/ind/en/
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http://ayush.gov.in/event/common-yoga-protocol-2016-0

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15A52601   MANAGEMENT SCIENCE

Course Objective: The objective of the course is to equip the student the fundamental knowledge of management science and its application for effective management of human resource, materials and operation of an organization. It also aims to expose the students about the latest and contemporary developments in the field of management.

UNIT –I:
Introduction to Management: Concept-Nature and Importance of Management, Functions-Evaluation of Scientific Management, Modern management-Motivation Theories-Leadership Styles-Decision Making Process-Designing Organization Structure-Principles and Types of Organization.

UNIT- II:
Operations Management: Plant location and Layout, Methods of production, Work-Study-Statistical Quality Control through Control Charts, Objectives of Inventory Management, Need for Inventory Control-EOQ&ABC Analysis(Simple Problems)**Marketing Management:**
Meaning,Nature, Functions of Marketing, Marketing Mix, Channels of distribution-Advertisement and sales promotion-Marketing strategies-Product Life Cycle.

UNIT -III:
Human Resource Management(HRM): Significant and Basic functions of HRM-Human Resource Planning(HRP), Job evaluation, Recruitment and Selection, Placement and Induction-Wage and Salary administration. Employee Training and development-Methods-Performance Appraisal-Employee Grievances-techniques of handling Grievances.

UNIT –IV:
Strategic Management: Vision, Mission, Goals and Strategy- Corporate   Planning Process-Environmental Scanning-SWOT analysis-Different Steps in Strateg Formulation, Implementation and Evaluation. **Project Management**: Network Analysis-PERT, CPM, Identifying Critical Path-Probability-Project Cost Analysis, Project Crashing (Simple Problems).

UNIT-V:
Contemporary Management Practices: Basic concepts of MIS-Materials Requirement Planning(MRP),Just-In-Time(JIT)System, Total Quality Management(TQM)-Six Sigma

and Capability Maturity Models(CMM) evies, Supply Chain Management, Enterprise Resource Planning(ERP),Performance Management, Business Process Outsourcing(BPO), Business Process Re-Engineering and Bench Marking, Balance Score Card.

Course Outcome: This course enables the student to know the principles and applications of management knowledge and exposure to the latest developments in the field. This helps to take effective and efficient management decisions on physical and human resources of an organization. Beside the knowledge of Management Science facilitates for his/her personal and professional development.

TEXT BOOKS:
1. A.R Aryasri: Management Science, TMH, 2013
2. Kumar /Rao/Chalill 'Introduction to Management Science' Cengage, Delhi, 2012.

REFERENCE BOOKS:
1. A.K.Gupta "Engineering Management",S.CHAND, New Delhi, 2016.
2. Stoner, Freeman, Gilbert, Management, Pearson Education,New Delhi, 2012.
3. Kotler Philip & Keller Kevin Lane: Marketing Mangement , PHI,2013.
5. Koontz & Weihrich: Essentials of Management, 6/e, TMH, 2005.
6. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
7. Memoria & S.V.Gauker, Personnel Management, Himalaya, 25/e, 2005
8. Parnell: Strategic Management, Biztantra, 2003.
9. L.S.Srinath: PERT/CPM,Affiliated East-West Press, 2005.

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15A02601   POWER SEMICONDUCTOR DRIVES

Course Objectives: The objectives of the course are to make the students learn about:
- The operation of electric motor drives controlled by power electronic converters.
- The stable steady-state operation and transient dynamics of a motor-load system.
- The operation of the chopper fed DC drive.
- The distinguishing features of synchronous motor drives and induction motor drives.

UNIT – I
CONVERTER FED DC MOTORS
Classification of Electric Drives, Basic elements of Electric Drive, Dynamic Control of a Drive system, Stability analysis, Introduction to Thyristor Controlled Drives, Single Phase, Three Phase Semi and Fully Controlled Converters Connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics- Problems.

UNIT – II
FOUR QUADRANT OPERATION OF DC DRIVES
Introduction to Four Quadrant Operation – Motoring Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only)

UNIT – III
CHOPPER FED DC MOTORS
Single Quadrant, Two Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output Voltage and Current Wave Forms – Speed Torque Expressions – Speed Torque Characteristics – Problems on Chopper Fed D.C Motors

UNIT – IV
CONTROL OF INDUCTION MOTOR

Induction Motor Stator Voltage Control and Characteristics. AC Voltage Controllers – Waveforms – Speed Torque Characteristics - Stator Frequency Control and Characteristics. Voltage Source and Current Source Inverter - PWM Control – Comparison of VSI and CSI Operations – Speed Torque Characteristics – Numerical Problems on Induction Motor Drives – Closed Loop Operation of Induction Motor Drives (Block Diagram Only) – Principles of Vector Control

Static Rotor Resistance Control – Slip Power Recovery – V/f control of Induction Motor – Their Performance and Speed Torque Characteristics – Advantages- Applications – Problems

UNIT – V
CONTROL OF SYNCHRONOUS MOTORS

Separate Control & Self Control of Synchronous Motors – Operation of Self Controlled Synchronous Motors by VSI and CSI Cycloconverters. Load Commutated CSI Fed Synchronous Motor – Operation – Waveforms – Speed Torque Characteristics – Applications – Advantages and Numerical Problems – Closed Loop Control Operation of Synchronous Motor Drives (Block Diagram Only), Introduction to variable frequency control.

Course Outcomes: The student should be able to:
- Identify the choice of the electric drive system based on their applications
- Explain the operation of single and multi quadrant electric drives
- Analyze single phase and three phase rectifiers fed DC motors as well as chopper fed DC motors
- Explain the speed control methods for AC-AC & DC-AC converters fed to Induction motors and Synchronous motors with closed loop, and open loop operations.

TEXT BOOKS:
1. Power semiconductor controlled drives, G K Dubey, Prentice Hall, 1995.
2. Modern Power Electronics and AC Drives, B.K.Bose, PHI, 2002.

REFERENCE BOOKS:
1. Power Electronics, MD Singh and K B Khanchandani, Tata McGraw-Hill Publishing company, 2008.
2. Power Electronic Circuits, Devices and applications, M.H.Rashid, PHI, 2005.
3. Electric drives Concepts and Applications, Vedam Subramanyam, Tata McGraw Hill Publications, 2nd Edition, 2011.

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15A02602   POWER SYSTEM PROTECTION

Course Objectives: The objectives of the course are to make the students learn about:
- The different types of electromagnetic relays and microprocessor based relays
- The protection of Generators
- The protection of Transformers
- The protection of feeders and lines
- The technical aspects involved in the operation of circuit breakers
- Generation of over voltages and protection from over voltages

UNIT – I
RELAYS
Electromagnetic Relays - Basic Requirements of Relays – Primary and Backup Protection - Construction Details of – Attracted Armature, Balanced Beam, Inductor Type and Differential Relays – Universal Torque Equation – Characteristics of Over Current, Direction and Distance Relays. Static Relays – Advantages and Disadvantages – Definite Time, Inverse and IDMT. Static Relays – Comparators – Amplitude and Phase Comparators. Microprocessor Based Relays – Advantages and Disadvantages – Block Diagram for Over Current (Definite, Inverse and IDMT) and Distance Relays and Their Flow Charts.

UNIT – II
PROTECTION OF GENERATORS & TRANSFORMERS
Protection of Generators Against Stator Faults, Rotor Faults and Abnormal Conditions. Restricted Earth Fault and Inter-Turn Fault Protection. Numerical Problems on percentage winding unprotected. Protection of Transformers: Percentage Differential Protection, Numerical Problems on Design of CT Ratio, Buchholtz Relay Protection, Numerical Problems.

UNIT – III
PROTECTION OF FEEDERS & LINES
Protection of Feeder (Radial & Ring Main) Using Over Current Relays. Protection of Transmission Line – 3 Zone Protection Using Distance Relays. Carrier Current Protection. Protection of Bus Bars.

UNIT – IV
CIRCUIT BREAKERS
Circuit Breakers: Elementary Principles of Arc Interruption, Restriking Voltage and Recovery Voltage - Restriking Phenomenon, Average and Max. RRRV, Numerical Problems - Current Chopping and Resistance Switching - CB Ratings and Specifications: Types and Numerical Problems. – Auto Reclosures. Description and Operation of Following Types of Circuit Breakers: Minimum Oil Circuit Breakers, Air Blast Circuit Breakers, Vacuum and SF6 Circuit Breakers.

UNIT – V
OVER VOLTAGES IN POWER SYSTEMS
Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve Type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL.

Course Outcomes: At the end of the course the student should be able to:

- Explain the principles of operation of various types of electromagnetic relays, Static relays as well as Microprocessor based relays
- Understanding the protection of generators and determination of what % generator winding is unprotected under fault occurrence
- Understanding the protection of transformers and make design calculations to determine the required CT ratio for transformer protection
- Explain the use of relays in protecting Feeders, lines and bus bars
- Solve numerical problems concerning the arc interruption and recovery in circuit breakers
- Understand why over voltages occur in power system and how to protect the system

TEXT BOOKS:
1. Power System Protection and Switchgear, Badri Ram, D.N Viswakarma, TMH Publications, 2011.
2. Switchgear and Protection, Sunil S Rao, Khanna Publishers, 1992.

REFERENCE BOOKS:
1. Electrical Power Systems, C.L.Wadhwa, New Age international (P) Limited, Publishers, 2012.
2. Transmission network Protection, Y.G. Paithankar ,Taylor and Francis,2009.
3. Power system protection and switch gear, Bhuvanesh Oza, TMH, 2010.

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15A04601   MICROPROCESSORS AND MICROCONTROLLERS

Course Outcomes:
After completion of this subject the students will be able to :
1. Do programming with 8086 microprocessors
2. Understand concepts of Intel x86 series of processors
3. Program MSP 430 for designing any basic Embedded System
4. Design and implement some specific real time applications
   Using MSP 430 low power microcontroller.

UNIT I
Introduction-8086 Architecture-Block Diagram, Register Organization, Flag Register, Pin Diagram, Timing and Control Signals, System Timing Diagrams, Memory Segmentation, Interrupt structure of 8086 and Interrupt Vector Table. Memory organization and memory banks accessing.

UNIT II
Instruction Formats -Addressing Modes-Instruction Set of 8086, Assembler Directives-Macros and Procedures.- Sorting, Multiplication, Division and multi byte arithmetic code conversion. String Manipulation instructions-Simple ALPs.

UNIT III
Low power RISC MSP430 – block diagram, features and architecture,Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, MSP430x5x series block diagram, Addressing modes, Instruction set Memory address space, on-chip peripherals (analog and digital), and Register sets.Sample embedded system on MSP430 microcontroller.

UNIT-IV
I/O ports pull up/down resistors concepts, Interrupts and interrupt programming. Watchdog timer. System clocks. Low Power aspects of MSP430: low power modes, Active vs Standby current consumption, FRAM vs Flash for low power & reliability.
Timer & Real Time Clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA.

UNIT-V
Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices. Implementing Embedded Wi-Fi using CC3100

Text Books:
1. "Microprocessor and Microcontrollers", N. Senthil Kumar, M. Saravanan, S. Jeevanathan,
   Oxford Publishers. 1 st Edition, 2010
2. "The X86 Microprocessors , Architecture, Programming and Inerfacing" , Lyla B. Das, Pearson
   Publications, 2010
3. MSP430 microcontroller basics. John H. Davies, Newnes Publication, I st Edition, 2008

References:
http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode
http://processors.wiki.ti.com/index.php/MSP430_16-Bit_Ultra-Low_Power_MCU_Training

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15A02603   POWER SYSTEM ANALYSIS

Course Objectives: The objectives of the course are to make the students learn about:

- Y bus and Z bus of a Power System network
- Power flow studies by various methods.
- Short circuit analysis of power systems.
- Swing equation and its solution
- Equal area criterion and its applications

UNIT -I
POWER SYSTEM NETWORK MATRICES
Representation of Power System Elements, Graph Theory: Definitions, Bus Incidence Matrix, Y_{bus} Formation by Direct and Singular Transformation Methods, Numerical Problems. Formation of Z_{Bus}: Partial Network, Algorithm for the Modification of Z_{Bus} Matrix for Addition Element for the Following Cases: Addition of Element from a New Bus to Reference, Addition of Element from a New Bus to an Old Bus, Addition of Element Between an Old Bus to Reference and Addition of Element Between Two Old Busses (Derivations and Numerical Problems).- Modification of Z_{Bus} for the Changes in Network (Problems)

UNIT – II
SHORT CIRCUIT ANALYSIS
Per-Unit System of Representation. Per-Unit Equivalent Reactance Network of a Three Phase Power System, Numerical Problems. Symmetrical Fault Analysis: Short Circuit Current and MVA Calculations, Fault Levels, Application of Series Reactors, Numerical Problems. Symmetrical Component Theory: Symmetrical Component Transformation, Positive, Negative and Zero Sequence Components: Voltages, Currents and Impedances. Sequence Networks: Positive, Negative and Zero sequence Networks, Numerical Problems. Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without Fault Impedance, Numerical Problems.

UNIT – III
POWER FLOW STUDIES-I

Necessity of Power Flow Studies – Data for Power Flow Studies – Derivation of Static Load Flow Equations – Load Flow Solutions using Gauss Seidel Method: Acceleration Factor, Load Flow Solution with and without P-V Buses, Algorithm and Flowchart. Numerical Load flow Solution for Simple Power Systems (Max. 3-Buses): Determination of Bus Voltages, Injected Active and Reactive Powers (Sample One Iteration only) and Finding Line Flows/Losses for the given Bus Voltages.

UNIT – IV
POWER FLOW STUDIES-II

Newton Raphson Method in Rectangular and Polar Co-Ordinates Form: Load Flow Solution with or without PV Buses- Derivation of Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods – DC Load Flow

UNIT – V
POWER SYSTEM STABILITY ANALYSIS

Elementary Concepts of Steady State, Dynamic and Transient Stabilities - Description of: Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of Steady State Stability and Methods to Improve Steady State Stability - Derivation of Swing Equation - Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Solution of Swing Equation by 4th Order Runga Kutta Method (up to 2 iterations) - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

Course Outcomes: At the end of the course the student should be able to:
- Form the Z_{bus} and Y_{bus} of a given power system network
- Compare different methods used for obtaining load flow solution
- Conduct load flow studies on a given system
- Make fault calculations for various types of faults
- Determine the transient stability by equal area criterion
- Determine steady state stability power limit
- Distinguish between different types of buses used in load flow solution

TEXT BOOKS:
1. Power Systems Analysis, Grainger and Stevenson, Tata Mc Graw-hill, 2005.
2. Modern Power system Analysis 2nd edition, I.J.Nagrath & D.P.Kothari: Tata McGraw-Hill Publishing Company, 2003.

REFERENCE BOOKS:
1. Computer Techniques in Power System Analysis 2nd Edition,, M A Pai, TMH, 2005.
2. Computer Techniques and Models in Power Systems, K. Uma Rao, I. K. International, 2007.
3. Electric Power Systems 1st Edition, S. A. Nasar, Schaum's Outline Series, TMH, 1997.
4. Computer Methods in Power System Analysis, E. I. Stagg and El-Abiad, Tata Mc Graw Hill, 1969.

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15A02604   NEURAL NETWORKS & FUZZY LOGIC
(CBCC-I)

Course Objective: The objectives of the course are to make the students learn about:
- ➢ Importance of AI techniques in engineering applications
- ➢ Artificial Neural network and Biological Neural Network concepts
- ➢ ANN approach in various Electrical Engineering problems
- ➢ Fuzzy Logic and Its use in various Electrical Engineering Applications

UNIT – I
INTRODUCTION TO ARTIFICIAL INTILLEGENCE
Introduction and motivation – Approaches to AI – Architectures of AI – Symbolic Reasoning System – Rule based Systems – Knowledge Representation – Expert Systems.

UNIT – II
ARTIFICIAL NEURAL NETWORKS
Basics of ANN - Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model – Learning Rules – ADALINE and MADALINE Models – Perceptron Networks – Back Propagation Neural Networks – Associative Memories.

UNIT – III
ANN APPLICATIONS TO ELECTRICAL SYSTEMS
ANN approach to: Electrical Load Forecasting Problem – System Identification – Control Systems – Pattern Recognition.

UNIT – IV
FUZZY LOGIC
Classical Sets – Fuzzy Sets – Fuzzy Properties and Operations – Fuzzy Logic System – Fuzzification – Defuzzification – Membership Functions – Fuzzy Rule base – Fuzzy Logic Controller Design.

UNIT – V
FUZZY LOGIC APPLICATIONS TO ELECTRICAL SYSTEMS
Fuzzy Logic Implementation for Induction Motor Control – Switched Reluctance Motor Control –Fuzzy Excitation Control Systems in Automatic Voltage Regulator - Fuzzy Logic Controller in an 18 Bus Bar System.

Course Outcomes: The students should acquire awareness about:
- ➢ Approaches and architectures of Artificial Intelligence
- ➢ Artificial Neural Networks terminologies and techniques
- ➢ Application of ANN to Electrical Load Forecasting problem, Control system problem
- ➢ Application of ANN to System Identification and Pattern recognition
- ➢ The development of Fuzzy Logic concept
- ➢ Use of Fuzzy Logic for motor control and AVR operation
- ➢ Use of Fuzzy Logic controller in an 18 bus bar system

Text Books:
1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Neural Networks using MATLAB", McGraw Hill Edition, 2006.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, WILEY India Edition, 2012.

References:
1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer International Edition, 2013.
2. Yung C. Shin and Chengying Xu, "Intelligent System – Modeling, Optimization & Control, CRC Press, 2009.

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15A02605   PROGRAMMABLE LOGIC CONTROLLER AND ITS APPLICATIONS
(CBCC-I)

Course Objectives: The objectives of the course are to make the students learn about:

- ➢ PLC and its basics, architecture, connecting devices and programming
- ➢ Implementation of Ladder logic for various Industrial applications
- ➢ Designing of control circuits for various applications
- ➢ PLC logic and arithmetic operations

UNIT-I
PLC Basics: PLC System, I/O Modules and Interfacing, CPU Processor, Programming Equipment, Programming Formats, Construction of PLC Ladder Diagrams, Devices Connected To I/O Modules. PLC Programming: Input Instructions, Outputs, Operational Procedures, Programming Examples Using Contacts and Coils. Drill Press Operation.

UNIT-II
Digital Logic Gates, Programming in the Boolean Algebra System, Conversion Examples. Ladder Diagrams for Process Control: Ladder Diagrams & Sequence Listings, Ladder Diagram Construction and Flowchart for Spray Process System.

UNIT-III
PLC Registers: Characteristics of Registers, Module Addressing, Holding Registers, Input Registers, Output Registers. PLC Functions: Timer Functions & Industrial Applications, Counter Function & Industrial Applications, Arithmetic Functions, Number Comparison Functions, Number Conversion Functions

UNIT-IV
Data Handling Functions: SKIP, Master Control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep Functions and Their Applications. Bit Pattern and Changing a Bit Shift Register, Sequence Functions and Applications, Controlling of Two-Axis & Three Axis Robots With PLC, Matrix Functions.

UNIT-V

Analog PLC Operation, Types of PLC Analog Modules and Systems, PLC Analog Signal Processing, BCD or Multibit data Processing, Analog output application examples, PID Modules, PID Tuning, Typical PID Functions, PLC Installation, Troubleshooting and Maintenance.

Course Outcomes: The student should be able to:

 ➢ Program a PLC for a given application
 ➢ Implement Ladder logic for various Industrial applications
 ➢ Design control circuits for various applications

TEXT BOOKS:

1. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, ELSEVIER Ltd., 2009.
2. Programmable Logic Controllers 5th Edition, William Bolton, Newnes, ELSEVIER Ltd., 2009.

REFERENCES:
1. Programmable Logic Controllers: An Emphasis on design & application, Kelvin T. Erickson, Dogwood Valley Press, 2011.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-II Sem. (EEE)

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3	1	0	3

15A02606   OPTIMIZATION TECHNIQUES
(CBCC-I)

Course Objectives :

The objectives of the course are to make the students learn about:
- The basic concepts of optimization and classification of optimization problems.
- Different classical Optimization techniques, linear programming, unconstrained and constrained nonlinear programming.
- Soft Computing methods – GA & PSO

UNIT-I
INTRODUCTION AND CLASSICAL OPTIMIZATION TECHNIQUE
Statement of an Optimization Problem- Design Vector- Design Constraints- Constraints Surface – Objective Function- Objective Function Surfaces- Classification of Optimization Problems. Classical Optimization Techniques- Single Variable Optimization- Multi Variable Optimization Without Constraints- Necessary and Sufficient Conditions for Minimum/Maximum- Multi Variable Optimization With Equality Constraints Solution by Method of Lagrange Multipliers- Multi Variable Optimization with Inequality Constraints – Kuhn- Tucker Conditions

UNIT-II
LINEAR PROGRAMMING
Standard Form of Linear Programming Problem- Geometry of Linear Programming Problems- Definitions and Theorems- Solution of a System of Linear Simultaneous Equations- Pivotal Reduction of a General System of Equations- Motivation to The Simplex Method- Simplex Algorithm – Revised Simplex Method – Two Phase Simplex Method - Initial Basic Feasible Solution by North- West Corner Rule, Approximation Method.

UNIT-III
UNCONSTRAINED NONLINEAR PROGRAMMING
One-Dimensional Minimization Methods: Classification, Fibonacci Method and Quadratic Interpolation Method- Unconstrained Optimization Techniques- Univariate Method, Powell's Method, Steepest Descent Method, Newtons Method.

UNIT-IV
CONSTRAINED NONLINEAR PROGRAMMING
Characteristics of a Constrained Problem, Classification, Basic Approach of Penalty Function Method; Basic Approaches of Interior and Exterior Penalty Function Methods, Introduction to Convex Programming Problem

UNIT-V
SOFT COMPUTING METHODS
Evolutionary programming methods - Introduction to Genetic Algorithms (GA)– Control parameters –Number of generation, population size, selection, reproduction, crossover and mutation – Operator selection criteria – Simple mapping of objective function to fitness function – constraints – Genetic algorithm steps – Stopping criteria –Simple examples.
Swarm intelligence programming methods - Basic Partial Swarm Optimization – Method – Characteristic features of PSO procedure of the global version – Parameters of PSO (Simple PSO algorithm – Operators selection criteria – Fitness function constraints)

Course Outcomes:
The student should be able to:
- ➢ Develop an objective function and obtain solution for multivariable optimization problem with equality/Inequality constraints
- ➢ Apply linear programming techniques for problem solving
- ➢ Apply nonlinear programming techniques for unconstrained/constrained optimization
- ➢ Use soft computing techniques to solve optimization problems

TEXT BOOKS:
1. Engineering optimization: Theory and practice 3rd edition, S.S.Rao, New Age International (P) Limited, 1998.
2. Optimization Methods in Operations Research and systems Analysis 3rd edition, K.V.Mital and C.Mohan, New Age International (P) Limited, 1996.
3. Soft Computing with Matlab Programming by N.P.Padhy&S.P.Simson, Oxford University Press – 2015

REFERENCE BOOKS:
1. Operations Research, Dr.S.D.Sharma, S.Chand & Sons, 2001.
2. Operation Research: An Introduction 6th edition, H.A.Taha, PHI , 2003.
3. Optimization for Engineering Design – Algorithms and Examples, Kalyanmoy Deb, 2nd Edition, PHI, 2014.
4. Soft Computing Advances and Applications, B. K. Tripathy and J. Anuradha, CENGAGE Learning, 2015.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-II Sem. (EEE)

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15A01608   INTELLECTUAL PROPERTY RIGHTS
(CBCC-I)

COURSE OBJECTIVE:
This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations.

UNIT – I
Introduction To Intellectual Property: Introduction, Types Of Intellectual Property, International Organizations, Agencies And Treaties, Importance Of Intellectual Property Rights.

UNIT – II
Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT – III
Law Of Copy Rights : Fundamental Of Copy Right Law, Originality Of Material, Rights Of Reproduction, Rights To Perform The Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice Of Copy Right, International Copy Right Law.
Law Of Patents : Foundation Of Patent Law, Patent Searching Process, Ownership Rights And Transfer

UNIT – IV
Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets, Protection For Submission, Trade Secrete Litigation.
Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

UNIT – V
New Developments Of Intellectual Property: New Developments In Trade Mark Law ; Copy Right Law, Patent Law, Intellectual Property Audits.
International Overview On Intellectual Property, International – Trade Mark Law, Copy Right Law, International Patent Law, International Development In Trade Secrets Law.

TEXT BOOKS & REFERENCES:
1. Intellectual Property Rights, Deborah. E. Bouchoux, Cengage Learing.
2. Intellectual Property Rights– Unleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,

Course Outcomes:
On completion of this course, the student will have an understanding of the following:
   a) *Intellectual Property Rights and what they mean*
   b) *Trade Marks and Patents and how to register them*
   c) *Laws Protecting the Trade Marks and Patents*
   d) *Copy Right and laws related to it.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

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B. Tech III-II Sem. (EEE)		0	0	4	2

15A04607 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

Part A : 8086 Microprocessor Programs using NASM/8086 microprocessor kit.

1. Introduction to MASM Programming.
2. Programs using arithmetic and logical operations
3. Programs using string operations and Instruction prefix: Move Block, Reverse string, Sorting, String comparison
4. Programs for code conversion
5. Multiplication and Division programs
6. Sorting and multi byte arithmetic
7. Programs using CALL and RET instructions

Part B Embedded C Experiments using MSP430 Microcontroller

1. Interfacing and programming GPIO ports in C using MSP430 (blinking LEDs , push buttons)
2. Usage of Low Power Modes: (Use MSPEXP430FR5969 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current)
3. Interrupt programming examples through GPIOs
4. PWM generation using Timer on MSP430 GPIO
5. Interfacing potentiometer with MSP430
6. PWM based Speed Control of Motor controlled by potentiometer connected to MSP430 GPIO
7. Using ULP advisor in Code Composer Studio on MSP430
8. Low Power modes and Energy trace++:
   a. Enable Energy Trace and Energy Trace ++ modes in CCS
   b. Compute Total Energy, and Estimated lifetime of an AA battery.

Note : Any six experiment from Part A and Six experiments from Part B are to be conducted

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

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15A02607   POWER ELECTRONICS AND SIMULATION LABORATORY

Course Objectives: The student will understand:
- The characteristics of power electronic devices with gate firing circuits
- Various forced commutation techniques
- The operation of single-phase voltage controller, converters and Inverters circuits with R and RL loads
- Analyze the TPS7A4901, TPS7A8300 and TPS54160 buck regulators

Any Eight of the Experiments in Power Electronics Lab
1. Gate Firing Circuits for SCRs
2. Single Phase AC Voltage Controller with R and RL Loads
3. DC Jones Chopper with R and RL Loads
4. Forced Commutation Circuits (Class A, Class B, Class C, Class D and Class E)
5. Three phase fully controlled Bridge converter with R- load
6. Single Phase Parallel, Inverter with R and RL Loads
7. Single phase Cycloconverter with R and RL loads
8. Single Phase Series Inverter with R and RL Loads
9. Single Phase Dual Converter with RL Loads
10. Illumination control / Fan control using TRIAC

Any Four Experiments of the following (1, 2, 3, A, B, C):

1. Using TPS7A4901 and TPS7A8300, study-
   a. Impact of line and load conditions on drop out voltage
   b. Impact of line and load conditions on efficiency
   c. Impact of capacitor on PSRR
   d. Impact of output capacitor on load-transient response

2. Study of DC-DC Buck converter
a) Investigate how the efficiency of a TPS54160 buck regulator depends on the line and load conditions and on the switching frequency.
b) Analyze the influence of switching frequency fs and of capacitance C and resistance ESR of the input and output capacitors on steady-state waveforms of TPS54160 buck regulator.

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3. Analyze how the switching frequency fs, the DC accuracy and the line noise rejection of the hysteretic buck regulator LM3475 depend on line voltage, the load current, the characteristics of the output capacitor and the impact of speed-up capacitor.

WEBENCH EXPERIMENTS:
   A. Design of a Low cost Boost Converter to derive 12V, 100mA from 5V USB
   B. Design of a low cost and power efficient Buck Converter that could be used as a USB charger for mobile devices deriving its power from an automotive battery.
   C. Design of a low cost synchronous buck converter.

Course Outcomes: Student should be able to:
   • Test the turn on –turn off characteristics of various power electronic devices.
   • Test and analyze firing circuits for SCRs
   • Test different types of voltage controllers, converters and Inverters with R and RL loads
   • Analyze the TPS7A4901, TPS7A8300 and TPS54160 buck regulators

REFERENCES:
   1. PMLK BUCK Lab manual - http://www.ti.com/lit/ug/ssqu007/ssqu007.pdf
   2. PMLK LDO Lab manual - http://www.ti.com/lit/ug/ssqu006/ssqu006.pdf
   3. WEBENCH – www.ti.com/webench

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B. Tech III-II Sem. (EEE)	**0**	**0**	**2**	**0**

15A52602   ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS (AELCS) LAB (Audit Course)

1. INTRODUCTION

With increased globalization and rapidly changing industry expectations, employers are looking for the wide cluster of skills to cater to the changing demand. The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information and to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Taking part in social and professional communication.

2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

3. SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

UNIT-I: COMMUNICATION SKILLS
1. Reading Comprehension
2. Listening comprehension
3. Vocabulary Development
4. Common Errors

UNIT-II: WRITING SKILLS
1. Report writing
2. Resume Preparation
3. E-mail Writing

UNIT-III: PRESENTATION SKILLS
1. Oral presentation
2. Power point presentation
3. Poster presentation

UNIT-IV: GETTING READY FOR JOB
1. Debates
2. Group discussions
3. Job Interviews

UNIT-V: INTERPERSONAL SKILLS
1. Time Management
2. Problem Solving & Decision Making
3. Etiquettes

4. LEARNING OUTCOMES:
- Accomplishment of sound vocabulary and its proper use contextually
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities

5. MINIMUM REQUIREMENT:
The Advanced English Communication Skills (AECS) Laboratory shall have the following infra-structural facilities to accommodate at least 60 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

6. SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should be procured and G

1. **Walden Infotech: Advanced English Communication Skills Lab**
2. **K-VAN SOLUTIONS-Advanced English Language Communication Skills lab**
3. **DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.**
4. **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
5. **Train2success.com**

7. BOOKS RECOMMENDED:

1. **Objective English for Competitive Exams**, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, O U Press 3rd Edn. 2015.
3. **Essay Writing for Exams, Audrone Raskauskiene, Irena Ragaisience & Ramute Zemaitience,OUP, 2016**
4. **Soft Skills for Everyone,** Butterfield Jeff, Cengage Publications, 2011.
5. **Management Shapers Series** by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. **Campus to Corporate,** Gangadhar Joshi, Sage Publications, 2015
7. **Communicative English,**E Suresh Kumar & P.Sreehari, Orient Blackswan, 2009.
8. **English for Success in Competitive Exams,** Philip Sunil Solomon OUP, 2015

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B. Tech IV-I Sem. (EEE)

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15A02701   ELECTRICAL DISTRIBUTION SYSTEMS

Course Objectives: The student has to acquire knowledge about:
- The classification of distribution systems
- The technical aspects and design considerations in DC and AC distribution systems and their comparison
- Technical issues of substations such as location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve power factor
- The principles in Distribution automation

UNIT – I
LOAD MODELING AND CHARACTERISTICS

Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural and Industrial) and Their Characteristics.

UNIT – II
CLASSIFICATION OF DISTRIBUTION SYSTEMS

Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System. Voltage Drop Calculations (Numerical Problems) In A.C. Distributors for The Following Cases: Power Factors Referred to Receiving End Voltage and With Respect to Respective Load Voltages.

UNIT – III
SUBSTATIONS

Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations.
Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment.
Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar, Sectionalized Single Bus Bar, Main and Transfer Bus Bar Double Breaker – One and Half Breaker System With Relevant Diagrams.

UNIT – IV
POWER FACTOR IMPROVEMENT

Voltage Drop and Power-Loss Calculations: Derivation for Voltage Drop and Power Loss in Lines, Manual Methods of Solution for Radial Networks, Three Phase Balanced Primary Lines.

Causes of Low P.F -Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Numerical Problems.

Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction- Economic Justification - Procedure to Determine the Best Capacitor Location.

UNIT – V
DISTRIBUTION AUTOMATION

Distribution Automation (DA) – Project Planning – Definitions – Communication Sensors- Supervisory Control and Data Acquisition (SCADA) – Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

Course Outcomes: Student should be able to:
- Compute the various factors associated with power distribution
- Make voltage drop calculations in given distribution networks
- Learn principles of substation maintenance
- Compute power factor improvement for a given system and load
- Understand implementation of SCADA for distribution automation

TEXT BOOKS:
1. Electric Power Distribution Engineering, Turan Gonen, CRC Press, 3rd Edition, 2014.
2. Electric Power Distribution, A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6th Edition, 2011.

REFERENCE BOOKS:
1. Electric Power Distribution Automation, Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010.
2. Electrical Power Distribution Systems, V. Kamaraju, Jain Book Depot. 2012.
3. Electrical Power Systems for Industrial Plants, Kamalesh Das, JAICO Publishing House, 2008.

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B. Tech IV-I Sem. (EEE)

15A04603   DIGITAL SIGNAL PROCESSING

Course Outcomes:

At the end of the course, the student should be able to:

- Formulate engineering problems in terms of DSP tasks.
- Apply engineering problems solving strategies to DSP problems.
- Design and test DSP algorithms.
- Analyze digital and analog signals and systems.
- Encode information into signals.
- Design digital signal processing algorithms.
- Design and simulate digital filters.
- Analyze and compare different signal processing strategies.

UNIT-I

Review of discrete-time signals and systems – Time domain analysis of discrete-time signals & systems, Frequency domain analysis of discrete-time signals and systems.

Discrete Fourier Transform: Frequency-domain sampling and reconstruction of discrete-time signals, Discrete Fourier Transform (DFT), The DFT as a linear transformation, Relationship of the DFT to other transforms, Properties of DFT, Linear filtering methods based on DFT, Frequency analysis of signals using the DFT.

UNIT-II

Efficient computation of the DFT – Direct computation of DFT, Divide and conquer approach to computation of DFT, Radix-2, Radix-4, and Split radix FFT algorithms, Implementation of FFT algorithms, Applications of FFT algorithms – Efficient computation of the DFT of two real sequences, 2N point real sequences, Use of the FFT algorithm in linear filtering and correlation, A linear filtering approach to computation of the DFT- the Goertzel, and the Chirp-z transform algorithms, Quantization errors in the computation of DFT.

UNIT-III

Structures for the realization of discrete-time systems, Structures for FIR systems - Direct form, Cascade form, Frequency sampling, and Lattice structures, Structures for IIR systems – Direct form, Signal flow graphs & Transposed, Cascade form, Parallel form and Lattice structures, Conversion from Lattice structure to direct form, lattice – Ladder structure.

UNIT-IV

General considerations – Causality and its implications, Characteristics of practical Frequency Selective Filters, Design of Finite Impulse Response (FIR) filters – Symmetric and asymmetric FIR filters, Design of linear phase FIR filters using windows, Design of linear phase FIR filters by the frequency sampling method, Design of optimum equi-ripple linear phase FIR filters, Comparison of design methods for linear phase FIR filters, Design of Impulse Invariance Response (IIR) filters from analog filters – IIR filter design by approximation of derivatives, by Impulse invariance, and by bilinear transformation methods, Characteristics of commonly used analog filters, Design examples of both FIR and IIR filters, Frequency transformation in the analog and digital domains, Illustrative problems.

UNIT-V

Introduction, Decimation, and interpolation, Sampling rate conversion by a rational factor, Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Sampling rate conversion of bandpass signals, Sampling rate conversion by arbitrary factor, Applications of multirate signal processing.

TEXT BOOKS:
1. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and applications," Pearson Education/PHI, 4th ed., 2007.
2. Sanjit K Mitra, "Digital signal processing, A computer base approach," Tata McGraw Hill, 3rd edition, 2009.

REFERENCES:
1. A.V.Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2nd ed., Pearson Education, 2012.
2. B. P. Lathi, "Principles of Signal Processing and Linear Systems," Oxford Univ. Press, 2011.
3. Li Tan, Jean Jiang, "Digital Signal Processing, Fundamentals and Applications," Academic Press, Second Edition, 2013.

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B. Tech IV-I Sem. (EEE)

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15A02702   POWER SYSTEM OPERATION AND CONTROL

Course Objectives: The objectives of the course are to make the students learn about:
- Optimum generation allocation
- Hydrothermal scheduling
- Modeling of turbines and generators
- Load frequency control in single area and two area systems
- Reactive power compensation in power systems
- Power system operation in competitive environment

UNIT – I
ECONOMIC OPERATION
Optimal Operation of Thermal Power Units, - Heat Rate Curve – Cost Curve – Incremental Fuel and Production Costs, Input-Output Characteristics, Optimum Generation Allocation with Line Losses Neglected. Optimum Generation Allocation Including the Effect of Transmission Line Losses – Loss Coefficients, General Transmission Line Loss Formula.

UNIT–II
HYDROTHERMAL SCHEDULING
Optimal Scheduling of Hydrothermal System: Hydroelectric Power Plant Models, Scheduling Problems-Short Term Hydrothermal Scheduling Problem. Modeling of Turbine: First Order Turbine Model, Block Diagram Representation of Steam Turbines and Approximate Linear Models. Modeling of Governor: Mathematical Modeling of Speed Governing System – Derivation of Small Signal Transfer Function – Block Diagram.

UNIT – III
LOAD FREQUENCY CONTROL
Necessity of Keeping Frequency Constant. Definitions of Control Area – Single Area Control – Block Diagram Representation of an Isolated Power System – Steady State Analysis – Dynamic Response – Uncontrolled Case. Load Frequency Control of 2-Area System – Uncontrolled Case and Controlled Case, Tie-Line Bias Control. Proportional Plus Integral Control of Single Area and Its Block Diagram Representation, Steady State Response – Load Frequency Control and Economic Dispatch Control.

UNIT – IV
REACTIVE POWER CONTROL

Overview of Reactive Power Control – Reactive Power Compensation in Transmission Systems – Advantages and Disadvantages of Different Types of Compensating Equipment for Transmission Systems; Load Compensation – Specifications of Load Compensator, Uncompensated and Compensated Transmission Lines: Shunt and Series Compensation.

UNIT – V
POWER SYSTEM OPERATION IN COMPETITIVE ENVIRONMENT

Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange - Market operations – Market Power – Standard cost – Transmission Pricing – Congestion Pricing – Management of Inter zonal/Intra zonal Congestion - Electricity Price Volatility Electricity Price Indexes – Challenges to Electricity Pricing – Construction of Forward Price Curves – Short-time Price Forecasting

Course Outcomes: After completion of the course, the student will able to:
- Develop the mathematical models of turbines and governors
- Address the Load Frequency Control problem
- Explain how shunt and series compensation helps in reactive power control
- Explain the issues concerned with power system operation in competitive environment

TEXT BOOKS:
1. Power System Analysis Operation and Control, Abhijit Chakrabarti and Sunita Halder, PHI Learning Pvt. Ltd.,, 3rd Edition, 2010.
2. Modern Power System Analysis, D.P.Kothari and I.J.Nagrath, Tata McGraw Hill Publishing Company Ltd., 3rd Edition, 2003, Ninth Reprint 2007.

REFERENCE BOOKS:
1. Power System Analysis and Design, J. Duncan Glover and M.S.Sharma, Thomson, 3rd Edition, 2008.
2. Electric Energy System Theory: An Introduction, Olle Ingemar Elgerd, Tata Mc Graw Hill, 2nd Edition, 1982.
3. Power System Stability and Control, P Kundur, Tata Mc Graw Hill, 1994, 5th Reprint, 2008.

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B. Tech IV-I Sem. (EEE)

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15A02703   UTILIZATION OF ELECTRICAL ENERGY

Course Objectives: The objectives of the course are to make the students learn about:
- The laws of illumination and their application for various lighting schemes
- Principles and methods for electric heating and welding.
- Systems of electric traction, study of traction equipment, mechanics of train movement and associated calculations.

UNIT–I
ILLUMINATION
Definition –Laws of Illumination–Polar Curves – Calculation of MHCP and MSCP. Lamps: Incandescent Lamp, Sodium Vapour Lamp, Fluorescent Lamp, CFL and LED. Requirement of Good Lighting Scheme – Types, Design and Calculation of Illumination. Street Lighting and Factory Lighting – Numerical Problems – Energy Conservation methods.

UNIT–II
ELECTRIC HEATING & WELDING
Electrical Heating: Advantages. Methods of Electric Heating – Resistance, Arc, Induction and Dielectric Heating – Energy conservation methods.
Electric Welding: Types – Resistance, Electric Arc, Gas Welding. Ultrasonic, Welding Electrodes of Various Metals, Defects in Welding.
Electrolysis - Faraday's Laws, Applications of Electrolysis, Power Supply for Electrolysis.

UNIT–III
ELECTRIC TRACTION – I
Introduction – Systems of Electric Traction. Comparison Between A. C. and D. C. Traction – Special Features of Traction Motors - The Locomotive – Wheel arrangement and Riding Qualities – Transmission of Drive – Characteristics and Control of Locomotives and Motor Coaches for Track Electrification – DC Equipment – AC Equipment – Electric Braking with DC Motors and with AC Motors – Control Gear – Auxiliary Equipment – Track Equipment and Collector Gear – Conductor-Rail Equipment – Overhead Equipment – Calculation of Sags and Tensions – Collector Gear for Overhead Equipment.

UNIT–IV
ELECTRIC TRACTION - II
Mechanics of Train Movement. Speed-Time Curves of Different Services – Trapezoidal and Quadrilateral Speed-Time Curves – Numerical Problems. Calculations of Tractive Effort, Power, Specific Energy Consumption - Effect of Varying Acceleration and Braking Retardation, Adhesive Weight and Coefficient of Adhesion – Problems.

UNIT–V
ECONOMIC ASPECTS OF UTILISING ELECTRICALENERGY
Power Factor Improvement, Load Factor improvement, Off Peak Loads- Use of Exhaust Steam, Waste Heat recovery, Pit Head Generation, Diesel Plant, General Comparison of Private Plant and Public Supply- Initial Cost and Efficiency, Capitalization of Losses, Choice of Voltage.

Course Outcomes: Student should be able to:
- Develop a lighting scheme for a given practical case.
- Analyze the performance of Heating and Welding methods
- Make all numerical calculations associated with electric traction.
- Assess the economic aspects in utilisation of electrical energy

TEXT BOOKS:
1. Utilization of Electric Energy, E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.
2. Art & Science of Utilization of electrical Energy, Partab, Dhanpat Rai & Co., 2004.

REFERENCE BOOKS:
1.Generation, distribution and utilization of electrical energy, C.L Wadhwa, Wiley Eastern Limited,1993
2.Electrical Power, S. L. Uppal, Khanna pulishers,1988.

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B. Tech IV-I Sem. (EEE)

L	T	P	C
3	**1**	**0**	**3**

15A02704   MODERN CONTROL THEORY
(CBCC-II)

Course Objective : The objectives of the course are to make the students learn about:
- Concepts of state vector, State transition matrix and solution of state equations.
- Importance of controllability and observability concepts.
- Pole placement, state estimation using observers
- Lyapunov criterion for stability analysis
- Types of nonlinearities, their effect on system performance

UNIT – I
STATE VARIABLE DESCRIPTION AND SOLUTION OF STATE EQUATION
Concept of State – Derivation of State Space models for Linear Continuous time Systems from Schematic Models, Differential equations, Transfer functions and block diagrams – Non uniqueness of state model – State diagrams for continuous time state models – Solution of state equations – State transition matrix. Complete response of continuous time systems.

UNIT – II
CONTROLLABILITY, 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 of state models in Jordan canonical form and other canonical forms. Effect of state feedback on controllability and observability.

UNIT – III
STATE FEEDBACK CONTROLLERS AND OBSERVERS
Design of State Feedback Controllers through Pole placement. Full-order observer and reduced-order observer. State estimation through Kalman Filters.

UNIT – IV
ANALYSIS OF NONLINEAR SYSTEMS
Introduction to nonlinear systems, Types of nonlinearities, Concept of describing functions, Derivation of describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phase-plane analysis of nonlinear control systems.

UNIT- V
STABILITY ANALYSIS
Stability in the sense of Lyapunov. Lyapunov's stability and Lypanov's instability theorems. Direct method of Lypanov for Linear and Nonlinear continuous time autonomous systems.

TEXT BOOKS:
1. Modern Control Engineering, Katsuhiko Ogata, Prentice Hall, 5th Edition, 2010.
2. Modern Control System Theory, M. Gopal, New Age International Publishers, Revised 2nd edition, 2005.

REFERENCE BOOKS:
1. Control Systems Engineering, I.J. Nagarath and M.Gopal, New Age International Publishers, 5th Edition, 2007, Reprint 2012.
2. Modern Control Engineering, D. Roy Choudhury, PHI Learning Private Limited, 9th Printing, January 2015.

Course Outcomes: At the end of studying the course, the student should be able to:
- Model a given dynamic system in state space and obtain the solution for the state equation
- Test whether a given system is controllable and/or observable
- Design a state feedback controller for pole placement
- Design an observer for state estimation
- Apply Lyapunov criterion and determine stability of a given system
- Analyze nonlinear systems

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15A02705   SWITCHED MODE POWER CONVERTERS
(**CBCC-II**)

Course Objectives: The objectives of the course are to make the students learn about:
- The concepts of modern power electronic converters and their applications in electric power utility.
- Analyzing and control of various power converter circuits

UNIT – I
NON-ISOLATED DC-DC CONVERTERS
Basic Types of Switching Power Supplies – Volt-Sec balance – Non-Isolated Switched-Mode DC-to-DC Converters – Buck Converter – Boost Converter – Buck-Boost Converter – Cuk Converter – SEPIC and Zeta Converters – Comparison of Non-Isolated Switched mode DC-to-DC Converters.

UNIT – II
ISOLATED DC-DC CONVERTERS
Need of Transformer Isolations in high frequency Power conversion - Isolated Switched Mode DC-to-DC Converters – Single Switch Isolated DC-to-DC Converters – Forward, Flyback, Push-Pull, Flux Weakening Phenomena, Half and Full Bridge Converters – Multi Switch Isolated DC-to-DC Converters – Comparison of Isolated and Non-Isolated Switched Mode DC-to-DC Converters.

UNIT-III
RESONANT CONVERTERS
Classification of Resonant converters-Basic resonant circuits- Series resonant circuit-parallel resonant circuits- Resonant switches, Concept of Zero voltage switching, principle of operation, analysis of M-type and L-type Resonant Buck and boost Converters.

UNIT-IV
DYNAMIC ANALYSIS OF DC-DC CONVERTERS
Formulation of dynamic equations of buck and boost converters, State-Space Models, Averaged Models, linearization technique, small-signal model and converter transfer functions, Significance of Small Signal Models, Dynamical Characterization.

UNIT-V
CONTROLLER DESIGN
Review of frequency-domain analysis of linear time-invariant systems, controller specifications, Proportional (P), Proportional plus Integral (PI), Proportional, Integral plus Derivative controller (PID), selection of controller parameters for Isolated and Non-Isolated DC -DC Converters.

Course Outcomes: Upon completion of this course,
➢ The student learns the fundamental concepts of DC - DC Converters
➢ Student can explain the operation of different topologies of DC to DC converters and their differences
➢ Student will be able to model various converters as per state space, time average etc.
➢ Student can analyse in frequency domain with different P, PI and PID converters

TEXT BOOKS:
1. Issa Batarseh**,** Fundamentals of Power Electronics**,** John Wiley Publications, 2009.
2. Robert Erickson and Dragon Maksimovic, Fundamentals of Power Electronics, Springer Publications., 2nd Edition, 2001.

REFERENCE BOOKS:
1. Switched Mode Power Supplies design and construction 2nd Edition, H W Whittington, B W Flynn and D E Macpherson, Universities Press, 2009.
2. Philip T.Krein Elements of Power Electronics - Oxford University Press, 1997.
3. L. Umanand Power Electronics**,** Tata Mc-Graw Hill, 2004.

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15A02706   ENERGY AUDITING & DEMAND SIDE MANAGEMENT
(**CBCC-II**)

Course Objectives: The objectives of this course include
- **To learn about energy consumption and situation in India**
- To learn about Energy Auditing.
- To learn about Energy Measuring Instruments.
- To understand the Demand Side Management.

UNI -I
INTRODUCTION TO ENERGY AUDITING
Energy Situation – World and India, Energy Consumption, Conservation, Codes, Standards and Legislation. Energy Audit- Definitions, Concept, Types of Audit, Energy Index, Cost Index, Pie Charts, Sankey Diagrams, Load Profiles, Energy Conservation Schemes. Measurements in Energy Audits, Presentation of Energy Audit Results.

UNIT -II
ENERGY EFFICIENT MOTORS AND POWER FACTOR IMPROVEMENT
Energy Efficient Motors , Factors Affecting Efficiency, Loss Distribution , Constructional Details , Characteristics - Variable Speed , Variable Duty Cycle Systems, RMS Hp-Voltage Variation-Voltage Unbalance- Over Motoring- Motor Energy Audit. Power Factor – Methods of Improvement, Power factor With Non Linear Loads

UNIT –III
LIGHTING AND ENERGY INSTRUMENTS FOR AUDIT
Good Lighting System Design and Practice, Lighting Control, Lighting Energy Audit - Energy Instruments- Watt Meter, Data Loggers, Thermocouples, Pyrometers, Lux Meters, Tong Testers, Application of PLC's

UNIT –IV
INTRODUCTION TO DEMAND SIDE MANAGEMENT
Introduction to DSM, Concept of DSM, Benefits of DSM, Different Techniques of DSM – Time of Day Pricing, Multi-Utility Power Exchange Model, Time of Day Models for Planning. Load Management, Load Priority Technique, Peak Clipping, Peak Shifting, Valley Filling, Strategic Conservation, Energy Efficient Equipment. Management and Organization of Energy Conservation Awareness Programs.

UNIT –V
ECONOMICS AND COST EFFECTIVENESS TESTS OF DSM PROGRAMS

Basic payback calculations, Depreciation, Net present value calculations. Taxes and Tax Credit – Numerical Problems. Importance of evaluation, measurement and verification of demand side management programs. Cost effectiveness test for demand side management programs - Ratepayer Impact Measure Test, Total Resource Cost, Participant Cost Test, Program Administrator Cost Test

Numerical problems: Participant cost test, Total Resource Cost test and Ratepayer impact measure test.

Course Outcomes: After completion of the course the student should be able to:
- Conduct energy auditing and evaluate energy audit results
- Carry out motor energy audit
- Analyze demand side management concepts through case study

TEXT BOOKS:
1. **Industrial Energy Management Systems,** Arry C. White, Philip S. Schmidt, David R. Brown, Hemisphere Publishing Corporation, New York, 1994.
2. **Fundamentals of Energy Engineering -** Albert Thumann, Prentice Hall Inc, Englewood Cliffs, New Jersey, 1984.

REFERENCES:
1. Economic Analysis of Demand Side Programs and Projects - California Standard Practice Manual, June 2002 – Free download available online http://www.calmac.org/events/spm_9_20_02.pdf
2. Energy management by W.R. Murphy & G. Mckay Butter worth, Heinemann publications, 2007.
3. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998
4. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd- 2nd edition, 1995.

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15A02707   SMART GRID
(**CBCC-III**)

Course Objectives: The objectives of the course are to make the students learn about:
- Overview of the technologies required for the smart grid
- Switching techniques and different means for data communication
- Standards for information exchange and smart metering
- Methods used for information security on smart grid
- Smart metering, and protocols for smart metering
- Management systems for Transmission and distribution

UNIT – I
THE SMART GRID
Introduction, Ageing Assets and Lack of Circuit Capacity, Thermal Constraints, Operational Constraints, Security of Supply, National Initiatives,
Early Smart Grid Initiatives, Active Distribution Networks, Virtual Power Plant, Other Initiatives and Demonstrations, Overview of The Technologies Required for The Smart Grid.

UNIT – II
COMMUNICATION TECHNOLOGIES
Data Communications: Introduction, Dedicated and Shared Communication Channels, Switching Techniques, Circuit Switching, Message Switching, Packet Switching, Communication Channels, Wired Communication, Optical Fibre, Radio Communication, Cellular Mobile Communication, Layered Architecture and Protocols, The ISO/OSI Model, TCP/IP

Communication Technologies: IEEE 802 Series, Mobile Communications, Multi Protocol Label Switching, Power line Communication, Standards for Information Exchange, Standards For Smart Metering, Modbus, DNP3, IEC61850

UNIT – III
INFORMATION SECURITY FOR THE SMART GRID
Introduction, Encryption and Decryption, Symmetric Key Encryption, Public Key Encryption, Authentication, Authentication Based on Shared Secret Key, Authentication Based on Key Distribution Center, Digital Signatures, Secret Key Signature, Public Key Signature, Message Digest, Cyber Security Standards, IEEE 1686: IEEE Standard for

Substation Intelligent Electronic Devices(IEDs) Cyber Security Capabilities, IEC 62351: Power Systems Management And Association Information Exchange – Data and Communication Security.

UNIT – IV
SMART METERING AND DEMAND SIDE INTEGRATION

Introduction, smart metering – evolution of electricity metering, key components of smart metering, smart meters: an overview of the hardware used – signal acquisition, signal conditioning, analogue to digital conversion, computation, input/output, communication.

Communication infrastructure and protocols for smart metering- Home area network, Neighbourhood Area Network, Data Concentrator, meter data management system, Protocols for communication. Demand Side Integration- Services Provided by DSI, Implementation of DSI, Hardware Support, Flexibility Delivered by Prosumers from the Demand Side, System Support from DSI.

UNIT – V
TRANSMISSION AND DISTRIBUTION MANAGEMENT SYSTEMS

Data Sources, Energy Management System, Wide Area Applications, Visualization Techniques, Data Sources and Associated External Systems, SCADA, Customer Information System, Modelling and Analysis Tools, Distribution System Modelling, Topology Analysis, Load Forecasting, Power Flow Analysis, Fault Calculations, State Estimation, Applications, System Monitoring, Operation, Management, Outage Management System, Energy Storage Technologies, Batteries, Flow Battery, Fuel Cell and Hydrogen Electrolyser, Flywheels, Superconducting Magnetic Energy Storage Systems, Supercapacitors.

Course Outcomes: The student should have learnt about:
- How to meet the standards for information exchange and for smart metering
- How to preserve data and Communication security by adopting encryption and decryption procedures.
- Monitoring, operating, and managing the transmission and distribution tasks under smart grid environment

TEXT BOOKS:
1. Smart Grid, Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, Wiley Publications, 2012, Reprint 2015.
2. Smart Grid: Fundamentals of Design and Analysis, James Momoh, Wiley, IEEE Press., 2012, Reprint 2016.

REFERENCES:
1. The Smart Grid – Enabling Energy efficiency and demand response, Clark W. Gellings, P.E., CRC Press, Taylor & Francis group, First Indian Reprint. 2015.
2. Smart Grid – Applications, Communications, and Security Edited by Lars Torsten Berger, Krzysztof Iniewski, WILEY, 2012, Reprint 2015.
3. Practical Electrical Network Automation and Communication Systems, Cobus Strauss, ELSVIER, 2003.

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15A02708   FLEXIBLE AC TRANSMISSION SYSTEMS
(CBCC-III)

Course Objectives: The objectives of the course are to make the students learn about:
- The basic concepts, different types, and applications of FACTS controllers in power transmission.
- The basic concepts of static shunt and series converters
- The working principle, structure and control of UPFC.

UNIT-I
CONCEPTS OF FLEXIBLE AC TRANSMISSION SYSTEMS
Transmission line Interconnections, Power flow in parallel lines, Mesh systems, Stability considerations, Relative importance of controllable parameters, Basic types of FACTS controllers, Shunt controllers, Series controllers, Combined shunt and series controllers, Benefits of FACTS.

UNIT-II
VOLTAGE AND CURRENT SOURCED CONVERTERS
Concept of Voltage Sourced Converters, Single Phase Full Wave Bridge Converter, Three Phase Full Wave Bridge Converter, Transformer Connections for 12-Pulse Operation, 24 and 48-Pulse Operation, Three Level Voltage Sourced Converter, Pulse Width Modulation (PWM) Converter, Converter Rating, Concept of Current Sourced Converters, Thyristor based converters, Current Sourced Converter with Turn off Devices, Current Sourced –vs- Voltage Sourced Converters.

UNIT-III
STATIC SHUNT COMPENSATORS
Objectives of Shunt Compensation, Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, Improvement of Transient Stability, Power Oscillation Damping, Methods of Controllable VAR Generation, Variable Impedance Type Static VAR Generators, Switching Converter Type VAR Generators, Hybrid VAR Generators, SVC and STATCOM, Transient Stability Enhancement and Power Oscillation Damping, Comparison Between STATCOM and SVC, V-I, V-Q Characteristics, Response Time.

UNIT-IV
STATIC SERIES COMPENSATORS
Objectives of Series Compensation, Voltage Stability, Improvement of Transient Stability, Power Oscillation Damping, Subsynchronous Oscillation Damping, Variable Impedance Type Series Compensators, GTO Thyristor Controlled Type Series Capacitor (GCSC), Thyristor Switched Series Capacitor (TSSC), Thyristor-Controlled Series Capacitor(TCSC), Basic Operating Control Schemes for GCSC, TSSC, and TCSC, Switching Converter Type Series Compensators, The Static Synchronous Series Capacitor(SSSC), Transmitted Power Versus Transmission Angle Characteristic, Control Range and VA Rating, Capability to Provide Real Power Compensation.

UNIT-V
POWER FLOW CONTROLLERS
The Unified Power Flow Controller-Basic Operating Principles, Conventional Transmission Control Capabilities, Independent Real and Reactive Power Flow Control. Control Structure, Basic Control System for P and Q Control, Dynamic Performance, The Interline Power Flow Controller (IPFC), Basic Operating Principles and Characteristics, Generalized and Multifunctional FACTS Controllers.

Course Outcomes: After completing this course the student will be able to:
- Understand various control issues, for the purpose of identifying the scope and for selection of specific FACTS controllers.
- Apply the concepts in solving problems of simple power systems with FACTS controllers.
- Design simple FACTS controllers and converters for better transmission of electric power.

TEXT BOOKS:
1. Understanding FACTS – Concepts and technology of Flexible AC Transmission systems, Narain G. Hingorani, Laszlo Gyugyi, IEEE Press, WILEY, 1st Edition, 2000, Reprint 2015.
2. FACTS Controllers in Power Transmission and Distribution, Padiyar K.R., New Age International Publishers, 1st Edition, 2007.

REFERENCE BOOKS:
1. Flexible AC Transmission Systems: Modelling and Control, Xiao – Ping Zhang, Christian Rehtanz, Bikash Pal, Springer, 2012, First Indian Reprint, 2015.
2. FACTS – Modelling and Simulation in Power Networks, Enrigue Acha, Claudio R. Fuerte – Esquival, Huge Ambriz – perez, Cesar Angeles – Camacho, WILEY India Private Ltd., 2004, Reprint 2012.

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15A02709   **POWER QUALITY**
(CBCC-III)

Course Objectives: The objectives of the course are to make the students learn about:
- Power quality issues and standards.
- The sources of power quality disturbances and power transients that occur in power systems.
- The sources of harmonics, harmonic indices, Devices for controlling harmonic distortion.
- The principle of operation of DVR and UPQC.

UNIT I
INTRODUCTION
Definition of Power Quality- Power Quality Terminology – Classification of Power Quality Issues-Magnitude Versus Duration Plot - Power Quality Standards - Responsibilities of Suppliers and Users of Electric Power-CBEMA and ITI Curves.

UNIT II
TRANSIENTS, SHORT DURATION AND LONG DURATION VARIATIONS
Categories and Characteristics of Electromagnetic Phenomena in Power Systems-Impulsive and Oscillatory Transients-Interruption - Sag-Swell-Sustained Interruption - Under Voltage – Over Voltage–Outage. Sources of Different Power Quality Disturbances- Principles of Regulating the Voltage- Conventional Devices for Voltage Regulation.

UNIT III
FUNDAMENTALS OF HARMONICS & APPLIED HARMONICS
Harmonic Distortion, Voltage Versus Current Distortion, Harmonics Versus Transients, Power System Quality Under Non Sinusoidal Conditions, Harmonic Indices, Harmonic Sources from Commercial Loads, Harmonic Sources from Industrial Loads. Applied Harmonics**:** Effects Of Harmonics, Harmonic Distortion Evaluations, Principles of Controlling Harmonics, Devices for Controlling Harmonic Distortion.

UNIT-IV
POWER QUALITY MONITORING
Power Quality Benchmarking-Monitoring Considerations- Choosing Monitoring Locations- Permanent Power Quality Monitoring Equipment-Historical Perspective of Power Quality Measuring Instruments- Power Quality Measurement Equipment-Types

of Instruments- Assessment of Power Quality Measurement Data- Power Quality Monitoring Standards.

UNITV
POWER QUALITY ENHANCEMENT USING CUSTOM POWER DEVICES
Introduction to Custom Power Devices-Network Reconfiguring Type: Solid State Current Limiter (SSCL)-Solid State Breaker (SSB) -Solid State Transfer Switch (SSTS) - Compensating Type: Dynamic Voltage Restorer (DVR)-Unified Power Quality Conditioner(UPQC)-Principle of Operation Only.

Course Outcomes: After completion of the course the student should be able to:
- Address power quality issues to ensure meeting of standards
- Apply the concepts of compensation for sags and swells using voltage regulating devices
- Assess harmonic distortion and its mitigation.
- Explain the power measurement data according to standards

TEXT BOOKS:
1. Electrical Power Systems Quality, Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H.Wayne Beaty, Mc Graw Hill Education (India) Pvt. Ltd., 3rd Edition, 2012.
2. Power quality, C. Sankaran, CRC Press, 2001.

REFERENCE BOOKS:
1. Understanding Power quality problems – Voltage Sags and Interruptions, Math H. J. Bollen IEEE Press Series on Power Engineering, WILEY, 2007.
2. Power quality – VAR Compensation in Power Systems, R. Sastry Vedam, Mulukutla S. Sarma, CRC Press, 2009, First Indian Reprint 2013.
3. Fundamentals of Electric Power Quality, Surya Santoso, Create Space, 2012.

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15A04608   DIGITAL SIGNAL PROCESSING LABORATORY

Course Outcomes:
- Able to design real time DSP systems and real world applications.
- Able to implement DSP algorithms using both fixed and floating point processors.

List of Experiments: (Minimum of 5 experiments are to be conducted from each part) Software Experiments (PART – A)
1. Generation of random signal and plot the same as a waveform showing all the specifications.
2. Finding Power and (or) Energy of a given signal.
3. Convolution and Correlation (auto and cross correlation) of discrete sequences without using built in functions for convolution and correlation operations.
4. DTFT of a given signal
5. N – point FFT algorithm
6. Design of FIR filter using windowing technique and verify the frequency response of the filter.
7. Design of IIR filter using any of the available methods and verify the frequency response of the filter.
8. Design of analog filters.

Using DSP Processor kits (Floating point) and Code Composure Studio (CCS) (PART – B)
1. Generation of random signal and plot the same as a waveform showing all the specifications.
2. Finding Power and (or) Energy of a given signal.
3. Convolution and Correlation (auto and cross correlation) of discrete sequences without using built in functions for convolution and correlation operations.
4. DTFT of a given signal
5. N – point FFT algorithm
6. Design of FIR filter using windowing technique and verify the frequency response of the filter.
7. Design of IIR filter using any of the available methods and verify the frequency response of the filter.
8. Design of analog filters.

Equipment/Software Required:

1. Licensed MATLAB software with required tool boxes for 30 users.
2. DSP floating Processor Kits with Code Composure Studio (8 nos.)
3. Function generators
4. CROs
5. Regulated Power Supplies.

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15A02710   POWER SYSTEMS AND SIMULATION LABORATORY

Course Objectives: The objectives of this course include:

- Experimental determination (in machines lab) of sequence impedance and subtrasient reactances of synchronous machine
- Conducting experiments to analyze LG, LL, LLG, LLLG faults
- The equivalent circuit of three winding transformer by conducting a suitable experiment.
- Developing MATLAB program for formation of Y and Z buses.
- Developing MATLAB programs for gauss-seidel and fast decoupled load flow studies.
- Developing the SIMULINK model for single area load frequency control problem.

List of Experiments:

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine.
2. Fault Analysis – I
   LG Fault
   LL Fault
3. Fault Analysis – II
   LLG Fault
   LLLG Fault
4. Determination of Subtransient reactances of salient pole synchronous machine.
5. Equivalent circuit of three winding transformer.
6. Y $_{bus}$ formation using MATLAB
7. Z $_{bus}$ formation using MATLAB
8. Gauss-Seidel load flow analysis using MATLAB
9. Fast decoupled load flow analysis using MATLAB
10. Develop a Simulink model for a single area load frequency control problem

Course Outcomes:
At the end of the lab course, the student should be able to do the following:

- Experimental determination (in machines lab) of sequence impedance and subtrasient reactances of synchronous machine
- Conducting experiments to analyze LG, LL, LLG, LLLG faults
- The equivalent circuit of three winding transformer by conducting a suitable experiment.
- Developing MATLAB program for formation of Y and Z buses.
- Developing MATLAB programs for gauss-seidel and fast decoupled load flow studies.
- Developing the SIMULINK model for single area load frequency control problem.

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15A02801   INSTRUMENTATION
(MOOCS-II)

Course Objectives: The objectives of the course are to make the students learn about:
- Common errors that occur in measurement systems, and their classification
- Characteristics of signals, their representation, and signal modulation techniques
- Methods of Data transmission, telemetry, and Data acquisition.
- Working principles of different signal analyzers and Digital meters.
- Several types of transducers and their use for measurement of non-electrical quantities.

UNIT-I
CHARACTERISTICS OF SIGNALS AND THEIR REPRESENTATION
Measuring Systems, Performance Characteristics, - Static Characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical Analysis of Random Errors. Signals and Their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation.

UNIT-II
DATA TRANSMISSION , TELEMETRY AND DAS
Methods of Data Transmission – General Telemetry System. Frequency Modulation (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Data Acquisition Systems – Components of Analog DAS – Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing – Digital DAS – Block Diagram –– Modern Digital DAS (Block Diagram)

UNIT-III
SIGNAL ANALYZERS, DIGITAL METERS
Wave Analysers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers- Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters, Digital Voltmeters - Successive Approximation, Ramp and Integrating Type-Digital Frequency Meter-Digital Multimeter-Digital Tachometer

UNIT-IV
TRANSDUCERS
Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle of Operation of Resistive, Inductive, Capacitive Transducers, LVDT, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Synchros, Piezoelectric Transducers, Photovoltaic, Photo Conductive Cells, Photo Diodes.

UNIT-V
MEASUREMENT OF NON-ELECTRICAL QUANTITIES
Measurement of strain, Gauge Sensitivity, Measurement of Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Flow, Liquid level.

Course Outcomes:
The student should be able to:
- Identify and explain the types of errors occuring in measurement systems
- Differentiate among the types of data transmission and modulation techniques
- Apply digital techniques to measure voltage, frequency and speed
- Choose suitable transducers for the measurement of non-electrical quantities

TEXT BOOKS:
1. A course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai & Co., 2012.
2. Transducers and Instrumentation, D.V.S Murty, Prentice Hall of India, 2nd Edition, 2004.

REFERENCE BOOKS:
1. Modern Electronic Instrumentation and Measurement technique, A.D Helfrick and W.D.Cooper, Pearson/Prentice Hall of India., 1990.
2. Electronic Instrumentation, H.S.Kalsi Tata MCGraw-Hill Edition, 2010.
3. Industrial Instrumentation – Principles and Design, T. R. Padmanabhan, Springer, 3rd re print, 2009.

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15A02802   POWER SYSTEM DYNAMICS AND CONTROL
(MOOCS-II)

Course Objectives: The objectives of the course are to make the students learn about:
- The kinds of power stability problems
- The basic concepts of modelling and analysis of dynamical systems.
- Modelling of power system components - generators, transmission lines, excitation and prime mover controllers.
- Stability of single machine and multi-machine systems is analyzed using digital simulation and small-signal analysis techniques.
- The impact of stability problems on power system planning and operation.

Unit – I Introduction to Power System Stability
Power System Operation and Control - Stability Problems faced by Power Systems - Impact on Power System Operation and Control - Analysis of Dynamical Systems - Concept of Equilibria, Small and Large Disturbance Stability - Example: Single Machine Infinite Bus System - Modal Analysis of Linear Systems - Analysis using Numerical Integration Techniques - Issues in Modelling: Slow and Fast Transients, Stiff Systems

Unit – II Modelling of a Synchronous Machine
Physical Characteristics - Rotor Position Dependent model - D-Q Transformation - Model with Standard Parameters - Steady State Analysis of Synchronous Machine - Short Circuit Transient Analysis of a Synchronous Machine - Synchronous Machine Connected to Infinite Bus.

Unit – III Modelling of power system components
Physical Characteristics and Models - Control system components - Excitation System Controllers - Prime Mover Control Systems - Transmission Line Physical Characteristics - Transmission Line Modeling - Load Models - induction machine model - Other Subsystems - HVDC, protection systems.

Unit – IV Stability Issues in Interconnected Power Systems
Single Machine Infinite Bus System - Multi-machine Systems - Stability of Relative Motion - Frequency Stability: Centre of Inertia Motion - Concept of Load Sharing: Governors - Single Machine Load Bus System: Voltage Stability - Torsional Oscillations

Unit – V Enhancing System Stability

Planning Measures - Stabilizing Controllers (Power System Stabilizers) - Operational Measures- Preventive Control - Emergency Control - Power System Stability Analysis Tools: Small Signal Analysis Program - Transient Stability Program - Real-Time Simulators.

Course Outcomes: After completion of Course, the student should be able to
- Understand the power stability problems
- Understand the basic concepts of modelling of synchronous machine and power system components
- Analyse the stability issues in interconnected systems
- Understand the power system stability analysis tools and enhancement of power system stability

Reference Books:
1. K.R.Padiyar, Power System Dynamics, Stability & Control, 2nd Edition, B.S. Publications, Hyderabad, 2002.
2. P.Kundur, Power System Stability and Control, McGraw Hill Inc, New York, 1995.
3. P.Sauer & M.A.Pai, Power System Dynamics & Stability, Prentice Hall, 1997.
4. Jan Machowski, Janusz Bialek, James Richard Bumby, Power system dynamics and control , John Wiley & Sons, 1997.

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15A02803   INDUSTRIAL AUTOMATION & CONTROL
(MOOCS-II)

Course Objectives: The objectives of the course are to make the students learn about
- Sensors and types of measurement systems
- Process control and sequence control of different controllers
- Operation of actuators
- Types of electric drives and their principles

Unit – I Introduction to sensors and measurement systems
Introduction to Industrial Automation and Control - Architecture of Industrial Automation Systems - Introduction to sensors and measurement systems - Temperature measurement - Pressure and Force measurements - Displacement and speed measurement - Flow measurement techniques - Measurement of level, humidity, pH etc - Signal Conditioning and Processing - Estimation of errors and Calibration.

Unit – II Introduction to Process Control
P-- I -- D Control - Controller Tuning - Implementation of PID Controllers - Special Control Structures : Feed forward and Ratio Control - Special Control Structures : Predictive Control, Control of Systems with Inverse Response - Special Control Structures : Cascade Control, Overriding Control, Selective Control, Split Range Control.

Unit – III Introduction to Sequence Control
PLCs and Relay Ladder Logic - Sequence Control: Scan Cycle, RLL Syntax - Sequence Control: Structured Design Approach - Sequence Control: Advanced RLL Programming - Sequence Control: The Hardware environment

Unit – IV Introduction to Actuators
Flow Control Valves - Hydraulic Actuator Systems: Principles, Components and Symbols - Hydraulic Actuator Systems: Pumps and Motors- Proportional and Servo Valves - Pneumatic Control Systems: System Components - Pneumatic Control Systems: Controllers and Integrated Control Systems - Networking of Sensors, Actuators and Controllers: The Fieldbus - The Field bus Communication Protocol

Unit – V Electric Drives

Introduction, Energy Saving with Adjustable Speed Drives - Step motors: Principles, Construction and Drives - DC Motor Drives: Introduction, DC--DC Converters, Adjustable Speed Drives - Induction Motor Drives: Introduction, Characteristics, Adjustable Speed Drives - Synchronous Motor Drives: Motor Principles, Adjustable Speed and Servo Drives.

Course Outcomes: After completion of Course, the student should be able to

- Understand the measurement of different quantities
- Apply principles of electric drives for different applications like speed control
- Understand the principles of process control and sequence control in relay ladder logic.
- Understand the operation of controller in integrated control systems

Reference Books:

1. S. Mukhopadhyay, S. Sen & A. K. Deb, Industrial instrumentation, control and automation, Jaico Publishing House, 2012
2. Madhuchhanda Mitra and Samarjit Sen Gupta, Programmable Logic Controllers And Industrial Automation An ntroduction,2008
3. David W. Pessen, Industrial Automation: Circuit Design and Components
4. Wiley India Publication, 2011
5. Rajput R.K, Robotics and Industrial Automation, S. Chand publications, 2008

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-II Sem. (EEE)

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15A02804   HVDC TRANSMISSION
(MOOCS-III)

Course Objectives: The objectives of the course are to make the students learn about:

- Technical and economic aspects of HVAC and HVDC transmission and their comparison.
- Static power converters
- Control of HVDC converter systems
- Origin, effects, classification and elimination of harmonics
- The occurrence of faults, and transients in HVDC system and their protection.

UNIT-I
INTRODUCTION TO HVDC TRANSMISSION
HVDC Transmission: Technical And Economical Comparison of HVAC and HVDC Transmission, Types of DC Links, Power Handling Capabilities of HVDC Lines, static Conversion Principles, Static Converter Configuration.

UNIT-II
STATIC POWER CONVERTER ANALYSIS
Static Power Converters: 3-Pulse, 6-Pulse & 12-Pulse Converters, Converter Station and Terminal Equipment, Commutation Process, Rectifier and Inverter Operation, Equivalent Circuit for Rectifier, Inverter and HVDC Link- Special Features of Converters.

UNIT-III
CONTROL OF HVDC CONVERTER SYSTEMS
Control of HVDC Converter Systems: Principle of DC Link Control – Constant Current, Constant Extinction Angle and Constant Ignition Angle Control and Voltage Dependent Current Control. Individual Phase Control and Equidistant Firing Angle Control

UNIT-IV
HARMONICS AND FILTERS
Origin of Harmonics in HVDC Systems, Classification of Harmonics, Elimination of Harmonics, Suppression Methods, Harmonic Instability Problems, Design of HVDC AC & DC Filters.

UNIT-V
TRANSIENTS, FAULTS AND PROTECTION OF HVDC SYSTEMS
Origin of over Voltages in HVDC Systems, Over Voltages due to DC and AC Side Line
Faults - Converter Faults, Over Current Protection- Valve Group and DC Line
Protection. Over Voltage Protection of Converters, Surge Arresters etc.

Course Outcomes: After Completion of Course, the student should be able to:
- Compare HVDC and HVAC transmission systems
- Understand the operation of various converters used in HVDC transmission systems
- Devise means to suppress / eliminate harmonics.
- Design HVDC and AC Filters

TEXT BOOKS:
1. HVDC Power Transmission Systems, K.R.Padiyar, 3rd Edition, New Age International publishers, 2015.
2. HVDC Transmission, S.Kamakshaiah, V.Kamaraju, Mc Graw Hill Education (India) Pvt. Ltd., 2011.

REFERENCES:
1. Direct Current Transmission, Vol. 1, E. W. Kimbark, Wiley, 1971
2. High Voltage Direct Current Transmission, Jos Arrillaga, IEE Power and Energy series 29, 2nd Edition, 1998
3. EHV-AC, HVDC Transmission & Distribution Engineering, S Rao, Khanna Publishers, 4th Edition, 2008.

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15A04702   EMBEDDED SYSTEMS
(MOOCS-III)

Course Outcomes:

After completion the students will be able to

- Design of embedded systems leading to 32-bit application development.
- Understand hardware-interfacing concepts to connect digital as well as analog sensors while ensuring low power considerations.
- Review and implement the protocols used by microcontroller to communicate with external sensors and actuators in real world.
- Understand Embedded Networking and IoT concepts based upon connected MCUs

UNIT-I
Introduction to Embedded Systems
Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design

UNIT-II
Embedded processor architecture
CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.

UNIT- III
Overview of Microcontroller and Embedded Systems
Embedded hardware and various building blocks, Processor Selection for an Embedded System , Interfacing Processor, Memories and I/O Devices, I/O Devices and I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices.

Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System, Uses of Target System or its Emulator and In-Circuit Emulator (ICE), Use of Software Tools for Development of an Embedded System

Design metrics of embedded systems - low power, high performance, engineering cost, time-to-market.

UNIT-IV
Microcontroller fundamentals for basic programming
I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

Unit-V
Embedded communications protocols and Internet of things
Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C, SPI interface using TM4C. Case Study: Tiva based embedded system application using the interface protocols for communication with external devices "Sensor Hub BoosterPack"

Embedded Networking fundamentals, IoT overview and architecture, Overview of wireless sensor networks and design examples. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API.

Case Study: Tiva based Embedded Networking Application: "Smart Plug with Remote Disconnect and Wi-Fi Connectivity"

Text Books:
1. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Create space publications ISBN: 978-1463590154.
2. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition
   Jonathan W Valvano, Createspace publications ISBN-13: 978-1477508992
3. Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education, 2011 ISBN-
4. 0070667640, 9780070667648

References:
1. http://processors.wiki.ti.com/index.php/Hands-On_Training_for_TI_Embedded_Processors
2. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop
3. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html
4. CC3100/CC3200 SimpleLink™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015.

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B. Tech IV-II Sem. (EEE)

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15A02805   ENERGY RESOURCES & TECHNOLOGY
(MOOCS-III)

Course Objectives: The objectives of the course are to make the students learn about:

- Production of quality of energy
- Types of generation plants and their principle of operation
- Methods of energy storage
- Economics of generation

Unit – I: Fundamentals principles of energy
Fundamentals of energy- Quality of energy- Complete Cycle Analysis of Fossil Fuels - Other Fossil Fuels - Energy Economics : Input-Output Analysis.

Unit – II: Thermal, Hydro and Nuclear power sources
Thermal Power Plants - Hydroelectric Power plants - Nuclear Power Generation- Nuclear Fusion Reactors - Environmental Effects of Conventional Power

Unit – III: Solar, wind and photo voltaic power sources
Solar Thermal Energy Conversion - Solar Concentrating Collectors - Photovoltaic Power Generation- Wind Energy - Wind Electrical Conversion

Unit – IV: Other sources of energy
Tidal Energy - Ocean Thermal Energy Conversion - Solar Pond and Wave Power - Geothermal Energy - Solar Distillation and Biomass Energy

Unit – V: Energy storage and Economy
Energy Storage - Energy in Transportation - Magneto hydrodynamic Power Generation - Hydrogen Economy.

Course Outcomes: After completion of Course, the student should be able to:
- Understand different types of sources of energy
- Analyse the generation principles and operation of variety of sources of energy
- Understand energy storage and economy

Reference Books:
1. Renewable energy Resources – Jhon Twidell and tony Weir, Second edition, Taylor and Francis Group, 2006
2. Non- conventional energy sources by G. D. Rai, Khanna Publishers, 2000
3. Electrical power generation, Transmission and distribution by S. N. Singh, PHI, 2003
4. Wind electrical systems by S. N. Bhadra, D. Kastha & S. Banerjee – Oxford University Press, 2013