With effect from the academic year 2016-2017

Dept. of ELECTRICAL & ELECTRONICS ENGINEERING

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

B.E. 4th YEAR SYLLABUS

For the Academic Year 2016-17

June 2016

With effect from the academic year 2016-2017

Semester- I

With effect from the academic year 2016-2017

SCHEME OF INSTRUCTION AND EXAMINATION
4/4 B.E.
ELECTRICAL & ELECTRONICS ENGINEERING

I-SEMESTER

S.No	Code	Subject	Scheme of Instruction			Scheme of Examination			
			Periods per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		End Exam	Sessionals	
1	EE 411	Power System Operation & Control	4	-	-		75	25	3
2	EE 412	Power Semiconductor Drives	4	-	-		75	25	3
3	EE 413	HVDC & FACTS	4		-		75	25	3
4		Managerial Economics & Accountancy	4				75	25	3
5		Elective –II	4	-	-		75	25	3
6	EE 414	Digital Signal Processing Lab	-	-	3		50	25	2
7	EE 415	Power Systems Lab	-	-	3		50	25	2
8	EE 416	Project Seminar	-	-	3		-	25	1
		TOTAL	**20**	**-**	**9**				**20**

L: Lecture, T: Tutorial, P: Practical

S.No	CODE	ELECTIVE-II
1	EE 461	Electrical Machine Design
2	EE 462	Artificial Intelligence Techniques in Electrical Engineering
3	EE 463	Principles of Embedded Systems
4	EE 464	Basic VLSI Design
5		Technical Writing & Presentation Skills
6	ME	Entrepreneurship

EE 411 POWER SYSTEM OPERATION AND CONTROL

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *Understand the formulation of Load-Flow problems applying different methods and carryout load-flow studies and compare.*
2. *Understand the importance of Economic Operation of Power Systems including losses*
3. *Understand the importance of Load Frequency Control in the operation of power systems.*
4. *Understand the basic definitions of and classification of power system stability, stability analysis of Single Machine Connected to Infinite Bus (SMIB) system, and voltage stability analysis.*
5. *Understand the importance of reactive power and FACTS devices for stable operation of Power systems.*

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

1. *Acquire knowledge in assessing the importance of load flow studies in power system operation. Carryout Load-Flow studies with different methods, compare and interpret the results.*
2. *Acquire knowledge in conducting Economic operation of power system without and with losses*
3. *Acquire knowledge in conducting Load Frequency Control for single and two area systems and also distinguish between different control methods.*
4. *Acquire knowledge in analyzing the Stability aspects of power system.*
5. *Acquire knowledge in assessing the system improvement through reactive power control and FACTS controllers.*

UNIT-I

Load Flow Studies: Formulation of Y bus for a system, modeling of tap changing and phase shifting transformer, Formulation of load flow problem, Solution of load flow by Gauss Seidel, Newton-Raphson, Decoupled and Fast Decoupled methods, comparison of different load flow methods.

UNIT-II

Economic operation of power system: Input-Output curves, Heat rates and incremental cost curves, Equal Incremental cost criterion Neglecting transmission losses with and without generator limits, Bmm Coefficients, Economic operation including transmission losses.

UNIT-III

Load Frequency control: Governor Characteristics, Regulation of two generators, coherency, concept of control area, Incremental power Balance of a control area, Single area control, Flat frequency control, Flat tie-line frequency control, Tie-line bias control, Advantages of pool Operation, Development of model for two- area control.

UNIT-IV

Power System Stability: Definitions Steady state stability and Transient stability, Steady state stability of a synchronous machine connected to infinite bus, calculation of steady state stability limit, synchronous machine models with and without saliency, Equal area criterion, Application of equal area criterion, Swing equation, Step by step solution of Swing equation, factors effecting transient stability, Auto Reclosures, mathematical formulation of voltage stability problem.

UNIT-V Reactive power control: Reactive power generation by synchronous generators, Automatic voltage regulators, FACTS Controllers, SVC, TCSC, STATCOM, UPFC.

Text Books:

1. *I. J. Nagrath & D.P. Kothari, Modern Power System Analysis,4th Edition TMH Publication,2011*
2. *CL Wadhwa, Electrical Power Systems, 3rd Edition New Age International Publications, 2014*
3. *O. Elgard, Electric Energy Systems Theory, 2nd Edition. TMH Publication,2001*

Suggested Reading:

1. *A. Chakrabarthy and S. Halder, Power System Analysis Operation and control, 3rd Edition PHI Publications.2010*
2. *D. Das, Electrical Power System 1st Edition New Age International Publications, 2010.*
3. *S. Sivanagaraju, G. Srinivas, Power system, Operation and control, Pearson publications.2010*

EE 412 POWER SEMICONDUCTOR DRIVES

Instruction	:	4 Periods per week
Duration of University Examination	:	3 Hours
University Examination	:	75 Marks
Sessional	:	25 Marks
Credits		3

Course Objectives:

1. *Understand the fundamental torque, speed, conventions for a given drive.*
2. *Comprehend D.C drive concepts and applications.*
3. *Assimilate the concepts and applications of A.C drives.*
4. *Know the suitability of a particular drive for a given application.*

Course Outcomes: The student will be able to

1. *Select a particular drive for a given application.*
2. *Design a proper controller for a D.C motor drive with the given detailed specifications.*
3. *Acquire knowledge in various speed control techniques of induction motor drives.*
4. *Acquire knowledge in various speed control techniques of synchronous motor drives.*
5. *Identify the adaptability of a particular drive (synchronous motor, BLDC, stepper motors and SRM) for given load requirements.*

UNIT- I

Electrical Drives – An introduction : Advantages of Electrical Drives, Parts of Electrical Drives, Choice of Electrical Drives.

Dynamics of Electrical Drives: Fundamental Torque Equations, Speed Torque Conventions and Multi-quadrant Operation, Equivalent Values of Drives Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy, Loss in Transient Operations, Steady State Stability, Load Equalization.

Selection of Motor Power Rating : Thermal Model of Motor for Heating and Cooling, Classes of Motor Duty, Determination of Motor Rating.

UNIT- II

DC Motor Drives: Dc Motors and Their Performance, Starting, Braking, Controlled Rectifier Fed dc Drives, Single- Phase Fully-Controlled Rectifier Control of dc Separately Excited Motor, Single- Phase Half-Controlled Rectifier Control of dc Separately Excited Motor, Three- Phase Fully-Controlled Rectifier Control of dc Separately Excited Motor, Three-Phase Half-Controlled Rectifier Control of dc Separately Excited Motor, Multi-quadrant Operation of dc separately Excited Motor Fed from Fully-controlled Rectifier, Supply Harmonics, Power Factor and Ripple in Motor Current, Chopper Controlled dc Drivers, Chopper control of separately Excited dc motors, Chopper control of series motor, Source current harmonics in Choppers, Converter ratings and closed-loop control.

UNIT- III

Induction Motor Drives: Soft start using saturable reactor starter, Unbalanced starting scheme for soft start, Part winding starting.

Braking: Regenerative braking, Plugging or reverse voltage braking, Dynamic (or rheostatic) braking, Transient Analysis, Stator Voltage Control, variable Frequency control from Voltage sources, Voltage Source Inverter (VSI) Control, Cycloconverter control, Closed loop speed control and converter Rating for VSI and Cyclo-converter, Induction Motor Drives, Variable Frequency Control from a Current Source, Rotor Resistance control, Slip Power Recovery, Static Kramer drive , Static Scherbius drive, Variable Speed constant Frequency Generation, Single- phase Induction Motors, Braking of single-phase induction motors, Speed control of single-phase induction motors.

UNIT- IV

Synchronous Motor Drives : Operations from Fixed Frequency Supply, Synchronous Motor variable speed drives, Variable frequency control of Multiple Synchronous Motors, Self–controlled Synchronous Motor Drive Employing Load Commutated Thyristor Inverter, Starting Large Synchronous Machines, Self-controlled Synchronous Motor Drive Employing a Cyclo-converter, Permanent Magnet ac Motor Drives, Brushless dc Drives.

UNIT- V

Special machines & Drives: Linear Induction Motor and its control, Stepper(or Stepping) Motors, Variable reluctance, permanent magnet, Important features of stepper motors, Torque versus stepping(or pulsing) rate characteristics, Drive circuits for stepper motors, Switched (or variable) Reluctance Motor, Operation and control requirements, Converter circuits, Modes of operation.

Text Books:

1. G.K.Dubey: fundamentals of electric drives, *2nd Edition* Narosa Publishing House, 2016
2. S.K.Pillai: A course in electric drives; *3rd Edition* New Age International, 2015

Suggested Reading:

1. Vedam Subrahmanyam: Electric Drives-Concepts and Applications, *2nd Edition* TMH, 2010
2. N.K.De & P.K. Sen, Electrical Drives, 1st Edition,PHI, 2006.

EE 413 **HVDC & FACTS**

Instruction :	4 Periods / Week
Duration of Semester Examination :	3 Hours
Semester Examination :	75 Marks
Sessional :	25 Marks
Credits	3

Course Objectives:

1. *Understand operating principles of HVDC systems and control aspects.*
2. *Understand the difference between AC and DC transmission and analysis the HVDC converter*
3. *Understand the concepts of HVDC system control and analyse the power flow in DC systems*
4. Understand and identify the problems and constraints with stability of large interconnected system.
5. Understand the concepts of shunt and series controllers

Course Outcomes: The student will be able to

1. *Acquire the knowledge to compare AC and HVDC systems in terms of power transmission and stability.*
2. *Will be able to compare AC and DC transmission systems and analyse the HVDC converter circuit*
3. *Will be able to acquire the knowledge about HVDC system control methods and power flow in DC systems*
4. Classify various types of FACTS devices/ controllers and *Identify and select the suitable FACTS device for specific application*
5. Acquire the knowledge of about shunt and series FACTS controllers and model the same
6. *Acquire knowledge in improving the stability of the power system by applying FACTS controllers.*

UNIT-1:

Comparison of AC and DC transmission system: , Applications of DC Transmission, Types of DC links, Analysis of HVDC converters, Pulse number, analysis with and without overlap, Equivalent circuit of Rectifier and Inverter, Converter bridge characteristics.

UNIT-2:

HVDC system control: Principles of dc link control, Starting and stopping of dc link, Power control, Harmonics & filters, Introduction and generation of harmonics, Types of ac filters, Power flow analysis in ac/dc systems, General modeling of dc links, Solutions of ac- dc power flow.

UNIT-3:

Flexible AC Transmission Systems (FACTS): Concept of FACTS, Flow of power in an AC system, Dynamic stability consideration, Basic types of FACTS controllers.

UNIT-4:

Static shunt compensators: SVC & STATCOM, Objectives of shunt compensation, Methods of controllable VAr generation, Switching converter type VAr generators, Basic operating principle and control approaches.

UNIT-5:

Static series compensators: GCSC, TSSC, TCSC & SSSC, Objectives of series compensator, Variable impedance type series compensators, Basic operating control schemes, Power angle characteristics, Control range and VA rating, External control, Combined compensators.

Text Books:

1. K.R. Padiyar, 'HVDC Power Transmission System', 3rd Edition, New Age International, 2015.
2. N.G. Hingorani and L.Gyugyi: 'Understanding FACTS', Wiley IEEE Press, 2000

Suggested Reading:

1. Arrillaga J., '*High Voltage Direct Current Transmission', 2nd edition, the Institution of Electrical Engineers,* London, 1998.

EE 461 ELECTRICAL MACHINE DESIGN (Elective-II)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. *To understand the nature of various Electrical Engineering Materials.*
2. *To understand the Specifications of various A.C. and D.C. machines.*
3. *To know the importance of magnetic and thermal circuit calculations in the design aspect.*
4. *To know the various design features of Electrical machines.*

Course Outcomes: The student will be able to

1. *Select a suitable material for a given application.*
2. *Identify the need and required pre-requisites for machine design*
3. *Distinguish the appropriate design procedure for a given DC/AC machine*
4. *Determine the main dimensions of a given DC/AC machine.*
5. *Design a proper cooling system for a given machine*

UNIT -I: Basic Considerations in Machine Design

Principles of Design: Introduction-Types of Electrical Machines, Specifications, Limitations in Design-O/P Co-efficient, Importance of specific loadings-effects of materials on design, General design procedure.

Electrical Materials: Conducting Materials and their properties, Classification, Applications Insulating Materials and their properties, Classification, Applications, Magnetic Materials and their properties, Classification, Applications.

UNIT-II: Design of Magnetic circuit and Thermal circuit

Magnetic circuit Design: Magnetic circuits of Electrical machines-Laws of magnetic circuits-Ampere turns for magnetic circuit-Calculation of Magnetic circuit of D.C.Machine and Induction Motor.

Thermal circuit Design : Temperature rise in Electrical machines-Standard ratings of electrical machines-Modes of heat dissipated-Quantity of Cooling Medium required.

UNIT-III: Design of DC Machines

Important features of DC Machines, O/P equation-Selection of Specific magnetic and electrical loadings-factors effecting selection of no. of poles-Selection of core length and Diameter, Calculation of length of air gap, Design of shunt field system-Design of armature winding only.

UNIT-IV: Design of Transformers

Introduction, O/P Equation(both 1φ & 3φ), E.M.F./turn, Different dimensions of Transformer, Steps to design a Transformer, Design of Main dimensions of Transformer Tank.

UNIT-V: Design of A.C.Rotating machines

Design of 3φ Induction Motor: Introduction-O/P Equation-Estimation of main Dimensions, air gap length of Induction Motor.

Design of 3φ Alternators: Introduction-O/P Equation, Estimation of main dimensions, length of air gap, Estimation of turns /phase, Design of tooth and slot.

Text Books:

1 K.G.Upadhyay,"Design of Electrical Machines", New Age Intl. Publishers, NewDelhi,2013.
2 Dr. V.N.Mittle & A.Mittal,"Design of Electrical Machines",5th reprint Edition, Standard Publishers Distributors,New Delhi,2013.

Suggested Reading :

1. A.K.Sawhney,"A Course in Electrical Machine Design", 6th Edition, Dhanpat Rai & Co.(P) Ltd.,Delhi,2014.
2. R.K.Agarwal, "Principles of Electrical Machine Design",5th Edition, S.K.Kataria & Sons, Delhi, 2014.
3. M.G.Say, "The Performance and Design of Alternating Current Machines",3rd Edition, CBS Publishers & Distributors,Delhi,2002

EE 462 AI TECHNIQUES IN ELECTRICAL ENGINEERING(Elective-II)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *To understand basics of ANN and FUZZY Logic.*
2. *To understand basics of advanced optimization algorithms such as Genetic algorithms.*
3. *To understand the techniques to apply to power system problems such as Economic load dispatch, load frequency control, Reactive power control etc.*

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

1. *Acquire knowledge of Different ANN algorithms.*
2. *Acquire knowledge of membership function fuzzification and Defuzzification*
3. *Understand different selection mechanisms in genetic algorithm.*
4. *Apply AI techniques in electrical engineering applications such as Economic load dispatches and reactive power control etc.*
5. *Apply AI techniques for speed control of ac & dc motors.*

UNIT – I

Artificial Neural Networks Introduction, Models of Neural Network, Architectures, Knowledge representation, Artificial Intelligence and Neural networks, Learning process, Error correction learning, Hebbian learning, Competitive learning, Boltzman learning, Supervised learning, Unsupervised learning, Reinforcement learning, learning tasks.

UNIT- II

ANN Paradigms Multilayer perception using Back propagation Algorithm, Self organizing Map, Radial Basis Function Network, Functional link, network, Hopfield Network.

UNIT – III

Fuzzy Logic Introduction, Fuzzy versus crisp, Fuzzy sets, Membership function, Basic Fuzzy set operations, Properties of Fuzzy sets, Fuzzy cartesion Product, Operations on Fuzzy relations, Fuzzy logic, Fuzzy Quantifiers, Fuzzy Inference, Fuzzy Rule based system, Defuzzification methods.

UNIT – IV

Genetic Algorithms Introduction, Encoding, Fitness Function, Reproduction operators, Genetic Modeling, Genetic operators, Crossover, Single, site crossover, Two point crossover, Multi point crossover, Uniform crossover, Matrix crossover, Crossover Rate, Inversion & Deletion, Mutation operator, Mutation, Mutation Rate, Bit, wise operators, Generational cycle, convergence of Genetic Algorithm.

UNIT–V

Applications of AI Techniques Economic load dispatch, Load frequency control, Single area system and two area system, Reactive power control, speed control of DC and AC Motors.

Text Books:

1. S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms"- PHI, New Delhi, 2010.
2. D.E.Goldberg," Genetic Algorithms", 4th Impression, Pearson Education Inc., 2009.
3. IEEE Journals.

Suggested Reading:

1. P.D.Wasserman,Van Nostrand Reinhold,"Neural Computing Theory & Practice"- New York,1989.
2. Bart Kosko,"Neural Network & Fuzzy System" Prentice Hall, 1992.
3. Kalyanmoy Deb, "Multi objective optimization using evolutionary algorithms", wiley publications, 2013.

EE 463 PRINCIPLES OF EMBEDDED SYSTEMS (Elective-II)

Instruction	4 Periods per week -
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *To understand the basic structure of 8051 Microcontroller.*
2. *To understand the concepts of 8051programming*
3. *To understand the concept of Real time operating systems.*
4. *To have a basic idea of advanced embedded processors*
5. *To understand a basic embedded architecture*

Course Outcomes: student will be able to:

1. *Acquire the knowledge on elements of microcontroller*
2. *Have knowledge on programming using 8051 microcontroller*
3. *Have basic knowledge on real time operations of system.*
4. *Have basic knowledge on advanced embedded processors*
5. *have basic knowledge on embedded programming*

UNIT-I:

Embedded Computing: Introduction, Complex Systems and Microprocessor, Embedded System Design Process, Formalisms for System Design, Design Examples, the 8051 Architecture: Introduction, 8051 Micro controller Hardware, Input / Output Ports and Circuits, External Memory, Counter and Timers" Serial data Input / Output, Interrupts.

UNIT-II

Basic Assembly Language Programming Concepts: Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051, Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic, Jump and Call Instructions, Further Details on Interrupts.

UNIT-III

Applications: Interfacing with Keyboards, Displays, D/A and NO Conversions, Multiple Interrupts, Serial Data Communication, Introduction to Real-Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, Shared Data, Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment.

UNIT-IV

Basic Design Using a Real-Time Operating System: Principles, Semaphores and Queues, Hard Real-Time ,Scheduling Considerations, Saving Memory and Power, An example RTOS like uC-OS (Open Source).

Embedded Software Development Tools:

Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System, Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

UNIT- V

Introduction to advanced architectures: ARM and SHARC, Processor And memory organization and Instruction level parallelism, Net advanced embedded systems: Bus protocols, 12C bus and CAN bus, Internet- Enabled Systems, Design Example-Elevator Controller.

Text Book:

1. Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Morgan Kaufmann Publisher, 2006.

Suggested Reading:

1. David E-Simon, "An Embedded Software Primer", Pearson Education, 2007.
2. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", dreamtech press, 2005.
3. Tim Wilmshurst, "An Introduction to the Design of Small Scale Embedded Systems", Pal grave Publisher, 2004.
4. Sriram V Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata Mc-Graw Hill, 2004.
5. Tammy Noergaard, "Embedded Systems Architecture", Elsevier,2006.

EE 464 **BASIC VLSI DESIGN (ELECTIVE-II)**

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *To understand the MOSFET structures and operations*
2. *To learn to design logic circuits using pMOS and nMOS*
3. *To learn to design concepts of CMOs and Bi-CMOs.*
4. *To Learn the bi-polar circuit designs*
5. *To learn HDL Programing.*

Course Outcomes: student will be able to:

1. *To design logic circuits using pMOS and nMOS technologies*
2. *To design cMOS and Bi-cMOS logic circuits.*
3. *To simulate logical circuits using HDL programming*
4. *To understand different modeling strategies*
5. *To understand FPGA design strategies*

UNIT I

MOS CIRCUIT DESIGN PROCESS: Introduction of MOSFET: Symbols, Enhancement mode-Depletion mode transistor operation – Threshold voltage derivation – body effect – Drain current Vs voltage derivation – channel length modulation. NMOS and CMOS inverter – Determination of pull up to pull down ratio –Stick diagrams – VLSI Circuit Design Flow.

UNIT II

MOS TECHNOLOGY: Chip Design Hierarchy – IC Layers – Photolithography and Pattern Transfers – Basic MOS Transistors – CMOS Fabrication: n-well – p-well – twin tub – Latch up and prevention (SOI) – Submicron CMOS Process-Masks and Layout - CMOS Design Rules: Lambda based layout – Types of rules- SCMOS Design Rule set II.

UNIT III

CMOS LOGIC GATES & OTHER COMPLEX GATES: Gate delays – Logical Effort - CMOS Static Logic – Transmission Gate Logic – Tri-State Logic – Pass Transistor Logic – Dynamic CMOS Logic – Domino CMOS Logic, NORA CMOS Logic, Differential Cascade Voltage Switch (DCVS) Logic, True Single Phase Clock (TSPC) Dynamic Logic.

UNIT IV

VERILOG HDL: Hierarchical modeling concepts – Basic concepts: Lexical conventions – Data types – Modules and ports. Gate level modeling – Dataflow modeling – Behavioral modeling – Design examples of Combinational and Sequential circuits – Switch level modeling

UNIT V

VLSI IMPLEMENTATION STRATEGIES: Introduction – Design of Adders: carry look ahead-carry select-carry save. Design of multipliers: Array – Braun array – Baugh-Wooley Array. Introduction to FPGA – Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures.

Text Books:

1. Douglas A. Pucknell & Kamran Eshraghian," Basic VLSI Design ", 3rd edition, Prentice Hall India, 2001.
2. Wayne Wolf, "Modern VLSI Design: System -on-chip design", Pearson Education, 3rd edition,, 2002.

Suggested Reading:

1. David A. Johns & Ken Martin, "Analog Integrated Circuit Design", John Wiley & Sons, 2004.
2. Neil. H.E. Weste & Kamran Eshraghian," principles of CMOS VLSI Design: A systems perspective ", 2nd edition,, Pearson Education, 2004.

EE 414 DIGITAL SIGNAL PROCESSING LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. *To understand fundamental concepts of Digital signal processing*
2. *To learn applications of various signal processing techniques using MATLAB*
3. *To learn to analyze signal using DSP*
4. *To learn to synthesize signal using DSP*
5. *To acquire knowledge on digital control of electrical appliances*

Course Outcomes : Students will be able to

1. *Simulate various signal transformations using MATLAB*
2. *Design filters using window techniques*
3. *Control AC machines using DSP*
4. *Control DC machines using DSP*
5. *To simulate control signals using MATLAB*

List of Experiments:

PART-A

1. Waveform generation -Square, Triangular and Trapezoidal.
2. Verification of Convolution Theorem-comparison Circular and Linear Convolutions.
3. Computation of DFT,IDFT using Direct and FFT methods.
4. Verification of Sampling Theorem
5. Design of Butterworth LP & HP filters.
6. Design of Chebyshev LP & HP filters
7. Design of FIR and IIR filters.
8. 16 bit Addition, Integer and fractional multiplication on 2407 DSP Trainer kit.
9. Generation of sine wave and square wave using DSP trainer kit.
10. Response of Low pass and High pass filters using DSP trainer kit.
11. Linear convolution using DSP trainer kit.
12. PWM Generation on DSP trainer kit.
13. Key pad interfacing with DSP.
14. LED interfacing with DSP.

PART-B

1. Stepper Motor Control using DSP.
2. DC Motor 4 - quadrant speed control using DSP.
3. Three phase IM speed control using DSP.
4. Brushless DC Motor Control.

Note: Any **EIGHT** experiments from **PART-A** and **TWO** from **PART-B** should be conducted in the semester.

EE 415 **POWER SYSTEMS LAB**

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. *To determine regulation & efficiency of short, medium and long transmission lines and to calculate A, B, C, D constants.*
2. *To understand the importance of protective relays in power system such as different protection of transformer DMT Characteristics of over current relay, Buchholz relay and static relays.*
3. *To understand the procedure to determine sequence parameters of transformer and alternator.*

Course Outcomes: After completion of the course: the student will be able to:

1. *Determine ABCD constants of transmission lines and evaluate regulation, efficiency.*
2. *Acquire knowledge in relay setting for safe operating of power system.*
3. *Determine sequence parameters of transformer and alternator and draw its importance.*
4. *Determine the time constant of an alternator.*
5. *Determine the dielectric strength of oil and calculate the efficiency of string insulators.*

List of Experiments:

1. Determination of regulation & efficiency of Short, Medium and Long transmission lines.
2. IDMT characteristics of Over-current relay.
3. Determination of A, B, C, D constants of Short, Medium , Long lines & circle diagrams.
4. Differential protection of transformer.
5. Sequence impedance of 3-Phase Alternators.
6. Determination of positive, negative and zero-sequence reactance of 3 -Phase transformers using sequence current excitation fault calculation.
7. Synchronous machine reactance and time constant from 3-Phase S.C test.
8. Characteristics of Static relays.
9. Static excitation of Synchronous Generator.
10. Determination of dielectric strength of oil & Study of Buchholz relay.
11. Parallel operation of Alternators.
12. Measurement of capacitance of 3-core cables.
13. Fault location of Underground cables.
14. Simulation of string of insulators for determination of Voltage distribution and String efficiency.

At least **TEN** experiments should be completed in the semester.

EE 416 **PROJECT SEMINAR**

Instruction	3L Periods per week
Sessionals	25 Marks
Credits	1

Course Outcomes: After completion of the course: the student will be able to:

1. *Develop the skills of analyzing a problem, solving it by different approaches, building interactions with the other organizations.*
2. *Develop the skills of presenting a concept, independent learning and addressing the societal issues, economical outlay*.

Dealing with a real time problem should be the focus of under graduate project. Faculty members should prepare project briefs (giving scope and references) well in advance, which should be made available to the students in the department. The project may be classified as hardware / software modeling / simulation. It may comprise any or all elements such as analysis, design and synthesis.

The department should appoint a project coordinator who will coordinate the following.

- Grouping of students (a maximum of 3 in group)
- Allotment of projects and project guides
- Project monitoring at regular intervals.

All project allotment are to be completed by the 3rd week of IV–Year, I-Semester, so that the students get sufficient time for completion of the project by the end of II-semester. Efforts be made the some of the projects are carried out in reputed industries / research organizations with the help of industry coordinators. Problems can also be invited from the industries to be worked out through undergraduate projects. Oral presentation is an important aspect of engineering education. The students have to deliver a seminar on the 'project' they have chosen or allotted by the department, on the advice and approval from the faculty members. Students are exposed to the following aspects for seminar presentation.

- Literature Survey
- Organization of the material
- Power point presentation
- Technical writing

Each student project batch is required to:

1. Submit a one-page synopsis before the seminar talk for display on the notice board.
2. Give a 20-30 minutes presentation through power point presentation.
3. Submit a report on the project with list of references and slides used.

Project Seminars are to be scheduled from the 4th week of the I-semester to the last week of the I-semester.

For award of Sessional marks students are judged by the project coordinator and guide on the basis of an oral and written presentation as well as their involvement in the discussions.

- Acquire knowledge in conducting systematic literature survey and preparing the summary on the chosen topic.
- Acquire knowledge in preparing the notes for presentation which exhibit the level of understands on the subject and further improvement.
- Acquire knowledge in prepare project report, which will help in preparing such report while taking up the jobs/ project works.

With effect from the academic year 2016-2017

Semester- II

With effect from the academic year 2016-2017

SCHEME OF INSTRUCTION AND EXAMINATION
4/4 B.E.
ELECTRICAL & ELECTRONICS ENGINEERING

II-SEMESTER

S.No	Code	Subject	L	T	P	Scheme of Examination			
						Duration in Hours	Maximum Marks		Credits
							Univ. Exam	Sessionals	
1	EE 421	Utilization of Electrical Energy	4	-	-		75	25	3
2		Industrial Administration & Financial Management	4	-	-		75	25	3
3		Elective –III	4		-		75	25	3
4		Open Elective/ Elective –IV	4	-	-		75	25	3
5	EE 422	Electrical Simulation Lab	-	-	3		50	25	2
6	EE 423	General Seminar	-	-	3		-	25	1
7	EE 901	Project	-	-	6		100	50	9
		TOTAL	**16**	**-**	**12**				**24**

S.No	CODE	ELECTIVE-III
1	EE 471	High Voltage Engineering
2	EE 472	Computer Methods in Power System
3	EE 473	Power System Operation & Deregulation
4	EE 474	Power Quality Engineering
5	EE 475	Electrical Distribution Systems
6	EE 476	Power System Reliability

S.No	CODE	ELECTIVE-IV
	EE 481	Electronic Instrumentation
		Intellectual Property Rights
		Image Processing
		Disaster Mitigation & Management
		Open Elective from other departments (IOT of things, Data warehousing)
		Open Elective from other departments (Network Security)

EE 421 **UTILIZATION OF ELECTRICAL ENERGY**

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *Understand the adaptability of heating and welding concepts for a given application*
2. *Know the necessity of illumination and batteries for specified requirement*
3. *Know selection of proper traction system and its corresponding drive for industrial applications*

Course outcomes: Students will able to

1. *Distinguish the adaptability of heating and welding concepts for a given application*
2. *Identify the necessity of illumination for specified requirement*
3. *Select proper traction system and its corresponding drive for industrial applications*
4. *Select the proper furnace System for a given requirement*
5. *Identify proper battery which suits the requirement*

UNIT-I

Electric Heating: Introduction, Classification of electric heating, Electric Resistance Heating, Resistance Ovens, Properties of good heating material, Different types of heating material, Causes of failure of heating element, Design of heating element- Numerical Problems.

Arc Furnaces or ovens: Direct Arc Furnace, Indirect Arc Furnace, Induction Heating, Direct Core-type Induction Furnace, Vertical Core-Type Induction Furnace, Indirect Core-Type Induction Furnace, Coreless Induction Furnace, High Frequency Eddy-current Heating, Dielectric Heating- Numerical Problems.

UNIT-II

Electric Welding: Introduction, Classification of Welding Processes, Formation and Characteristics of Electric Arc, Effect of Arc Length, Electrodes for Metal Arc Welding, Advantages of Coated Electrodes, Types of Joints - Welding Transformer-**Electric arc welding:** Carbon Arc Welding, Submerged Arc Welding, Atomic Hydrogen Welding-**Resistance Welding:** Spot Welding, Seam Welding, Projection Welding, Butt Welding, Flash Butt Welding, Upset Welding, Electron Beam Welding, Laser Welding - Numerical Problems

Unit-III

Illumination: Introduction, Terms used in illumination, laws of illumination, Polar Curves of C.P. Distribution –Determination of M.S.C.P. and M.H.C.P. from Polar Diagrams- Rousseau's construction, Lighting Schemes- Design of Lighting Schemes- Application to factory lighting, Street lighting and Flood lighting- **Electric Lamps:** Incandescent Lamps, Discharge lamps, Sodium vapour lamps, Mercury vapour lamps, Fluorescent lamps, CFL Lamp, LED Lamp, Stroboscopic effects- Numerical Problems

Unit-IV

Electric Traction-I: Introduction, Systems of electric traction and track electrification- DC system, single phase and 3-phase low frequency and high frequency system, composite system, kando system, comparison between AC and DC systems- Train Movement-Typical Speed/Time Curve - Factors affecting scheduled speed - Simplified Speed/Time Curve - Average and Schedule Speed -Tractive Effort for Propulsion of a Train - Power Output from Driving Axles - Energy Output from Driving Axles - Numerical Problems

Unit-V

Electric Traction-II: Specific Energy Output - Evaluation of Specific Energy Output -Energy Consumption - Specific Energy Consumption-Adhesive Weight - Coefficient of Adhesion - Mechanism of Train Movement - Numerical Problems

Batteries: Classification, Construction and maintenance, Charging and rating of Lead acid batteries and SMF batteries

Text Books:

1. C L Wadhwa, Generation, Distribution and Utilization of Electrical Energy- 3rd Edition New age international publishers, 2015.
2. B.L. Theraja, A Textbook of Electrical Technology Volume-III Transmission and Distribution S. Chand Limited, 23rd Edition, 2013.
3. Partab H, Art and Science of Utilization of Electric power, Dhanpatrai & Sons, 2014

Suggested Reading:

1. Utilization of Electric Power and Electric Traction-J.B.GUPTA, S.K.KATARIA & SONS, 2013.
2. Utilization of Electrical Power-R K. Rajput, 2nd Edition, Laxmi Publications(p)Ltd, 2016.

EE 471 **HIGH VOLTAGE ENGINEERING (Elective -III)**

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives

1. *Understand the breakdown mechanism in gases, liquids and solid dielectrics.*
2. *Understand the methods of generation and measurement of high voltages and currents.*
3. *Understand the procedure for testing of high voltage equipment.*

Course Outcomes After completion of the course the student will:

1. *Acquire knowledge in breakdown mechanism in Gases and specially pertaining to high voltage engineering and in importance.*
2. *Acquire knowledge in different aspects of breakdown mechanism in liquids and solids specifically pertaining to high voltage aspect.*
3. *Acquire knowledge in respect of generation of High Voltages and currents, generation of impulse voltage and currents. To Analyze multistage impulse generation of impulses voltages and current generation.*
4. *Acquire knowledge relating to measurement of high AC currents, High DC currents measurement of impulse currents and associated measuring equipment.*
5. *Acquire knowledge in testing of high voltage electrical equipment such as power capacitor, power transforms, circuit breaker, insulator, bushings, cables, surge arresters etc.*

UNIT-I

Breakdown mechanism in Gases: Mechanism of breakdown, Types of collisions, Ionization processes, Townsend's First and second Ionization coefficients, Townsend's breakdown mechanism, Time lags for breakdown, Streamer theory of breakdown, Paschen's Law, Penning effect, Corona discharges.

UNIT II

Breakdown mechanism in liquids and solids: Breakdown in liquid dielectrics: Classification of liquid dielectrics, Pure liquids and commercial liquids, conduction and breakdown in pure liquids and commercial liquids. Testing of transformer oil. Breakdown in solid dielectrics: Intrinsic breakdown, Electro-mechanical breakdown, Thermal breakdown, Breakdown due to treeing and tracking, Breakdown due to internal discharges.

UNIT-III

Generation of High Voltages and Currents: Generation of Hugh DC voltages: Half and full wave rectifier circuits, Voltage doubler circuits, Cockroft Walton voltage multiplier circuit. Generation of Hugh AC voltages: Electrostatic generator, Van de Graf generator, Cascaded transformers, Series resonant circuit. Generation of Impulse Voltages and Currents: Analysis of impulse generator circuit, Multistage Impulse generator circuit, Impulse current generation.

UNIT-IV

Measurement of High Voltage and Currents: Sphere gap, Uniform field spark gap, Rod gap, electrostatic voltmeter, Generating voltmeter, Chubb Fortescue method, Impulse voltage measurement using voltage dividers. Measurement of high D.C currents using Hall generators, Measurement of high A.C currents using current transformer and electro-optical system. Measurement of Impulse currents: Resistive shunts, Rogouuski coils, Faraday generator.

UNIT-V

Testing of High Voltage Equipment: Testing of Power capacitors. Testing of power transformers. Testing of circuit breaker. Testing of Insulators and bushings. Testing of Cables. Testing of Surge Arresters.

Text Books

1. M.S.Naidu and V.Kamaraju, High Voltage Engineering, 4th Edition, Tata McGraw Hill 2009.
2. C.L. Wadhwa, High Voltage Engineering, Wiley Eastern Ltd.., 2007.

Suggested Reading:

1. E.Kuffel and W.S. Zaengl, High Voltage Engineering, 3rd Edition, Pergamon Press, 2016.

EE472 COMPUTER METHODS IN POWER SYSTEMS(Elective -III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *To study the formulation of various incidence matrices*
2. *To study the formulation of network matrices such as Y_{BUS}, Y_{BR} and Z_{loop}.*
3. *To know about the formation of Z_{BUS} for given power system network.*
4. *To understand the calculation of fault currents using Z_{BUS} in three phase power system network.*

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

1. *Draw the graph and find the network metrics for the given power system network.*
2. *Modify the Z_{bus} for changes in the network structure.*
3. *Determine the fault currents in three-phase power system for different faults*
4. *Acquire the knowledge of different transformation techniques*
5. *Find the ZBUS for given three-phase network.*

UNIT -I

Graph Theory: Definitions, Incidence Matrices, Element node incidence matrix, Bus incidence matrix, Branch path incidence matrix, Basic and Augmented cut set incidence matrices, Basic and Augmented branch incidence matrices, Basic and Augmented loop incidence matrices, Construction of Primitive network element.

UNIT - II

Formulation of Network Matrices Formation of Y_{bus}, Y_{BR} and Z_{loop} by Singular Transformation Method, Derivation of Y_{BR}, Y_{loop}, Z_{bus} and Y_{bus} from non-singular transformation method.

UNIT -III

Z_{bus} algorithm 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 Modification of Z_{Bus} for the changes in network.

UNIT -IV

Three-phase Networks Representation and performance equation of 3-phase network elements ,Three phase network elements with balanced and unbalanced excitation, Transformation matrices, Symmetrical and Clarke's components, Algorithm for formation of 3-phase bus impedance matrix, Modification of three phase Z_{BUS} for changes in network

UNIT - V

Short Circuit Studies Basic assumption in short circuit studies, System representation, General equations for short circuit study in phase variables and Symmetrical components for fault current and node voltage, Short circuit calculations for balanced three phase network using Z_{BUS}, Fault impedance and admittance matrices, Analysis of 3-phase line to ground and double line to ground faults, Flow chart for short circuit study.

Text Books:

1. Stagg & El-Abiad, 'Computer methods in Power System Analysis', 9th Edition, Tata McGraw Hill, 1983.
2. M.A.Pai, 'Computer techniques in Power System Analysis', 3rd Edition,Tata McGraw Hill, 2014.

Suggested Reading:

1. L.P. Singh, 'Advanced Power System Analysis and Dynamics', 6th Edition, New Age International Publishers, 2014
2. Kusic Gearge L, 'Computer Aided Power System Analysis', 2nd Edition, CRC Press, 2008.

EE 473 POWER SYSTEM OPERATION AND DEREGULATION
(Elective-III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives

1. *To understand the importance of optimal power flow in power system operation*
2. *To know how to operate power system as securely as possible*
3. *To understand various methods of state estimation*
4. *To discuss about power system deregulation*
5. *To calculate the available transfer capability of the lines*

Course Outcomes

1. *Able to calculate the optimal power flows for the given power system*
2. *Able to carry out contingency analysis*
3. *Able to determine the state estimation of the system and difference between ***nvential LF and SE.*
4. *Able to understand the benefits of deregulation*
5. *Able to determine the available transfer capability of a line and know the various pricing methods in deregulated power system*

UNIT- I

Optimal Power Flow Introduction, OPF formulation, OPF solution technique, Linear programming OPF, Interior point method, unit commitment solution methods, priority list method, dynamic programming method

UNIT-II

Power System Security Introduction, Factors affecting power system security, Contingency analysis, AC power flow security analysis with contingency case selection, concentric relaxation, Bounding area method

UNIT-III

State Estimation Introduction, Power system state estimation, Methods of Least squares, Maximum likelihood Weighted Least squares estimation, Matrix formulation, State estimation by orthogonal decomposition, detection and identification of Bad measurements, Network observability and pseudo measurements

UNIT-IV

Power System Restructuring Introduction, Motivation for restructuring of power system, Electricity market entities and model, benefits of deregulation, terminology, deregulation in Indian power sector, Operations in power markets, power pools, transmission networks and electricity markets.

UNIT-V

ATC, Transmission Open Access& Pricing Introduction, definitions, methods of determination of ATC, ATC calculation considering the effect of contingency analysis, Transmission open access, types of services, cost components of transmission system, transmission pricing methods, Incremental cost based transmission pricing.

Text Books:

1. A. J. Wood & B.F.Woollenberg- Power Generation, Operation and Control, 3rd Edition. John Wiley, 2013.
2. P. Venkatesh, B. V. Manikandan, S. Charles Raja- A. Srinivasan, "Electrical Power Systems Analysis, Security, Deregulation"– PHI 2012.
3. K.Bhattacharya, M. Bollen and J.E. Daalder Operation of Restructured Power Systems, 1st Edition Springer Publishers 2012.

Suggested Reading:

1. Md Shahidephpour and M. Alomoush, 'Restructured Electrical Power Systems', Marcel Dekker Inc, 2001.
2. T.K.Nagsarkar, M.S.Sukhija, Power System Analysis, Illustrated Edition, Oxford publications, 2007

EE 474 POWER QUALITY ENGINEERING (Elective-III)

Instruction :	4 Periods / week
Duration of Semester Examination :	3 Hours
Semester Examination : 7	5 Marks
Sessional :	25 Marks

Course Objectives:

1. *Understand the theoretical concepts and standards of Power Quality(PQ), and methods to calculate and analyse voltage sag in distribution systems.*
2. *Understand PQ issues and sources in Industrial systems and its mitigation*
3. *Understand the presence and sources of harmonics in industrial and commercial loads.*
4. *To know about devices for controlling and mitigating the harmonics.*

Course Outcomes: After completion of this course, the student will be able to:

1. *Have the knowledge of theoretical concepts and standards of Power Quality and issues in industrial systems*
2. *Have the knowledge to calculate and analyze voltage sag in distribution systems*
3. *Acquire knowledge in identifying sources of harmonic.*
4. *Acquire the knowledge in mitigation of harmonics in industrial and commercial loads systems*
5. *Acquire the knowledge in measurement of PQ problems.*

UNIT I

Introduction: Power Quality (PQ), PQ problems, Sags, Swells, Transients, Harmonics, Interruptions, Flicker, Voltage fluctuations, Notch. PQ Issues, **Transient Over-voltages:** Sources of Transient Over-voltages, Wiring and Grounding, Reasons for Grounding, Typical wiring and grounding problems, Solutions to wiring and grounding problems.

UNIT II

Voltage Sag Analysis: Voltage sag characteristics, Methodology for computation of voltage sag magnitude and occurrence, Accuracy of sag analysis, Duration & frequency of sags, Faults behind transformers, Effect of pre-fault voltage, Voltage dip problems, Fast assessment methods for voltage sags in distribution systems.

UNIT III

PQ Consideration in Industrial Power Systems: Adjustable speed drive (ASD) systems and applications, Sources of power system harmonics, Mitigation of harmonics, Characterization of voltage sags experienced by three-phase ASD systems, Types of sags and phase angle jumps, Effects of momentary voltage dips on the operation of induction and synchronous motors .

UNIT IV

Harmonics: Harmonic distortion, Voltage versus current distortion, Harmonics versus Transients, Harmonic Indices, Harmonic sources from commercial loads, Harmonic sources from industrial loads, Locating Harmonic sources, Effects of Harmonic distortion, Inter harmonics, Devices for controlling harmonic distortion.

UNIT V

Assessing PQ: Remedies, Customer side of meter, Utility side of the meter, Power quality monitoring, Monitoring considerations, PQ measurement equipment, PQ monitoring standards.

Text Book

1. C.Sankaran, ‘Power Quality’, CRC Press, 2001

2. R.Sastry Vedam, M.Sarma, "Power Quality- Var Compensation in Power Systems ", CRC Press, 2009

Suggested Reading:

1. Math H.J. Bollen, ‘Understanding Power Quality Problems’, IEEE Press, 2000.

2. Roger C.Dugan, Mark F.McGranaghan, Surya Santoso, H.Wayne Beaty, ‘Electrical Power Systems Quality’, 3rd Edition,Tata McGraw-Hill, 2012.

EE 475 ELECTRICAL DISTRIBUTION SYSTEMS (Elective-III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *To Study the load characteristics and application of distribution transformers.*
2. *To understand the substation schemes, voltage drop calculation of different service areas.*
3. *To know about primary and secondary distribution systems and their characteristics.*
4. *To study the application of capacitors in distribution systems and distribution automation control functions.*

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

1. *Find the load factors, diversity factor etc. for different systems.*
2. *Acquire the knowledge of substation bus schemes and calculation of rating of substation.*
3. *Find voltage drop and power loss calculations of primary and secondary distribution systems.*
4. *Competent to calculate respective power requirement of distribution systems and requirement of distribution automation system*.
5. *Acquire the knowledge of voltage control methods*.

UNIT-I

Load Characteristics Demand, demand curve, load duration curve, Diversified demand, Non-coincident Demand, Coincidence factor, Contribution factor problems, Relationship between load and loss factors load growth, Rate structure, Customer billing, Application of distribution transformers, Types of distribution transformers.

UNIT-II

Sub transmission lines and Substations Types of sub-transmission lines, Distribution substations, Substation bus schemes, Rating of distribution substation, Service area with multiple feeders, Substation application curves, Percent voltage drop calculations.

UNIT-III

Primary and Secondary Feeders Types of primary systems, Radial type, Loop type and Primary network, Primary feeder loading, Radial feeder with uniformly distributed load, Secondary voltage levels, Secondary banking, Secondary networks, Economic design of secondaries, Unbalanced load and voltages.

UNIT-IV

Voltage drop and Power loss calculations Voltage drop and power loss calculations, 3-phase, Non 3-phase primary lines, Single phase two-wire laterals with ungrounded neutral, Single phase two wire unigrounded laterals, Two phase plus neutral lateral, Method to analyze distribution costs, Voltage control methods, Feeder voltage regulators.

UNIT-V

Application of capacitors to Distribution Systems Effects of series and shunt capacitors, Power factor correction, Economic justification for capacitors, Location and sizing of capacitors in distribution system.
Distribution System Automation: Definitions, control functions, Level of penetration of DA, Types of communication systems, Supervisory control and data acquisition, Advanced SCADA concepts.

Text Books:

1. Turan Gonen, Electric Power Distribution Engineering, 3rd *Edition* TMH, 2016.
2. A.S.Pabla, Electric Power Distribution, 6th Edition, TMH, 2012.

Suggested Reading:

1. William Kersting, Distribution System Modeling & Analysis, 3rd *Edition* CRC Press, 2015.
2. S.Sivanagaraju, V.Sanker, Electric power distribution and Automation, Dhanpat Rai & Co, 2012.

EE 476 POWER SYSTEM RELIABLITY (Elective-III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *To understand probability theory and distributions*
2. *To Understand component reliability types and causes of failures ,reliability logic diagram for different configuration.*
3. *To Understand discrete Markov chains and continuous Markov process and the importance of reliability evaluation of repairable systems*

Course Outcomes: After completion of the course the student will be able to:

1. *Acquire knowledge and to apply probability theory and distribution functions to engineering applications.*
2. *Acquire knowledge to study and to classify types of causes of failures, reliability logic diagram for different configurations.*
3. *Acquire knowledge to study discrete and continuous Markov chains and process and give thrust to reliability evaluation of repairable systems.*
4. *Evaluate various load models*
5. *Apply reliability analysis on a given distribution system.*

UNIT –I

Elements of probability theory -Probability distributions: Random variables, density and distribution functions, Mathematical expectation- Mean and Variance, Binominal distribution, Poisson distribution, Normal .distribution, Exponential distribution, Weibull distribution.

UNIT-II

Reliability: Definition, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazarad rate. Causes of failures, types of failures. Bath tub curve, MTTR, MTBF. Reliability logic diagrams for series, parallel, series-parallel, non series-parallel configurations. Minimal cut-set and decomposition methods.

UNIT-III

Discrete Markov Chains: General modeling concepts, stochastic transitional probability matrix, time dependent probability evaluation and limiting state probability evaluation. Absorbing states. Continuous Markov Processes: Modeling concepts, State space diagrams, Stochastic Transitional Probability Matrix, Evaluating limiting state Probabilities. Reliability evaluation of repairable systems.

UNIT-IV

Generating System Reliability Analysis: Generation system model- capacity outage probability tables -Recursive relation for capacitive model building '- sequential addition method -unit removal- Evaluation of loss of load and energy indices. Evaluation of equivalent transitional rates of identical and nonidentical units -Evaluation of cumulative probability and cumulative frequency of nonidentical generating units -2'-level daily load representation - merging generation and load models

UNIT-V

Distribution System Reliabiliry Analysis: Radial networks –Evaluation of Basic reliability indices, performance indices -load point and system reliability indices - customer oriented, loss and energy oriented indices. Parallel networks- inclusion of bus bar failures, scheduled maintenance -temporary and transient failures -weather effects - common mode failures -Evaluation of various indices.

Text Books:

1. Roy Billinton and Ronald N. Aallan "Reliability Evaluation of Engineering Systems", Concepts and Techniques, 2nd Edition Springer International Edition, 1992
2. Roy Billinton and Ronald N. Aallan "Reliability Evaluation of Power Systems", 2nd Edition BS Publicaitons, 1996.

Suggested Reading:

J. Endrenyi, " Reliability Modeling in Electrical Power Systems", Wiley Inter science publications.1978

EE 481 ELECTRONIC INSTRUMENTATION SYSTEMS (Elective -IV)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course objectives:

1. To understand the concept of transducers.
2. To know the features of data converters.
3. To understand construction and working details of different signal generators, signal analyzers and CRO.

Course Outcomes: After completion of this course, the student will be able to:

1. *To know the effectiveness of data converters.*
2. Know the applications of various transducers.
3. Know the suitable signal analyzer which suits for a particular application.
4. Understands how different signal generators can be used.
5. know how to work on CRO for different applications.

UNIT-I

Analog and Digital Measuring Systems: Interfacing Active and Passive Transducers. Amplifiers: Instrumentation amplifiers (Fixed and Programmable gain types and its specifications), Isolation amplifiers (Types and its specifications).

Digital to Analog Converters: R-2R ladder and Inverted ladder DACs. Main DAC specifications. Analog to Digital Converter: R-2R Ladder and Inverted Ladder DACs, Main DAC specifications, Analog to Digital Converters: Parallel (or Flash) ADC successive approximation, ADC Microprocessor compatibility, Dual slope ADC, Principal specifications of an ADC.

UNIT-II

Digital Voltmeters and Multimeters: Simple D.C Voltage attenuator, Current toVoltage converter, Resistance to Voltage Converter, Automatic ranging and Automatic zeroing RMS detector in DMM and RMS and True RMS, Digital Frequency and Time measurements, Frequency Measurements, frequency ratio Time Interval and Pulse width measurements, Scaling and Checking modes. Counting errors, Input signal conditioning, Trigger level, Hysteresis.

UNIT-III

Signal Analysis: Wave Analyzers: Signal analysis and wave Analyzer: Type and Applications. Harmonic Distortion Analyzers: harmonic Distortion, heterodyne harmonic Analyzer or Wave meter, Tuned circuit, Fundamental Suppression. Spectrum Analysis: Block Diagram, Phase locked circuit for the local oscillator, Successive Limiting type of Log IF amplifier.

UNIT-IV

Signal generators: fixed and variable Audio frequency oscillator, Audio frequency sine and square wave generator, function generator, square wave pulse generator, random noise generator, TV sweep generator, marker generator and beat frequency oscillator(BFO). synchronized signal generator interfaced with 488 Bus, relay switched attenuator, IEE 488 Electrical interface.

UNIT-V

Cathode ray Oscilloscope: Block Diagram, Basic Concepts, Vertical amplifier, Time Base, Trigger Delay line and their role in a CRO, Digital storage Oscilloscope, Magnetic Re orders, Digital Interface for Programmable Instrumentation, Description and Sample examples of Automatic Instrumentation.

Text books:

1. H .S. Kalsi, " Electronic Instrumentation" , 2nd Edition, TMH publications, 2007.
2.A.K.Sawhney-" A Course in Electrical and Electronics Measurements and Instrumentation", 4th Edition Dhanpat Rai & Sons, New Delhi, 2012.

Suggested reading:

1. E.W Golding " Electrical Measurements and measuring Instruments". TMH publications, 2011.
2. Helfrick, Albert D. Cooper, William D, "Modern Electronic Instruments and measuring Instruments ". Prentice Hall of India, 1992.

With effect from the academic year 2016-2017

EE 422 **ELECTRICAL SIMULATION LAB**

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. *Understand the load flows in power system transient stability economic power scheduling to load frequency control.*
2. *To simulate power system fault analysis.*
3. *To practice programming using embedded processor*
4. *To learn to interface various electrical equipments to embedded controller*
5. *To simulate out put sequence using embedded system.*

Course Outcomes: After completion of this course, the student will be able to:

1. *Acquire knowledge to conduct Load frequency studies and study the power systems under transient state .importance of economic optimization of power system and relevance of LFC to maintain constant torque*
2. *Program using embedded processor*
3. *Acquire knowledge in simulation of load flow and transient stability studies.*
4. *To generate the output sequence using micro controller.*
5. *Control the operation of different equipments to embedded controller*

List of Experiments

Part A

1. Simulation of Load Flow Studies.
2. Simulation of Fault Analysis.
3. Simulation of Transient stability studies.
4. Simulation of Economic power scheduling.
5. Simulation of Load Frequency control of one area system.
6. Simulation of Load Frequency control of two area system

Part B

1. Simulation of switching sequence for relay operations.
2. Simulation of switching sequence with time delay.
3. Simulation of relay operations using different ports.
4. Interfacing 7 segment display using SPI through microcontroller.
5. Interfacing ADC through microcontroller.
6. Interfacing DAC through microcontroller.
7. Interfacing stepper Motors through microcontroller.

Note: At least **FIVE** experiments from **PART-A** and **PART-B** should be conducted in the semester.

EE 423 **GENERAL SEMINAR**

Instruction	3L Periods per week
Sessionals	25 Marks
Credits	1

Course Outcomes: After completion of this course, the student will be able to:

1. Acquire knowledge in systematic way of carrying out literate survey and select the topic for seminar.
2. Acquire knowledge in preparing details summary on the select topic and refer cross reference to gain in depth knowledge on the chosen topic.
3. Acquire knowledge in preparing summary highlights the direction in which work has progressed and the gaps.
4. Acquire knowledge to fill gaps in highlighting the method of solution.
5. Acquire knowledge in summarizing and highlighting the affrication aspects.

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of the specialization.

Seminar topics may be chosen by the student with advice and approval from the faculty members. Students are to be exposed to the following aspects of seminar presentation.

- Literature Survey
- Consolidation of available information
- Power point presentation
- Technical writing

Each student is required to:

1. Submit a one-page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through power point followed by a 10 minutes discussion.
3. Submit a report on the seminar topic with list of references.

Seminars are to be scheduled from the 3rd week of to the last week of the II-semester.

For award of Sessional marks students are judged on the basis of an oral and written presentation as well as their involvement in the discussions by at least two faculty members.

EE 901 **PROJECT**

Instruction	6L Periods per week
University Examination	Viva-voce
University Examination	100 Marks
Sessionals	50 Marks
Credits	9

Course Outcomes: After completion of the course the student will be able to:

- Acquire knowledge in conducting systematic way the literature Survey by referring to reputed journals/ textbooks etc.
- Acquire knowledge in segregating /Classifying the literature survey paper : Design, Analysis, experimental etc.
- Able to prepare a detailed summary of the paper as per the classification and choose the area and topic fitting in to the classification such as simulation studies, experimentation, preparing prototype etc.
- Acquire knowledge to conduct simulation studies/ experimental studies and tabulate the results and compare the perform and chose the design parameter to improve the performance etc.
- Acquire knowledge in writing the project work report in different chapters: Introduction, back ground, description, problem formulation, Analysis, Discussion, results and suggestions for further studies and conclusions.

Dealing with a real time problem should be the focus of under graduate project.

All projects will be monitored at least four times in the II-semester through individual presentations (Project batch wise).

Every student should maintain a project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Problems can also be invited from the industries to be worked out through undergraduate projects. Efforts may be made such that the projects may be carried out in reputed industries/ research organizations/PSUs.

Sessional marks should be based on the marks, awarded by a monitoring project committee of faculty members as well as the marks given by the guide.

Common norms should be established for final documentation of the project report by the respective department on the following lines:

1. The project little should be task oriented for example "Analysis and Modeling of ……."
2. Objectives of the project should be identified clearly and each student of the project batch should fulfill at least one of the objectives identified. The chapters of the project report should reflect the objectives achieved.
3. Contents of the report should include the following
    a. Title page
    b. Certificate
    c. Acknowledgements
    d. Abstract (limited to one/two paragraphs, page no.1 should start from this)
    e. Contents (Ch. No. Title of the chapter/section Page No.)
    f. List figures (Fig. No. caption of the figure Page No.)
    g. List of Tables (Table. No. Caption of the table Page No.)
    h. List of Symbols (ex. C: Velocity of light 3×10^8 m/s)
    i. Chapter I should be introduction . This should contain sections as objectives of the project, technical approach, literature survey, the importance of the project and organization of the report.
    j. The remaining chapters should include regarding the implementation of the project, results with discussions and conclusions. Students are expected to write about future scope of the project.
    k. References should be indicated as per IEEE or standard format, which should be duly referred in the report.
    l. The algorithms related to the software developed should be thoroughly discussed in Appendices etc..

4. The project reports should be hard bound.

The project report should be evaluated for 100 Marks by the External Examiner.

The project work, if found inadequate in the external examination, the candidate should repeat the project work with a new problem or improve the quality of work and report it again.