Faculty of Engineering
Scheme of Instruction and Syllabi of

B.E IVth YEAR

OF

FOUR YEAR DEGREE COURSE

IN

ELECTRICAL & ELECTRONICS

ENGINEERING

(With effect from the Academic Year 2013-2014)

July 2013

Osmania University

Hyderabad - 500 007

CONTENTS

WITH EFFECT FROM THE ACADEMIC YEAR 2013-2014

SCHEME OF INSTRUCTION & EXAMINATION
BE IV/IV (REGULAR)
ELECTRICAL & ELECTRONCS ENGINEERING

Semester I

Sl.No	Code No	Subject	Scheme of Instruction		Scheme of Examination		
			Periods per Week		Duration in Hours	Maximum Marks	
			L/T	D/P		Univ. Exam	Sessional
		THEORY					
1.	**EE 401**	Power System Operation and Control	4	-	3	75	25
2.	**EE 402**	Electric Drives and Static Control	4	-	3	75	25
3.	**EE 403**	Electrical Machine Design	4	-	3	75	25
4.	**EE/CS/ ME**	Elective - I	4	-	3	75	25
		PRACTICALS					
1.	**EE 431**	Electrical Simulation Lab	-	3	3	50	25
2.	**EE 432**	Microprocessors and Microcontrollers Lab	-	3	3	50	25
3.	**EE 433**	Power Systems Lab	-	3	3	50	25
4.	**EE 434**	Project seminar	-	3	3	-	25
		Total	**16**	**12**	**24**	**450**	**200**

Elective – I

EE 404: High Voltage DC Transmission
EE 405: High Voltage Engg.
EE 406: Power Quality
EE 407: Nuclear Energy
ME 411: Entrepreneurship
CS 467: Embedded Systems
CS 410: Cyber Security/Information Security

EE 401

POWER SYSTEM OPERATION AND CONTROL

Instruction	:	4 periods per week
Duration of University Examination	:	3 Hours
University Examination	:	75 marks
Sessional	:	25 marks

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, B_{mn} 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 of 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-TCSC, STATCOM, UPFC.

Suggested Reading:

1. D.P.Kothari and I.J.Nagrath, Modern Power System Analysis, 3rd edition, Tata McGraw Hill, 2004.
2. John,J,Grangier, William D.Stevenson Jr., Power System Analysis, Tata McGraw Hill, 2003.
3. C.L.Wadhwa, Electric Power Systems, 3rd edition, New Age International(P) Ltd., 2002.
4. Haadi Sadat, Power System Analysis, Tata Mc Graw Hill.
5. Elgard, Electrical energy Systems Theory
6. Chakravarthy, Power System Operation and Control.
7. Understanding Facts: Concepts and Technology of Flexible AC Transmission Systems by Narain G. Hingorani, Laszlo Gyugyi

EE 402

ELECTRIC DRIVES AND STATIC CONTROL

Instruction	:	4 periods per week
Duration of University Examination	:	3 Hours
University Examination	:	75 marks
Sessional	:	25 marks

UNIT I

Electric Drives: Concept and classification, Dynamics of Electric Drives, Types of Loads, Torque characteristics of Load, characteristics of Motor-Load combination, Dynamics of Motor-Load combination, Steady-state and Transient stability of Electric Drive. Characteristics of Electric Drives: Modified Speed-Torque Characteristics of D.C Shunt motors, D.C Series motor and Induction motors.

UNIT II

Starting of Electric Motors: Methods of Starting Electric Motors, Acceleration time, Energy relation during starting, D.C Shunt and series motor and Induction motors, Methods to reduce the energy loss during starting.

Electric Braking: Types of Braking, Braking of D.C and A.C motors, Energy relation and Dynamics of Braking. Effect of load inertia and load equalization.

UNIT III

D.C motor control: Single-phase controlled rectifier and chopper circuit arrangement for continuous armature current operation. Dual converter control, Circulating current and non-circulating current modes of operation, Principles of closed loop control for D.C drives.

UNIT IV

Induction motor control: Speed control of 3-phase induction motor with A.C voltage regulators, Voltage source inverters and Cyclo-converters, Static rotor resistance control, slip power recovery schemes: Static Krammer drive and Scherbius drive.

UNIT V

Synchronous motor control: Self controlled and Separately controlled synchronous motors, Brushless D.C motors, Switched reluctance motors.

Suggested Reading:

1. S.K.Pillai, A First Course in Electrical Drives, New Age International,2000
2. G.K.Dubey, Fundamentals of Electric Drives, Narosa Public House, Delhi, 2001
3. M.D.Singh and K.B.Khanchandani, Power Electronics, Tata McGraw Hill Publishing Company Ltd., 2000
4. Bimal.K.Bose, Modern Power Electronics and AC Drives, Pearson Education Asia, 2002

EE 403

ELECTRICAL MACHINE DESIGN

Instruction	:	4 periods per week
Duration of University Examination	:	3 Hours
University Examination	:	75 marks
Sessional	:	25 marks

UNIT-I

Electrical engineering Materials Insulating Materials: Properties of ideal insulating materials, classification and types of insulating materials – conducting materials- general properties of copper, aluminum and steel, high resistance alloys, carbon and other conducting materials, Super conductors – Magnetic materials: Classification of magnetic materials, soft and hard magnetic materials, sheet steel, Cold rolled steels solid core and laminated core materials.

UNIT-II

Magnetic circuit: Basic principles, magnetic circuit calculations, flux density in airgap and tooth – Carter's coefficient, ampere turns for gap and teeth, real and apparent flux density, magnetic leakage, armature leakage, leakage flux from salient poles, field distribution curves, field turns, armature reaction ampere turns.

Thermal Circuit: Type of enclosures ventilation and cooling methods in electrical machines – losses, temperature rise time curve- rating of electrical machines, calculation for quantity of cooling medium.

Rating of Motors: Heating effects, Load conditions and classes of duty, determination of power rating.

UNIT-III

DC Machine Design: Output equation – main dimensions, choice of specific magnetic and electric loading, selection of number of poles, choice of armature core length, Armature diameter, length of air gap, armature design, design of field system.

UNIT-IV

AC Machine Design: Transformer Design - Main dimensions, Output equation, Core design, cooling system design. Three phase Induction Motors - Output equation, main dimensions, design of stator and rotor, design of squirrel cage rotor, design of end-rings.

Synchronous machines - Output equation, Main dimensions, short Circuit Ratio (SCR). Length of air gap, selection of armature slots, design of field system, design of turbo alternators.

UNIT-V

Computer Aided Design: Introduction, Advantages of Digital computers, Computer Aided Design - different approaches: Analysis method, Synthesis method, Hybrid method, Optimization, General procedure for optimization, variable constraints, Computer aided design of 3-phase induction motor, List of symbols used, General design procedure.

Suggested Reading:

1. A.K.Sawhney, A Course in Electrical Machines Design, Dhanpat Rai and sons, 1996.
2. R.K.Agarwal, Principles of Electrical Machines Design, S.K.Kataria & Sons, Nai Sarak, New Delhi-6, Forth edition, 2000.

EE 404

HIGH VOLTAGE DC TRANSMISSION
(Elective I)

Instruction	:	4 periods per week
Duration of University Examination	:	3 Hours
University Examination	:	75 marks
Sessional	:	25 marks

UNIT I

General consideration of DC and AC transmission systems: Comparison of AC and DC transmission systems, Application of DC transmission, Economic Consideration, Kinds of DC links, planning for HVDC transmission, Modern trends in DC transmission, Corona loss in AC & DC systems

UNIT II

Converter circuits: Properties of Converter circuits, Different kinds of arrangements, Analysis of Bridge converters with grid control, With and without overlap angle, Equivalent circuit of rectifier.

Inversion: Operation as Inverter, Equivalent circuit of Inverter

UNIT III

Control: Basic means of control, Limitations of manual control, Desired features of control, Combined characteristics of rectifier and inverter, Power reversal, constant minimum angle Ignition angle control, Constant current control, Constant Extinction angle control.

UNIT IV

Protection: Short circuit current, Arc-back, Commutation failure, Bypass valves, DC reactors, DC circuit breakers, Protection against over voltages, Harmonic filters.

UNIT V

Multi-terminal DC Systems: Application of MTDC systems, Types of MTDC systems, Comparison of series and parallel MTDC systems, Control of MTDC system.

Suggested Reading:

1. Kimbark E.W., Direct Current Transmission Vol-1, John Wiley, 1971.
2. Padiyar KR., HVDC Power Transmission Systems, Wiley Eastern, 1990
3. Arrillaga J., High Voltage Direct Current Transmission, Peter Peregrinus Ltd., London, Pergamon Press,1983

EE 405

HIGH VOLTAGE ENGINEERING
(Elective I)

Instruction	:	4 periods per week
Duration of University Examination	:	3 Hours
University Examination	:	75 marks
Sessional	:	25 marks

UNIT-I

Breakdown mechanism of Gases, Liquids and Solid materials: Mechanism of breakdown of Gases, Townsend's First Ionization coefficient, Cathode processes, Secondary effects, Townsend's Second Ionization coefficient, Townsend's breakdown mechanism, The sparking potential, Paschen's Law, Penning effect, Corona discharges, Time lag, breakdown in liquid dielectrics, treatment of transformer oil, Testing of transformer oil, Breakdown in solid dielectrics.

UNIT-II

Generation of High D.C and A.C Voltages: Half wave rectifier circuit, Cockroft Walton voltage multiplier circuit, Electrostatic generator, Van de Graf generator, Generation of high A.C voltages, series resonant circuit.

UNIT-III

Generation of Impulse Voltages and Currents: Impulse generator circuits, Analysis of circuits 'a' and 'b', Multistage Impulse generator circuit, Construction of Impulse generator, 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, A.C and Impulse currents.

UNIT-V

Testing of power capacitors, Testing of power transformers, Testing of circuit breaker, Test voltages, Voltage and power ratings of test equipment, layout of high voltage laboratories. Lightning phenomena and Line design.

Suggested Reading:

1. M.S.Naidu and V.Kamaraju, High Voltage Engineering, Tata McGraw Hill 2001.
2. C.L.Wadhwa, High Voltage Engineering, Wiley Eastern Ltd., 1994.
   E.Kuffel and W.S. Zaengl, High Voltage Engineering, Pergamon Press, 1984.

EE 406

POWER QUALITY
(Elective I)

Instruction	:	4 periods per week
Duration of University Examination	:	3 Hours
University Examination	:	75 marks
Sessional	:	25 marks

UNIT I

Introduction: Introduction of the Power Quality (PQ) problem, Terms used in PQ: Voltage Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring. Power Quality Data: Data collection, Data analysis, Database structure, Creating PQ databases, Processing PQ data.

UNIT II

Voltage sag – characterization: Voltage sag – definition, causes of voltage sag, voltage sag magnitude, monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, voltage sag duration.
Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

UNIT III

PQ considerations in Industrial Power Systems: Adjustable speed drive (ASD) systems and applications, 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. Voltage sag coordination for reliable plant operation.

UNIT IV

Effects of Harmonics on Power Quality: Harmonic analysis of industrial customers, technical barriers in ASDs. Methods of evaluation of harmonic levels in industrial distribution systems. Harmonic effects on transformers. Impact of distribution system capacitor banks on PQ. Guidelines for limiting voltage harmonics.

UNIT V

Power Quality Monitoring: Introduction, site surveys, Transducers, IEC-measurement techniques for Harmonics, Flicker, IEC Flicker meter.

Suggested Reading:

1. "Understanding Power Quality Problems" by Math HJ Bollen. IEEE Press.
2. "Power Quality" by C. Sankaran, CRC Press.
3. R.Sastry Vedam, M.Sarma, "Power Quality- Var Compensation in Power Systems", CRC Press, 2009.

EE 407

NUCLEAR ENERGY
(Elective I)

Instruction	:	4 periods per week
Duration of University Examination	:	3 Hours
University Examination	:	75 marks
Sessional	:	25 marks

UNIT I

Introduction to Nuclear Physics: Basic nuclear properties, mass and abundance of nuclides, nuclear mass and binding energy, radio active decay, units for measuring nuclear radiation and radiation dose. Alpha decay, beta decay, gamma decay; detection of nuclear radiation, nuclear reactions, neutron physics, nuclear fission, chain reaction, controlled fission reactors, atom bomb, nuclear fusion, controlled fusion reactors, hydrogen bomb.

UNIT II

Various types of Nuclear Reactors: Types of nuclear materials-fuels, moderators, coolants, control rods, shielding materials etc. PWR, BWR, Heavy water, CANDU, gas-cooled, liquid-metal cooled reactors, fast breed reactors.

UNIT III

Nuclear Power Plants: Heat transfer aspects of nuclear power plants, Nuclear power plants: layout, site selection, controls and instrumentation, India's Programme for nuclear power, Survey of present nuclear power plants in India and future scenario.

UNIT IV

Safety aspects of nuclear power reactors: Biological effects of nuclear radiation. Reactor shielding, Reactor safety, Nuclear power and environment, nuclear reactor accidents; review of the Three-Mile-Island accident, and the Chernobyl accident. Storage and disposal of nuclear waste.

UNIT V

Nuclear fusion reactors: Basic properties of nuclear fusion and thermo nuclear reactions, technology of controlled fusion reactors, International Thermonuclear Energy Research (ITER) project in France.

Suggested Reading:

1. Samuel Glasstone and A. Sesonke, " Nuclear Reactor Engineering" Vol 1 & 2
2. J. Kenneth Shultis and Richard E. Faw, "Fundamentals of nuclear science and engineering"
3. John R.Lamarsh and Antony J.Baratta, "Introduction to nuclear power engineering"

ME 411

ENTREPRENEURSHIP
(Elective I)

Instruction	:	4 periods per week
Duration of University Examination	:	3 Hours
University Examination	:	75 marks
Sessional	:	25 marks

CS 467

EMBEDDED SYSTEMS
(Elective I)

Instruction	:	4 periods per week
Duration of University Examination	:	3 Hours
University Examination	:	75 marks
Sessional	:	25 marks

CS 410

CYBER SECURITY/INFORMATION SECURITY
(Elective I)

Instruction	:	4 periods per week
Duration of University Examination	:	3 Hours
University Examination	:	75 marks
Sessional	:	25 marks

EE 431

ELECTRICAL SIMULATION LAB

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

Simulation experiments should be conducted in the following areas using MATLAB /Simulink with DSP Tool Box, Control System Tool Box & Power System Tool Box I PSpice /PSCAD /MiPower /SABER /PowerTrans etc.

1. Verification of Network theorems (i) Thevinin's theorem (ii) Superposition theorem (iii) Maximum power transfer theorem
2. Transient responses of Series RLC, RL and RC circuits with Sine and Step inputs.
3. Series and Parallel resonance.
4. Bode plot, Root-Locus plot and Nyquist plot.
5. Transfer function analysis (i) Time response for Step input (ii) Frequency response for Sinusoidal input.
6. Design of Lag, Lead and Lag-Lead compensators;
7. Load flow studies.
8. Fault analysis
9. Transient stability studies.
10. Economic power scheduling
11. Load frequency control
12. Chopper fed D.C motor drives.
13. VSI /CSI fed Induction motor drives.

At least ten experiments should be completed in the semester.

EE 432

MICROPROCESSORS AND MICROCONTROLLERS LABORATORY
(Common to EEE &IE)

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

List of Experiments:

For 8086:

Section 1 : Using MASM/TASM

1. Programs for signed/unsigned multiplication and division.
2. Programs for finding average of N 16-bit numbers.
3. Programs for finding the largest number in an array.
4. Programs for code conversion like BCD numbers to 7-Segment.
5. Programs for compute factorial of a positive integer number

Section 2 : *Using 8086 Kit (Interfacing)*

1. 8279 – Keyboard Display: Write a small program to display a string of characters.
2. 8255-PPI: Write ALP to generate triangular wave using DAC.
3. 8253- Timer/Counter: Application of different modes.
4. 8251-USART: Write a program in ALP to establish Communication between two processors.
5. Traffic Signal Controller.

For 8051:

Section 3: *Using 8051 Kit (Simple Programs)*

1 Data Transfer – Block move, Exchange, sorting, Finding largest element in an array.
2 Arithmetic Instructions: Multibyte operations.
3 Boolean & Logical Instructions (Bit manipulations).
4 Programs to generate delay, programs using serial port and on-Chip timer/Counter.
5. Use of JUMP and CALL instructions.

Section 4 : *Program Development using 'C' cross compiler for 8051*

1. Square Wave Generation using timers.
2. Interfacing of keyboard and 7-segment Display Module.
3. ADC interfacing for temperature monitoring.
4. DAC interfacing for Generation of Sinusoidal wave.
5. Stepper motor control (clockwise, anticlockwise and in precise angles)

List of equipment:

1. 8086 Kit (with inbuilt assembler/disassembler).
2. MASM/TASM software.

EE 433

POWER SYSTEMS LAB

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

List of Experiments:

1. Determination of regulation & efficiency of Short, Medium and Long transmission lines.
2. IDMT characteristics of Over-current relay & Study of Bucholz relay.
3. Determination of A, B, C, D constants of Short, Medium and Long lines. Drawing of 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 oils and study of Megger.
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 434

PROJECT SEMINAR

Instruction	:	3 Periods per Week
Sessional	:	25 Marks

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 his/her specialization.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to following aspects of a Seminar presentation.

- Literature survey
- Organization of the material
- Presentation of OHP slides / PC 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 OHP or PC or Slide projector followed by a 10 minutes discussion.
3. Submit a report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from 3rd week to the last week of semester and any change in schedule should be discouraged

For award of sessional marks, students are to be judged by at least two faculty members on the basis of an oral and written presentation as well as their involvement in the discussion.