Department of Electrical Engineering
Course Structure for B.Tech. (EE)
Batch: 2016-20

Course Title: **Electric Drives**	Course Code: **EA7210**
Credit: 4.5	L T P **3 1 2**
Year: **4th**	Semester: **VII**

UNIT – 1

Fundamentals of Electric Drive: Electric Drives and its parts, advantages of electric drives, classification of electric drives; Speed-torque conventions and multi-quadrant operations; Types of load, Load torque: components, nature and classification

Dynamics of Electric Drive: Dynamics of motor-load combination; Steady state stability of Electric Drive; Load equalization.

UNIT – 2

Selection of Motor Power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty.

UNIT – 3

Electric Braking: Purpose and types of electric braking, braking of dc, three phase induction and synchronous motors

Dynamics During Starting and Braking: Calculation of acceleration time and energy loss during starting of dc shunt and three phaseinduction motors, methods of reducing energy loss during starting; Energy relations during braking, dynamics during braking

Special Drives: Switched Reluctance motor,.

UNIT – 4

Power Electronic Control of DC Drives: Single phase and three phase controlled converter fed separately excited dc motor drives (continuous conduction only); dual converter fed separately excited dc motor drive; rectifier control of dc series motor; Chopper control of separately excited dc motor and dc series motor.

UNIT – 5

Power Electronic Control of AC Drives:

Three Phase Induction Motor Drive: Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo – converterbased) static rotor resistance and slip power recovery control schemes.

Text Books:

1. G.K. Dubey, “Fundamentals of Electric Drives”, Narosa publishing House.
2. V.Subrahmanyam, “Electric Drives: Concepts and Applications”, Tata McGraw Hill.

Reference Books:

1. M.Chilkin, “Electric Drives”,Mir Publishers, Moscow.
2. Mohammed A. El-Sharkawi, “Fundamentals of Electric Drives”, Thomson Asia Pvt. Ltd. ,Singapore.
3. N.K. De and Prashant K.Sen, “Electric Drives”, Prentice Hall of India Ltd.
4. S.K.Pillai, “A First Course on Electric Drives”, New Age International.

Department of Electrical Engineering
Course Structure for B.Tech. (EE)
Batch: 2016-20

Course Title: **Artificial Neural Network and Fuzzy Logic**	Course Code: **EA7010**		
Credit: 3.5	L **3**	T **1**	P **0**
Year: **4th**	Semester: **VII**		

UNIT – 1

Neural Networks-1(Introduction & Architecture): Neuron, biological neuron, Artificial Neuron and its model, activation functions, Neural network architecture: Single layer and multilayer feed forward networks, recurrent networks, and various learning techniques.

UNIT – 2

Back propagation networks Architecture: perceptron model, single layer artificial neural networks, multilayer perceptron model; back propagation algorithm, effects of learning coefficient; factors affecting back propagation training, applications.

UNIT – 3

Fuzzy logic-I (Introduction): Basic concept of fuzzy, Fuzzy sets and crisp sets, Fuzzy sets theory and operations, Properties of fuzzy sets. Fuzzy and crisp relation.

UNIT – 4

Fuzzy Membership Functions, Rules: Membership functions, inference in fuzzy logic, fuzzy if then rules, fuzzifications & defuzzifications, fuzzy controller.

UNIT – 5

Application of Neural and fuzzy logic: Application of neural network, Neural Network approach in load flow study. Fuzzy logic application in industries.

Text Books:

1. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI

Reference Books:

1. Simon Haykins, ”Neural Networks” Prentice Hall of India
2. Moore, “Digital control devices”, ISA press, 1986.
3. Kumar Satish, “Neural Networks”, Tata McGraw Hill
4. Timothy J Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill 1997

Department of Electrical Engineering
Course Structure for B.Tech. (EE)
Batch: 2016-20

Course Title: **Power System Operation and Control**	Course Code: **EA7020**
Credit: 3.5	L T P **3 1 0**
Year: **4th**	Semester: **VII**

UNIT 1

Introduction: Structure of power system, power system control center,level decomposition in power system, power system security, various operational stages of power system, power system voltage stability, introduction to SCADA

UNIT 2

Economic Operation: Concept and problems of unit commitment, input output characteristics of thermal and hydroplants, system constraints, Optimal operation of thermal units without and with transmission losses, penalty factor, incremental transmission loss, transmission loss , formula (without derivation), hydrothermal scheduling long and short terms, concept of optimal power flow

UNIT 3

Load Frequency Control: Concept of load frequency control, load frequency control of signal area system: turbine speed governing system and modeling, block diagram representation of single area system, steady state analysis, dynamic response control area concept, P-I control, load frequency
Control and economic dispatch control. Load frequency control of two area system tie line power modeling, block diagram representation of two area system,

UNIT 5

Automatic Voltage Control: Schematic diagram and block diagram representation, Different type of excitation system & their controllers. Concept of voltage control, methods of voltage control, control by tap changing transformer. Shunt compensation, series compensation, phase angle compensation

UNIT 6

Fact Devices

Concept and objectives of FACTS controllers, Introduction to different FACT controllers like TCR, FC-TCR, TSC, SVC, STATCOM, TSSC, TCSC, SSSC, TC-PAR, UPFC

Text Books:

1. D.P. Kothari & I.J. Nagrath, "Modern Power System Analysis" Tata McGraw Hill, 3rd edition.
2. P.S.R. Murty, "Operation and Control in Power Systems" B.S. publications

Reference Books:

1. N.G. Hingorani& l. Gyugyi, "Understanding Facts “Concepts and Technology of Flexible AC Transmission Systems", IEEE Press Publications
2. A.J. Wood & B.F. Wollenburg, "Power Generation, Operation and Control ", John Wiley & Sons
3. O.J. Elgerd,"Electric Energy System Theory”, Tata McGraw Hill.
4. P. Kundur, "Power System Stability and Control”, McGraw Hill.
5. M.H. Rashid, "Power Electronics: Circuits, Devices and Applications "Prentice Hall of India”, 3rd edition.
6. T.K. Nagsarkar& M.S. Sukhiza, “Power System Analysis”, Oxford University Press

Department of Electrical Engineering
Course Structure for B.Tech. (EE)
Batch: 2016-20

Course Title: **Electrical Machine Design**	Course Code: **EA7030**
Credit: 3.5	L T P **3 1 0**
Year: **4th**	Semester: **VII**

UNIT 1

Introduction

Standards & standardization, Classification of insulating materials. Modes of heat dissipation & temperature rise-time curves. Methods of cooling ventilation (induced & forced, radial & axial), direct cooling & quantity of cooling medium.

UNIT 2

Design of Transformer

Output equation design of core, yoke and windings, overall dimensions, Computation of no load current to voltage regulation, efficiency and cooling system designs.

UNIT 3

Design of Synchronous Machines

Output equations of synchronous machines, specific electric and magnetic loadings, separation of main dimensions, Rotor design, Design of field system. Estimation of performance from design data.
Flow chart for design of three phase synchronous generators.

UNIT 4

Design of Induction Machines

Output equations , specific electric and magnetic loadings, factors affecting size of rotating machines, separation of main dimensions, selection of frame size, Rotor design of three phase induction motors. Circle diagram, Estimation of performance from design data. Flow chart for design of three phase induction motors

UNIT 5

Design of DC Machines & Computer Aided Design

Output equation, Main dimensions, Design of armature, commutator, flow chart for design of dc machines.
Philosophy of computer aided design, advantages and limitations. Computer aided design approaches analysis- , synthesis and hybrid methods.

Text Books:

1. A.K. Sawhney, “Electrical Machine Design”, DhanpatRai& Sons.
2. S. K. Sen, “Principles of Electrical Machine Design with Computer Programmes”, Oxford & IBH Pub. Company

Reference Books

1. M.G. Say, “Alternating Current Machines”, Pitman Publishing Company Ltd.
2.A.E. Clayton, “The Performance and Design of DC Machines”, Pitman Publishing Company Ltd.
3. H. Cotton, “Advanced Electrical Technology” Wheeler Publishing.

Department of Electrical Engineering
Course Structure for B.Tech. (EE)
Batch: 2016-20

EA7210: ELECTRIC DRIVES LAB

Note: - At least 8 experiments should be performed out of which 3 should be simulation based. The department may add 3 to 4 more experiments in the following list.

Hardware Based Experiments:

1. To study speed control of separately excited dc motor by varying armature voltage using single-phase fully controlled bridge convertor.
2. To study speed control of separately excited dc motor by varying armature voltage using single-phase half controlled bridge convertor.
3. To study speed control of separately excited dc motor using single-phase dual converter (Static Ward-Leonard Control)
4. To study speed control of separately excited dc motor using MOSFET/IGBT chopper.
5. To study closed loop control of separately excited dc motor.
6. To study speed control of single-phase induction motor using single-phase ac voltage controller.
7. To study speed control of three-phase induction motor using three-phase ac voltage controller.
8. To study speed control of three-phase induction motor using three-phase current source inverter.
9. To study speed control of three-phase induction motor using three-phase voltage source inverter.
10. To study speed control of three-phase slip ring induction motor using static rotor resistance control using rectifier and chopper.
11. To study speed control of three-phase slip ring induction motor using static scherbius slip power recovery control scheme.

Simulation Based Experiments (using MATLAB or any other software)

1. To study starting transient response of separately excited dc motor.
2. To study speed control of separately excited dc motor using single phase fully/half controlled bridge converter in discontinuous and continuous current modes.
3. To study speed control of separately excited dc motor using chopper control in motoring and braking modes.
4. To study starting transient response of three phase induction motor.

Department of Electrical Engineering
Course Structure for B.Tech. (EE)
Batch: 2016-20

Course Title: **High Voltage Engineering** (***Departmental Elective–I***)	Course Code: **EA7610**
Credit: 3.5	L **3** T **1** P **0**
Year: **4th**	Semester: **VII**

UNIT – 1

Break Down In Gases: Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law, breakdown in non- uniform field, breakdown in vacuum.

Break Down In Liquid Dielectrics: Classification of liquid dielectric, characteristics of liquid dielectric, breakdown in pure liquid and commercial liquid.

Break Down In Solid Dielectric: Intrinsic breakdown, electromechanical breakdown, breakdown of solid, dielectric in practice, breakdown in composite dielectrics.

UNIT – 2

Generation of High Voltage and Currents: Generation of High direct Current Voltage, Generation of high voltage alternating voltages, generation of impulse voltages generation of impulse currents, tripping and control of impulse generators.

UNIT – 3

Measurement of High Voltage and Currents: Measurement of High direct Current Voltages, Measurement of High alternating & Impulse voltages, Measurement of High direct, alternating & Impulse Currents, Cathode ray Oscillographs for impulse voltage and current measurements.

UNIT – 4

Over Voltage Phenomenon & insulation Coordination: Lighting Phenomenon as natural cause for over voltage, over voltage due to switching surges and abnormal conditions, Principal of insulation coordination.

UNIT – 5

Non -Destructive Testing: Measurement of direct current resistively, measurement of dielectric constant and loss factor, partial discharge measurements.

High voltage testing: Testing of insulator & bushing, testing of isolators and circuit breakers, testing of cables, testing of transformers, testing of surge arresters, radio interference measurements.

Text Book:

1. M.S. Naidu & V. Kamraju," High voltage Engineering, Tata Mc-Graw hill.

Reference books:

1. E Kuffel and W.S.Zacngal , High voltage Engineering:, Pergamum Press
2. M.P Churasia, High Voltage Engineering Khanna Publishers.
3. R.S. Jha,"High voltage Engineering", DhanpatRai& Sons.
4. C.L. Wadhwa,"High Voltage Engineering", Wiley Eastern Ltd.
5. M.Khalifa," High Voltage Engineering theory and practice, "Marcel Dekker.
6. Subir Ray." An Introduction to High Voltage Engineering" Prentice Hall of India.

Department of Electrical Engineering
Course Structure for B.Tech. (EE)
Batch: 2016-20

Course Title: **FACTS Devices** (***Departmental Elective–I***)	Course Code: **EA7620**
Credit: 3.5	L **3** T **1** P **0**
Year: **4th**	Semester: **VII**

UNIT – 1
FACTS: Concept, power flow and stability, basic theory of line compensation
Power Electronic Controllers: Review of PWM voltage source inverters used in FACTS, classifications of FACTS controllers.

UNIT – 2
Static Shunt Compensators: SVC and STATCOM- TCR, TSC, system stability.
Static Series Compensators: GCSC, TSSC, TCSC and SSSC, control techniques.

UNIT – 3
Static Voltage and Phase Angle Regulators: Power flow control, TCVR and TCPAR.
Unified Power Flow Controller (UPFC): Concept of power flow control, operation and control of UPFC, Interline Power Flow Controller.

UNIT – 4
Stability Analysis: Modeling of FACTS devices, optimization of FACTS, transient and dynamic stability enhancement

UNIT – 5
Applications of FACTS controller: Principle of control of FACTS in HVDC links, co- ordination of FACTS devices with HVDC links, case study. Advanced FACTS devices.

Text Books:

1. Hingorani N.G. and Gyugyi L., "Understanding FACTS", IEEE Press, Standard Publishers Distributors.
2. Ghosh A. and Ledwich G., "Power Quality Enhancement Using Custom Power Devices," Kluwer Academic Publishers.

Reference Books:

1. Song Y. H. and Johns A. T., "Flexible AC Transmission Systems (FACTS)", IEE Press.
2. Mathur R.M. and Varma R.K., "Thyristor–Based FACTS Controllers for Electrical Transmission Systems," John Wiley and Sons.
3. Padiyar K.R., "FACTS Controller in Power Transmission and Distribution", New Age International Private Limited.
4. Miller T.J.E., "Reactive Power Control in Electric Systems," Wiley-Interscience.

Department of Electrical Engineering
Course Structure for B.Tech. (EE)
Batch: 2016-20

Course Title: **Power Converter Applications** (***Departmental Elective–I***)			Course Code: **EA7630**
Credit: 3.5	L	T	P
	3	**1**	**0**
Year: **4th**			Semester: **VII**

UNIT – 1
HVDC Transmission:
Schematic diagram, modes of operation, twelve pulse line commutated converters, effect of source [59]inductance, control of HVDC converters, converter faults and protection, harmonic filters.

UNIT – 2
FACT Controllers:
Principle of power transmission, principles of shunt compensation and series compensation; Shunt compensators-TCR, TSC, SVC,STATCOM
Series compensators-TSSC, FCSC, TCSC, SSVC; Phase angle compensator, Unified power flow controller (UPFC), comparison of compensators.

UNIT – 3
Power Supplies:
Desirable specifications of power supplies, drawbacks of linear power supply.
Switch-Mode Power supply (SMPS)-schematic diagram, flyback converter, forward converter, push-pull converter, half bridge and full bridge converters; Uninterruptible power supply (UPS)-configurations of offline and on-line UPS, switch mode and resonant power supplies; air-craft power supply.

UNIT – 4
Industrial Applications:
High frequency inverters for induction and dielectric heating, ac voltage controllers for resistance heating and illumination control, high frequency fluorescent lighting, electric welding control.

UNIT – 5
Interconnection of Renewable Energy Sources to the Utility Grid:
Photovoltaic array interconnection, wind and small hydro interconnection, interconnection of energy storage systems; DC circuit breaker, single phase and three phase ac switches; Excitation control of synchronous generators.

Text Books:
1. Ned Mohan, T.M. Undeland and William P. Robins, "Power Electronics: Converters, Applications and Design", John Wiley & Sons.
2. M.H. Rashid, "Power Electronics: Circuits, Devices and Applications" Prentice Hall of India.

Reference Books:
1. K.R. Padiyar, "HVDC Power Transmission: Technology and System Reactions" New Age International

Department of Electrical Engineering
Course Structure for B.Tech. (EE)
Batch: 2016-20

Course Title: **Bio Instrumentation** (***Departmental Elective–I***)	Course Code: **EA7640**
Credit: 3.5	L **3** T **1** P **0**
Year: **4th**	Semester: **VII**

UNIT – 1

Basic Physiological system of body: Problem encountering measuring leaving system, bioelectric potential, biomaterial, Basic transducers principle, Active and passive transducers, transducer for biomedical applications, Generation, propagation and distribution of bioelectric potential (ECG, EEG and EMG)

UNIT – 2

Bio Potential Electrode: Basic type (micro skin surface and needle electrodes), Biochemical transducer (PH, blood gas and specification electrodes), Cardiovascular System & Measurement, Heat and cardiovascular system and circulation block diagram blood pressure and, measurement, characteristics of blood flow and heart sound, Electrocardiography, ECG an lead, configuration, ECG recording and their types

UNIT – 3

Nervous System: The anatomy of nervous system, neuronal communication, EPSP, IPSP, Organization of brain, Measurement from the nervous system, Systematic skin and body temperature measurement, Temperature measurement, Brief idea about ultrasonic measurements

UNIT – 4

Patient Care Monitoring: Element of intensive care, Organizational the hospital for patient-care monitoring, Pace makers-type, systems, mode and generators, Defibrillator-types. Biotelemetry and application of telemeter inpatient care

UNIT – 5

Automation of Chemical Test: Instrumentation for diagnostic X rays, Interfacing computer with medical instrumentation and other equipments, Bio medical computer application. Shock hazards from electrical equipments, methods of accident prevention.

Text Books:

1. Khandpur R.S. - Biomedical Instrumentation- TMH
2. Venkata Ram, S.K.-Bio-Medical Electronics & Instrumentation (Revised) - Galgotia.

Reference Books:

1. Cromwell- Biomedical Instrumentation and Measurements- PHI
2. Webster, J.G. –Bio- Instrumentation, Wiley (2004)
3. Ananthi, S. –A Text Book of Medical Instruments-2005-New Age International
4. Carr & Brown –Introduction to Biomedical Equipment Technology – Pearson
5. Pandey & Kumar-Biomedical Electronics and Instrumentation. - Kataria