SYLLABUS

FOR

B.TECH. PROGRAMME

IN

ELECTRICAL ENGINEERING

INSTITUTE OF TECHNOLOGY

ZAKURA CAMPUS
UNIVERSITY OF KASHMIR
SRINAGAR J&K, 190006
As Per BOS Held In August 2017

COURSE STRUCTURE
B.Tech 8thSemester ELE
University of Kashmir, Zakura Campus

Course Code	Course Title	Teaching Periods per week			Credits
		L	T	P	
ELE8117B	Industrial Drives & Control	3	1	0	4
HUM8217B	General Management & Economics	3	1	0	4
ELE8*17BE	Elective – III	3	1	0	4
ELE8417B	Major Project	2	6	10	13
	Total	11	9	10	25

Applicable To Batch 2016 & Onwards

ELE8*17BE:
*serial no of below mentioned subjects (e.g. for Advanced Power System; code is ELE80117BE)

Elective – I
01. Advanced Power System Analysis
02. Restructuring of Power System
03. HVDC System
04. Power System Dynamics & Stability

EIGHT SEMESTER

COURSE CODE: ELE-8117B

INDUSTRIAL DRIVES & CONTROL

Credits: 04

S. No.	Topic	No. of Hours
1.	Electrical Drives: Introduction, AC & DC Drives, Advantages, components, General applications	04
2.	Modelling of DC Machines: Theory of operation, Torque-speed characteristics revision, State-Space Modelling, Block Diagram & Transfer Function	06
3.	Control of DC Drives: Revision of speed control methods of DC motors, Controlled rectifier based drives, Modes of operation, Speed control & Drive classification, Closed Loop speed control of Drives	06
4.	Chopper Controlled DC Motor Drive: Introduction, Principle of operation of the Chopper, Four-quadrant Chopper Circuit, and Closed Loop Operation.	08
5.	Modelling of Induction Motor: Introduction, equivalent circuit of IM, Park's transformation, stator, rotor and synchronously rotating reference frame models, state space equations.	08
6.	Induction motor drive control: Introduction to scalar and vector control, direct and indirect vector control, principle of operation and control strategy (VSI, VSI fed drive, block diagram, controllers, etc.),	10
7.	Direct torque control, Sensorless control of AC drives	08
	Total	50

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Modern power electronics & AC drives	B K Bose	Pearson
2.	Vector Control and Dynamics of AC Drives	D W Novotny and T A Lipo	Oxford university press
3.	Sensorless Vector and Direct Torque Control	P Vas	Oxford university press
4.	Electric Motor Drives	R Krishnan	Prentice Hall India

COURSE CODE: HUM-8217B

GENERAL MANAGEMENT & ECONOMICS

Credits: 04

S. No.	Topic	No. of Hours
1.	IndustrialEconomics:Meaning &ImportanceofIndustrialization.Organizations – Varioustypesof organizations.Division ofEconomics: Microand MacroEconomics.	3
2.	ConsumptionandMarketStructure:LawandElasticity ofdemand–Consumer'ssurplus, Utility anditsmeasurement. Typesofmarketstructure–Perfect,Monopoly,Monopolisticand Oligopoly.DemandForecastingTechniques.Meaningandfactorsinfluencinglocationof IndustrialUnits,ScaleofProductionLarge VsSmallIndustrialUnits.	6
3.	Management:IntroductionofManagement, Nature,purposeanddefinitions.Processand functionsofManagementPlanning,Organizing,ActuatingandControlling,FunctionalArea sof management,Skills and roleofManagement.	5
4.	Planning:Natureandpurposeofplanning, Typesof Plans,StepsinPlanning Process.Objectives:TheNatureandimportanceofobjectives;Typesof objectives,primary,Secondary,individualandpersonalObjectives,Guidelinesforsetting objectives.	5
5.	DecisionMakingImportanceand limitationsofRationalDecisionMaking,typesofdecisions – Programmedandnon-programmeddecisions–processofDecisionMakingundercertainty, uncertainty andRisk.	4
6.	Organizing:Natureand PurposeofOrganizing:Steps in Organizing/Processof Organizing;Formaland informalorganization;SpanofControl&factorsdeterminingeffectivespan. DecentralizationofAuthority;Thenatureofdecentralization- Degreeofdecentralization. Decentralizationasphilosophy&Policy.	6
7.	DelegationofAuthority:Meaningof Authority/delegation steps intheprocessofdelegation, Factorsdeterminingthedegreeofdelegation. Artofdelegation.	3
8.	Line/StaffOrganization:Lineorganization,Stafforganization,LineandStafforganization, FunctionalandCommitteeOrganization,thenatureoflineandstaff relationship.Line/Staff Organization:Lineorganization,Stafforganization, LineandStafforganization,Functionaland CommitteeOrganization, thenature ofline andstaffrelationship.	6
9.	EssentialsofHumanResource management.Importance andfunctionsofHuman Resource Management.Importance ofHuman Resourceplanning,Recruitment,Selection, training andDevelopment,PerformanceAppraisal, Compensationpackages,promotions, Transfers,demotionandSeparationetc.	6
10.	Leadership:Meaning and importance,Leadershipqualities.Motivation: TheNeed–want–Satisfactionchain.Controlling: Natureandpurposeofcontrolling,Steps incontrolling/processofcontrolling, Typesofcontrols, Recruitmentsofeffectivecontrols.	6
	Total	50

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Industrial Organization and Management	Y. K. Bushan.	Sultan chand
2.	Principles of Management	A.K. Chatterjee.	-
3.	Principles of Management	George Terry.	R. D. Irwin
4.	Industrial Organization and Management	V.D. Sinha and Gad Gill.	-

5.	Principles of Management	Kroontz& O' Donnell	McGraw-Hill,
6.	Elementary Economics Theory	K.K. Dewett and J.D. Verma	S. Chand & Company
7.	An Introduction to Economics	M.L. Sethi	Sultan chand

COURSE CODE: ELE-8*17BE

ELECTIVE – III

Credits: 04

S. No.	Topic	No. of Hours
1.	Syllabi shown in Annexure-III	
Total		50

<p style="text-align:center">**COURSE CODE: ELE-8417B**</p>

<p style="text-align:center">**MAJOR PROJECT**</p>

<p style="text-align:center">**Credits: 13**</p>

Pre-project description

In the final project the students are required to extend the pre-project work for the final submission of the course. The final project work is to be carried out in the last semester of their respective fields of study. The supervisors will guide the students from the beginning of the pre-project in 7th semester to its accomplishment as a final project in the 8th semester.

The students will be asked to submit a project report (one copy per student) in a group. These reports will be evaluated in partial fulfilment for the award of the degree of bachelors of Technology in their respective branches of study

ANNEXURE I

UTILISATION & TRACTION

S. No.	Topic	No. of Hours
1.	Electric Drive: Factors governing selection of Electric drive. Control devices for industrial motors. Motors for particular services. Applications of Electric Drive.	06
2.	ELECTRIC TRACTION: Introduction, requirements of an ideal traction, systems of traction, speed time curve, tractive effort, co-efficient of adhesion, selection of traction motors, method of speed control, energy saving by series parallel control, ac traction equipment. Breaking methods used in Traction Motor, specific energy consumption and factors affecting it.	11
3.	INTRODUCTION TO ELECTRIC AND HYBRID VEHICLES: Configuration and performance of electrical vehicles, traction motor characteristics, tractive effort, transmission requirement, vehicle performance and energy consumption.	08
4.	ILLUMINATION: Laws of illumination, lighting calculation, factory lighting, flood lighting, street lighting, different types of lamps-incandescent, fluorescent, CFL and LED lamps and their working, comparison, Glare and its remedy	06
5.	HEATING AND WELDING: Advantages and methods of electric of heating, resistance ovens, induction heating, dielectric heating, the arc furnace, heating of building. Electric welding, resistance and arc welding, control devices and welding equipment.	08
Total		39

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Utilization Of Electric Energy,	E Openshaw Taylor	12th Impression, 2009, Universities Press
2.	Modern Electric, Hybrid Electric and Fuel Cell Vehicles,	E. Gay, Mehrdad, Ehsani, YiminGao, Sabastien.	Ali Emadi- CRC Press.
3.	Art & utilization of Electric Energy	H. Partab	Bhandari Benevolent & Educational Society
4.	Utilization of Electric Power & Electric Traction	J.B Gupta	S. K. Kataria& Sons

POWER STATION PRACTICE

S. No.	Topic	No. of Hours
1.	Economic A spects and power factor improvement: Economics of generation, factors affecting the cost of generation, reduction of costs by interconnection of stations, curves useful in system operation, choice of size and number of generating units. Power factor, disadvantages of low power factor, methods of improving power factor, location of power factor improvement apparatus, and economics of power factor improvement.	10
2.	Power Tariff: Cost ofgeneratingstation,fixedcapital,runningcapital,annualcost,runningcharges, fixed charges, factors influencing the rate of tariff, designing tariff, different types of tariff, flat rate tariff, block rate tariff, two part tariff, maximum demand tariff, power factor tariff.	10
3.	Neutral Grounding: Neutral grounding, solid grounding, resistance grounding, reactance grounding, arc suppression oil grounding, earthing transformers, choice of methods of neutral grounding equipment, grounding for safety.	07
4.	Overview of different types of power stations and their auxiliaries: Thermal power plants, hydroelectric stations, nuclear power stations, diesel power stations, gas turbine plants	07
5.	Overview of substations and substation equipment	05
Total		39

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Elements of Electrical Power Station Design	Deshpande	PHI learning
2.	The Art and Science of Utilisation of Electric Energy	H. Pratab	DhanpatRai& Co
3.	Substation Design and Equipment	Satnam	DhanpatRai
4.	A Course in Electrical Power	Soni, Gupta and Batnagar	DhanpatRai& Co

HIGH VOLTAGE ENGINEERING

S. No.	Topic	No. of Hours
1.	CONDUCTION AND BREAKDOWN IN GASES: Gases as insulators, ionization, current growth, Townsend's criterion for breakdown, electro-negative gases, Paschen's Law, Streamer breakdown mechanism, corona discharges, post breakdown phenomena, practical considerations in using gases for insulating materials.	08
2.	CONDUCTION AND BREAKDOWN IN LIQUID DIELECTRICS: Classification of liquid dielectrics, conduction and breakdown in pure liquids and in commercial liquids.	04
3.	BREAKDOWN IN SOLID DIELECTRICS: Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, breakdown of composite insulation, solid dielectric used in practice.	05
4.	APPLICATIONS OF INSULATING MATERIALS IN DIFFERENT ELECTRICAL APPARATUS: Applications in power transformers, rotating machines, circuit breakers, cables, power capacitors, electronic equipment.	03
5.	GENERATION OF HIGH VOLTAGES AND CURRENTS:Generation of high d.c. and a.c. voltages, generation of impulse voltages and currents.	07
6.	MEASUREMENT OF HIGH VOLTAGES AND CURRENTS: Measurement of high d.c., a c. and impulse voltages, Measurement of high d.c., a.c and impulse currents.	05
7.	NON DESTRUCTIVE TESTING: Measurement of d.c. resistivity, dielectric constant and loss factor, partial discharge measurement.	04
8.	TESTING OF ELECTRICAL APPARATUS: Testing of insulators, bushings, isolators, circuit breakers, cables, transformers and surge diverters.	03
Total		39

TextBooks:

S. No	Name of Book	Author	Publisher
1.	High Voltage Engineering Fundamentals	E. Kuffel, W.S Zaengl	Newnes
2.	High Voltage Engineering	M.S. Naidu, V. Karamraju	Tata McGraw-Hill
3.	High voltage test techniques	Dieter kind, Kurt Feser.	Newnes
4.	An Introduction to High Voltage Engineering	Subir Ray.	Prentice Hall of India

ADVANCED CONTROL SYSTEM

S. No.	Topic	No. of Hours
1.	Introduction: State-space representation of nonlinear systems, Basic characteristics of nonlinear systems, methods of analysis of non-linear systems and comparison	5
2.	Concept of phase plane, singular points, phase trajectory, phase portraits, methods of plotting phase plane trajectories Vander Pol's equation, stability from phase portrait, time response from trajectories, Isocline method, Delta method of phase trajectory construction,	7
3.	Describing function analysis, The principle of harmonic balance. Describing functions for various nonlinearities, Stability of limit cycles by describing function method, Limit cycle analysis of control systems.	12
4.	Lyapunov's Stability Theorem, Mathematical preliminaries, Lyapunov's direct method, Definite functions, Lyapunov's equation for time-invariant systems, Stability conditions for time varying systems, Lyapunov's linearization (indirect) method	15
	Total	39

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Nonlinear Control Systems: Analysis and Design	H. J. Marquez	John Wiley Inter-science
2.	Nonlinear Systems Analysis	M. Vidyasagar	SIAM
3.	Nonlinear Systems	H. K. Khalil	Prentice Hall

ANNEXURE II

FLEXIBLE AC TRANSMISSION SYSTEM

S. No.	Topic	No. of Hours
1.	Introduction to FACTS	3
2.	Voltage-Sourced Converters: Single-Phase Full-Wave Bridge Converter Operation, Square-Wave Voltage Harmonics for a Single-Phase Bridge, Three-Phase Full-Wave Bridge Converter , Multipulse converters, Transformer Connections for 12-Pulse, 24-pulse and 48 pulse Operation, Fundamental and Harmonic Voltages for a Three-Level Converter, Pulse-Width Modulation (PWM) Converter	6
3.	Voltage stability and voltage collapse	2
4.	Static Shunt Compensators: Objectives of Shunt Compensation, Methods of Controllable VAR Generation, Static VAR Compensators: SVC and STATCOM, Comparison Between STATCOM and SVC	6
5.	Static Series Compensators (GCSC, TSSC, TCSC, and SSSC):Objectives of Series Compensation, Variable Impedance Type Series Compensators, Switching Converter Type Series Compensators	7
6.	Static Voltage and Phase Angle Regulators (TCVR and TCPAR): Objectives of Voltage and Phase Angle Regulators, Approaches to Thyristor-Controlled Voltage and Phase Angle Regulators, Switching Converter-Based Voltage and Phase Angle Regulators, Hybrid Phase Angle Regulators	6
7.	Combined Compensators (Unified Power Flow Controller (UPFC) and Interline Power Flow Controller (IPFC)): Introduction, basic principle operation, control structure and applications.	7
8.	Introduction to Special Purpose Facts Controllers: NGH-SSR Damping Scheme and Thyristor-Controlled Braking Resistor	2
	Total	39

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Understanding FACTS	Narain G. Hingorani, Laszlo Gyugyi,	Wiley
2.	FACTS Controllers In Power Transmission And Distribution	K R Padiyar	New Age International Publishers

SCADA &ENERGY MANAGEMENT

S. No.	Topic	No. of Hours
1.	Introduction to SCADA, advantages, general structure, data acquisition, transmission & monitoring. General power system hierarchical Structure. Overview of the methods of data acquisition systems, commonly acquired data, transducers, RTUs, data concentrators, various communication channels- cables, telephone lines, power line carrier, microwaves, fibre optical channels and satellites.	8
2.	Supervisory and Control Functions:Data acquisitions, status indications, majored values, energy values, monitoring alarm and event application processing. Control Function: ON/ OFF control of lines, transformers, capacitors and applications in process in industry - valve, opening, closing etc. Regulatory functions: Set points and feedback loops, time tagged data, disturbance data collection and analysis. Calculation and report preparation.	9
3.	MAN- Machine Communication: Operator consoles and VDUs, displays, operator dialogues, alarm and event loggers, mimic diagrams, report and printing facilities.	7
4.	Data basis-SCADA, EMS and network data basis. SCADA system structure - local system, communication system and central system. Configuration- NON-redundant- single processor, redundant dual processor. Multi-control centers, system configuration. Performance considerations: real time operation system requirements, modularization of software programming languages.	8
5.	Energy Management Center: Functions performed at a centralized management center, production control and load management economic dispatch, distributed centers and power pool management	7
6.		
Total		39

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Power System Control Technology.	TorstenCergrell	Prentice Hall International
2.	Computer Aided Power System Analysis	George L Kusic	Prentice Hall of India
3.	Power Generation Operation and Control	A. J. Wood and B. Woolenberg	John Wiley & Sons
4.	Switchgear Protection & Control System	Sunil S Rao	Khanna Publishers

SPECIAL ELECTRICAL MACHINES

S. No.	Topic	No. of Hours
1.	SYNCHRONOUS RELUCTANCE MOTORS: Constructional features – Types – Axial and Radial flux motors – Operating principles – Variable Reluctance Motors – Voltage and Torque Equations - Phasor diagram - performance characteristics – Applications	09
2.	STEPPER MOTORS: Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi-stack configurations – Torque equations – Modes of excitation – Characteristics – Drive circuits – Microprocessor control of stepper motors – Closed loop control-Concept of lead angle – Applications	10
3.	PERMANENT MAGNET BRUSHLESS D.C. MOTORS: Permanent Magnet materials – Minor hysteresis loop and recoil line-Magnetic Characteristics – Permeance coefficient -Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations –Commutation - Power Converter Circuits and their controllers – Motor characteristics and control– Applications.	10
4.	PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM): Principle of operation – Ideal PMSM – EMF and Torque equations – Armature MMF – Synchronous Reactance – Sine wave motor with practical windings - Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements– Applications.	10
Total		39

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Electric Machinery	Fitzgerald, Kingslay, Umans	Tata McGraw-Hill
2.	Electric Machinery Fundamentals	Chapman	McGraw-Hill Higher Education
3.	Electric Machines	Nagrath and Kothari	Tata McGraw-Hill

ANNEXURE III

ADVANCED POWER SYSTEM ANALYSIS

S. No.	Topic	No. of Hours
1.	Revision of Newton Raphson, Gauss Siedel method, Fast decoupled load flow.	06
2.	DC power flow : Single phase and three phase, AC-DC load flow, DC system model, Sequential Solution Techniques, Extension to Multiple and Multi-terminal DC systems, DC convergence tolerance, Test System and results.	12
3.	Fault Studies, Analysis of balanced and unbalanced three phase faults, fault calculations.	08
4.	System optimization, strategy for two generator systems, generalized strategies, effect of transmission losses, Sensitivity of the objective function, Formulation of optimal power flow, solution by Gradient method-Newton's method.	12
5.	State Estimation, method of least squares, statistics, errors, estimates, test for baddata, structure and formation of Hessian matrix, power system state estimation.	12
Total		50

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Power System Analysis	Grainger, J.J. and Stevenson, W.D.	Tata McGraw hill
2.	Computer analysis of power systems	Arrillaga, J and Arnold, C.P.	John Wiley and Sons
3.	Computer Techniques in Power System Analysis	Pai, M.A.	Tata McGraw hill

RESTRUCTURING OF POWER SYSTEM

S. No.	Topic	No. of Hours
1.	Introduction to restructuring of power industry.	02
2.	Fundamentals of Economics.	05
3.	The Philosophy of Market Models.	06
4.	Transmission Congestion Management.	07
5.	Locational Marginal Prices (LMP) and Financial Transmission Rights (FTR).	07
6.	Ancillary Service Management.	06
7.	Pricing of transmission network usage and loss allocation.	07
8.	Market power and generators bidding.	06
9.	Reforms in Indian power sector.	04
	Total	50

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Fundamentals of Power System economics	Daniel Kirschen and GoranStrbac	John Wiley & Sons
2.	Operation of restructured power systems	Kankar Bhattacharya, Jaap E. Daadler, Math H.J Bollen, Kluwer	Academic Pub.

HVDC SYSTEM

S. No.	Topic	No. of Hours
1.	Introduction to HVDC and comparison with AC transmission	2
2.	HVDC Operation-Converters and Inverters	5
3.	HVDC- different control schemes	6
4.	AC-DC interaction	6
5.	Harmonics Analysis and elimination	4
6.	Filter Design	5
7.	Multi-Terminal HVDC	4
8.	HVDC protection methods	6
9.	Modeling of HVDC links	4
10.	AC-DC Power flow solution	4
11.	HVDC light	4
Total		50

TextBooks:

S. No	Name of Book	Author	Publisher
1.	HVDC Power Transmission Systems,	K.R. Padiyar	New Age International
2.	Power System Stability and control	PrabhaKundur	Tata McGraw-Hill

POWER SYSTEM DYNAMICS & STABILITY

S. No.	Topic	No. of Hours
1.	Introduction to Power System Stability	04
2.	Analysis of Dynamical Systems	08
3.	Modeling of a Synchronous Machine	10
4.	Modeling of Excitation and Prime Mover Systems	05
5.	Modeling of Transmission Lines and Loads	05
6.	Stability Issues in Interconnected Power Systems	08
7.	Power System Stability Analysis Tools	05
8.	Enhancing System Stability	05
Total		50

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Power System Stability and Control,	P.Kundur	McGraw Hill Inc
2.	Power System Dynamics & Stability	P.Sauer&M.A.Pai	Prentice Hall
3.	Power System Dynamics, Stability & Control	K.R.Padiyar	B.S. Publications,