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 7th Semester ELE
University of Kashmir, Zakura Campus

Course Code	Course Title	Teaching Periods per week			Credits
		L	T	P	
ELE7117B	Power System Protection	2	1	0	3
ELE7217B	Advanced Power Electronics	2	1	0	3
ELE7317B	Power System – III	2	1	0	3
ELE7*17BE	Elective – I	2	1	0	3
ELE7*17BE	Elective – II	2	1	0	3
ELE7417B	Industrial Training & Viva*	0	0	0	1
ELE7517B	Pre - Project	2	2	2	5
ELE7117BL	Power System Protection Lab	0	0	4	2
ELE7617BL	Computer Aided Power System Design Lab	0	0	4	2
Total		12	7	10	25

*** Industrial Training has to be covered up in winter (or summer) vacations. It is a One credit course.**
ELE7*17BE:
***serial no of below mentioned subjects (e.g. for Utilisation & Traction; code is ELE70117BE)**

Elective – I
01. Utilisation & Traction
02. Power Station Practice
03. High Voltage Engineering
04. Advanced Control System

Elective – II
05. Flexible AC Transmission System (FACTS)
06. SCADA & Energy Management
07. Special Electrical Machines

Applicable To Batch 2016 & Onwards

SEVENTH SEMESTER

COURSE CODE: ELE-7117B

POWER SYSTEM PROTECTION

Credits: 03

S. No.	Topic	No. of Hours
1.	**PROTECTIVE RELAYING:** Function, fundamental principle, primary and backup relaying, characteristics	02
2.	**CLASSIFICATION OF RELAYS:** Operating principles and characteristics of the following electromechanical relays: Current, voltage, directional, current balance, voltage balance, differential relays, and distance relays.	06
3.	**PROTECTION OF GENERATORS:** Short- circuit protection of stator windings, protection against turn-to-turn fault, stator ground-fault protection, stator open circuit protection.	06
4.	**TRANSFORMER PROTECTION:** Short circuit protection, over current and earth-fault protection differential protection. Use of biased relay for differential protection, Buchholz relay, protection of parallel transformer banks	05
5.	**PROTECTION OF FEEDERS, BUSBARS AND TRANSMISSION LINES:** Protection of feeders, time limit fuse, over current protection for radial feeders, protection of parallel feeders, differential protection for parallel feeders, protection of ring mains, differential pilot wire protection, Circulating current protection, protection for bus-bars, frame leakage protection, differential protection, for bus bars, protection for double bus-bar system, transmission line protection, using over-current relays, using distance relays. Setting of over-current and distance relays, coordination of relays. Phase fault and earth fault protection.	07
6.	**FUSES:** Fusing element, classification of fuses, current carrying capacity of fuses, high rupturing capacity, characteristics of H.R.C. fuses, selection of HRC fuses.	04
7.	**CIRCUIT BREAKERS:** Types of circuit breakers , basic principle of operation, phenomena of arc, initiation, maintenance &arc extinction, d. c. circuit breaking, a.c. circuit breaking, arc voltage and current waveforms in a.c. circuit breaking, restriking and recovery voltages, de-ionization and current chopping, ratings of circuit breakers, oil circuit breakers, air blast circuit breakers, SF6 Circuit breakers , Vacuum breakers.	09
Total		39

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Art and Science of Protective Relaying	Mason	John Wiley & Sons
2.	Protective relaying, Principles and Applications	J. L Black Burn	CRC Press
3.	Computer Relaying for Power Systems	A.G. Phadke and J.S Thorp	John Wiley and sons New York

COURSE CODE: ELE-7217B

ADVANCED POWER ELECTRONICS

Credits: 03

S. No.	Topic	No. of Hours
1.	dc-dc switched mode converters: introduction, control of dc-dc converters, Continuous and discontinuous conditions of buck, boost and buck-boost converters, Cuk dc-dc converter, full bridge dc-dc converter	6
2.	Introduction to switched dc power supplies, Flyback converter, forward and push-pull converter	4
3.	Cascaded H-Bridge Multilevel Inverters: Introduction, Bipolar and unipolar for H-Bridge Inverter, Multilevel Inverter Topologies, Carrier-Based PWM Schemes, Staircase Modulation, Applications	7
4.	Diode-Clamped Multilevel Inverter: Introduction, Three-Level Inverter, Neutral-Point Voltage Control, Carrier-Based PWM Scheme, other modulation schemes, Applications	6
5.	Other Multilevel Voltage Source Inverters: Introduction, Multilevel Flying-Capacitor Inverter, Modular Multilevel Converter, Applications	4
6.	Grid synchronization of single phase power converters: grid synchronization using Fourier analysis and PLL, phase detection based on in-quadrature signals, Enhanced PLL, second order generalized integrator PLL, introduction to grid synchronization of three phase power converters.	6
7.	Power quality problems and Custom power devices (DSTATCOM, DVR, UPQC):principle of operation, classification, controls and applications	6
Total		39

TextBooks:

S. No	Name of Book	Author	Publisher
1.	High-Power Converters and AC Drives	Bin Wu	Wiley
2.	Power Electronics - converters, Applications, and Design	Ned Mohan, Tore. M. Undeland, William P. Robbins	Wiley
3.	Power Quality: Problems and Mitigation Techniques	Bhim Singh, Ambrish Chandra and Kamal Al-Haddad	John Wiley & Sons
4.	Grid converters for photovoltaic and wind power systems,	Remus Teodorescu, Marco Liserre and Pedro Rodríguez,	John Wiley & Sons

COURSE CODE: ELE-7317B

POWER SYSTEM – III

Credits: 03

S. No.	Topic	No. of Hours
1.	**Load Flows:**Nature and importance of the problem, Network model formulation, algorithm for the formulation of Y-bus matrix, formulation of Y-bus by singular transformation, primitive network, Bus incidence matrix, load flow problem, load flow equations, bus classification – List of variables in load flow equations, Gauss - Seidel & Newton-Raphson method for solving load flow problem, comparison of load flow methods, De-coupled & Fast de-coupled power flow method, Modeling of tap-changing transformers and phase-shifters	10
2.	**Power System Stability:**The stability problem, steady state, dynamic and transient stability, rotor dynamics and swing equation, power- angle curve, equal-area criterion of stability, Numerical solution of swing equation, Factors affecting transient stability.	07
3.	**Automatic Generation Control:**Real power balance and its effect on system frequency, load frequency control of single area system – Models of speed governing system, turbine and generator load, steady state analysis and dynamic response, proportional plus integral control, two area load frequency control, economic dispatch control.	08
4.	**Control of voltage and Reactive Power:**Generation and absorption of reactive power, Relation between voltage and reactive power, Need for voltage control at various system buses, Methods of voltage control – injection of reactive power, tap changing transformers, booster transformers, phase – shift transformers	08
5.	**Economic Operation of Power System:**Introduction, system constraints, economic dispatch neglecting losses, penalty factor, economic dispatch with losses, transmission loss equation, automatic load dispatching.	06
Total		39

TextBooks:

S. No	Name of Book	Author	Publisher
1.	Power System Analysis	J.J. Grainger and W.D Stevenson	Tata McGraw-Hill
2.	Electrical Power Systems	B.M. Weedy and Cory	John Wiley & sons.
3.	Power Systems Engineering	Nagrath and Kothari	McGraw-Hill Education
4.	Electric Power Systems	C.L. Wadlhwa	New Age Publications
5.	Electric Energy System Theory	O. I Elgard	McGraw-Hill

COURSE CODE: ELE-7*17BE

ELECTIVE – I

Credits: 03

S. No.	Topic	No. of Hours
1.	Syllabi shown in Annexure-I	
Total		39

COURSE CODE: ELE-7*17BE

ELECTIVE – II

Credits: 03

S. No.	Topic	No. of Hours
1.	Syllabi shown in Annexure-II	
Total		39

COURSE CODE: ELE-7417B

INDUSTRIAL TRAINING & VIVA

Credits: 01

Practical /Industrial Training/Internship:

The students have to undergo a minimum four week practical training/internship/industrial training at 7^{th} semester level in any relevant industrial organization. The students will be asked to submit a Practical training 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.

COURSE CODE: ELE-7517B

PRE-PROJECT

Credits: 05

Pre-project description

The pre-project work is carried out by students in a group. The group comprises of a minimum of three and a maximum of five students. The number of students in a group depends on the type and scale of project being undertaken. In the pre project work students shall choose a specific topic/area for the project. The selected areas shall encompass recent and emerging trends in technologies that prove beneficial for society in general and humanity in particular. Supervisors will be assigned to each group in the beginning of the 7^{th} semester of their course. Each student at the end of the course will submit a Project report and a working prototype or simulation regarding the project and the same will be evaluated for final award of the course. The pre-project can be a full-fledged project or a part of major project.

COURSE CODE: ELE-7117BL

POWER SYSTEM PROTECTION LAB

Credits: 02

S. No.	Experiment
1.	Study of various types of relays.
2.	Characteristics of fuses.
3.	Characteristics of inverse time over current relays
4.	Time graded protection using inverse time O/C relay
5.	Study of circuit breakers.
6.	Study of differential protection scheme.
7.	Study of an oil circuit breaker.
8.	Operating quantity versus polarizing quantity characteristic of a directional attracted Armature relay.

COURSE CODE: ELE-7617BL

COMPUTER AIDED POWER SYSTEM DESIGN LAB

Credits: 02

S. No.	Experiment
1.	Introduction, Modeling of Power System Components,
2.	Power FlowEquations,
3.	Formation of Ybus Matrix
4.	Power Flow Solution Algorithms,
5.	Newton Raphson Load FlowMethod,
6.	Fast Decoupled Load Flow Method
7.	DC Load Flow Method,
8.	AC-DC System Power Flow Analysis-
9.	Sequential and Simultaneous Solution Algorithms