TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

4-Year Bachelor of Technology (B.Tech.) Curriculum and Syllabus for Electrical Engineering (EE)

Fifth Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-UTR-T301	Career Advancement &Skill Development	2	1	0	3
TIU-UEE-T303	Digital Electronic Circuits	3	0	0	3
TIU-UEE-T305	Electrical Power Systems I	3	1	0	4
TIU-UEE-T307	Control Systems Engineering	3	1	0	4
TIU-UEE-T309	Electrical Machines II	3	1	0	4
TIU-UCS-T311	Computer Organization &Architecture	3	0	0	3
Practical					
TIU-UEE-L303	Digital Electronic Circuits Lab	0	0	3	2
TIU-UEE-L305	Electrical Power Systems Lab I	0	0	3	2
TIU-UEE-L307	Control System Engineering Lab	0	0	3	2
TIU-UEE-L309	Electrical Machines Lab II	0	0	3	2
Sessional					
TIU-UES-S399	Entrepreneurship Skill Development	0	0	2	2
Total Credits					31

Detailed Syllabus

Career Advancement & Skill Development
TIU-UTR-T301
LTP: 2-1-0
Credits: 3

The detailed syllabus to be provided by the Department of Training & Placement.

Digital Electronic Circuits
TIU-UEE-T303

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

LTP: 3-0-0
Credits: 3

Basic Digital Logic: Characteristics of TTL, LSTTL, CMOS and HCMOS Logic Families; Tri-State Logic. Number Systems: Different Number Systems; Addition, subtraction, multiplication and division methods. Combinational Logic: Implementation using Gates; Minimization of gates using K-Map. Sequential Logic: RS, JK, T and D Flip Flops; Counters; Cascading of Counters; Shift Registers with Serial and Parallel Inputs and Outputs; Cascading of Shift Registers; Latch, Encoder, Decoder and Display Drivers.

Recommended Textbooks

- Digital Electronics: Mano
- Digital Electronics: Anand Kumar
- Digital Electronics: Malvino

Electrical Power Systems I
TIU-UEE-T305
LTP: 3-1-0
Credits: 4

Structure of Power System – Generation, transmission and distribution. Power generating stations – different types. Steam power stations: Main parts and working, types of boilers and their characteristics. Characteristics of steam turbines and alternators. Main flow circuits of steam power station. Power station auxiliaries, cooling system of alternators. Starting up and shut down procedures of thermal units.

Gasturbinepower stations- Main parts, plant layout and Bryton cycle operation. Combined cycle generation & Co-generation.

Nuclear power stations- Layout of nuclear power station, types of power reactors, main parts and control of reactors, nuclear waste disposal, radioactivity and hazards.

Hydroelectric stations: Arrangement and location of hydroelectric stations, principles of working, types of turbines and their characteristics, Pumped storage plants.

Coordination of operation of different power stations .

Substation - Classification of substations, Major equipments in Substation, Busbarlayouts. Power distribution system: Primary and secondary distribution, types of conductors in distribution system, comparison of distribution systems. Distributor design,radial and ring main, current and voltage profiles along a distributor, economics of feeder design.

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

Electrical wiring and installation - Domestic, commercial and industrial wiring, estimation of main, submain and subcircuit wiring. Earthing practice. Testing of installation. Special lighting connections. Conductors, Fuse and disconnecting devices.

Administrative aspects of electricity supply- Development of power sector in India.
Administrative set up and organisations in power sector. Stages involved in power planning- load analysis, load management & load forecasting. Legal aspects of electricity supply- Electricity acts, rules and codes. Standards followed in power supply, environmental and safety measures. Commercial aspects of electricity supply – Expenditure in power Utility. Factors influencing tariffs, types of consumers, different types of tariffs. IE rule etc.

Insulators – Materials of insulators, types of insulators – Pin and Disc type – their applications. Underground Cables – Construction of cables, single and multicore cables, different types, capacitance of belted cables, dielectric loss in cables, heating of cables.

Transmission line parameters – Resistance, Inductance, Capacitance and Conductance.Inductance of single phase line, inductance of three phase line with symmetrical and unsymmetrical spacing, concept of GMD and GMR . Inductance of composite conductor systems – stranded conductors, bundle conductor and Double circuit lines . Capacitance of single phase line, capacitance of three phase lines with symmetrical and unsymmetrical spacings, capacitance calculation for double circuit line and bundle conductor. Effect of earth on capacitance calculation. Skin effect and proximity effect. Line representation – Representation of short, medium and long lines, Pai and T models. A,B,C,D constants of transmission lines and their measurement. Travelling wave interpretation of long line equations, tuned lines. Transmission line structure- Types of conductors, line supports – poles, towers, struts & Guy wires, sag and tension calculations, stringing chart, sag template.

Recommended Textbooks

- Power System Engineering: I.J.Nagrath & D.P.Kothari
- A Course in Power System: JB Gupta
- Electrical Power Systems: Wadhwa
- Power System Analysis: J.J.Grainger & W.D.Stevension

Control Systems Engineering
TIU-UEE-T307
LTP: 3-1-0
Credits: 4

Introduction to Control Systems: Classification of control systems with examples.Properties of Control Systems: Stability, steady-state & transient errors, disturbance rejection, insensitivity and robustness. Errors and Error constants, System types.

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

Time response of system: Time domain specifications, Ramp response of second order system, concept of dominant poles, Time response with NMP zeros.Review of frequency domain methods: Bode and Nichols plots. Frequency DomainSpecifications in open loop and closed loop and their significance, Concept of Bandwidth(3 dB BW & 90 degree BW) and Cut-off frequency, Effect of addition of poles and zeros on Bandwidth. Control system components: Position and velocity sensors and encoders, servomotors and voice coil actuators.

Basic Control actions: Proportional, integral, derivative, and their combinations.Design and compensation of control systems in frequency domain: Lag compensator, lead compensator, lead-lag compensator and lag-lead compensator.

Review of Matrix Algebra: Rank of matrix, Generalised matrix inverse, eigenvalues, eigenvector, computation of function of matrix.

Stability of linear systems: Routh-Hurwitz criterion, Nyquist criterion. Stability margins.
Root locus analysis. Effects of system gain and additional pole-zeros on stability.
Block diagram representation of control systems: Block diagram reduction and signal flow graph analysis.

State variable analysis: Concept of state, state variable, state model. State variable formulation of control system, diagonalization, Relating transfer function with state model. Time response of state model of linear time-invariant system. Alternative representations in state space (cascade form, parallel form, controllable canonical form, observable canonical form). Elementary concept of controllability & observability.

Overview of Non-linear systems. Phase plane method. Construction of phase Trajectories.
System Analysis on phase plane. Optimal switching in Bang-Bang Control Systems. Describing Functions. Limit Cycles.

Recommended Textbooks

- Modern Control Systems: Dorf, Bishop
- Modern Control Engineering: Ogata
- Control Systems: Ramesh Babu
- Control System Engineering: S. Salivahanan
- Benjamin C. Kuo, Digital Control Systems, Holt-Saunders International Edition.

Electrical Machines II
TIU-UEE-T309
LTP: 3-1-0
Credits: 3

Synchronous machines: Constructional features and types; Operation of synchronous generators and motors connected to bus and phasor diagrams for normal, under and over excited conditions; Power and

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

torque characteristics and capability curves. Parallel operation. Salient pole synchronous machine - phasor diagram and determination of synchronous reactances; starting and speed control of synchronous motors.

Three-phase induction motor : Construction of IM and materials used. Squirrel cage and Slip-ring rotor construction. Operating principle ; slip. Per-phase equivalent circuit. Phasor diagram. Equations for torque. Torque-speed & torque-slip characteristics. Effect of change in rotor resistance in slip-ring machine and slip power recovery. Deep bar and Double cage rotor. Pole changing motor. Methods of starting and speed control.
No-load and blocked rotor test : determination of equivalent circuit parameters. Separation of losses. Circle diagram.Space harmonics : Crawling & cogging.Tests as per standards.Operation of the induction machine as a generator.

Single Phase AC motors: Single Phase induction motor÷,Double revolving field theory and development of equivalent circuit. Methods of starting using auxiliary winding; selection of capacitor value during starting and running.

Recommended Textbooks

- Performance and Design of Alternating Current Machines: M.G. Say
- Performance and Design of DC machines: Clayton & Hancock.
- Electrical Machinery : P. S. Bimbhra
- Electric Machines : I. J. Nagrath & D. P. Kothari
- Electrical Machines: A. Hussain
- Electrical Machines: A. Chakrabarti

Computer Organization & Architecture
TIU-UCS-T311
LTP: 3-0-0
Credits: 3

The detailed syllabus to be provided by the Department of Computer Science.