



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

Seventh Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-UEE-T401	Career Advancement & Skill Development	2	1	0	3
TIU-UEE-T403	Power System Protection & Switchgear	3	1	0	4
TIU-UEE-T405	Power Electronics & Drives	4	0	0	4
TIU-UEE-T407	Digital Signal Processing	3	1	0	4
TIU-UMG-T401	Industrial Management	3	0	0	3
Practical					
TIU-UEE-L403	Digital Signal Processing Lab	0	0	3	2
TIU-UEE-L405	Power Electronics & Drives Lab	0	0	3	2
TIU-UEE-L407	Power System Protection & Switchgear Lab	0	0	3	2
Sessional					
TIU-UES-S499	Entrepreneurship Skill Development	0	0	2	2
TIU-UEE-I499	Project Work-I	0	0	2	2
TIU-UEE-P499	Industrial Training	0	0	2	2
Total Credits					30

Detailed Syllabus

Career Advancement & Skill Development

TIU-UEE-T401

LTP: 2-1-0

Credits: 3

High voltage power transmission and distribution. Insulators: Type of insulators and their applications, voltage distribution and string efficiency of disc insulators. Corona: Theory of corona formation, corona loss and radio interference. Overvoltage phenomena: Lightning and switching surges. Travelling waves:



Reflection and refraction w.r.t. different type of line terminations. Overvoltage protection: Grounding practice and overvoltage due to earth fault, lightning arresters and surge suppressors. Insulation coordination scheme of open-air substation. High voltage cables: Single core, belted, XLPE and gas-filled. Inter-sheath grading. Requirement of extra high voltage cables. Bushings: Non-condenser and condenser bushings, field distribution. Statistical Methods Generation of High AC Voltage – Testing transformer and its cascade connection, single-phase series resonance circuit, Generation of High DC Voltage – Single-stage and multi-stage symmetric as well as asymmetric voltage multiplier circuits, Generation of Impulse Voltage – Single-stage and multi-stage impulse generators circuits, Triggering and synchronization with CRO Measurement of Peak value of high AC Voltage – Frequency dependent method: Chubb & Fortescue Method, Frequency independent methods: Davis-Bowdler Method, Rabus Method, Sphere-Gap Method Measurement of RMS value of high AC Voltage – Capacitive Voltage Transformer, Potential Dividers, Electrostatic Voltmeter Measurement of High DC Voltage – Ammeter in series with high resistance Measurement of Dielectric Loss-factor – High Voltage Schering Bridge High Voltage type tests of insulators, Impulse test of transformers as per relevant Indian standards.

Recommended Textbooks

- High Voltage Engineering – Kuffel and Zaengl
- High Voltage Measurement Techniques– A.J.Schwab
- High Voltage Engineering –D.V.Razevig 4. High Voltage Engineering – Naidu & Kamaraju

Power System Protection & Switchgear

TIU-UEE-T403

LTP: 3-1-0

Credits: 4

Analysis of asymmetrical faults in power system. General requirements of circuit breakers. Auto-reclosing feature – three pole & single pole autoreclosing. Formation of electric arc. Arc build-up and quenching theory, recovery voltage and RRRV, Arc restriking phenomena. Problems of capacitive and low inductive current interruptions.

Rating of circuit breakers and effect of transient current on it. Different types of arc quenching media and special devices for arc quenching. Different types of circuit breakers - their relative merits and demerits. Specific field of usage. Testing of circuit breakers. D.C circuit breaking. Fundamental principles of protective relays, their properties and block diagrams. Single input relays, overcurrent, earth fault and over voltage relays. Principle and application of directional overcurrent and earth fault relays. Principle of 2-input comparison, two and multi input comparators. Distance relays their settings, errors and remedies to errors. Differential relays current and voltage comparison. Motor protection, Different types of pilot protection wire, carrier and wireless pilot. Carrier aided distance protection. Carrier phase comparison schemes. Static & Digital Relaying: Generalised approach for two input and multi input comparators, Phase and amplitude comparison, inputs for different types of static distance protection, hard- ware for static relays, concept of digital relaying, main components of digital relays, digital relaying algorithms.

Recommended Textbooks



- The Art And Science Of Protective Relaying: C.R.Mason, John Wiley
- Power System Protection: S.P.Patra, S.K.Basu & S.Choudhuri
- Power System Protection & Switchgear: B.Ravindranath & M.Chander
- Switchgear & Protection: S. S. Rao
- Power Systems Protection and Switchgear, Ram, Vishwakarma

Power Electronics & Drives

TIU-UEE-T405

LTP: 4-0-0

Credits: 4

Introduction: need for power conversion with efficient, high frequency, lightweight converters; Power electronic converters classifications and scope; Power semiconductor switches: power/fast diodes, SCR, and transistors(BJT, MOSFET and IGBT) Ratings, static and dynamic characteristics, drive and switching aid circuits and cooling; isolation; protection; DC to DC conversion: Choppers: non-isolated: Buck, Boost and BuckBoost converters; circuit configuration and analysis with; continuous and discontinuous loads; H-bridge converter multi-quadrant operation; isolated: forward, fly-back converters; example of a typical drive circuit; AC to DC conversion: Rectifiers: controlled/half-controlled/uncontrolled: single phase and three phase operation, Operation with R, R-L, back emf load; power factor, harmonics and effect of source inductance; Cascade operation; dual converters; a typical trigger / drive circuit; DC to AC conversion: Inverters: current source and voltage source inverters, active and reactive power handling; single phase and three phase voltage source and PWM inverters; PWM techniques; active frontend rectifier; a typical trigger / drive circuit; AC to AC conversion: Single phase AC static switches; transient-free switching of inductive loads; voltage regulators; cycloconverter;

Recommended Textbooks

- Electric Drives: N.K. De, P.K. Sen
- Power Electronics: Rashid
- Power Electronics: Khanchandani
- Power Electronics: N. Mohan, T.M. Undeland & W.P. Robbins



Digital Signal Processing
TIU-UEE-T407
LTP: 3-1-0
Credits: 4

Analog Signal Processing versus Digital Signal Processing. Review of Sampling. Aliasing. Frequency domain representation of uniformly-sampled signals. Anti-alias filter. Power and energy sequences. Odd and even sequences. Causal, anticausal and two-sided sequences. Periodic sequences. Time-domain operation on sequences--- timescaling, time-reversal, time-shifting. Review of Z-transform and its properties. ROCs of Z-transforms. Mapping between z-plane and s-plane. Discrete-Time Fourier Transform and its properties. Parseval's formula. Discrete-time LTI systems, Z-transfer function. Discrete-time convolution, its properties and interconnection of LTI systems. Recursive and Non-recursive systems. Z-Transforms Of Causal Sequences & Time Domain Behavior. FIR and IIR systems. Ideal interpolation formula for reconstructing analog signals from their samples. DAC employing zero-order hold. Image rejection postfiltering, compensated reconstruction filter. Design of IIR filters: Standard transformation techniques- Impulse invariant transformation, Bilinear transformation, Mapping of differentials, Matched z-transformation. Structures for IIR filters: Direct form, cascade realization, parallel realization, transposed structures, ladder structure. Finite-word length effects in digital IIR filters, limit cycles.

Introduction to Discrete Fourier transform (DFT): Fourier series for a periodic signal, Fourier series for a periodic discrete sequence, discrete Fourier transform (DFT), inverse discrete Fourier transform (IDFT). Properties of DFT: periodicity, symmetry. Computation of DFT. Fast Fourier transform (FFT): radix-2 decimation in frequency in-place FFT algorithm. Comparison of DFT and FFT. Applications of FFT.

FIR digital filters. Distortion less transmission of signal through a filter: linear phase characteristic. Concepts of phase delay and group delay. Linear phase digital filter. Properties of linear phase digital filter: periodicity, symmetry. Design of digital filter by Fourier series method. Frequency response of digital filters, realization problems. Direct realization of linear phase FIR digital filters, effect of truncation of impulse response, circular complex convolution integral, Gibbs phenomenon. Common window functions for linear phase FIR filter design: Bartlett, Hamming, Hann, Blackman. Frequency domain characteristic of common window functions. Design of brick-wall type low pass, high pass, band pass FIR digital filters. Design of linear phase FIR filters by the frequency sampling method. Design of optimum equiripple linear phase FIR filters. FIR digital filters for off-line analysis for one-dimensional (1-D) and two-dimensional (2-D) data. 2-D finite impulse sequence of digital FIR filter.

Introduction to image processing: gray image as a 2-D continuous function of space. Image filtering: a 2-D filtering problem, FIR image filters for low pass and high pass filtering. Contrast enhancement by histogram equalization.

Recommended Textbooks

- Digital Signal Processing: Principles, Algorithms & Applications: J.G. Proakis and M. G. Manolakis



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- Digital Signal Processing: A Computer Based Approach: S. K. Mitra
- Digital Signal Processing: P. Ramesh Babu
- Discrete-Time Signal Processing: Oppenheim, Schaffer and Buck
- Digital Image Processing: Gonzalez and Woods

Industrial Management:

TIU-UMG-T401

LTP: 3-0-0

Credits: 3

The detailed syllabus to be provided by the Department of Management.