Course details: 4th Year Odd Semester

ECE 4109 Power Station, Switchgear and Protection Credits: 3
Introduction to various power plants- steam, hydro, gas, combined cycle, and nuclear power plants. Plant factor, load factor, diversity factor, load curve, chronological load curve, load duration curve. Base load and peak load, selection of units. Power plant economy. Introduction to switchgear and protection.
Circuit breakers, principle of arc extinction in DC and AC circuit breakers. Recovery voltage, rate of rise of recovery voltage and other transient phenomena. Switching surges. Disconnection of unloaded transformer and transmission line. Speed of circuit breaker. Construction, operation, rating and testing of bulk oil and minimum oil breaker, SF6 circuit breaker, ABCB, ACB, and VCB. Selection of circuit breaker. Travelling wave in transmission line. Surge absorber, lightning arrester, horn gap, its rating and testing.
Protective relaying: Relay voltage rating, high, medium and low. Basic protective zone. Relaying Scheme. Electromechanical Relays: Principal, general equation. overcurrent, balanced current, overvoltage, distance, directional, positive sequence, negative sequence and differential relays and their applications.
Static relays: Introduction to solid state device in the construction of static relays. Different type of static relays. Generator protection. Transformer protection, Bucholz's relay. Protection of bus bar, transmission line, feeder etc. Relay testing.

Credits: 3

ECE 4123 Digital Signal Processing
Introduction: signals, systems and signal processing, classification of signals, the concept of frequency in continuous time and discrete time signals, analog to digital and digital to analog conversion, Sampling and quantization.
Discrete time signals and systems: Discrete time signals, discrete time systems, analysis of discrete time linear time invariant systems. Discrete time systems described by difference equations, implementation of discrete time systems, correlation and convolution of discrete time signals.
The z-transform: Introduction, definition of the z-transform, z-transform and ROC of infinite duration sequence, properties of z-transform inversion of the z-transform, the one-sided z-transform.
Frequency analysis of signals and systems: Frequency analysis of continuous time signals, Frequency analysis of discrete time signals, Properties of Fourier transform of discrete time signals, Frequency domain characteristics of linear time invariant system, linear time invariant systems as frequency selective filters, Inverse systems and deconvolution.
Discrete Fourier Transform (DFT): Discrete Fourier Series (DFS), Properties of DFS, Discrete Fourier Transformation (DFT), Properties and application of DFT.
Fast Fourier Transform Algorithms: FFT algorithms, applications of FFT algorithm.
Digital Filter Design Techniques: Differential and difference equations, Digital Transfer Functions, frequency response, Digital filter realization scheme, Finite Impulse response (FIR) Infinite Impulse Response (IIR) filter design.
Application of DSP: Speech processing, analysis and coding, Matlab application to DSP.

ECE 4124 Digital Signal ProcessingSessional   Credits: 1.5

Sessional based on the theory of course ECE 4123.

ECE 4121 Electromagnetic Fields & Waves Credits:3
Contact hours/week: 3
Electrostatics and Magnetostatics using vector methods. Fields in dielectrics and conductors. Boundary conditions of Electric and Magnetic fields. Time Varying Fields; Maxwell's equation and poynting vector. Uniform plane wave and its transmission and reflection. Skin effect and Surface resistance. Wave guides. Introduction to radiation system.

ECE 4100 Industrial Training Credits: 1.00
Students will be attached with the industries/service agencies for two weeks after completing their Third year odd semester (before starting Third year even semester/during any vacation in Third year even semester) to gain practical knowledge.

ECE 4000 Thesis/ Project-I Credits: 1.50
A project/thesis course will be assigned to the students in 4th year odd semester class and it will continue till 4th year even semester. The objective is to provide an opportunity to the students to develop initiative, creative ability, confidence and engineering judgment. The results of the work should be submitted in the form of a dissertation, which should include appropriate drawings, charts, tables, references etc. A grade X shall be awarded for this course in 4th year odd semester. Final assessment on this course will be done in 4th year even semester.

ECE 4122 Seminar Credits: 0.75
Students will works in groups or individually to prepare review papers on topics assigned by the teachers and will present before audience.

Optional Course Details for the 4th year Odd Semester

Optional I:
ECE 4111 Computer Aided Power System Design Credit: 3.00
Computer algorithm Mathematical modeling of physical systems. Iterative Techniques, Solution of simultaneous equations, Interpolation, Curve fitting, Solution of Differential Equations. Numerical solution of Integration. Application of the above techniques in Electrical & Electronic Engineering through computer program.
ECE 4112 Computer Aided Power System Design Sessional Contact hours/week: 3/2 Credits: 0.75
Sessional based on the theory of course ECE 4111
ECE 4115 Renewable Energy Credits: 3.00
Importance of renewable energy, sources. Statistics regarding solar radiation and wind speed. Insulation: geographical distribution, atmospheric factors, measurements. Solar cell: principle of operation, spectral response, factors affecting conversion efficiency, I-V characteristics, maximum power output. PV modules and arrays: stationary and tracking. PV systems: stand alone, battery storage, inverter interfaces with grid. Wind turbine

generators: types, operational characteristics, cut-in and cut-out speed, control, grid interfacings, AC-DC-AC link. Wind and Tidal energy conversion.

ECE 4117 Microwave Engineering Credit: 3.00

UHF Transmission Lines: Voltage and current in ideal transmission lines, reflection, transmission, standing wave, impedance transformation, smith chart, impedance matching and lossy transmission lines. Microwave Components: Cavities, Slow wave structures, Waveguide Tees, Directional Couplers, Circulators and Isolators, S-parameter. Microwave tubes: Klystron amplifier, multicavity klystron amplifier, Reflex Klystron oscillator, magnetron, TWT amplifier, BWO. Semiconductor microwave devices: Tunnel diodes, Gunn-Effect diodes, IMPATT diodes. Microwave measurements.

ECE 4118 Microwave Engineering Sessional Contact hours/week: 3/2 Credits: 0.75

Sessional based on the theory of course EEE 4117.

ECE 4141 Power System Operation & Control Credits: 3.00

Design and constructional features of overhead power transmission lines and underground cables. DC and AC power distribution. Stability: Swing equation, power angle equation, equal area criterion, multi-machine system, step-by-step solution of swing equation, factors affecting transient stability. Flexible AC transmission system. Highvoltage DC transmission system. Power system harmonics.

Principles of power system operation : SCADA, convention and competitive environment. Unit commitment, static security analysis, state estimation, optimal power flow, automatic generation control and dynamic security analysis.

ECE 4142 Power System Operation & Control Sessional Credits: 0.75

Sessional based on the theory of course EEE 4141.

ECE 4143 High Voltage Engineering Credits: 3

Ionization and decay process: Townsend's first and second ionization coefficient. Electric breakdown in gases. Townsend's criterion for spark breakdown. Sparking potential. Penning effect. Corona discharges, power loss calculation. Breakdown of solid and liquid dielectrics.

Generation of high voltage: Alternating voltage, transformer cascade. Series resonant circuit for high voltage ac testing. Test of dc and ac cable.

Transient Voltage: Impulse wave shape. Impulse voltage generator and its mathematical analysis. Design consideration of impulse generators. Triggering of impulse generators.

DC voltage doubler and cascade circuits. Electrostatic generator, voltage stabilization. Measurement of high voltage. Electrostatic voltmeter, sphere gap. Potential divider. High Voltage testing of power system equipment. Oil testing. Design consideration of transmission line based on direct stroke. High voltage transient in transmission line. High voltage lightning arrester. Insulation co-ordination.

ECE 4144 High Voltage Engineering Sessional Credits: 0.75

Sessional based on ECE 4143 **ECE 4125 System   Credit: 3**

Simulation and Modeling

Optional II

ECE 4127 Computer Networks Credits: 3

Introduction: Definition, uses of computer networks, network topology, network media, network devices, different types of network: LAN, MAN, WAN etc.

IP addressing: Classification of IP addressing, subnet mask, CIDR, private IP Address, public IP address, sub netting, VLSM etc.

Network Model: OSI Reference Model, TCP/IT Reference Model, ATM Reference Model, functions of the layers of different models, Network Protocols working at different layers.

Data Link Layer Design Issues and Framing: Character count, byte stuffing, bit stuffing, error detection: cyclic redundancy check, parity bit checking and correction: Hamming code, windowing protocols: go back N ARQ, selective repeat ARQ, elementary data link protocols, high-level data link control, point to point protocol, the medium access control sub-layer.

Multiple Access: Random Access; ALOHA, CSMA, CSMA/CD, CSMA/CA, channelized access, CDMA, TDMA, FDMA, controlled access, reservation, poling, token passing, Ethernet, wireless LANs and Bluetooth.

Switching: Circuit switching, packet switching, message switching, routing algorithms, virtual circuit and datagram, congestion control algorithms, quality of service, internetworking, internetworking devices etc.

Network Layer Protocols: Address resolution protocol, internet protocol, internet control, message protocol, ipv6, routing information protocol, open shortest path first, border gateway protocol, user datagram protocol, transmission control protocol.

Network Security: Cryptography, substitution cipher, transposition cipher, one time pads, public key cryptography, encryption and decryption, authentication protocol 1.0 to 5.0, digital signature, key distribution center, different symmetric key algorithm, certificate authority, DNS, electronic mail, world wide web.

Other: HTTP and recent advances in internet protocols, Web server performance, proxy servers, load balancing in web servers, IP security, Queuing models for networks and protocols, Real time protocols such as RTP, RTCP and RTSP, Voice over IP, Cloud computing.

ECE 4128 Computer Network Sessional Credits: 0.75

Sessional based on the theory of course ECE 4127.

ECE 4129 Network Planning Credits: 3

Introduction: Network components, Theoretical network, Real world networks.

Network Architectural Design: Designing the LAN, Configuring the network server and client, Network administration, Remote access, Expanding the network, Wide area network troubleshooting, Major protocol suites.

Network Simulation: Network simulation and optimization, Network operations, control and maintenance, Network administration, Network management database and tools, Capacity planning.

Network Optimization: Network security and integrity, Linear programming and network algorithms for planning, Reliability theory and network planning.

ECE 4130 Network Planning Sessional Credit: 0.75

Sessional based on the theory of course ECE 4129

ECE 4131 Wireless Networks Credits: 3

Introduction to wireless networks: wireless access networks – wireless mesh networks, personal area networks (wireless sensor networks, body area networks, LowPan, and Bluetooth), wireless and mobile ad hoc networks, challenged networks (DTNs, VANETs).

Wireless MAC protocols: IEEE 802.11, IEEE 802.11e, IEEE 802.11n, IEEE 802.11s, IEEE 802.15.4, S-MAC, B-MAC, IEEE 802.22/20, IEEE 802.16d/e.

Wireless routing: routing matrix – ETX, ETT, WCETT, Air Time Metric, routing protocols – AODV, DSR, DSDV, HWMP, sensor network routing, VANET routing etc.

Others: Wireless Transport protocols; Wireless TCP and its variants, Hop by Hop Congestion Control, Rate based Congestion Control etc. Quality of Service in Wireless Networks.

ECE 4132 Wireless Networks Sessional Credits:0.75 Contact hours/week: 3/2

Sessional based on the theory of course ECE 4131

ECE 4133 Artificial Intelligence **Credits: 3 Contact hours/week: 3**

Fundamental: Definition of Al, historical development of Al, application of Al.

Production systems: Introduction of product system, production rules, the working memory, the control unit interpretation, conflict resolution strategies, alternative approach for conflict resolution, types of production systems, forward versus backward production systems, knowledge base optimization in a production system.

General Problem Solving Approaches: Breadth first search, depth first search, iterative deepening search, hill climbing, simulated annealing, heuristic search, A* algorithm, adversary search, the minimax algorithm, constraint satisfaction problems.

Logic and Structural Knowledge Representation: Propositional logic, first-order logic, resolution principle, frames, semantic-nets, petri nets, relational data model.

Reasoning under Uncertainty: Bayesian reasoning, fuzzy knowledge, probability theory, Dempster-shafer theory, fuzzy set theory, expert systems.

Machine Learning and Natural language processing: Naive Bayes algorithm, syntactic semantics and pragmatic, top-down passing, bottom-up pursing, lexicon.

Programming Languages for Al Research: Historical overview, features of Al programming languages, major Al programming languages LISP, PROLOG, Implementation of AI algorithms through PROLOG.

ECE 4134 Artificial Intelligence Sessional **Contact hours/week: 3/2**

Sessional based on the theory of course ECE 4133 **Credits: 0.75**

ECE 4135 Contact hours/week: 3 Human Computer Interaction Credits: 3

Process and Model: Introduction to Human-computer interaction (HCI), human information processing systems, Models of interaction, Approaches to HCI, User interface, HCI in software process, Cognitive models.

Issues and Requirements: Socio-organizational Issues and stakeholders Requirements, Communication and collaboration models, Task Analysis, Dialog notation and design, Groupware, CSCW and social issues.

User system interaction: analysis and design, User interface design, Interface technique and technology, case studies.

ECE 4136 Human Computer Interaction Sessional Contact hours/week: 3/2

Sessional based on the theory of course ECE 4135 **Credits: 0.75**