Bachelor of Technology - Electrical & Electronics Engineering

Syllabus - First Semester

INTRODUCTION TO COMPUTERS AND PROGRAMMING IN C

Course Code: EEE2105 **Credit Units : 03**

Course Objective:
The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction
Introduction to computer, history, von-Neumann architecture, memory system (hierarchy, characteristics and types), H/W concepts (I/O Devices), S/W concepts (System S/W & Application S/W, utilities). Data Representation: Number systems, character representation codes, Binary, octal, hexadecimal and their interconversions. Binary arithmetic, floating point arithmetic, signed and unsigned numbers, Memory storage unit.

Module II: Programming in C
History of C, Introduction of C, Basic structure of C program, Concept of variables, constants and data types in C, Operators and expressions: Introduction, arithmetic, relational, Logical, Assignment, Increment and decrement operator, Conditional, bitwise operators, Expressions, Operator precedence and associativity. Managing Input and output Operation, formatting I/O.

Module III: Fundamental Features in C
C Statements, conditional executing using if, else, nesting of if, switch and break Concepts of loops, example of loops in C using for, while and do-while, continue and break. Storage types (automatic, register etc.), predefined processor, Command Line Argument.

Module IV: Arrays and Functions
One dimensional arrays and example of iterative programs using arrays, 2-D arrays Use in matrix computations.
Concept of Sub-programming, functions Example of user defined functions. Function prototype, Return values and their types, calling function, function argument, function with variable number of argument, recursion.

Module V: Advanced features in C
Pointers, relationship between arrays and pointers Argument passing using pointers, Array of pointers. Passing arrays as arguments.
Strings and C string library.
Structure and Union. Defining C structures, Giving values to members, Array of structure, Nested structure, passing strings as arguments.
File Handling.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:

- "ANSI C" by E Balagurusamy
- YashwantKanetkar, "Let us C", BPB Publications, 2nd Edition, 2001.
- Herbert Schildt, "C: The complete reference", Osbourne Mcgraw Hill, 4th Edition, 2002.
- V. Raja Raman, "Computer Programming in C", Prentice Hall of India, 1995.

References:

- Kernighan & Ritchie, "C Programming Language", The (Ansi C Version), PHI, 2nd Edition.
- J. B Dixit, "Fundamentals of Computers and Programming in 'C'.
- P.K. Sinha and Priti Sinha, "Computer Fundamentals", BPB publication.

PROGRAMMING IN C LAB

Course Code:EEE2110 **CreditUnits : 01**

Software Required: Turbo C

Course Contents:

- C program involving problems like finding the nth value of cosine series, Fibonacci series. Etc.
- C programs including user defined function calls
- C programs involving pointers, and solving various problems with the help of those.
- File handling

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Syllabus - Second Semester

OBJECT ORIENTED PROGRAMMING USING C++

Course Code:EEE2203 **CreditUnits : 03**

Course Objective:

The objective of this module is to introduce object oriented programming. To explore and implement the various features of OOP such as inheritance, polymorphism, Exceptional handling using programming language C++. After completing this course student can easily identify the basic difference between the programming approaches like procedural and object oriented.

Course Contents:

Module I: Introduction

Review of C, Difference between C and C++, Procedure Oriented and Object Oriented Approach. Basic Concepts: Objects, classes, Principals like Abstraction, Encapsulation, Inheritance and Polymorphism. Dynamic Binding, Message Passing. Characteristics of Object-Oriented Languages. Introduction to Object-Oriented Modeling techniques (Object, Functional and Dynamic Modeling).

Module II: Classes and Objects

Abstract data types, Object & classes, attributes, methods, C++ class declaration, Local Class and Global Class, State identity and behaviour of an object, Local Object and Global Object, Scope resolution operator, Friend Functions, Inline functions, Constructors and destructors, instantiation of objects, Types of Constructors, Static Class Data, Array of Objects, Constant member functions and Objects, Memory management Operators.

Module III: Inheritance

Inheritance, Types of Inheritance, access modes – public, private & protected, Abstract Classes, Ambiguity resolution using scope resolution operator and Virtual base class, Aggregation, composition vs classification hiérarchies, Overriding inheritance methods, Constructors in derived classes, Nesting of Classes.

Module IV: Polymorphism

Polymorphism, Type of Polymorphism – Compile time and runtime, Function Overloading, Operator Overloading (Unary and Binary) Polymorphism by parameter, Pointer to objects, this pointer, Virtual Functions, pure virtual functions.

Module V: Strings, Files and Exception Handling

Manipulating strings, Streams and files handling, formatted and Unformatted Input output. Exception handling, Generic Programming – function template, class Template Standard Template Library: Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, The Container Classes, General Theory of Operation, Vectors.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

Text & References:

Text:

- A.R. Venugopal, Rajkumar, T. Ravishanker “Mastering C++”, TMH, 1997
- R. Lafore, “Object Oriented Programming using C++”, BPB Publications, 2004.
- “Object Oriented Programming with C++” By E. Balagurusamy.
- Schildt Herbert, “C++: The Complete Reference”, Wiley DreamTech, 2005.

References:

- Parasons, “Object Oriented Programming with C++”, BPB Publication, 1999.
- Steven C. Lawlor, “The Art of Programming Computer Science with C++”, Vikas Publication, 2002.
- YashwantKanethkar, “Object Oriented Programming using C++”, BPB, 2004

OBJECT ORIENTED PROGRAMMING USING C++ LAB

Course Code:EEE2206 **CreditUnits : 01**

Software Required: Turbo C++

Course Contents:

- Creation of objects in programs and solving problems through them.
- Different use of private, public member variables and functions and friend functions.
- Use of constructors and destructors.
- Operator overloading
- Use of inheritance in and accessing objects of different derived classes.
- Polymorphism and virtual functions (using pointers).
- File handling.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab

Syllabus - Third Semester

ANALOG ELECTRONICS-I

Course Code:EEE2302 **CreditUnits : 03**

Course Objective:
This course builds from basic knowledge of Semiconductor Physics to an understanding of basic devices and their models. This course builds a foundation for courses on VLSI design and analog CMOS IC Design.

Course Contents:

Module I: Semiconductor Diode and Diode Circuits
Different types of diodes: Zener, Schottky, LED. Zener as voltage regulator, Diffusion capacitance, Drift capacitance, the load line concept, half wave, full wave rectifiers, clipping and clamping circuits.

Module II: Bipolar Junction Transistor
Bipolar junction transistor: Introduction, Transistor, construction, transistor operations, BJT characteristics, load line, operating point, leakage currents, saturation and cut off mode of operations. Bias stabilization: Need for stabilization, fixed Bias, emitter bias, self bias, bias stability with respect to variations in $I_{co,}$ V_{BE} &β, Stabilization factors, thermal stability.

Module III: Small signal Analysis of transistor and Multistage Amplifier
Hybrid model for transistors at low frequencies, Analysis of transistor amplifier using h parameters, emitter follower, Miller's theorem, THE CE amplifier with an emitter resistance, Hybrid π model, Hybrid π Conducatnces and Capacitances, CE short circuit current gain, CE short circuit current gain with R_L Multistage amplifier: Cascading of Amplifiers, Coupling schemes(RC coupling and Transformer coupling)

Module IV: Field Effect Transistors
Field effect transistor (JFET, MOSFET): volt-ampere characteristics, small signal model –common drain, common source, common gate, operating point, MOSFET, enhancement and -depletion mode, Common source amplifier, Source follower

Module V: Feedback Amplifiers
Feedback concept, Classification of Feedback amplifiers, Properties of negative Feedback amplifiers, Impedance considerations in different Configurations, Examples of analysis of feedback Amplifiers.

Module VI: Power amplifiers
Power dissipation in transistors, difference with voltage amplifiers, Amplifier classification (Class A, Class B, Class C, Class AB) class AB push pull amplifier, collector efficiency of each, cross over distortion.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Robert F. Pierret: Semiconductor Device Fundamentals, Pearson Education.

- Millman and Halkias: Electronic Devices and circuits, Tata McGraw.
- Boylestad: Electronic Devices and Circuits, Pearson Education.

CIRCUITS & SYSTEMS

Course Code:EEE2303 **CreditUnits : 03**

Course Objective:
The course intends to make the students proficient in analyzing circuits. At the completion of the course, the student should be able to construct and interpret block diagrams and signal flow graphs of control systems and to use basic methods of determining their stability.

Course Contents:

Module I: Graph Theory and Network equations
Graph of a network, Trees, Co-trees and loops, Cut set matrix, Tie set matrix, number of possible trees of a graph, duality, Loop Analysis and Node Analysis.

Module II: Analysis of circuits using classical Method
Time and Frequency domain analysis of RL, RC and RLC circuits, Linear constant coefficient differential equation.

Module III: Signals and Laplace Transforms
Unit step signal, Ramp signal, impulse signal, Laplace transformations and its properties, Gate function, Inverse Laplace transformations, Application of Laplace Transforms in circuit analysis.

Module IV: Network Theorems
Reciprocity theorem, Superposition theorem, Thevenin's and Norton's theorems, Millman's theorem, Maximum power transfer theorem, Compensation theorem, Tellegan's theorem.

Module V: Two port Network & Network Functions
Introduction, two port z-, y-, T-, h-parameters, Inter-relations among parameters, Condition for reciprocity and symmetry, Interconnections of two port networks, Driving point and transfer functions, Poles, Zeros and necessary condition for driving point and transfer function,.

Module VI: Network Synthesis
Hurwitz polynomial, Positive real functions, synthesis of LC, RC, RL immittance functions.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- M.E. Valkenburg, "Network analysis", PHI.
- D. R. Choudhary, "Networks and Systems", New Age International.
- K.M. Soni, 2009, "Circuits and Systems", VIII Edition, S.K. Kataria & Sons Delhi.

References:
- Bhise, Chadda, Kulshreshtha, "Engineering network analysis and filter design", Umesh Publication.
- F.F. Kuo, "Network Analysis and Synthesis", Wiley India Pvt. Ltd.

SIGNALS AND SYSTEMS

Course Code:EEE2304 **CreditUnits : 03**

Course Objective:
The objective of the course is to provide knowledge of Signals and Systems to students of ECE. This Course includes good insight of types of signals and types of systems, various operations performed on them through the use of Fourier series, Fourier transform, z transform.

Course Contents:

Module I: Signals and Systems
Introduction of signals and systems; classification of signal, continuous time and discrete time signals, operations performed on them, even and odd signals, periodic and non periodic signals, deterministic and random signals, energy signals, power signals, elementary signals: impulse, step, ramp and exponentials, classification of systems.

Module II: LTI system
Response of LTI system for continuous and discrete time systems, Impulse response, Step response, properties of continuous LTI and discrete LTI systems, LTI systems described by differential and difference equation, analysis of LTI Systems, interconnection of systems.

Module III: Fourier series
Representation of continuous time periodic signal, properties of continuous time Fourier series, representation of discrete time periodic signals, convergence of the Fourier series, properties of discrete time Fourier series, Fourier series and LTI systems.

Module IV: Fourier Transform
Continuous time Fourier transform, properties of continuous time Fourier transform, discrete time Fourier transform, properties of discrete time Fourier transform; applications; Bandwidth determination of signals and systems.

Module V: z-Transform
Definition of z-transform, region of convergence, properties of z-transform, first order system, second order system, inverse z-transform, analysis of LTI system using z-transform.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References
Text:
- Alan.V Oppenheim, Signals and Systems, 4th Edition 2007, Pearson Prentice Hall Publication.
- K.M. Soni, Signals and Systems; 3rd Edition, S.K. Kataria & Sons Publication.
- P.RameshBabu, Signal and Systems, 3rd Edition, Scitech Publications (INDIA) Pvt. Ltd.

References:
- Simon Haykin, Signals and Systems, 2nd Edition, Willy Publications.
- B.P.Lathi, Linear Systems & Signals, 2nd Edition, Oxford Publication.
- Roberts, Fundamentals of Signals and Systems, TMH Publication.

ANALOG ELECTRONICS-I LAB

Course Code:EEE2305 **CreditUnits : 01**

Course Contents:

- To study and plot the characteristics of a junction diode.
- To study Zener diode I-V characteristics.
- To study diode based clipping and clamping circuits.
- To study half wave, full wave and bridge rectifier with filters.
- To study the input and output characteristics of a transistor in its various configurations (CE and CB).
- To study and plot the characteristics of a JFET in its various configurations.
- To study and plot the characteristics of a MOSFET in its various configurations.
- To study various types of Bias Stabilization for a transistor.
- To study the gain and plot the frequency response of a single stage transistor amplifier.
- To measure gain and plot the frequency response of double stage RC coupled amplifier.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

CIRCUITS & SYSTEMS LAB

Course Code:EEE2306 **CreditUnits : 01**

List of Experiments:

1. To verify Thevenin's theorem in a given network.
2. To verify reciprocity theorem in a given network.
3. To verify maximum power transfer theorem in a given network.
4. To verify Tellegen's theorem in a given network.
5. To determine the Z- and Y- parameters of a resistive two-port network.
6. To determine the T- (ABCD) parameters of a resistive two-port network.
7. To determine the h- parameters of a resistive two-port network.
8. To design series-series connection of 2 two-port networks and determine its Z- parameters.
9. To design parallel-parallel connection of 2 two-port networks and determine its Y- parameters.
10. To design a cascade connection of 2 two-port networks and determine its T- (ABCD) parameters.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

DATA STRUCTURE USING C

Course Code:EEE2309 **CreditUnits : 02**

Course Objective:
Data structure deals with organizing large amount of data in order to reduce space complexity and time requirement. This course gives knowledge of algorithms, different types of data structures and the estimation space and time complexity.

Course Contents:

Module I: Introduction to Data structures
Data structures: Definition, Types. Algorithm design, Complexity, Time-Space Trade offs. Use of pointers in data structures.
Array Definition and Analysis, Representation of Linear Arrays in Memory, Traversing of Linear Arrays, Insertion And Deletion, Single Dimensional Arrays, Two Dimensional Arrays, Multidimensional Arrays, Function Associated with Arrays, Character String in C, Character String Operations, Arrays as parameters, Implementing One Dimensional Array, Sparse matrix.

Module II: Introduction to Stacks and queue
Stack: Definition, Array representation of stacks, Operations Associated with Stacks- Push & Pop, Polish expressions, Conversion of infix to postfix, infix to prefix (and vice versa),Application of stacks recursion, polish expression and their compilation, conversion of infix expression to prefix and postfix expression, Tower of Hanoi problem.
Queue: Definition, Representation of Queues, Operations of queues- QInsert, QDelete, Priority Queues, Circular Queue, Deque.

Module III: Dynamic Data Structure
Linked list: Introduction to Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list, doubly linked list, circular linked list, generalized list. Applications of Linked List-Polynomial representation using linked list and basic operation.
Stack and queue implementation using linked list.

Module IV: Trees and Graphs
Trees: Basic Terminology, Binary Trees and their representation, expression evaluation, Complete Binary trees, extended binary trees, Traversing binary trees, Searching, Insertion and Deletion in binary search trees, General trees, AVL trees, Threaded trees, B trees.
Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Transversal Connected Component and Spanning trees.

Module V: Sorting and Searching and file structures
Sorting: Insertion Sort, Bubble sort, Selection sort, Quick sort, two-way Merge sort, Heap sort, Partition exchange sort, Shell sort, Sorting on different keys, External sorting.
Searching: Linear search, Binary search

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- Horowitz and Sahani, "Fundamentals of Data structures", Galgotia publications
- Tannenbaum, "Data Structures", PHI
- R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C" PHI
- "Data structures and algorithms" – Schaum Series.

DATA STRUCTURE USING C LAB

Course Code:EEE2310 **CreditUnits : 01**

Software Required: Turbo C++

Assignment will be provided for following:

- Practical application of sorting and searching algorithm.
- Practical application of various data structure like linked list, queue, stack, tree

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

VIRTUAL INSTRUMENTATION

Course Code:EEE2311 **CreditUnits : 02**

Course Objective:
The purpose of this course is to provide a thorough introduction to virtual instrumentation with an in depth study of virtual instrument, software, hardware and its applications.

Course Contents:

Module I:Introduction to Virtual Instrumentation: Introduction,Historical perspective, advantages, block diagram and architecture of a virtual instrument, conventional vs. virtual instrumentation.

Module II: Introduction to Software : Introduction to Lab VIEW, Front panel, back panel representations, Block diagram, Menus, Palettes, VI and Sub VI, Editing and Debugging VI, Structures, Arrays, Clusters, Charts and Graphs, Data acquisition, Instrument Control, Signal Generation and Signal Processing Examples.

Module III: Introduction to systems hardware: ADC, DAC, D/O, counters and timer, PC hardware structure, timing, interrupts, DMA, software and hardware installation, Configuring data acquisition hardware using the drives in application software, use of DAQ library functions for different analog and digital input/output operations. Input/output devices & functions like data gloves, joysticks, CRT etc.

Module IV:Application of Virtual Instrumentation in various fields: Aviation, Automotive, High Voltage, Defense, Chemical, Industrial, Marine, Medical, Mining, Nuclear Energy, Virtual landscapes.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

LABORATORY / FIELD EXPERIENCES

- **.** Geographical programming using Lab VIEW
- . Applications of Lab VIEW

Text & references:

- . Learning with LabVIEW 7 Express – R.H. Bishop, Pearson Education, Delhi.
- . LabVIEW Basic 1 Course Manual, National Instruments
- Virtual Instrumentation Using LabVIEW- Sanjay Gupta & Joseph John, TMG; 2005.
- LabVIEW for everyone -Wells Lisa K and Travis Jeffrey, Prentice Hall.

VIRTUAL INSTRUMENTATION LAB

Course Code:EEE2312 **CreditUnits : 01**

List of Experiments:

- To open, and explore the components of LabView.
- To build a simple VI that converts a Celsius temperature reading to Fahrenheit.
- (a) To create an icon and a connector pane so you can use a VI as a subVI.
  (b) To build a VI and create its icon and connector pane so you can use it as a subVI.
- To build a VI to generate 4*5 two dimensional array of random numbers (between1 to 2).
- To Build a VI that generate Fibonacci series starting from '0'.
- To build a VI which finds roots of quadratic equation using formula node.
- To build a VI that reverses the contents of an array.
- To build a VI that can be used for sorting of numeric array i.e. in ascending or descending order.
- To build a VI for 4*1 multiplexer operation.
- To build a VI for 3*8 Decoder operation.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Syllabus - Fourth Semester

ELECTRIC MACHINE-I

Course Code:EEE2402 **CreditUnits : 03**

Course Objective:
The purpose of this course is to introduce the student to the various types of basic machines used in the industry and its application.

Course Contents:

Module I: Principles of EMEC
Introduction, Energy in Electro-Magnetic System, Flow of Energy in Electro-Mechanical Devices, Energy in Magnetic field and co-energy, Dynamics of Electromechanical Systems, Singly excited systems. Torque and EMF equations.

Module II: D. C. Machines
EMF and Torque equations, Armature windings, Armature Reaction, Demagnetizing and Cross-magnetizing armature MMF, Inter pole and compensating windings, commutation. Characteristics of D.C.generators.
D.C. motors and their characteristics
Starting of D.C.motors. Starter step calculation for a D.C. shunt and series motor. Speed control of D.C. motors. Ward Leonard control. Braking of d.c.motors. Efficiency and testing of d.c. machines, Hopkinson test.

Module III:1- Ø Transformers
Transformer construction and practical considerations. Equivalent circuit, Exact and approximate, per unit values, Phasor diagram, Transformer testing: open circuit test, Short Circuit test, Sumpner's test, Efficiency and voltage regulation, All day efficiency, Auto-transformer.

Module IV:3 – Ø Transformer
Three-phase Bank of Single-phase Transformers, Parallel operations of 1 and 3 phase transformers, 3 to 2 and 6 phase conversion. Load division between transformers in parallel. Three winding transformers, Tertiary winding, Tap Changing, Transformers for special purpose, Welding, Traction, Instruments and pulse Transformers.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- Electrical Machines: I. J. Nagrath and D. P. Kothari (Tata McGraw Hill)
- Electrical Machniery: Fitzerald, Kingsley (McGraw Hill)
- Electrical Machnies: P. C. Sen

References:
- Electrical Machines and their Applications: J. Hindmarsh
- Electrical Machines: P. K. Mukherjee & S. Chakravoti (Dhanpat Rai Publications)
- Electric Machines: Ashfaq Hussain (Dhanpat Rai Publications)

ELECTROMAGNETIC FIELD THEORY

Course Code: ECE2403 **Credit Units: 03**

Course Objective:
This course provides a general introduction to the important physical concepts and mathematical methods used in treating all types of wave phenomena, but stresses electromagnetic signal propagation and issues of central importance in electrical engineering. As a core course in the Electrical Computer and Systems Engineering option of the Engineering Sciences concentration, it provides essential background and basic preparation for more advanced work in device physics, microwave and ultra-fast circuitry, antenna design, optics, optical communication and optoelectronics.

Course Contents:

Module I: Mathematical Basics and Electrostatics
Coordinate Systems: Spherical and Cylindrical coordinates, Dirac delta function, Coulomb's law, Gauss's law, Poisson's Equation, Laplace's Equation, Electrostatic Boundary conditions, Work and Energy in Electrostatics, Conductors, Surface charge and force on conductors

Module II: Magnetostatics and Magnetic Fields in matter
Magnetic induction and Faraday's law, Magnetic Flux density, Magnetic Field Intensity, Biot Savart Law, steady currents, Ampere's law, Magnetostatic Boundary conditions, magnetic field inside matter, magnetic susceptibility and permeability, ferromagnetism, energy stored in a Magnetic field, Magnetic Vector Potential

Module III: Electrodynamics
Faraday's laws, Maxwell's equations, Maxwell's modification of Ampere's law, continuity equation and Poynting theorem.

Module IV: Electrodynamic Waves
Wave propagation in unbounded media, Boundary conditions, reflection and transmission, polarization, E.M. waves in vacuum, E. M. waves in matter: reflection and transmission of plane waves.

Module V: Introduction to Transmission Lines
Transmission Line, Line Parameters, Characteristic Impedance, Image Impedance, HVDC and HVAC Common faults in transmission lines. Skin Effect, Ferranti Effect and Corona.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Griffiths: Introduction to Electrodynamics
- Fawwaz T. Ulaby:Fundamentals of Applied Electromagnetics
- Hayt, William H., Buck, John A. Hayt, William H., Buck, John A., Engineering Electromagnetics

ANALOG ELECTRONICS-II

Course Code:EEE2408 **Credit Units: 03**

Course Objective:
The purpose of this course is to introduce the student to the application of semiconductor devices in linear analog circuits. To insure the usefulness of the course material to both computer engineers and electrical engineers, the course stresses circuit designs using the operational amplifier.

Course Contents:

Module I: Building Blocks of Analog ICs
Differential amplifier, Op-amp Model, op-amp DC & AC parameters, virtual ground, Current mirrors, Active loads, Level shifters and output stages.

Module II: Operational amplifiers
Introduction, open loop and closed loop configuration, op-amp parameters (input offset current, output offset current, i/p bias current, CMRR, PSRR, null adjustment range, etc,) Inverting and non-inverting configuration, voltage gain of inverting and non inverting configurations.

Module III: Linear & Non Linear Wave shaping
Adders, Voltage to current, current to voltage Converter, Integrators, Differentiators**,** Voltage follower (voltage buffer), summer, subtractor, Comparators, log/antilog circuits using Op-amps, precision rectifiers

Module IV: Waveform Generations
Damped and undamped oscillations, Barkhausen criterion for sustained oscillation. Tank circuit generator Astable multi Vibrators, OTA-C Oscillators, Crystal oscillator**.** Types of oscillators: LC-Hartley and Colpitts, RC-RC phase shift and Wien bridge oscillator, Basics of tuned Amplifiers, Voltage Controlled Oscillator.

Module V: Active RC Filters & Applications of Linear Circuits
Idealistic & Realistic response of filters (LP, BP, and HP), Butter worth & Chebyshev approximation filter functions, LP,BP,HP and All pass, Notch Filter, Operational transconductance amplifier (OTA)-C filters.

Module VI: Applications of IC Analog Multiplier & Timer
IC phase locked loops, 555 Timer, IC voltage regulators-(fixed, variable) 78xx, 79xx series and adjustable.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Richard C. Jaeger: Microelectronic Circuit Design
- Adel S. Sedra and K. C. Smith: Microelectronic Circuits
- RamakantGaekwad: Operational Amplifiers
- Rolf Schaumann and Mac E. Van Valkenburg: Design of Analog Filters
- D. Roy Choudhury and Shail B. Jain: Linear Integrated Circuits

DIGITAL ELECTRONICS

Course Code: EEE2412 **Credit Units: 02**

Course Objective:
This course is an introduction to the basic principles of digital electronics. At the conclusion of this course, the student will be able to quantitatively identify the fundamentals of computers, including number systems, logic gates, logic and arithmetic subsystems, and integrated circuits. They will gain the practical skills necessary to work with digital circuits through problem solving and hands on laboratory experience with logic gates, encoders, flip-flops, counters, shift registers, adders, etc. The student will be able to analyze and design simple logic circuits using tools such as Boolean Algebra and Karnaugh Mapping, and will be able to draw logic diagrams.

Course Contents:

Module I: Boolean Functions
Analog & digital signals, AND, OR, NOT, NAND, NOR , XOR & XNOR gates, Boolean algebra, DeMorgan's theorems, Implementation of logical function using only NAND/NOR gates, 1`s complement and 2`s complement, BCD to Gray and Gray to BCD code conversion, Standard representation of logical functions (SOP and POS forms), K-map representation and simplification of logical function up to five variables, don't care conditions, XOR & XNOR simplifications of K-maps, Tabulation method.

Module II: Combinational Circuits
Adders, Subtractors, Implementation of full adder using half adder, full subtractor using half subtractor, Multiplexer, de-multiplexer, decoder & encoder, code converters, 1 & 2 bit comparators, BCD to seven segment decoder/encoder, Implementation of logic functions using multiplexer/de-multiplexer and decoder, Implementation of 16×1 MUX using 4×1 MUX, 4×16 decoder using 3×8 decoder etc., logic implementations using PROM, PLA & PAL.

Module III: Sequential Circuits
Difference between combinational and sequential circuits, Latch, Flip-flops: SR, JK, D & T flip flops – Truth table, Excitation table, Conversion of flip-flops, set up and hold time, race around condition, Master Slave flip flop, Shift registers: SIPO, PISO, PIPO, SIPO, Bi-directional, 4-bit universal shift register; Counters: Asynchronous/ripple & synchronous counters – up/down, Ring counter, sequence detector.

Module IV: Logic families & data converters
Logic families: Special characteristics (Fan out, Power dissipation, propagation delay, noise margin), working of RTL, DTL, TTL, ECL and CMOS families; Data converters: Special characteristics, ADC – successive approximation, linear ramp, dual slope; DAC – Binary Weighted, R-2R ladder type.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- MorisMano : Digital Design, Pearson Education.
- R. P. Jain: Digital Electronics, Tata McGraw Hill.
- Thomas L. Floyd: Digital Fundamentals, Pearson Education.
- Malvino and Leech: Digital Principles & Applications, Tata McGraw Hill.

ELECTRIC MACHINE LAB-I

Course Code: EEE2406 **Credit Units: 01**

List of Experiments:

- Load test on a single phase transformer.
- To perform Open circuit and short circuit tests on a single phase transformer and hence find equivalent circuit, voltage regulation and efficiency.
- To find the efficiency and voltage regulation of single phase transformer under different loading conditions.
- To perform parallel operation of two single phase transformers.
- To study the various connections of three phase transformer.
- To study the constructional details of D.C. machine and to draw sketches of different components.
- To measure armature and field resistance of d.c. shunt generator and to obtain its open circuit characteristics.
- To obtain load characteristics of d.c. shunt/series /compound generator.
- To draw speed-torque characteristics of d.c. shunt/series /compound generator.
- To study d.c. motor starters.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

ANALOG ELECTRONICS LAB-II

Course Code: EEE2409 **Credit Units: 01**

List of Experiments:

1. To study the op amp as an inverting and non inverting amplifier.

2. To use the op amp as an adder, subtractor, integrator and differentiator.

3. To design a ramp and a square wave generator.

4. To study the IC-555 timer as stable and bistablemultivibrator.

5. To design low pass, high pass and band pass filters using op- amp. and plot their frequency response.

6. To design and study class a power amplifier.

7. To design and study a class B push pull amplifier.

8. To study various feedbacks such as voltage series feedback.

9. To design RC phase shift and Wein bridge oscillators using op amplifier.

10. To design and study Colpitt and Hartley oscillators.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

DIGITAL ELECTRONICS LAB

Course Code: EEE2413 **Credit Units: 01**

List of Experiments:

- To verify the truth tables of NOT, OR, AND, NOR, NAND, XOR, XNOR gates.
- To obtain half adder, full adder using gates and verify their truth tables.
- To obtain half subtractor, full subtractor using gates and verify their truth tables.
- To implement control circuit using multiplexer.
- To convert BCD code into excess 3 code and verify the truth table.
- To verify the truth tables of RS, D, JK and T flip- flops.
- To implement and verify 3-bit bi-directional shift register.
- To design and study asynchronous/ripple counter.
- To design and study synchronous counter.
- To design and study a sequence detector.

Examination Scheme:

IA				**EE**	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

POWER PLANT PRACTICES

Course Code: EEE2411 **Credit Units: 03**

Course Objective:
The objective of this course is that the students come to know different ways of producing energy such as thermal energy from gas and steam, hydraulic energy nuclear energy, non conventional source of energy from wind, solar and tidal. And their different uses in productive works.

Course Contents:

Module I: Steam Generator Plant
Fuel handling systems, Indian coals, combustion of coal in furnaces; fluidized bed combustion; High pressure heavy duty boilers, Super critical and once through boilers influence of operating conditions on layout of evaporator, superheated, reheated and economizer; dust collectors; ash disposal, fans and draft systems.

Module II: Turbine Plane
Layout of turbine plant room, corrosion in condensers and boilers, feed water treatment; feed heating and de aeration system; cooling water systems and cooling towers.

Module III: Control
Important instruments on steam generator and turbine; drum water level control, combustion control and super heat temperature control; testing of power plants and heat balance.

Module IV: Other Power Plant
General layout of I.C. Engines and turbine power plants, types, gas turbine plants, fields of application, Nuclear power plants, power reactors and nuclear steam turbines; handling of nuclear waste and safety measures, peak load power generation methods.

Module V: Economics
Planning for power generation in India, super thermal power plants, estimation of cost of power generation; choice of plant site.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- Arora &Domkundwar, "A course in Power Plant Engineering", Dhanpat Rai & Sons

References:
- Black Veatch, "Power Plant Engineering", CBS Publisher

DATABASE MANAGEMENT SYSTEMS

Course Code: EEE2414 **Credit Units: 02**

Course Objective:
The objective of this course is to get students familiar with Databases and their use. They can identify different types of available database model, concurrency techniques and new applications of the DBMS.

Course Contents:
Module I: Introduction
Concept and goals of DBMS, Database Languages, Database Users, Database Abstraction. Basic Concepts of ER Model, Relationship sets, Keys, Mapping, Design of ER Model

Module II: Hierarchical model &Network Model
Concepts, Data definition, Data manipulation and implementation. Network Data Model, DBTG Set Constructs, and Implementation

Module III: Relational Model
Relational database, Relational Algebra, Relational & Tuple Calculus.

Module IV: Relational Database Design and Query Language
SQL, QUEL, QBE, Normalization using Functional Dependency, Multivalued dependency and Join dependency.

Module V: Concurrency Control and New Applications
Lock Based Protocols, Time Stamped Based Protocols, Deadlock Handling, Crash Recovery. Distributed Database, Objective Oriented Database, Multimedia Database, Data Mining, Digital Libraries.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- Korth, Silberschatz, "Database System Concepts", 4th Ed., TMH, 2000.
- Steve Bobrowski, "Oracle & Architecture", TMH, 2000

References:
- Date C. J., "An Introduction to Database Systems", 7th Ed., Narosa Publishing, 2004
- Elmsari and Navathe, "Fundamentals of Database Systems", 4th Ed., A. Wesley, 2004
- Ullman J. D., "Principles of Database Systems", 2nd Ed., Galgotia Publications, 1999.

DATABASE MANAGEMENT SYSTEMS LAB

Course Code:EEE2415 **Credit Units: 01**

Software Required: Oracle 9i

Topics covered in lab will include:

- Database Design
- Data Definition (SQL)
- Data Retrieval (SQL)
- Data Modification (SQL)
- Views
- Triggers and Procedures
- PL\SQL

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Syllabus - Fifth Semester

DIGITAL CIRCUITS AND SYSTEMS

Course Code:EEE2501 Credit Units: 03

Course Objective:
This course builds on the course Digital Circuits and Systems - Hardware development language VHDL is introduced; the usage of the same to implement the systems is dealt in detail.

Course Contents:

Module I: Design of Sequential circuits
SR, JK, T and D flip flops and their timing diagrams with delay, characteristic table, characteristic equation and excitation tables. Design of Finite State Machines: Mealy and Moore type using next state tables, state diagrams, state minimization, state encoding: minimum bit change and hot one encodings. Comparative cost and delays of different implementations and their optimization and timing diagrams, Asynchronous and synchronous sequential circuits Static Timing Analysis –setup, hold time, clock skew, clock period
Data paths, FSMs with datapaths, ASM charts

Module II: Basics of VHDL
Introduction and Basic Design Units of VHDL, Writing Entities for Digital circuits like decoders, registers etc, Scalar Data types and Operations: Object types: constants, variables, signal and files. Data Types: scalar, integer, floating, physical, enumeration, type declarations, subtypes, expressions and operators for various types.
Sequential statements: If, case, Null, Loop, Exit, Next statements, while loops, For loops, Assertion and report statements
Composite Arrays: arrays, Array aggregates, unconstrained array types, strings, Bit vectors, Standard Logic Arrays, array operations and records

Module III: VHDL Programming
Behavioral Modeling: process statements, variable and signal assignments, inertial and transport delay models, signal drivers, multiple and postponed processes
Dataflow Modeling: Concurrent signal assignment, multiple drivers, block statement
Structural Modeling: component declaration, component instantiation, resolving signal values, and configuration: basic configuration, configuration for structural modeling, mapping library entities.
Generics, generic (AND, NAND, OR, NOR, XOR and XNOR) gates, functions and subprograms, packages and libraries

Module IV: Synthesis: mapping statements to gates
Writing a test bench, converting real and integers to time, dumping and reading from text file
Vhdl modeling of basic gates, half and full adder AOI, IOA, OAI, multiplexes, decoders (dataflow, behavioral and structural modeling), three state driver, parity checker, D, T, JK and SR flip flops, flip flops with preset and clear, modeling for multiplexer, priority encoder, ALU etc, modeling regular structures, delays, conditional operations, synchronous logic, state machine modeling, Moore and Mealy machines, generic priority encoder, clock divider, shift registers, pulse counter etc

Module V: Overview of the following
PLD devices, PROM, PAL, PLA, CPLD, EPLD GAL, FPGA, DRAM etc and their applications, FPGA programming, Design exercises ASIC design using CAD tools

Examination Scheme:

Components	HA	V/S/Q	CT	AT	ESE
Weightage (%)	7	8	10	5	70

Text & References:

- Daniel Gajski: Principles of Digital Design
- Bhasker: A VHDL Primer 3/e
- Pedroni: Circuit Design with VHDL
- Perry: VHDL: Programming by examples K. Skahill, VHDL for programmable Logic

MICROPROCESSOR SYSTEMS

Course Code: EEE2502 **Credit Units: 03**

Course Objective:
This course deals with the systematic study of the Architecture and programming issues of 8085-microprocessor family. The aim of this course is to give the students basic knowledge of the above microprocessor needed to develop the systems using it.

Course Contents:

Module I: Introduction to Microcomputer Systems
Introduction to Microprocessors and microcomputers, Study of 8 bit Microprocessor, 8085 pin configuration, Internal Architecture and operations,interrupts, Stacks and subroutines, various data transfer schemes.

Module II: ALP and timing diagrams
Introduction to 8085 instruction set, advance 8085 programming , Addressing modes, Counters and time Delays, , Instruction cycle, machine cycle, T-states, timing diagram for 8085 instruction.

Module III: Memory System Design & I/O Interfacing
Memory interfacing with 8085. Interfacing with input/output devices (memory mapped, peripheral I/O), Cache memory system. Study of following peripheral devices 8255, 8253, 8257, 8259, 8251.

Module IV: Architecture of 16-Bit Microprocessor
Difference between 8085 and 8086, Block diagram and architecture of 8086 family, pin configuration of 8086, minimum mode & maximum mode Operation, Bus Interface Unit, Register Organization, Instruction Pointer, Stack & Stack pointer, merits of memory segmentation, Execution Unit, Register Organization.

Module V: Pentium Processors
.Internal architecture of 8087, Operational overview of 8087, Introduction to 80186, 80286, 80386 & 80486 processors, Pentium processor (P-II, P-III, P-IV).

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Ramesh. S. Gaonkar, "Microprocessor architecture Programming and Application with 8085" Penram International Publishing, 4th Edition
- B. Ram, "Fundamentals of microprocessors and microcomputer" Dhanpat Rai, 5th Edition.]
- Douglas V Hall.
- M. Rafiquzzaman, "Microprocessor Theory and Application" PHI – 10th Indian Reprint.
- Naresh Grover, "Microprocessor comprehensive studies Architecture, Programming and Interfacing" Dhanpat Rai, 2003.
- Gosh," 0000 to 8085" PHI.

POWER SYSTEM-I

Course Code: EEE2503 **Credit Units: 03**

Course Objective:
This course deals with the analysis of faults and method of protection.

Course Contents:
Module I: Representation of Power Systems
Introduction, types of short circuits, sources of fault current, Percentage resistance and reactance, Base KVA, Short circuit KVA, Fault level, The one line diagram, Impedance and reactance diagram, Points to be noted for drawing Impedance diagram, procedure for short circuit calculation, Per Unit method and quantities, Selection and Changing the base of per unit quantities, per unit impedance of three winding transformers, Advantage of per unit computation, Wave form of short circuit current- sub transient, transient and steady state, Current limiting reactors- air insulated, oil immersed, Reactor location- generator, feeder, bus-bar

Module II: Symmetrical Components and Analysis of Faults
Introduction, Meaning of sequence, Definition of Sequence systems, Operator 'h', Determination of sequence components, per unit and percent quantities, Three phase short circuit, Line to ground fault, Maximum and minimum fault currents, Meaning of sequence impedances and sequence networks, independence of sequence components.

Module III: Short Circuit Currents
Introduction, causes and sources of short circuits, Stability, Symmetrical and asymmetrical short circuits, Analysis of asymmetrical currents, DC components of asymmetrical short circuits, Initial magnitude of DC Component, Sub transient reactance, Negative sequence reactance, Zero sequence reactance.

Module IV: Fuses
Introduction, Definition and types, Construction, HRC Fuse link, Action of HRC fuse, Shapes of fuse element, Specifications of a fuse link, Characteristic of a fuse, Cut off, Classification and categories P-Q-R, Selection of a fuse link, Silver as fuse elements, purpose of filler, Guide lines for some applications, protection of motor, discrimination, protection of radial lines, coordination of fuse and circuit breakers, protection of meshed feeders with steady load, tests on fuse

Circuit Breakers Introduction, Requirement of circuit breakers, Basic operation, establishment and properties of arc, Principles of arc interruption, DC Circuit breaking and AC circuit breaking, Recovery and re-striking voltage, Methods of arc extinction, Mathematical expression for re-striking voltage, Active recovery voltage, Switching, magnetizing and capacitive currents, Current chopping, Resistance switching, Operating mechanisms and types, Contacts- types and materials, Types of Circuit breakers- oil circuit breakers, Air circuit breakers, Vacuum Circuit breakers, SF6 circuit breakers, Rating of Circuit breakers- Braking capacity, Making capacity, Short time rating, Normal current rating, Maintenance, Auto re-closure, Selection of circuit breakers.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Electric Power System: By – C.L.Wadhwa
- Electric Power System: By - Asfaq Husain
- Elements of Power System Analysis: By – William D.Stevenson
- Power System Analysis & Design: By – B.R.Gupta
- HVDC Transmission: By K.R. Padiyar
- Electric power by Soni, Gupta and Bhatnagar

CONTROL SYSTEM

Course Code: EEE2509 **Credit Units: 03**

Course Objective:
The basic objective of this course is to provide the students the core knowledge of control systems, in which time & frequency domain analysis, concept of stability.

Course Contents:

Module I: Input / Output Relationship
Introduction of open loop and closed loop control systems, mathematical modeling and representation of physical systems (Electrical Mechanical and Thermal), derivation of transfer function for different types of systems, block diagram & signal flow graph, Reduction Technique, Mason's Gain Formula.

Module II: Time – Domain Analysis
Time domain performance criteria, transient response of first, second & higher order systems, steady state errors and static error constants in unity feedback control systems, error criteria, generalized error constants, performance indices, response with P, PI and PID Controllers.

Module III: Frequency Domain Analysis
Polar and inverse polar plots, frequency domain specifications, Logarithmic plots (Bode Plots),gain and phase margins, relative stability, Correlation with time domain, constant close loop frequency responses, from open loop response, Nyquist Plot.

Module IV: Concept of Stability
Asymptotic stability and conditional stability, Routh – Hurwitz criterion, Root Locus plots and their applications. Compensation Techniques:Concept of compensation, Lag, Lead and Lag-Lead networks, design of closed loop systems using compensation techniques. P, PI, PID controllers.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:
- Dr. N.K Jain, 2005,"Automatic Control System Engineering", Dhanpat Rai Publication.
- J. Nagrath& M. Gopal, 2000, "Control System Engineering", New Age International.

References:
- M, K. Ogata, 2002, "Modern Control Engineering, PHI.
- B. C. Kuo, 2001, "Automatic Control system, Prentice Hall of India.

DIGITAL CIRCUITS AND SYSTEMS LAB

Course Code: EEE2505 **Credit Units: 01**

List of Experiments

To implement VHDL code for

1. 2, 3, 4 inputs AND, OR, XOR and XNOR gates and testing their simulation with signals.
2. Half adder, full adder and full subtractor. Also trying out other simple combinatorial circuits like AOI, IOA, OAI.
3. D and T, flip-flops.
4. JK and SR flip-flops.
5. 2 to 4 and 3 to 8 decoders.
6. 2 to 1, 4 to 1 and 8 to 1 multiplexers.
7. a register.
8. 2 to 1, 4 to 2 and 8 to 3 priority encoders.
9. 8 bit tri state drivers.
10. 9 input parity checker.
11. 1 bit, 4 bit 8 bit comparators.
12. Adding and subtracting 8 bit integers of various types.
13. Clock divider
14. shift register
15. Pulse counters.
16. VHDL Design examples of Moore machine, Mealy machine, generic gate inputs and delays.
17. VHDL code examples of structural modeling showing binding.

Experiments based Field Programmable Gate Array (FPGA) Programming

18. Implementation of all the above VHDL experiments using FPGA.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

MICROPROCESSOR SYSTEMS LAB

Course Code:EEE2506 **Credit Units: 01**

List of experiments:

1) Write at least three different programs for addition of two 8 bit numbers assuming carry may or may not be generated.

2) Write at least three different programs for subtraction of two 8 bit numbers assuming borrow may or may not be generated.

3) Write two different programs for 16 bit addition, one using instruction DAD and another without using instruction DAD.

4) Write assembly language program for 8 bit multiplication and division.

5) To study, understand, interface and two peripheral devices with 8085.

6) Any three programs using 8085 based on block of data.

7) Using 8086 write an ALP to add list of 10 given numbers.

8) Using 8086 write an ALP to sum the numbers from 1-100.

9) Using 8086 write an ALP to count negative numbers from a given list of 10 numbers.

10) Using 8086 write an ALP to check number of vowels in a given string.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

CONTROL SYSTEM LAB

Course Code:EEE2510 **Credit Units: 01**

Course Contents:

1. Study and draw

a) Step response of open Loop system (linear 1st order, 2nd order

b) Step response of closed loop systems (1st order)

2. Study and draw temperature control system the open loop response and closed loop response with different values of gains
3. Study of operations and characteristics of a stepper motor
4. To Study a D.C. motor speed control system.
5. Performance evaluation and design of PID controller.
6. Study of microprocessor control of a simulated linear system.
7. To design a suitable cascade compensator for the given system and verify the resulting improvement.
8. Note: three experiments in MATLAB have to be performed in the slot of MATLAB.

   Using MATLAB obtain the unit-step response and unit impulse response of the following system:

$$\frac{C(s)}{R(s)} = \frac{16}{s^2 + 1.6s + 16}$$

9. For a 2nd order transfer function using MATLAB

   a) Bode Plot

   b)Root locus plot

   c)Nyquist plot.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

SUMMER INTERNSHIP EVALUATION-I

Course Code: EEE2535 **Credit Units: 03**

Methodology:

Practical training is based on the theoretical subjects studied by students. It can be arranged within the college or in any related industrial unit. The students are to learn various industrial, technical and administrative processes followed in the industry. In case of on-campus training the students will be given specific task of fabrication/assembly/testing/analysis. On completion of the practical training the students are to present a report covering various aspects learnt by them and give a presentation on same.

Examination Scheme:

Feedback from industry/work place	20
Training Report	40
Viva	15
Presentation	25
Total	**100**

BIOMEDICAL INSTRUMENTATION

Course Code:EEE2507 **Credit Units: 03**

Course Objective:
This course aims to give an understanding of instruments used in biomedical applications.

Course Content:

Module-I: Sensors and Transducers for biological applications
Types, properties, characteristics and selection of transducers for biological instrumentation.

Module-II: Measurement of electrical parameters
Leads and electrodes, electrocardiography, electrical activity of the heart, equivalent cardiac generator. Einthoven lead system, standardization of recording and display of ECT (Electrocardiogram), EEG (Electroencephalogram), EMG (Electromyogram), EOG (Electroocculogram), ERG (Electroretinogram), EGG (Electrogastogram).

Module-III: Measurement of non-electrical parameters
Blood flow, drop recorder, electromagnetic flow meter, measurement of systolic and diastolic pressures, blood pressure instruments, intraocular pressure, lung air pressure, Audiometers. Measurement of body temperature, thermography. Cardiac tachometer, respiration rate phonocardiogram, heart sounds electrical stethoscope pulmonary function analysers. CO2 - O2 - Concentration in exhaled air, blood and lungs, pH value of blood, impedance pletnysmography blood gas analysers, blood cell counters.

Module-IV: Medical Imaging Systems
Medical display systems, medical thermography X-Ray, diathermy equipment. Ultrasonics in biomedical application for diagnostic and therapeutic, CAT, MRI, Laser applications in biomedical field.

Module-V: Patient safety
Electrical Safety of Medical Equipments, Shock Hazards from Electrical Equipment, Methods of Accident Prevention, Test Instruments for checking Safety parameters of biomedical equipments.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

BOOKS RECOMMENDED

- Biomedical Instrumentation and Measurements; L.C. Cronwell F.J. Weibell. E.A. Pfeiffer, PHI.
- Principles of applied instrumentation: Gaddes and Baker, John Wiley & Sons.
- Handbook of Bio-medical Instrumentation; R.S. Khandpur, Mc Graw Hill
- Medical Instrumentation – Application & Design, John G. Webster, Editor, John Wiley & Sons.

FUZZY LOGIC AND NEURAL NETWORKS

Course Code: EEE2508 **Credit Units: 02**

Course Objective

Course has been divided in to two parts: Neural Networks and Fuzzy Logic. Neural networks part aims at introducing the fundamental theory and concepts of biological and artificial neural network and their applications in the area of machine intelligence. This part also offers knowledge of learning rules and architecture of various neural nets. The second part covers fuzzy logic: Fuzzy logic is a tool that can be applied to ambiguous problems, which cannot easily solved by classical techniques. Course discusses the fundamental of fuzzy set theory and fuzzy logic. In addition, this course also introduces applications of fuzzy logic in several areas such as fuzzy control and fuzzy decision making.

Course Contents :

Module I: Introduction

Biological neurons & memory: structure & function of simple neuron; Artificial Neural Networks (ANN); Typical applications of ANN: Classification, pattern recognition, control, optimization; Basic approach of working on ANN – Training, learning and generalization.

Module II:

Back propagation –architecture –algorithm-derivation of learning rules –number of hidden layers-learningfactors-Hopfield neural net : architecture – algorithm –applications.

Module III:

Neural network based on competition: fixed- weight competitive nets- kohonenself organizing maps andapplications. Adaptive Renonace theory: Basic architecture and operation. Neural controller for a temperature
process.

Module IV:

Basic concepts of fuzzy sets – Relational equation – fuzzy logic control – fuzzification – defuzzification –knowledge base – Decision making logic –membership functions – rule base.

Module V:

Fuzzy logic controller: functional diagram, membership functions: triangular, trapezoidal- scale factors.Fuzzificatoin: membership value assignments using intuition –knowledge base. Defuzzification :maxmembershipprinciple – centeroid method – weighted average method –rule. Choice of variables-derivation ofrules- case study: fuzzy logic controller design for a temperature process

Modes of Evaluation: Quiz/Assignment/ Seminar/Written Examination

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text Books

- Timothy J.Ross, Fuzzy logic with Engineering Applications, McGraw Hill, New york, 1996.
- Kosko.B, Neural Network and fuzzy systems- o\prentice Hall of India Pvt. Ltd., New Delhi, 1992.
- Zurada Jacek M, Introduction to Artificial Neural Systems, West, 1992. (QA76.87.Z96)
- S.N.Shivanandam, S.N.Deepa, Principles of Soft Computing, Wiley 2008

Reference Books

- Neural Networks by Rolf Pfeifer, Dana Damian, Rudolf Fuchslin - University of Zurich.
- Jang Jyh-Shing Roger, Sun Chuen-Tsai and MizutaniEiji, NeuroFuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, Prentice-Hall, 1997.

FUZZY LOGIC AND NEURAL NETWORKS LAB

Course code: EEE2511 **Credit Units: 01**

List of Experiments

- To study about Matlab and learn basic matrix operations.
- Write program to draw straight line, circle and sine functions.
- Study of Biological Neural Network & Artificial Neural Network
- How the weight and bias value effect the output of neuron.
- How weight and bias values are able to represent a decision boundary in feature space.
- Implementation of logic gate (AND,OR,NOT,NAND,NOR) using McCulloh-pitts model.
- How the choice of activation function effects the output of neuron. Experiment with following function: binary threshold and sigmoid function.
- Write a program to implement single layer perception algorithm..
- To Study Fuzzy Logic
- To study and analysis of Fuzzy vs Crisp logic.
- Write the program to implement various Fuzzy set operations (complement , union, intersection etc.)
- Implementation of fuzzy relations (Max-Min Composition

Modes of Evaluation: Quiz/Assignment/ Seminar/Written Examination

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

POWER SYSTEM-II

Course Code:EEE2601CreditUnits: 04

Course Objective:
The basic objective of the course is to impart knowledge to the students on power system protection

Course Contents:

Module I: Metal Enclosed Switchgear
Introduction, Types of switchgear, High voltage indoor metal enclosed switchgear- general features, draw out type metal enclosed switchgear, sheet steel switch boards, switchgear with vacuum interrupters, Low voltage metal clad switchgear and low voltage circuit breakers- unit type, classification, rated quantities, tests on low voltage circuit breakers, Explosion proof switchgear, Low voltage control gear and contactor- terms and definition, rated characteristics, tests, Control panels

Module II: Neutral Earthing
Introduction, Terms and definition, Disadvantages of ungrounded Systems, Advantages of neutral grounding, Types of grounding, Ungrounded system, Connection of arc suppression coil, Neutral point earthing of transformer LV circuits, Neutral grounding practice, Earthing transformer, Station earthing system, Resonant grounding - Methods of neutral grounding.

Module III: Protective Relaying
Introduction, Importance, Protective zones, primary and backup protection, desirable quantities of protective relaying, Some terms in protective relaying, Basic operation of relay, Classification of relays, Buchholz's relay, Induction relays, Directional relays, Distance relays- impedance relay, admittance relay, classification of distance relays and distance protection, Differential relays

Module IV: Static Relays
Introduction, Static relay techniques using semi conductors,: Phase and amplitude comparators, Duality between phase and amplitude comparators, general equation for comparators, Basic elements of a static relay, over-current relays, differential protection, static distance protection.

Module V: Apparatus Protection
Alternator protection- types of faults, Stator protection, differential protection, rotor protection, over load protection, loss of excitation protection, un balanced loading protection, prime mover protection, over speed protection, over voltage protection, Transformer protection-, nature, faults in auxiliary equipment, winding faults, over load and external short circuits, differential protection of transformers, over current and earth fault protection, tank leakage protection, restricted earth fault protection, gas relays, transformer feeder protection, Induction Motor Protection: Abnormal operating conditions, Contactors and circuit breakers for motors, Under voltage protection, phase and Earth fault protection, Overload protection, Unbalanced voltage protection, Single phasing preventer, Phase reversal protection.

Module VI: Computer aided relaying
Introduction to microcomputer based relays, general functional diagram of micro computer based relays. Advantages over conventional relaying techniques. Relay testing: Relay test benches

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:

- S. S. Rao - Switchgear and Protection - Khanna Publishers, N.Delhi, 1990.
- T.S.Madhava Rao - Power System Protection - TMH, 1979
- I. J. Nagrath and D. P. Kothari - Power System Engineering, TMH, 1994

References:

- Badriram and D. Vishwakarma - Power System Protection and Switchgear - TMH, 1995
- Ravindranath B. and Chander. M - Power System Protection and Switchgear - Wiley Eastern, 1994.
- ArunG.Phadke and S. H. Horowitz - Power System Relaying (Ed.2) - John Wiley, 1995.
- C. L. Wadhwa - Electrical Power Systems (Ed. 2) – Wiley Eastern, 1993
- Ravindranath and Chander - Power System Protection and Switchgear - Wiley Eastern, 1994

ELECTRIC MACHINE-II

Course Code: EEE2602CreditUnits: 04

Course Objective:
This course deals with the systematic study and application of the AC machines which are widely used in the Industry

Course Contents:

Module I: Poly phase Induction Machines – I
Construction features, production of rotating magnetic field, phasor diagram, equivalent circuit, torque and power equations, torque-slip characteristics, no load and blocked rotor tests' efficiency. Induction generator.

Poly phase Induction Machines – II
Starting and speed control (with and without e.m.f. injection in the rotor circuit), deep bar and double cage induction motors, cogging and crawling.

Module II: Single- Phase Induction Motor
Double revolving field theory, equivalent circuit, no load and blocked rotor tests, starting methods, repulsion motor.
A.C. Commutator Motor:
E.M.F. induced in commutator windings, single phase a.c. series motor, Universal motor

Module III: Synchronous Machines - I
Constructional features, armature windings, E.M.F. equation, winding coefficients, harmonics in the induced E.M.F., armature reaction, O.C. and S.C. tests, voltage regulation-Synchronous impedance method, MMF Method, Potier's triangle method and parallel operation, operation on infinite bus, cooling.

Module IV: Synchronous Machines - II
Two reaction theory, power expressions for cylindrical and salient pole machines, performance characteristics.
Synchronous Motor
Principle of operation, starting methods, phasor diagram torque-angle characteristics, V-curves hunting and dampling, synchronous condenser, reluctance motor.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- M.G.Say, "Alternating Current machines", Pitman & Sons.
- P.S. Bimbhra, "Electric Machinery", Khanna Publishers.

References:
- P.S. Bimbhra, "Generalized Theory of Electrical Machnies", Khanna Publishers.
- I.J. Nagrath and D.P. Kothari, "Electrical Machnies", Tata McGraw Hill.
- B.R. Gupta and V. Singhal, "fundamental of Electrical Machines", New Age International

ELECTRICAL POWER GENERATION, TRANSMISSION AND DISTRIBUTION-I

Course Code: EEE2603 **CreditUnits: 04**

Course Objective:
The basic objective of this course is to provide the students the core knowledge of electric power transmission and distribution.

Course Contents:

Module I: General Background
Introduction, Structureof electric power systems, Single and double script notation, Power in single phase AC circuits, Complex power, Direction of power flow, Voltage, current and Power in balanced 3 phase circuits

Module II: Supply Systems
Introduction, Method of transmission and distribution-overhead, underground, comparison between them, Choice of transmission voltage, System voltage and transmission efficiency, Systems of transmission and distribution- DC 2 wire, AC 1 phase two wire, AC 2 phase four wire, AC 2 phase three wire, AC 3 phase three wire, AC 3 phase four wire, influence of voltage on cost and efficiency, comparison of different systems of transmission and distribution based on equal potential difference any conductor and earth and between two conductors, Need for AC for transmission

Module III: Mechanical Design of Overhead Lines
Main items of overhead lines-Conductors, supports, Insulators, metal hardware, Conductor material and properties-copper, aluminum, ACSR, cadmium copper, Supports- main requirements of supports,, types of supports-wooden, RCC, steel tubular, steel towers, Insulators-factors involved in design, types-`pin, suspension and their comparison, Strain and shackle insulators, Insulator failure, Potential difference over a string of suspension insulators, String efficiency and methods used for increasing it, Capacitance grading, Static shielding, Sag tension calculations with supports at same and different levels, Effect of ice and wind

Module IV: Constants of Overhead Lines
Introduction, Resistance, Inductance-single conductor, two wire system, three phase line symmetrically and asymmetrically placed, composite conductor, three phase line with more than one circuit, Capacitance- single phase two wire system, between two lines, 3 phase line symmetrical spacing and effect of transposition in case of unsymmetrical spacing, effect of earth on capacitance of conductor, Skin and proximity effect, Classification of overhead lines based on capacitance- short, medium and long

Module V: Corona
Introduction, Voltage gradient, Corona formation, Factors affecting corona, Critical voltage, Visual critical voltage, Disruptive critical voltage, Power loss due to corona, Advantages and disadvantages, Methods to reduce corona

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Electric Power System: By – C.L. Wadhwa
- Electric Power System: By - Asfaq Husain
- Elements of Power System Analysis: By – William D. Stevenson
- Power System Analysis & Design: By – B.R. Gupta
- HVDC Transmission: By K.R. Padiyar
- Electric power by Soni, Gupta and Bhatnagar

MODERN AND DIGITAL CONTROL ENGINEERING

Course Code: EEE2608 **CreditUnits: 03**

Course Objective:
The basic objective of the course is to impart knowledge to the students on modern control theory and design of control systems.

Course Contents:
Module I: Control System Components
Basic components, amplifiers, plants, transducers, error detectors, servo systems and regulator, DC and AC position and speed control systems.
Design of Feedback control systems
Introduction, cascade compensation networks, phase lag and lead design using Bode and Root locus plots

Module II: Modern theory
Introduction- State variables, state differential equations(homogeneous and non-homogeneous), Solution, state transition matrix- properties and computation, Laplace solution of state equations, transfer function matrix, representation of state equations in term of state transition matrix, characteristic equation
Modeling- state variable modeling, state model signal flow graph, state models-physical, phase, Jordan, similarity transformation, other useful transformation- controllability and observability canonical, diagonal canonical, Jordan canonical
Decomposition- direct, cascade, parallel
Controllability and observability – introduction, definition, tests, theorems, rank of a matrix, output controllability, duality theorem, pole- zero cancellation
Design-state feedback, relationship with closed-loop transfer function, pole placement and assignment, design of controller by transformation, Observer design, Ackerman's formula

Module III: Discrete time signals and systems
Introduction, SDC systems, sampling and data reconstruction.
Transform analysis of discrete systems: Introduction, linear difference equations, the pulse T.F. and pulse response, Z-transform equivalence of Zdomain to S-domain, stability analysis.

Module IV: Design of digital controls
Introduction, design of a positional
Servomechanism, digital PID controller, multivariable controllers.

Module V: State space models of discrete time systems: Introduction, discrete time state equation and solution, design examples, concepts of controllability and observability Liapunov stability analysis.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- R C Dorf," Modern Control Systems", Pearson Education
- J. Nagrath& M. Gopal, 2000, "Control System Engineering", New Age International.
- Norman S Nise, "Control system Engineering", Wiley publishers

References:
- M, K. Ogata, 2002, "Modern Control Engineering, PHI.
- B. C. Kuo, 2001, "Automatic Control system, Prentice Hall of India

POWER SYSTEM LAB

Course Code: EEE2604 **CreditUnits: 01**

List of Experiments:

1. To study the performance of a transmission line. Also compute its ABCD parameters.
2. Study of Characteristics of over current and earth fault protection.
3. To study the operating characteristics of fuse. (HRC or open type)
4. To find the earth resistance using three spikes
5. To study over current static relay.
6. To study the different types of faults on transmission line demonstration panel/model.
7. To study the radial feeder performance when
   (a) Fed at one end.
   (b) Fed at both ends
8. To study the performance of under voltage and over voltage relay.
9. To study the characteristics of bimetal mini circuit breakers.
10. To study the characteristics of Distance Relay.
11. To find the breakdown strength of transformer oil.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

ELECTRIC MACHINE-II LAB

Course Code:EEE2605CreditUnits: 01

List of Experiments:

1. To Perform load-test on 3 ph. Induction motor & to plot torque V/S speed characteristics.
2. To Perform no-load & blocked –rotor tests on 3 ph. Induction motor to obtain equivalent ckt. Parameters & to draw circle diagram.
3. To study the speed control of 3 ph. Induction motor by Kramer's Concept.
4. To study the speed control of 3 ph. Induction motor by cascading of two induction motors, i.e. by feeding the slip power of one motor into the other motor.
5. To study star- delta starters physically and
   (a) to draw electrical connection diagram
   (b) to start the 3 ph. Induction motor using it.
   (c) To reverse the direction of 3 ph. I.M.
6. To start a 3 phase slip –ring induction motor by inserting different levels of resistance in the rotor ckt. And to plot torque –speed characteristics.
7. To perform no-load & blocked –rotor test on 1 ph. Induction motor & to determine the parameters of equivalent ckt. Drawn on the basis of double revolving field theory.
8. To Perform load –test on 1 ph. Induction motor & plot torque –speed characteristics.
9. To Perform no load & short ckt. Test on 3- phase alternator and draw open ckt. And
10. Short ckt. Characteristics.
11. To find voltage regulation of an alternator by zero power factor (z.p.f.) method.
12. To study effect of variation of field current upon the stator current and power factor
13. With synchronous motor running at no load and draw V & inverted V curves of motor.
14. To measure negative sequence & zero sequence reactance of Syn. Machines.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

UTILIZATION OF ELECTRICAL ENERGY

Course Code: EEE2606 **CreditUnits: 03**

Course Objective:
This course intends to impart knowledge on the practical and practice aspects of electrical engineering

Course Contents:

Module I: Heating and Welding
Electrical heating-advantages, methods and application, resistance over general construction, design of heating elements, efficiency and losses control. Induction heating: core type furnaces, core less furnaces and high frequency eddy current heating, dielectric heating: principle and special applications, arc furnaces: direct arc furnaces, Indirect arc furnaces, electrodes, power supply and control. Different methods of electrical welding and electrical equipment for them. Arc furnaces transformer and welding transformers.

Module II: Traction
Advantages and disadvantages, system of electric traction, diesel electric locomotives. Mechanics of train movement: simplified speed time curves, average and schedule speed, tractive effort, specific energy consumption, factors affecting specific energy consumption.

Module III: Traction Motors
DC motors, single phase and three phase motors, starting and control of traction motors, braking of traction motors. Modern 25 KV a.c. single phase traction systems: advantages, equipment and layout of 25 KV, single phase power frequency A.C. traction.

Module IV: Electric Drives
Individual and collective drives- electrical braking, plugging, rheostatic and regenerative braking load equalization use of fly wheel criteria for selection of motors for various
industrial drives.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Utilization of Elect. Energy - E.O. Taylor
- Utilization of Elect. Energy - H. Pratab
- Utilization of Elect. Energy - J.B. Gupta

SUBSTATION ENGINEERING

Course Code: EEE2607CreditUnits: 03

Course Objective:
The purpose of this course is to provide a thorough introduction to Substation engineering with an in depth study of various components that make a complete Substation.

Course Contents:

Module I
IntroductionFunctions of a substation, Classification, Layout, Design and Construction of Bus Bar and earth wire in substation.
Jumpering of conducters, Factors affecting layout of substation, Testing of substation. Reactive power management, Fundamentals of earthing

Module II
Load Management, importance of capacitor banks, power factor improvement, protection and installment of capacitor banks. types of overhead insulators, pollution flashover mechanism in insulators,basics of current transformers and voltage transformers. Economic operation of power system.

Module III
Computer applications, SCADA subsystem, Data acquisition and data processing, supervisory control, voltage control and voltage stability, Protection using circuit breakers,fuse and protection against overvoltage.Bus bar protection.

Module IV
Technical standards for construction of sub stations, Substation automation system. Gas insulated substations,.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Substation Engineering by Er. R.S.Dahiya (KATSON BOOKS)
- EHV AC and DC by S.Rao

ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION-II

Course Code:EEE2701 **Credit Units: 04**

Course Objective:
The basic objective of this course is to provide the students the core knowledge of electric power transmission and distribution

Course Contents:

Module I: Short and Medium Lines
Introduction, Classification of lines,Short single phase lineand phasor diagram, Short 3 phase ine, Transmission line as a two port network, Line regulation and efficiency, Line with transformers, Medium lines, Nominal T and pie models, Transmission efficiency and regulation of medium lines

Module II: Long Lines
Introduction, Exact solution of a long line, Physical interpretation of the long line equation, Propagation – constant, wavelength and velocity, Characteristic Impedance, Hyperbolic form of line equation, ABCD constants and evaluation, Ferranti effect, Surge impedance loading

Module III: Cables
Introduction, Classification, cable conductors, Cable requirements and construction, Properties and classification of Insulating materials, metallic sheathing, mechanical protection, Dielectric stress and insulation resistance, Capacitance – single core and three core cable, Grading of cables- Capacitive, inter-sheath, Limitation of inter-sheath grading, Economical diameter, Methods of laying, Cable specifications, Current carrying capacity of cables, LT cables. HT cables, Super tension Cables, Extra high tension cables, Advantages and disadvantages of oil filled cables

Module IV: Distribution
Kelvin's law and modified Kelvin's law for feeder conductor size, limitations of Kelvin's laws, DC distribution, radial and ring main systems, DC three wire systems, Different types of distributors,, DC distributor with concentrated load fed at one end and both ends with ends maintained at equal and unequal voltages, DC distributor with distributed load fed at one end and at both ends, DC ring main distributor, Dc ring main distributor with interconnector, DC three wire distributor fed at one end and at both ends, AC Distribution- method of calculations, AC distributor with concentrared loads, Power factors with respect to respective load points.

Module V
Introduction, comparison of a.c. and d.c. transmission system, Advantages and limitations of HVDC transmission, principal parts, control and applications of HVDC transmission.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Electric Power System: By – C.L.Wadhwa
- Electric Power System: By - Asfaq Husain
- Elements of Power System Analysis: By – William D.Stevenson
- Power System Analysis & Design: By – B.R.Gupta
- HVDC Transmission: By K.R. Padiyar
- Electric power by Soni, Gupta and Bhatnagar

MEASURMENT AND MEASURING INSTRUMENTS

Course Code: EEE2702 **Credit Units: 03**

Course Objective:
The objective of the course is to provide a brief knowledge of measurements and measuring instruments related to engineering. The basic idea of this course is to give the sufficient information of measurements in any kind of industry viz. electrical, electronics, mechanical e t c.

Course Contents:

Module I: Theory of Measurement
Introduction, Unit System, Performance Characteristics: static & dynamic standards, Error analysis: Sources, types and statistical analysis.

Module II: Transducers
Passive transducers, Active transducers: Classification, selection, Measurement of Pressure, Strain, Resistance, Capacitance and inductance. strain gauges, rossettes, LVDT, interfacing resistive transducers to electronic circuits.

Module III: Analog Meters
AC analog meter: Average, Peak and RMS voltmeters, sampling voltmeters. Electronics Analog meters: Electronics analog DC and AC voltmeter and ammeters, ohmmeter and multimeter

Module IV: Data Acquisition System
Introduction to data acquisition systems, Bridges: Wheatstone's bridge, Kelvin double bridge; Megger; Andersons Bridge; Schering Bridge; sources and detectors, shielding of bridges.

Module V: Digital Meters and Oscilloscopes
Display devices: Decimal, BCD and straight binary number, indicating system, numeric & alpha number display using LCD & LED, specification of digital meters: display digit & counts resolution, sensitivity, accuracy, speed & settling time etc.
Types of oscilloscopes, Measurement of Frequency.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:
- Electronic Instrumentation Technology by MMS Anand, PHI Pvt. Ltd., New Delhi Ed. 2005.
- Electronics Instrumentation by H.S. Kalsi TMH Ed. 2004.

References:
- Electronics Instrumentation & Measurement Techniques by W.D. Cooper & A.D. Helfrick, PHI 3rd Ed.
- Electronics Measurement & Instrumentation by Oliver & Cage Mc-Graw Hill.

MEASURMENT AND MEASURING INSTRUMENTS LAB

Course Code: EEE2703 **Credit Units: 01**

Course Contents:

1. Measurement of resolution and sensitivity of thermocouple (study of various thermocouples J, K, T, etc.) (Calibration)
2. Measurement of resolution, sensitivity and non linearity of thermistor (thermistor instability)
3. Measurement of thickness of LVDT.
4. Measurement of resolution of LVDT (and displacement measurement)
5. Study of proportional control and offset Problems.
6. Study of proportional integral control.
7. Study of proportional integral derivative (PID) control.
8. Vibration measurement by stroboscope (natural frequency of a cantilever)
9. Angular frequency (speed of rotating objects) measurement by stroboscope.
10. Pressure transducer study and calibration.
11. Proving ring (force measurement)

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

SUMMER INTERNSHIP EVALUATION-II

Course Code: EEE2735 **Credit Units: 03**

Methodology:
Practical training is based on the theoretical subjects studied by students. It can be arranged within the college or in any related industrial unit. The students are to learn various industrial, technical and administrative processes followed in the industry. In case of on-campus training the students will be given specific task of fabrication/assembly/testing/analysis. On completion of the practical training the students are to present a report covering various aspects learnt by them and give a presentation on same.

Examination Scheme:

Feedback from industry/work place	20
Training Report	40
Viva	15
Presentation	25
Total	**100**

SOFTWARE ENGINEERING

Course Code: EEE2704 **Credit Units: 02**

Course Objective:
The basic objective of Software Engineering is to develop methods and procedures for software development that can scale up for large systems and that can be used to consistently produce high-quality software at low cost and with a small cycle time. Software Engineering is the systematic approach to the development, operation, maintenance, and retirement of software. The course provides a thorough introduction to the fundamentals principles of software engineering. The organization broadly be based on the classical analysis-design-implementation framework.

Course Contents:

Module I: Introduction
Software life cycle models: Waterfall, Prototype, Evolutionary and Spiral models, Overview of Quality Standards like ISO 9001, SEI-CMM

Module II: Software Metrics and Project Planning
Size Metrics like LOC, Token Count, Function Count, Design Metrics, Data Structure Metrics, Information Flow Metrics. Cost estimation, static, Single and multivariate models, COCOMO model, Putnam Resource Allocation Model, Risk management.

Module III: Software Requirement Analysis, design and coding
Problem Analysis, Software Requirement and Specifications, Behavioural and non-behavioural requirements, Software Prototyping Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design Top-down and bottom-up Structured programming, Information hiding,

Module IV: Software Reliability, Testing and Maintenance
Failure and Faults, Reliability Models: Basic Model, Logarithmic Poisson Model, Software process, Functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing: path testing, Data flow and mutation testing, unit testing, integration and system testing, Debugging, Testing Tools, & Standards.Management of maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software RE-engineering

Module V: UML
Introduction to UML, Use Case Diagrams, Class Diagram: State Diagram in UMLActivity Diagram in UMLSequence Diagram in UMLCollaboration Diagram in UML

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:
Text:

- K. K. Aggarwal & Yogesh Singh, "Software Engineering", 2nd Ed, New Age International, 2005.
- R. S. Pressman, "Software Engineering – A practitioner's approach", 5th Ed., McGraw Hill Int. Ed., 2001.

References:

- R. Fairley, "Software Engineering Concepts", Tata McGraw Hill, 1997.
- P. Jalote, "An Integrated approach to Software Engineering", Narosa, 1991.
- Stephen R. Schach, "Classical & Object Oriented Software Engineering", IRWIN, 1996.
- James Peter, W. Pedrycz, "Software Engineering", John Wiley & Sons.
- Sommerville, "Software Engineering", Addison Wesley, 1999.
- Sommerville, "Software Engineering", Addison Wesley, 1999.

SOFTWARE ENGINEERING LAB

Course Code: EEE2708 **Credit Units: 01**

Software Required: Rational Rose

Assignments will be provided for the following:

- Use of Rational Rose for visual modeling.
- Creating various UML diagrams such as use case, sequence, collaboration, activity, state diagram, and class diagrams.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

DIGITAL SIGNAL PROCESSING

Course Code: EEE2705 **Credit Units: 02**

Course Objective:
The objective of the course in Digital signal processing is to provide the student with significant skills in general as well as advanced theories and methods for modification, analysis, detection and classification of analog and digital signals. Furthermore, the objective is to give the student a broad knowledge of central issues regarding design, realisation and test of analog and in particular digital signal processing systems consisting of hardware and/or software components. The specialization in signal processing makes it possible to study practical or theoretic fields, ranging from mathematics/signal theory over algorithmic design to development of instruments based on hardware and/or software for real time signal

Course Contents:

Module I: Discrete time signals and systems in time domain
Classification of signal, signal processing operations, classification of systems, discrete time systems, examples of types of signal, sampling process, time domain characterization of LTI discrete- time systems, state space representation of LTI discrete time systems.

Module II: Discrete time signals in transform domain
DTFT, properties, applications, inverse DTFT, DFT, properties, applications, inverse DFT, Z-transform, properties, applications, inverse Z-transform, frequency response, transfer function, Fast Fourier transform algorithms: DIT algorithm, DIF algorithm.

Module III
Discrete time processing of continuous time signals: sampling, analog filter design, antiliasing filter design.

Module IV: Discrete time processing of discrete- time signals
Digital filters: Digital filter structure: FIR filter structure, IIR filter structure
Digital filter design: Impulse invariance method, bilinear transform method of IIR filter design, FIR filter design.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Prokis, Manolakis: Digital signal processing
- Oppenheim & Schaffer : Digital Signal Processing
- Fafael C. Gonzalez, Richrd E. Woods: Digital Image Processing
- Anil Kumar Jain Fundamentals of Digital Image Processing

DIGITAL SIGNAL PROCESSING LAB

Course Code: EEE2709 **Credit Units: 01**

List of Experiments:

- To generate unit step sequence, exponential sequence and sinusoidal sequence
- To determine convolution of two given sequences.
- To plot the frequency response of an FIR system
- To compute DFT and IDFT of a given sequence
- To determine the circular convolution of two given sequences
- To design various analog filters
- To design FIR filter using Hamming window
- To convert Analog filter into Digital Filter using bilinear transformation
- To determine z and inverse z transform of a given sequence
- To verify 8 points FFT algorithm in decimation in time (DIT) & decimation in frequency (DIF).
- To determine the filter coefficient using Ramez exchange algorithm.
- To design an IIR digital filter and its parallel realization.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

ROBOTICS AND MECHATRONICS

Course Code: EEE2706 **Credit Units: 02**

Course Objective:
The course aims to introduce the working of robots their geometric interpretations and planning of trajectories. This course also provides knowledge on mecharonics.

Course Contents:

Module I: Robot Arm Kinematics
Introduction. The Direct Kinematics Problem. Rotation Matrices, Composite Rotation Matrix. Rotation Matrix about an Arbitrary Axis, Rotation Matricswith Euler Angles Representation, GeometricInterpretation of Rotation Matrics, HomogeneousCoordinates and transformation Matrix,

Module II
Geometric Interpretation of Homogeneous Transformation Matrices, Composite Homogeneous Transformation Matrix.
II&III Links, Joints and Their Parameters, The David-Hhartenberg Representation, ½ Kinematics Equation for Manipulators, Other specifications of the Location of the End-Effector, Classification of manipulators, The Inverse Kinematics Problem, Inverse Transform Technique for Euler Angles Solution.

Module III: Planning of Manipulator Trajectories
Introduction, General considerations on Trajectory planning, joint- Interpolated Trajectiries, Calculation of a 4-3-4 joint Trajectory, Cubic Spline Trajectory (five Cubics).

Module IV: Mechatronics
What is Mechatronics, Systems, Measurement systems, Control systems, Microprocessor- based controllers, Response of systems, The Mechatronics Approach.

Module V: Actuators
Pneumatic and Hydraulic Actuation systems; Actuation systems, Pneumatic and Hydraulic systems, Directional control valves, Pressure control valves, Cylinders, Process Control Valves, Rotary Actuators.
Mechanical Actuation Systems: Mechanical systems, Types of motion, Kinematic chains, Cams, Gear trains, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection.
Electrical Actuation Systems: Electrical systems, Mechanical switches, Solid state switches, Solenoids, D.C. Motors, A.C. Motors, Stepper Motors.
Programmable Logic Controllers: Introduction, Basic Structure, Input Output Processing, Programming, Mnemonics, Timers, Internal Relays and Counters, Shift Registers, Master and jump controls, Data handling, Analogue input/output, Selection of a PLC.
Mechatronics Systems: Traditional and Mechatronics Designs, Possible
Mechatronics Design Solutions, Case Studies of Mechatronic Systems.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

Text:
- Robotics, Control, Sensing, Vision and Intelligence, K S FU,
- R C GONZALEZ, C S G LEE, McGraw Hill, 1987.
- Mechatronics, W BOLTON, Pearson Education Ltd, 2003.

References:

- Introduction to Robotic Mechanics and Control, JOHN J. CRAIG, Pearson Education Ltd. 2003
- Introduction to Robotics, SYED V NIKU, PHI, Pearson, 2003
- Robotics and Control, R K Mittal, I J Nagrath, TMH, 2003
- Mechatronics, Principles Concepts and Applications – N.P. Mahalik TMH 2005
- Introduction to Mechatronics and Measurement systems – David G.Alciator and Michael B. Histand TMH 2005

ROBOTICS AND MECHATRONICS LAB

Course Code: EEE2710 **Credit Units: 01**

1. To study Robot Arm (Model 1055)
2. To make the sequential operation
   $A^+ B^+ A^- B^-$; A^+, B^+, $B^- A^-$ using Pneumatic trainer
3. For the above write a ladder logic giving time delays
4. Design a Pneumatic Circuit for clamping type & operated by PLC
5. Design a Hydraulic Circuit for clamping type & operated by PLC
6. To make the ladder logic for water level control & reaction vessel to detect different levels of water and switch off the water supply.
7. Starter Control & Star Delta Starter for ¼ HP AC. Motor to demonstrate the use of PLC Motor Starting
8. Design Fan operation using PLC
9. Design n a Lift Control
10. Design Sequential Switching Motors

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

C BASED EMBEDDED SYSTEM DESIGN

Course Code: EEE2707 **Credit Units: 02**

Course Objective:
The syllabus is divided into two parts, the first one deals with 8051 architecture and its interfacing with other devices. Second part of the syllabus deals with the basic embedded system and it's design. A microcontroller is an integrated circuit that is programmable. The syllabus makes student perfect in assembly language programming, addressing modes etc apart from it input-output programming is discussed in detail. In the second part Embedded systems and it's application is discussed. Real Time Operating System is also explained at length.8051 C programming is also incorporated in the syllabus.

Course Contents:

Module I: Introduction to an embedded systems design & RTOS
Introduction to Embedded system, Processor in the System, Microcontroller, Memory Devices, Embedded System Project Management, ESD and Co-design issues in System development Process, Design cycle in the development phase for an embedded system, Use of target system or its emulator and In-circuit emulator, Use of software tools for development of an ES.Inter-process Communication and Synchronization of Processes, Tasks and Threads, Problem of Sharing Data by Multiple Tasks, Real Time Operating Systems: OS Services, I/O Subsystems, Interrupt Routines in RTOS Environment, RTOS Task Scheduling model, Interrupt Latency and Response times of the tasks.

Module II: Overview of Microcontroller
Microcontroller and Embedded Processors, Overview of 8051 Microcontroller family: Architecture, basic assembly language programming concepts, The program Counter and ROM Spaces in the 8051, Data types, 8051 Flag Bits ad PSW Register, 8051 Register Banks and Stack Instruction set, Loop and Jump Instructions, Call Instructions, Time delay generations and calculations, I/O port programming Addressing Modes, accessing memory using various addressing modes, Arithmetic instructions and programs, Logical instructions, BCD and ASCII application programs, Single-bit instruction programming, Reading input pins vs. port Latch, Programming of 8051 Timers, Counter Programming.

Module III: Communication with 8051
Basics of Communication, Overview of RS-232, I2C Bus, UART, USB, IEEE 488 (GPIB). Parallel input output applications. (Stepper motor Sequencer program, Strobed input/output). Interrupt driven applications (real time clock, serial input/output with interrupt). Analog-digital interfacing (Pulse width modulator, 8-bit ADC).

Module IV: Basics of 8051 C Programming
Introduction to 8051 C, 8051 memory constitution, Constants, variables and data types. Arrays structures and unions, pointers, Loops and decisions, Functions, Modules and programs.

Module V: 8051 C Programming
Data interface, Timer control, Interrupt operations, Digital operations, A/D and D/A conversions, Common control problem examples (Centronics parallel interface, Printer interace, Memory access, Key matrix scanning, Stepper motor control and digital clock).

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:

- Raj Kamal, 2004, "Embedded Systems", TMH.
- James W. Stewart and Kai X. Miao, 2en Edition. "The 8051 microcontroller" Pearson Edu. Prentice Hall.
- M.A. Mazidi and J. G. Mazidi, 2004 "The 8051 Microcontroller and Embedded Systems", PHI.

References:

- David E. Simon,1999, "An Embedded Software Primer", Pearson Education
- K.J. Ayala, 1991, "The 8051 Microcontroller", Penram International.
- Dr. Rajiv Kapadia, "8051 Microcontroller & Embedded Systems", Jaico Press
- Dr. Prasad, 2004, "Embedded Real Time System", Wiley Dreamtech.

C BASED EMBEDDED SYSTEM DESIGN LAB

Course Code: EEE2711 **Credit Units: 01**

Course Contents:

1. Write a program to add two 8-bit numbers using microcontroller 8051.
2. Write a program to multiply two 8-bit numbers using microcontroller 8051.
3. Write a program to divide two 8-bit numbers using microcontroller 8051.
4. Write a program to subtract two 8-bit numbers using microcontroller 8051.
5. Write a program to generate a geometric progression using microcontroller 8051.
6. Write a program to generate a square wave using microcontroller 8051.
7. Write a program to generate a delay of 5 ms using microcontroller 8051.
8. Study and implement serial communication by interfacing microcontroller with a computer.
9. Study and implement parallel data communication by interfacing microcontroller with a LCD.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

INDEPENDENT STUDY

Course Code: EEE2712 **Credit Units: 02**

This is an elective, self-directed course to investigate a emerging areas of IT and Computer Science like Mobile Operating System, Cloud Computing, or from Current Research Areas etc. The primary goal of the course is to provide students with research exploration of a specific topic of interest to the individual student under the advisement of an instructor who will monitor and critique the student's progress.

Independent study provides students with the opportunity to work one-on-one with a Faculty on a particular topic. The student and faculty should discuss the aims and content of the study and present the proposal to Head of Department. The independent study proposal should include the study's title, theme, readings, work to be submitted, and syllabus. Faculty and student should meet for a minimum number of 2 hours per week. Student will give a seminar after completion of study.

TERM PAPER

Course Code: EEE2731 **Credit Units: 02**

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.
The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER
The procedure for writing a term paper may consist of the following steps:
1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject
The subject chosen should not be too general.

2. Finding Sources of Materials
a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazine articles, news stories, periodicals, scientific journals etc.

3. Collecting the notes
Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.
a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

4. Outlining the paper
a) Review notes to find main sub-divisions of the subject.
b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the first draft
Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:
a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion
Avoid short, bumpy sentences and long straggling sentences with more than one main idea.

6. Editing &Preparing the final Paper
a) Before writing a term paper, you should ensure you have a question which you attempt to

answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.

b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
   (i) Show evidence of what an author has said.
   (ii) Avoid misrepresentation through restatement.
   (iii) Save unnecessary writing when ideas have been well expressed by the original author.
f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Term papers should be composed of the following sections:

1) Title page
2) Table of contents
3) Introduction
4) Review
5) Discussion&Conclusion
6) References
7) Appendix

Generally, the introduction, discussion, conclusion and bibliography part should account for a third of the paper and the review part should be two thirds of the paper.

Discussion

The discussion section either follows the results or may alternatively be integrated in the results section. The section should consist of a discussion of the results of the study focusing on the question posed in the research paper.

Conclusion

The conclusion is often thought of as the easiest part of the paper but should by no means be disregarded. There are a number of key components which should not be omitted. These include:

a) summary of question posed
b) summary of findings
c) summary of main limitations of the study at hand
d) details of possibilities for related future research

Reference

From the very beginning of a research project, you should be careful to note all details of articles gathered.
The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

Conventions

Monographs
Crystal, D. (2001), Language and the internet. Cambridge: Cambridge University Press.

Edited volumes

Gass, S./Neu, J. (eds.) (1996), Speech acts across cultures. Challenges to communication in a second language. Berlin/ NY: Mouton de Gruyter.

[(eds.) is used when there is more than one editor; and (ed.) where there is only one editor. In German the abbreviation used is (Hrsg.) for Herausgeber].

Edited articles
Schmidt, R./Shimura, A./Wang, Z./Jeong, H. (1996), Suggestions to buy: Television commercials from the U.S., Japan, China, and Korea. In: Gass, S./Neu, J. (eds.) (1996), Speech acts across cultures. Challenges to communication in a second language. Berlin/ NY: Mouton de Gruyter: 285-316.

Journal articles
McQuarrie, E.F./Mick, D.G. (1992), On resonance: A critical pluralistic inquiry into advertising rhetoric. Journal of consumer research 19, 180-197.

Electronic book
Chandler, D. (1994), Semiotics for beginners [HTML document]. Retrieved [5.10.'01] from the World Wide Web, http://www.aber.ac.uk/media/Documents/S4B/.

Electronic journal articles
Watts, S. (2000) Teaching talk: Should students learn 'real German'? [HTML document]. German as a Foreign Language Journal [online] 1. Retrieved [12.09.'00] from the World Wide Web, http://www.gfl-journal.com/.

Other websites
Verterhus, S.A. (n.y.), Anglicisms in German car advertising. The problem of gender assignment [HTML document]. Retrieved [13.10.'01] from the World Wide Web, http://olaf.hiof.no/~sverrev/eng.html.

Unpublished papers
Takahashi, S./DuFon, M.A. (1989), Cross-linguistic influence in indirectness: The case of English directives performed by native Russian speakers. Unpublished paper, Department of English as a Second Language, University of Hawai'i at Manoa, Honolulu.

sUnpublished theses/ dissertations
Möhl, S. (1996), Alltagssituationen im interkulturellen Vergleich: Realisierung von Kritik und Ablehnung im Deutschen und Englischen. Unpublished MA thesis, University of Hamburg.
Walsh, R. (1995), Language development and the year abroad: A study of oral grammatical accuracy amongst adult learners of German as a foreign language. Unpublished PhD dissertation, University College Dublin.

Appendix
The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: (Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)	40%
Final Evaluation: (Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)	60%

PROJECT

Course Code: EEE2732 **Credit Units: 02**

Course Objective:
The objective of this course is to provide practical training on some live/demo projects that will increase capability to work on actual problem in industry. It will be an in house training on some latest software which is in high demand in market. This training will be designed such that it will useful for their future employment in industry.

STUDENT ASSESSMENT RECORD (SAR)

Record to be maintained by project guide.

1. Project Tools (Hardware/ Software) used fot implementation.

2. Project Evaluation & Execution.

Examination Scheme:

Components	**V**	**S**	**R**	**FP**
Weightage (%)	20	20	20	40

V – Viva, S – Synopsis, FP – Final Presentation, R - Report

Syllabus - Eighth Semester

POWER ELECTRONICS

Course Code: EEE2801 **Credit Units: 03**

Course Objective:
The course aims to introduce them to the theory of operation, analytical and circuit models and basic design concepts of Electric Power components and systems.

Course Contents:

Module I: Triggering Devices
Triggering devices, Unijunction Transistor, Characteristics and applications of UJT, Programmable Unijunction Transistor, DIAC, Silicon Controlled Switch, Silicon Unilateral Switch, silicon Silicon bilateral Switch, Shockley diode.

Module II: Thyristor Firing Circuits, Turn on systems
Two transistor model of Thyristor, Method of Triggering a thyristor, Thyristor Types, Requirement for triggering circuits, Thyristor Firing Circuits, Fullwave control of Ac with one thryristor, Light activated SCrs (LASCR), Control Circuit, dv/dt and di/dt protection of Thyristor, Pulse Transformer triggering, Firing SCR by UJT, TRIAC firing circuit, Phase control of SCR by pedestal and Ramp.

Module III: Controlled Rectifiers
Types of Converters, effect of inductive load, Commutating diode or free wheeling diode, controlled rectifiers, Bi phase half wave, single phase full wave phase controlled converter using bridge principle, harmonics.

Module IV: Inverters
Types of Inverters, Bridge Inverters, Voltage Source Inverters, Pulse Width Modulation Inverters, Current source Inverters.

Module V: AC Voltage Controllers
Types of AC voltage Controllers, AC Phase Voltage controllers, single Phase Voltage Controller with RL load, harmonic analysis of single phase full wave controller with RL load.

Module VI: DC to DC Converters
DC choppers, Chopper classification, two quadrant chopper, Four quadrant chopper.

Module VII: Cyclo Converter
Single phase and three phase cycloconverters.

Module VIII: Industrial Applications
One shot Thyristor trigger Circuit, over voltage protection, simple battery charger, battery charging regulator, AC static switches, DC static switch

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:

- J. Michael: Power Electronics: Principles and Applications
- M. H. Rashid: Power Electronics circuits

References:

- H. C. Rai, "Power Electronics Devices, Circuits, Systems and Application", Galgotia, 3rd Ed.
- P. S. Bimbhara, "Electrical Machinery, Theory Performance and Applications" Khanna Publications, 7th Ed

PROJECT-DISSERTATION

Course Code: EEE2837 **Credit Units: 08**

Methodology

Topics of project are to be based on the latest trends, verifying engineering concepts /principals and should involve elementary research work. The projects may involve design, fabrications, testing, computer modeling, and analysis of any engineering problem. On completion of the practical training the students are to present a report covering various aspects learnt by them and give a presentation on same.

Guidelines for Project File and Project Report

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critically analyzed by the faculty guide and corrected by the student at each stage.

Project File

The Project File may be a very useful tool for undertaking an assignment along-with a normal semester, an exploratory study, sponsored projects, a project undertaken during summer period or any other period where the researcher is not working with a company/organization. The project/ assignment may also be a part of the bigger research agenda being pursued by a faculty/ institution/ department

The Project File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation. This file may be considered in continuous assessment.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated objectives;
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen and may be useful to document for future reference.

Project Report

The Project Report is the final research report that the student prepares on the project assigned to him. In case of sponsored project the lay out of the project could be as prescribed by the sponsoring organization. However, in other cases the following components should be included in the project report:

- **Title or Cover Page**
  The title page should contain Project Title; Student's Name; Programme; Year and Semester and Name of the Faculty Guide.
- **Acknowledgement(s)**
  Acknowledgment to any advisory or financial assistance received in the course of work may be given. It is incomplete without student's signature.
- **Abstract**
  A good"Abstract" should be straight to the point; not too descriptive but fully informative. First

paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project. It should not exceed more than 1000 words.

- **Table of Contents**
  Titles and subtitles are to correspond exactly with those in the text.
- **Introduction**
  Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.
- **Materials and Methods**
  This section should aim at experimental designs, materials used (wherever applicable). Methodology should be mentioned in details including modifications undertaken, if any. It includes organization site(s), sample, instruments used with its validation, procedures followed and precautions.
- **Results and Discussion**
  Present results, discuss and compare these with those from other workers, etc. In writing this section, emphasis should be laid on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.
  Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary, do not write in "point" form.
  While presenting the results, write at length about the the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be in congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion rather, it should lead to generalization of data on the chosen sample.
  Results and its discussion should be supporting/contradicting with the previous research work in the given area. Usually one should not use more than two researches in either case of supporing or contradicting the present case of research.
- **Conclusion(s) & Recommendations**
  A conclusion should be the final section in which the outcome of the work is mentioned briefly.
  Check that your work answers the following questions:
  - Did the research project meet its aims (check back to introduction for stated aims)?
  - What are the main findings of the research?
  - Are there any recommendations?
  - Do you have any conclusion on the research process itself?
- **Implications for Future Research**
  This should bring out further prospects for the study either thrown open by the present work or with the purpose of making it more comprehensive.
- **Appendices**
  The Appendices contain material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.
- **References**
  References should include papers, books etc. referred to in the body of the report. These should be written in the alphabetical order of the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.
  Examples
  For research article
  Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic*Escherichia*

*coli*O157: H7. *ClinMicrobiol Infect*, **8** (suppl 1): 116–117.

For book

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Layout Guidelines for the Project File & Project Report

- A4 size Paper
- Font: Arial (10 points) or Times New Roman (12 points)
- Line spacing: 1.5
- Top and bottom margins: 1 inch/ 2.5 cm; left and right margins: 1.25 inches/ 3 cm

Assessment of the Project File and the Project Report

Essentially, the assessment will be based on the quality of the report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project. Project execution is concerned with assessing how much work has been put in.

The Project should fulfill the following assessment objectives:

- Range of Research Methods used to oASEin information
- Execution of Research
- Data Analyses (Analyse Quantitative/ Qualitative information)
- Quality Control
- Conclusions

Assessment Scheme:

Continuous Evaluation:

40% (Based on punctuality, regularity of work, adherence to plan and methodology,refinements/ mid-course corrections etc. as reflected in the Project File.)

Final Evaluation:

60% (Based on the Documentation in the file, Final report layout, analysis andresults, achievement of objectives, presentation/ viva)

Examination Scheme:

Literature study/ Fabrication/ Experimentation	40
Written Report	20
Viva	15
Presentation	25

HIGH VOLTAGE ENGINEERING

Course Code: EEE2802 **Credit Units: 03**

Course Objective:
This subject deals with the detailed analysis of Breakdown occur in gaseous, liquids and solid dielectrics. Information about generation and measurement of High voltage and current. In addition the High voltage testing methods are also discussed.

Course Contents:

Module I: Introduction to High Voltage Technology and Applications
Electric Field Stresses, Gas / Vaccum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

Module II: Break Down in Gaseous and Liquid Dielectrics
Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids.

Module III: Break Down in Solid Dielectrics
Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.

Module IV: Generation of High Voltages and Currents
Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators.

Module V: Measurement of High Voltages and Currents
Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

Module VI: Over Voltage Phenomenon and Insulation Co-Ordination
Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

Module VII: Non-Distructive Testing Of Material and Electrical Apparatus
Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements.

Module VIII: High Voltage Testing Of Electrical Apparatus
Testing of Insulators and bushings, Testing of Isolators and circuit breakers, testing of cables, Testing of Transformers, Testing of Surge Arresters, Radio Interference measurements.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:

- High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition
- High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition.

References:

- High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 1997.
- High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.

NUCLEAR POWER ENGINEERING

Course Code: EEE2803 **Credit Units: 03**

Course Objective:
The aim of this course is to make the students learn about the theory and engineering behind establishment Nuclear power stations

Course Contents:

Module I: Introduction to Nuclear Engineering
Introduction, Why Nuclear Power for Developing Countries, Atomic Nuclei, Atomic Number and Mass Number, Isotopes, Atomic Mass Unit, Radioactivity and Radioactive Change Rate of Radioactive Decay, Mass – Energy Equivalence, Binding Energy, Release of Energy by Nuclear Reaction, types of Nuclear Reactions, Initiation of Nuclear Reaction, Nuclear Cross – section, Nuclear Fission, The Fission Chain Reaction, moderation, Fertile Materials and Breeding.

Module II: Nuclear Reactors
Introduction, General Components of Nuclear Reactor, General Problems of Reactor Operation, Different Types of Reactors, Pressurised Water Reactors (PWR), Boiling Water Reactors (BWR), Heavy Water – cooled and Moderated CANDU (Canadian Deuterium Uranium) Type Reactors, Gas-cooled Reactors, Breeder Reactors, Reactor Containment Design, Location of Nuclear Power Plant, Nuclear Power Station in India, India's 3-stage Programme for Nuclear Power Development, Comparison Nuclear Plants with Thermal Plants.

Module III: Nuclear Materials
Introduction, Fuels, Cladding and Structural Materials Coolants, Moderating and Reflecting Materials, Control Rod Materials, Shielding Materials.

Module IV: Nuclear Waste & Its Disposal
Introduction, Unit of Nuclear Radiation, Types of Nuclear Waste, Effects of Nuclear Radiation, Radioactive Waste Disposal System, Gas Disposal System.
Safety Rules: Personal Monitoring, Radiation Protection (Radiation Workers, Non-Radiation Workers, Public at large), Radiation Dose (Early effect, Late effect hereditary effect)

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- P.K. Nag " Power Plant Engineering ", Tata McGraw Hill
- Arora &Domkundwar "Power Plant Engineering ", Dhanpat Rai & Co.
- Combined Power Plants by J.H. HorlockPergamon Press.
- Soni, Gupta and Bhatnagar- A course in Electric Power-Dhanpat rai and Sons

References:
- Black / Veatch, "Power Plant Engineering", CBS Published & Distributors.
- Gas Turbine Theory –by Sh. H. Cohen, G.F.C. Rogers. H.I.H. Saravanamuttoo.
- Longman Scientific & Technical.

THERMAL POWER ENGINEERING

Course Code: EEE2804 **Credit Units: 03**

Course Objective:
The aim of this course is to make the students learn about the theory and engineering behind establishment Thermal power stations

Course Contents:

Module I
Introduction, Uses, Trends, Selection of site for Thermal Station, Main Parts & Working, Boilers, Economizers, Air Preheater, Super heaters, &Reheaters, Steam Prime Mover, Condensers, Spray pond, Cooling Tower, Fuels, Analysis of coal, Liquid fuels, Gaseous Fuels, Hull Handling, Delivery of coal, Unloading Preparation, Transfer, Outdoor (Dead) Storage, Indoor (Live) Storage, Inplant Handling, Coal Weighing, Combustion & Combustion Equipment, Hand Firing, Stoker Hiring, Pulverized Fuel system, Coal Pulverizing Mills, pulverized Fuel burners, automatic combustion control Ash Disposal & dust collection, Ash Handling System, Dust collection, Draught Systems, Types of different Methods of feed water treatment, Evaporators, feed Water Heaters, Steam turbines, Turbo-alternators, steam Station Layouts, steam Station Control.

Module II: Diesel Electric Stations
Introduction, Uses Selection of Site for a Diesel Stations, Diesel Electric Plant: Main Components, Different Types of Engines Used in Diesel Power and their working, Diesel Plant Etnciency and Heat Balance Choice and characteristics of Diesel engines, Auxiliary equipment for Diesel Power Plant, Plant Layout and Maintenance.

Gas Turbine Plants
Introduction, A Simple Gas Turbine plant, Methods to Improve Thermal Efficiency of Gas Turbine Plant, Open Cycle and closed cycle gas Turbine Plants, Components of a Gas Turbine Plant, Fuels for Gas Turbine Plants, Different Arrangements of Components, Combination Gas Turbine Cycle, Plant Layout, Advantages of Gas Turbine Plants over steam Plants

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Soni, Gupta and Bhatnagar- A course in Electric Power-Dhanpat rai and Sons

HYDRO POWER ENGINEERING

Course Code: EEE2805 **Credit Units: 03**

Course Objective:
The aim of this course is to make the students learn about the theory and engineering behind establishment Hydro power stations

Course Contents:
Module I
Introduction, Potential of hydropower in India- its development and future prospect. Selection of site and investigation, General Hydrology- hydrological cycle, precipitation, run-off and its measurement, hydrography, unit hydrograph, flow duration and mass curve,

Module II
Classification of Hydro-Electric Plant, Pondage and storage, Classification of Hydro-Electric Plants according to Quantity of Water available, Classification of Hydro-electric Plants According to Available Head, Classification of Hydro-electric Plants According to Nature of Load,

Module III
General Arrangement & Operation of a hydro electric Plant Functions of different Components in storage Reservoir Plants, Principle of Working of a Hydro electric Plant,

Module IV
Construction & Operation of a different components, Dams, Spillways, Gates, Intake & Outlet works, Canals & Penstocks, Water Hammer & Surge Tank, Type of Turbine, Characteristic of turbines, Governing of turbines, Draft Tube, Hydro-Electric Generators,

Module V
Power station structure lay out and control, Selection of prime mover, speed and pressure regulation, methods of governing, starting and stopping of water turbines, operation of hydro turbines. Machine loading and frequency control, Maintenance of hydropower plants

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Soni, Gupta and Bhatnagar- A course in Electric Power-Dhanpat rai and Sons
- Jagdish Lal, "Hydraulic Machines", Metropolitan book company(P) ltd. Modi, P.N., & Seth, S.M., Hydraulic & Fluid mechanics including Hydraulic Machines", Standard Book House.
- Guthrie Brown," Hydroelectric Engg. Practice", 2nd ed.(in 3 vols.)
- Vol. I : Civil Engineering
- Vol. II : Mechanical & Electrical Engg.
- Vol III : Economics, Operation, Maintenance
- Hydro Power an Indian Perspective Author-Cum-Editor Dr. B.S.K. Naidu, Director General, NPTI.
- Hydro –Electric and Pump storage Plants – MG Jog, Wiley Eastern Limited.
- Micro Hydroelectric Power Stations – By L.Monition, Power Stations- by Lamination, MleNir, J.Roux translated by Joan Mc Mullan, John Wiley & Sons.
- Hydro Power by Professor Dr. Ing. Joachim Raable VDI- Verlag Gmbtt.
- Hydro Power Plant Familarisation, NPTI Publication.

SOLAR ENGINEERING

Course Code: EEE2806 **Credit Units: 03**

Course Objective:
To get in depth knowledge and deep understanding about the manufacturing methods of thin film solar panels and to gain an overview of the whole manufacturing process. To get in depth knowledge and understanding about the manufacturing methods of solar wafer and cells.

Course Contents:

Module I: Introduction
Basics of Solar Panels, Fundamentals of solar cells: types of solar cells, semi conducting materials, band gap theory, Solar cell properties and design; p-n junction photodiodes, Single junction and triple-junction solar panels, metal-semiconductor hetero junctions, and Semiconducting materials for solar cells. Types of solar energy concentrators, Fresnel lenses and Fresnel reflectors, operating solar cells at high incident energy for maximum power output

Module II: Solar cell manufacturing processes
Material resources, chemistry, low cost manufacturing processes. Single crystal, polycrystalline and amorphous silicon solar cells, cadmium telluride thin-film solar cells, conversion efficiency, Current trends in photovoltaic research and applications, solution based processes solar cell production.

Module III: Different Coating Methods
ASi (Amorphos Silicon), ASI/µcSi (Amorphous and micro crystalline Silicon), CIS (Copper Indium Sulfid), CdTe(Cadmium Telluride)
Inline Production: Machine overview, Laser Scribing Systems, Edge Ablation, Cutting of glases

Module IV: Process Methods
Texturizing, Diffusion, PSG_etching, SIN-coating, Metalization.
Inline production: Machine overview, Handling Systems, Testing and Sorting, Laser Edge Isolation

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Principles of Solar Engineering, D. Yogi Goswami, Taylor and Francis
- Applied Photovoltaics, Stuart Wenham, Martin Green, and Muriel Watt, Earthscan
- Photovoltaic Engineering Handbook, F. Lasnier and T. G. Ang, IOP Publishing UK (Adam HilgerUSA)
- H.P. Garg and J. Prakash, “Solar Energy fundamental and Applications”, Tata McGraw Hill Pulishing Co. Ltd.
- Magal, “Solar Power Engineering”, Tata McGraw Hill Publishing Co. Ltd

PROCESS AND MACHINE TECHNOLOGY

Course Code: EEE2807 **Credit Units: 03**

Course Objective:
To get a thorough knowledge and understanding of the complete product management and troubleshooting. To be able to maintain the solar machines and to gain the strategic competence to optimize the whole process of maintenance. To get a capacity to optimize the work flow.

Course Contents:

Module I: Troubleshooting
Inspection Procedures, Troubleshooting Methods, Troubleshooting Procedures, Load Problem, Inverter Problem, Array Problem, Troubleshooting Records

Module II: Maintenance
Basics, Maintenance Procedures, Module array cleaning, Electrical check and maintenance, Inverter preventative maintenance, Maintenance instructions

Module III: Asset lifecycle management
Introduction, Upkeep strategy & philosophy, General Product Management, Energy production analysis and reporting.

Module IV: Support guidelines
Optimization process, Controlling of maintenance, Repair and Replacement, User manual.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Bower, W., J. Dunlop and C. Maytrott, "Performance of Battery Charge Controllers: An Interim Test Report," Proceedings of 21st IEEE Photovoltaic Specialists Conference
- Vinal, George W., Storage Batteries, Fourth Edition, John Wiley and Sons
- Kiehne, H. A., Battery Technology Handbook, Marcel Dekkar, Inc.
- Linden, D., Handbook of Batteries and Fuel Cells, McGraw-Hill
- Lane, C., Dunlop, J., and W. Bower, "Cecil Field Photovoltaic Systems Evaluation," Sandia National Laboratory
- Hammond, B. and J. Dunlop, "Venice Photovoltaic Systems Evaluation," Sandia National Laboratory,