SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY "DNYANTEERTH", VISHNUPURI, NANDED

PROPOSED CURRICULUM FOR

T.E. (Electrical Engineering & Electrical, Electronics and Power)

(CGPA Revised)

w.e.f. 2020-21

Teaching Scheme - Third Year Electrical Engineering & Electrical, Electronics and Power

SEMESTER – V

S.No	Category	Code	Course Title	Hours per Week				Marking Scheme					Theory Total
				L	T	P	CR	PR	OR	TW	MSE	ESE	
1.	Professional Core Courses	PCC-EE501	Power System-I (Apparatus & Modeling)	3	0	2	4	25#	-	25	30	70	150
2.	Professional Core Courses	PCC-EE502	Control System	3	0	2	4	25#	-	25	30	70	150
3.	Professional Core Courses	PCC-EE503	Microprocessor & Microcontroller	3	0	2	4	50#	-	25	30	70	150
4.	Professional Elective Courses	PEC-EE504(A)	Elective 1-(Electrical Machine Design)	3	0	2	4	25@	-	25	30	70	150
		PEC-EE504(B)	Elective 1- (Electrical Drives)										
5.	Open Elective Course	OEC-EE505(A)	Open Elective-01 ((Digital Control System)	2	0	2	3	25@	-	25	15	35	100
		OEC-EE505(B)	Open Elective-01 (Computer Networks)										
6.	Mandatory Course	MC 506	Management	2	0	0	1	-	-	-	15	35	50
7	Humanities & Social Sciences including Management Course	HSMC507	Seminar- III	0	0	2	1	0	25@	0	0	0	25
8	Humanities & Social Sciences including Management Course	HSMC508	Soft skills Personality Development	0	0	2	0	0	0	25	0	0	25
9	Professional Core Courses	PCC-EE509	NPTEL Course – I	0	0	2	1	0	0	0	0	0	0
Total				**16**	**0**	**16**	**22**	**175**	**25**	**150**	**150**	**350**	**800**

Symbols to remember: -@ - Internal Assessment, # - External Assessment

T-Theory. P –Practical , T –Tutorial , CR-Credit , OR-Oral , TW- Term Work,MSE-Mid Semester Examination , ESE-End Semester Examination.

Chairman

Dr. B. M. Patre	**Dr.S.N.Talbar**	**Dr.A.B.Gonde**	**Dr.S.T.Hamde**	**Ms.Deshmukh S.S**	**Mr.Landge M.S**
SGGSIE&T	**SGGSIE&T**	**SGGSIE&T**	**SGGSIE&T**	**Gramin College of Engg.**	**Gramin College of Engg**
Vishnupuri,Nanded	**Vishnupuri,Nanded**	**Vishnupuri,Nanded**	**Vishnupuri,Nanded**	**Vishnupuri,Nanded**	**Vishnupuri,Nanded**

Dean Engineering
SRTM University Nanded

Teaching Scheme - Third Year Electrical Engineering & Electrical, Electronics and Power

SEMESTER – VI

S.No.	Category	Code	Course Title	Hours per Week				Marking Scheme					Theory Total
				L	T	P	CR	PR	OR	TW	MSE	ESE	
1.	Professional Core Courses	PCC-EE 601	Power System-II (Operation & Control)	3	0	2	4	25#	-	25	30	70	150
2.	Professional Core Courses	PCC-EE 602	Electromagnetic Field	3	0	0	3	-	-	-	30	70	100
3.	Professional Core Courses	PCC-EE603	Measurement & Instrumentation Laboratory	0	0	2	1	50#	-	50	-	-	100
4.	Professional Elective Courses	PEC- EE 604(A)	Elective 2- (Industrial Electrical System)	3	0	2	4	25@	-	25	30	70	150
		PEC- EE 604(B)	Elective 2- (PLC ,SCADA Application)										
5.	Professional Elective Courses	PEC- EE 605(A)	Elective 3- (High Voltage Engineering)	3	0	2	4	25@	-	25	30	70	150
		PEC- EE 605(B)	Elective 3- (Computer Architecture)										
6.	Open Elective Course	OEC-EE606(A)	Open elective-02 (Power Plant Engineering)	3	0	0	3	25@	-	25	15	35	100
		OEC-EE606(B)	Open elective-02 (Thermal & Fluid engineering)										
7.	Humanities and Social Sciences including Management Courses	HSMC607	Seminar-IV	0	0	2	1	0	25@	0	-	-	25
8.	Humanities and Social Sciences including Management Courses	HSMC 608	Technical & Competitive Skills	0	0	2	1	0	25@	0	0	0	25
9.	Professional Core Courses	PCC-EE609	NPTEL Course – II	0	0	2	1	0	0	0	0	0	0
Total				**12**	**0**	**20**	**22**	**200**	**50**	**200**	**105**	**245**	**800**

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Vishnupuri,Nanded	**Vishnupuri,Nanded**	**Vishnupuri,Nanded**	**Vishnupuri,Nanded**	**Vishnupuri,Nanded**	**Vishnupuri,Nanded**

Dean Engineering
SRTM University Nanded

PCC-EE-501	Power System-I (Appratus&Modeling)	3L:0T:2P	4 credits

Course Objectives:

a) To introduce students to the basic structure and requirements of any electric power supply system.
b) To develop knowledge about nature of power systems engineering and the profession.
c) To develop an understanding of components in a power system and to understand the basic principles involved in these components.
d) To explore analysis and design principles for the complete power system.

Course Content:

Module 1: Basic Concepts (08 Hrs)

Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids. Generation: Conventional and Renewable Energy Sources. Distributed Energy Resources.Energy Storage. Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. Review of Three-phase systems. Analysis of simple three-phase circuits. Power Transfer in AC circuits and Reactive Power.

Module 2: Power System Components (10 Hrs)

Overhead Transmission Lines and Cables: Electrical and Magnetic Fields around conductors, Corona. Parameters of lines and cables.Capacitance and Inductance calculations for simple configurations.Travelling-wave Equations. Sinusoidal Steady state representation of Lines: Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power.Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines.Transformers: Three-phase connections and Phase-shifts. Three-winding transformers, autotransformers, Neutral Grounding transformers. Tap-Changing in transformers.Transformer Parameters.Single phase equivalent of three-phase transformers.Synchronous Machines: Steady-state performance characteristics. Operation when connected to infinite bus. Real and Reactive Power Capability Curve of generators. Typical waveform under balanced terminal short circuit conditions steady state, transient and sub-

transient equivalent circuits. Loads: Types, Voltage and Frequency Dependence of Loads. Per-unit System and per-unit calculations.

Module 3: Over-voltages and Insulation Requirements (06 Hrs)

Generation of Over-voltages: Lightning and Switching Surges. Protection against Over voltages, Insulation Coordination. Propagation of Surges. Voltages produced by traveling surges. BewleyDiagrams.

Module 4: Fault Analysis and Protection Systems (08 Hrs)

Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults.Representation of generators, lines and transformers in sequence networks.Computation of Fault Currents.Neutral Grounding.Switchgear: Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection.Protection schemes (Over-current, directional, distance protection, differential protection) and their application.

Module 5: Introduction to DC Transmission & Renewable Energy Systems (08 Hrs)

DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC). LCC and VSC based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission. Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine. Fixed and variable speed turbines.Permanent Magnetic Synchronous Generators and Induction Generators. Power Electronics interfaces of wind generators to the grid.

Course Outcomes:

At the end student will able to

1. Understand the concepts of power systems.
2. Understand the various power system components.
3. Evaluate fault currents for different types of faults.
4. Understand the generation of over-voltages and insulation coordination.
5. Understand basic protection schemes.
6. Understand concepts of HVDC power transmission and renewable energy generation.

Reference Books :

1. J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1994.

2. O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.

3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.

4. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.

5. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.

List of Practical's & Term work:-

1. Visits to power system installations (generation stations, EHV substations etc.)
2. Exposure to fault analysis and Electro-magnetic transient program (EMTP) and Numerical Relays.
3. Visit the wind energy generation plant and Collect information about different types of turbines used in wind energy plant.
4. Visit the solar energy generation plant and study their I – V and P - V characteristics.
5. To plot the characteristic of over current thermal /induction relay.

PCC-EE502	Control System	3L:0T:2P	4 credits

Course Objectives:

a) To enhance the analytical ability of the students in facing the challenges posed by growing trends in control system
b) To enhance the describing ability of the students to represent the control system mathematically.
c) To enhance the describing ability of the students to analyze the system in time and frequency domain.

Course Content:

Module 1: Introduction to control problem **(6Hrs)**

Concept of open & closed loop control system, Transfer Function: a) Concept of system: physical system, Physical model, Linear and nonlinear systems, Time variant and invariant system. b) Equations of physical systems (Mass-Spring-Dashpot system, R-L-C series & parallel circuit) transfer function, Procedure of obtaining transfer function.

Module 2: Block diagrams and Signal flow graphs: **(8Hrs)**

a) Block diagram, Block Diagram reduction, and Numerical examples.

b) Signal flow graph; Masons gain formula for deriving overall transfer function of systems. Feedback characteristics of control system: Concept of negative and positive feedback, Sensitivity of the system to parameter variation.

Module 3 : Time domain analysis: **(07 Hrs)**

Test signals, Time domain specifications, Steady state response, Types of system, Steady state error constants and steady state error, Numerical examples, transient response,
Concept of stability, Determination of stability by Routh - Hurwitz criterion.

Module 4 : Frequency domain analysis: **(06 Hrs)**

Introduction to frequency response, Advantages of frequency domain analysis, Polar plots, Bode plots, Nyquist criterion, Relative stability from Nyquist criterion. Definition of Root Locus, Construction of root locus, and Stability from root locus plots, Effect of addition of poles & zeros on root locus plots.

Module 5: State Variable Technique: **(06 Hrs)**

Concept of state & state variable, State Variable Analysis: Different forms of state variable representations (Phase, physical & canonical form), Concept of diagonalization, Obtaining state equations from transfer function representation and vice versa, solution of state equations, State transition matrix (STM), Methods of finding STM, Laplace transform method, Calay Hamilton method, Controllability & observability of linear system, Kalman's test.

Module 6: Controllers in Control System: (07 Hrs)

Defination of controller, Uses of Controller, Types of Controller, Analog Controller, Introduction to Proportional (P), Integral (I) & Derivative (D) , PI, PD, PID Controller Advantages And Disadvantages of these controller. Digital Controller.Introduction to nonlinear controller (Fuzzy logic Controller, Artificial Neural Network)

Course Outcomes:

At the end student will able to

1. Characterize a system and find its study state behavior
2. Investigate stability of a system using different tests
3. Design various controllers
4. Solve liner and non-liner control problems

Reference Books:

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.

2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.

3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.

4. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi

5. Nagarath I. J., Gopal M., 'Control System Engineering' Willey Eastern.

6. Gopal .M. – Control System.(Prentice Hall Of India).

List of Practical's:(Attempt Any 10 Practicals)

1. Temperature controller with on-off controller.
2. Temperature controller with PI controller.
3. Temperature controller with PID controller.
4. To obtain the time response of a given second order system with its damping frequency

5. To plot the root locus for a given transfer function of the system using MATLAB.
6. To obtain bode plot for a given transfer function of the system using MATLAB
7. To obtain the transfer function from the state model
8. To obtain a state model from given poles and zeros using MATLAB.
9. To obtain poles and zeros from a given state model using MATLAB
10. To find the step response of a state model for a given system using MATLAB
11. To obtain the impulse response of a state model for a given system.
12. To obtain ramp response of a state model for a given system
13. To control the closed loop system using PID controller
14. To design a lag compensator for a closed loop system
15. To design a lead compensator for a closed loop system
16. To design lag-lead compensator using closed loop system.

PCC-EE-503	Microprocessor & Microcontroller	3L:0T:2P	4 credits

Course Objectives:

a) To study the Architecture of microcontroller 8051and microprocessor 8086
b) To study the addressing modes & instruction set of 8051 and 8086.
c) To develop skill in simple applications development with programming 8051 & 8086.
d) Developing of assembly language programs and providing the basics of the microcontroller and microprocessors.
e) To provide solid foundation on interfacing the external devices to the controller and processor.

Course Content:

Module 1: 8086 Microprocessors (08 Hours)

Introduction, A Microprocessor survey, Architecture of 8086 Microprocessor, 8086 pin signals, timing diagram of 8086 Microprocessor, 8086 Addressing modes, instruction set, Interrupt vector table, 8086 Assembly language programming.

Module 2: Microcomputers and Microcontrollers (08 Hrs)

Introduction to Microcomputer,elements of microcomputer,fundamental architecture to access memory,microcontroller, comparison of Microprocessor and microcontroller,Selection factors of microcontrollers, Comparison of all 8 bit microcontrollers,Features of 8051, Intel 8051 microcontroller architecture, Pin diagram, Memory organization of 8051, special function registers, Internal structure of I/O ports, operation of I/O ports.

Module 3: Assembly Language Programming (08 Hrs)

Addressing modes of 8051, Instruction set of 8051, Stack and Stack Related instruction, Data exchange, byte level logical operations, bit level logical operations, rotate and swap operations, instruction affecting flags, incrementing, decrementing, arithmetic operations, jump and recall instruction, Call and return subroutines. Microcontroller development tools- study of simulator, emulator, assemblers, programmers, cross assembler for microcontrollers.Assembler directives

Assembly language programming of 8051.

Module 4:Timers, Interuppts and serial port (08Hrs)

Counters and timers in 8051, timer modes and its programming.Interrupts- timer flag interrupt, serial port interrupt, external interrupts, software generated, interrupt control and interrupt

programming. Serial communication and its programming. Serial data input, output, Serial data modes, interfacing of 8051 with PC through RS232.

Module 05: Interfacing (08Hrs)

External memory interfacing,Programming and Interfacing of 8051 with single key, LED, Relay, speed control of dc motors, Stepper motor control (speed /position).8 bit ADC (0809) and DAC (0808)

Course Outcomes:

At the end student will able to

1. Differentiate between microprocessor and microcontroller.
2. Describe the architecture and features of various types of microcontroller.
3. Demonstrate programming proficiency using the various addressing modes and all types of instructions of the target microcontroller.
4. Program using the capabilities of the stack, the program counter the internal and external memory, timer and interrupts and show how these are used to execute a programme.
5. Write assemble assembly language programs on PC and download and run their program on the training boards.
6. Design electrical circuitry to the Microcontroller I/O ports in order to interface with external devices.
7. Write assembly language programs and download the machine code that will provide solutions real-world control problems such as fluid level control, temperature control, and batch processes.

References Books:

1. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, “The8051Microcontroller and Embedded Systems: Using Assembly and C”,Pearson Education, 2007.

2. K. J. Ayala, “8051 Microcontroller”, Delmar Cengage Learning,2004.

3. R. Kamal, “Embedded System”, McGraw Hill Education,2009.

4. R. S. Gaonkar, “, Microprocessor Architecture: Programming and Applications with the 8085”, Penram International Publishing, 1996

5. D. A. Patterson and J. H. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Morgan Kaufman Publishers, 2013.

6. D. V. Hall, "Microprocessors & Interfacing", McGraw Hill Higher Education, 1991.

List of Practical's

Write assembly program for (Simulation using Keil µ-vision simulator or equivalent)

1. Any four programs 0f 8086 (DEBUG/MASM)
2. To know IDE Keil**µ-vision or equivalent**
3. Write and execulte ALP for arithematic operation
4. Write and execulte ALP for block data transfer
5. Write and execulte ALP for block data exchange
6. Write and execulte ALP for square wave generation using timer
7. Write and execulte ALP for serial communication
8. Interfacing of an LED and switch to 8051
9. Interfacing of Relay to8051
10. Interfacing of stepper motor to8051
11. Interfacing of DC motor to 8051
12. Interfacing of ADC 0809 to 8051
13. Interafcing of DAC 0808 to 8051

PEC-EE-504-(A)	**Electrical Machine Design**	**3L:0T:2P**	**4 credits**

Course Objectives:

a) To make the student conversant with the design process of electrical machines and
b) Computer aided design of the electrical machines.
c) To develop the capabilities in the student to apply basics of electrical engineering for design of electrical machines.

Course Content:

Module 1: Introduction **(08 Hrs)**

Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

Module 2: Transformers **(08 Hrs)**

Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

Module 3: Induction Motors **(08 Hrs)**

Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines,magnetizing current, short circuit current, circle diagram, operating characteristics.

Module 4: Synchronous Machines **(08 Hrs)**

Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

Module 5: **Computer aided Design (CAD):** **(08 Hrs)**

Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem

formulation. Introduction to FEM based machine design. Introduction to **c**omplex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

Course Outcomes:

At the end student will able to

1. Understand the construction and performance characteristics of electrical machines.
2. Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines
3. Understand the principles of electrical machine design and carry out a basic design of an AC machine.
4. Use software tools to do design calculations.

Reference Books:

1. A. K. Sawhney, "A Course in Electrical Machine Design", DhanpatRai and Sons, 1970.

2. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London.

3. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.

4. K. L. Narang, "A Text Book of Electrical Engineering Drawings", SatyaPrakashan, 1969.

5. A. Shanmugasundaram, G. Gangadharan and R. Pala ni, "Electrical Machine Design Data Book", New Age International, 1979.

6. K. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.

7. Electrical machines and equipment design exercise examples using Ansoft's Maxwell 2D machine design package.

List of Practical

1. In design a report of design of dc machine is prepared for a typical dc machine which will Contain the entire design procedure and calculations and sketches with dimensions calculated On 1/8 size drawing paper. (**Any 4 Numerical on Drawing Sheet)**

2. In design, a report of design of Induction motor is prepared which will contain the entire design Procedure, calculations and sketches with dimensions calculated on 1/8 size drawing paper. **(Any 4 Numerical on Drawing Sheet)**

3. In design, a report of design of transformer is prepared which will contain the entire design Procedure, calculations and sketches with dimensions calculated on 1/8 size drawing paper.

(Any 4 Numerical on Drawing Sheet)

1. In design a report of design of Synchronous machine is prepared for a typical dc machine Which will contain the entire design procedure and calculations and sketches with dimensions? Calculated on 1/8 size drawing paper. **(Any 4 Numerical on Drawing Sheet)**

PEC-EE-504-(B)	Electrical Drives	3L:0T:2P	4 credits

Course Objectives:

a) To study and analyze the operation of the converter,chopper fed dc drive
b) To study and understantthe operationof bothclassical and modern induction motor drives
c) To study and analyzethe operation of PMSM and BLDC drives
d) To analyzeand designthe current and speed controllers for different drives

Course Content:

Module 1: DC motor characteristics (06 Hrs)

Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varying motor speed, flux weakening for high speed operation.

Module 2: Chopper fed DC drive (06 Hrs)

Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting.

Module 3: Multi-quadrant DC drive (06 Hrs)

Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking.

Module 4: Closed-loop control of DC Drive (06 Hrs)

Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions, modeling of chopper as gain with switching delay, plant transfer function, for controller design, current controller specification and design, speed controller specification and design.

Module 5: Induction motor characteristics (06 Hrs)

Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and

frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation.

Module 6: Scalar control or constant V/f control of induction motor (06 Hrs)

Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation.

Module 7: Control of slip ring induction motor (06 Hrs)

Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery.

Course Outcomes:

At the end student will able to

1. Understand the characteristics of dc motors and induction motors.
2. Understand the principles of speed-control of dc motors and induction motors.
3. Understand the power electronic converters used for dc motor and induction motor speed control.

Text / References:

1. G. K. Dubey, “Power Semiconductor Controlled Drives”, Prentice Hall, 1989.

2**.** R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control”, Prentice Hall, 2001.

3. G. K. Dubey, “Fundamentals of Electrical Drives”, CRC Press, 2002.

4. W. Leonhard, “Control of Electric Drives”, Springer Science & Business Media, 2001.

List of Practical’s:

1) Speed control of dc motor using dc chopper.

2) Speed control of dc motor using single- phase converter.

3) Speed control of dc motor using 3- phase converter.

4) Speed control of single- phase induction motor using ac regulator.

5) Inverter fed three-phase induction motor drive.

6) Simulation of Chopper fed DC drive.

7) Simulation of DC drive using single phase converter.

8) Simulation of three phase IM drive.

9) Simulation of four quadrant DC drive

OEC-EE-505-(A)	Digital Control System	2L:0T:2P	3 credits

Course Objectives:

a) To study present control theory that is relevant to the analysis and design of computer-controlled systems, with an emphasis on basic concepts and ideas.

b) The control-system design is carried out up to the stage of implementation in the form of computer programs in a high-level language.

Course Content:

Module1:Introduction to Discrete Time Control System (06 Hrs)

Basic building blocks of Discrete time Control system, Sampling Theorem, Z transform and Inverse Z transform for applications for solving differential equations, Mapping between the S plane and the Zplane, Impulse sampling and Data Hold.

Module2:Pulse Transfer Function and Digital PID Controllers (06 Hrs)

The pulse transfer function, pulse transfer function of Closed Loop systems, Pulse transfer function of Digital PID controller, Velocity & Position forms of Digital PID Controller, Realization of Digital Controllers, Deadbeat response and ringing of poles

Module3:Design of Discrete Time Control System by conventional methods (06 Hrs)

Stability analysis in Z-plane, Jury stability criterion, Bilinear transformations,Design based on the root locus method, Digital Controller Design using Analytical Design Method.

Module4:State Space Analysis of Discrete Time Control System (06 Hrs)

State space representation of discrete time systems, Solution of discrete time state space equations, Pulse transfer function matrix, Eigen Values, Eigen Vectors and Matrix Diagonalization, Discretization of continuous time state space equations, Similarity transformations.

Module5:Pole Placement and Observer Design (06 Hrs)

Concept of Controllability and Observability, Useful transformations in state space analysis and design, Stability improvement by state feedback, Design via pole placement, State observers

Course Outcomes:

At the end student will able to

1. Obtain discrete representation of LTI systems.

2. Analyse stability of open loop and closed loop discrete-time systems.
3. Design and analyse digital controllers.
4. Design state feedback and output feedback controllers.

Reference Books :

1. K. Ogata, "Digital Control Engineering", Prentice Hall, Englewood Cliffs, 1995.

2. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.

3. G. F. Franklin, J. D. Powell and M. L. Workman, "Digital Control of Dynamic Systems", Addison-Wesley, 1998.

4. B.C. Kuo, "Digital Control System", Holt, Rinehart and Winston, 1980.

List of Practical's:-

1. Find the Response of the Discrete Time Control System for any two standard inputs.

2. Unit step Response of Discrete Time Control System using Digital PID controller.

3. Design of deadbeat controller for Discrete Time Control System.

4. Determine effect of sampling period on stability of Discrete Time Control System

5. Discretization of continuous time state equation

6. Investigation of the controllability and Observability of a system

7. Design of control system using pole placement technique

8. Design of State observer.

9. Design of Discrete Time Control System based on minimization of quadratic performance index.

10. The solution of steady state quadratic optical control using riccati equation

OEC-EE-505-(B)	Computer Networks	2L:0T:2P	3 credits

Course Objectives:

a) To develop an understanding of computer networking basics.

b) To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications.

Course Content:

Module 1:Data communication Components (06 Hrs)

Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing – Frequency division, Time division and Wave division, Concepts on spread spectrum.

Module 2: Data Link Layer and Medium Access Sub Layer (06 Hrs)

Error Detection and Error Correction Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

Module 3:Network Layer (06 Hrs)

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Module 4: Transport Layer (06 Hrs)

Process to Process Communication, User Datagram Protocol (UDP),Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Module 5: Application Layer (06 Hrs)

Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

Course Outcomes:

At the end student will able to

1. Explain the functions of the different layer of the OSI Protocol.
2. Draw the functional block diagram of wide-area networks (WANs), local area
3. Networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
4. For a given requirement (small scale) of wide-area networks (WANs), local area
5. networks (LANs) and Wireless LANs (WLANs) design it based on the market available
6. component
7. For a given problem related TCP/IP protocol developed the network programming.
8. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW,
9. HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

Reference Books:-

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw- Hill.

2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

3. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.

4. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.

5 .TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

List of Practical's: Any 10

1. Observe of network laboratory components. Write specifications of latest desktops and laptops.
2. Observe, identify and understand different Transmission Media and Network Control devices.
3. Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool. Use LAN Tester to check cable.
4. Install a network interface card
5. Study of Network Devices in Detail.

6. Connect Computers in Star Topology using Wired Media and any Network control Device.
7. Connect two hubs/switch by creating crossover connection
8. Study of network IP.
9. Study of router and other internetworking device.
10. Configure Peer-to-Peer Network.
11. Connect the computers in Local Area Network.
12. Configure a Network topology using packet tracer software.
13. Share Printer and Folder in Network.
14. Configure advanced features of TCP/IP Protocols.
15. Install Wireshark software to capture packet and configure it to capture Ethernet packet. Verify Ethernet frame structure and its 48 bit address.
16. To Run Basic TCP/IP Utilities and Network Commands with all options.(Ping, Ping ::1, ipconfig, Tracert, Netstat, Wireshark, ARP, NBTSTAT.EXE, WINIPCFG.EXE),
17. Use Wireshark packet sniffer software to capture TCP, UDP, IP, ARP, ICMP, Telnet, FTP packets
18. Designing and implementing Class A, B, and C Networks.
19. Subnet planning and its implementation.
20. Study Subnet Masking and create two subnets

MC-EE-506	Managment	2L:0T:0P	0 credits

Course Objectives:

a) Students can assess and apply their strengths in marketing.
b) Students can distinguish themselves as effective communicators.
c) Students excel in problem solving.
d) Students model ethical and professional behavior.
e) Students are prepared to pursue professional development opportunities and/or graduate education.

Course Content:

Module 1: Introduction: **(04 Hrs)**

Managing and managers, management- science, theory and practice, functions of management, evolution of management theory, contributions of Taylor, Fayol and others.

Planning: The nature and purpose of planning, objectives, strategies, policies and planning premises, decision making.

Organizing: The nature and purpose of organizing, departmenation, Line/ staff authority and decentralization, effective organizing and organizational culture.

Module2:Staffing **(04 Hrs)**

Staffing: Human resource management and selection, orientation, apprentice training and Apprentice Act (1961), performance appraisal and career strategy, job evolution and merit rating, incentive schemes.

Leading: Managing and human factor, motivation, leadership, morale, team building, and communication.

Controlling: The system and process of controlling control techniques, overall and preventive control.

Module 3: Leadership & Motivation **(04 Hrs)**

Leadership- Styles & type Motivation –Definition , Intrinsic & Extrinsic Moslow's theory of Motivation and its significance

Module 4: Safety Management **(04 Hrs)**

Causes of AccidentsSafety Procedures Introduction, Objectives & feature of Industrial Legislationsuch as

- Factory Act
- ESI Act,
- Workman Compensation Act,
- Industrial Dispute Act.
- Industrial Dispute Act.

Module 6: Financial Management (No Numericals) (04 Hrs)

Financial Management- Objectives &Functions , Capital Generation & Management ,Types of capitalsSources of finance Budgets and Accounts Types of Budgets Production Budget (including Varience Report)Labour BudgetIntroduction to Profit & Loss Account (Only concept) Balance sheet etc.

Module 7: Materials Management (04 Hrs)

Inventory Management (No Numericals) Meaning & Objectives ,ABC Analysis,Economic Order Quantity: Introduction & Graphical Representation Purchase Procedure Objectives of PurchasingFunctions of Purchasing Department Steps inPurchasing

Course Outcomes:

At the end Students will be able to

1. Manage people, processes, and resources within a diverse organization.
2. Apply knowledge of leadership concepts in an integrated manner.
3. Analyze the internal/external factors affecting a business/organization to evaluate business opportunities.

Texts/Reference Books:

1.Koontz, H. and Weirich, H., Essentials of Management, McGraw-Hill book Co., Singapore, International Edition, 5 th Edition, 1990.

2.Buffa, E.S. and Sarin, R.K., Modern Production/Operations Management, John Wiley & Sons, New York, International Edition, 8 th Edition, 1987.

3.Hicks, P.E., Industrial Engineering and Management: A New Perspective, McGraw-Hill Book Co., Singapore, International Edition, 2 nd Edition, 1994.

References:

1.Riggs, J.L., Production Systems: Planning, Analysis and Control, John Wiley & Sons, New York, International Edition, 4 th Edition, 1987.

2.Amrine, H.T., Ritchey, J.A., Moodie, C.L. and Kmec, J.F. Manufacturing Organization and Management, 6 th Ed., Pearson Education, 2004.

3.International Labour Organization (ILO), Introduction to Work Study, International Labour Office, Geneva, 3 rd Ed., 1987.

HSMC-EE-507	Seminar-III	0L:0T:2P	1 credits

Course Objectives:

a) To increase competency of the students.
b) Understand more vital issues of electrical engineering.
c) To improve communication skills and stage courage of the students.
d) To understand the ethics of presentation and to get a scope of self improvement..

Course Content:

Note: - Seminar delivered on any relevant topics of Fifth semester or on recent technologies in the field.

Every individual student shall work on a recent topic selected or assigned from any engineering/allied/applied fields for the seminar of academic or industrial interest. It is expected that the student has to collect information on a topic which is allotted by the Guide or not covered in curriculum of the under graduate course. Student has to refer hand book, research journals, reference books, proceeding of conference through library or internet and record of references considered for seminar is to preserved in hard copy or soft copy, which shall be produced at the time of seminar.

The report of seminar should be submitted in printed volume duly certified by guide, HOD and Principal in prescribed format given below. The student should deliver a seminar talk at least for **20 minutes** based on the work done by him/her. The performance will be judged by his guide and another expert appointed by HOD.

INSTRUCTIONS TO PREPARE REPORT AND PPT:-

1. Seminar report shall be typed on A-4 size white bond paper.

2. Typing shall be with line spacing of 1.5using black inkjet print on one side of the paper.

3. Margins

- Left 37.5mm
- Right, Top and Bottom 25mm.

4. Page number - At the bottom center aligned 12 point font size.

5. Header and Footer (12 point font size - Times New Roman)

- Header - Right side at top stating title of the seminar.

- Footer - Right side at bottom stating institute name.

6. Font

- Main title font - 14 point - bold - Times New Roman - Upper case
- Sub title font - 12 point - bold - Times New Roman - Title case
- Text font - 12 point - normal - Times New Roman - Running d) Graph / Figure / Table
- titles - 12 point - normal - Times New Roman - Title case .

7. Graph / Figure / Table: - shall be located at the center along with its title and Graph No. / Figure No. / Table No. If Graph / Figure / Table or any information is copied from any of the references, reference no. is to be shown at the end of its title / statement in square bracket superscripted form

8. Seminar report shall consists of at least following contents

- First page.
- Certificate.
- Acknowledgement.
- Index page (Chapter wise)
- Graph index (Graph no., Title, Page no.)
- Figure index (Figure no., Title, Page no.)
- Table index (Table no., Title, Page no.)
- Introduction /Abstract of seminar.
- Literature review.
- Core content of seminar.
- Merits and demerits of subject.
- Future scope.
- Conclusion.
- References.
- Appendix
- Compact Disc.

9. Format of seminar report:-

a. First page (Title page) and cover of seminar report.

(Institute logo)

Seminar Report

on

"Title of Seminar"

By

Name of student

Submitted in partial fulfillment of the requirement for the degree of

Bachelor of Engineering (Electrical)

Guide Head of Department Principal
(Name) (Name) (Name)

Department of Electrical Engineering

Name of Institute

Year 2018-19.

c. Acknowledgement:- Acknowledgement shall consists of students opinion related to the seminar topic and his gratitude towards his guide, other staff, social members and his friends those who have really helped him to complete seminar report.

d. Chapter Index: - Shall have title as "INDEX" in bold - 14 point aligned at top center and page consisting of table with three columns as Chapter No., Chapter particulars, and Page No.

Chapter No. and Page No shall be aligned at center of cell and chapter particulars left aligned in the cell.

e. Graph Index / Figure Index / Table Index: - Shall have title as "GRAPH INDEX / FIGURE INDEX / TABLE INDEX" in bold - 14 point center aligned at top of page. Page consisting of three column table as Graph No. / Figure No. / Table No. in first column, Title of Graph / Figure / Table in second column and Page No. in third column. (Similar to chapter index.)

10. Sketches:-Shall be drawn on separate sheet, center aligned with Figure No. and Title of sketch at its bottom.
11. Table shall preferably be typed in text format only with table no. and its title at the top, centrally aligned.
12. Standard mathematical symbols and notations shall be used.
13. The last item on Index should be references.
14. Compact Disc (C.D.) consisting of soft copy of seminar report, PPT, and supporting literature shall be affixed at back cover of report.
15. Presentation shall be made with help of Power point.

- Preferably each slide shall have plain white or faint yellow or navy blue or maroon colored back ground with contrast matching font.
- Each slide shall be numbered and header - footer shall be added similar to report.
- Figure / Graph / Table shall be labeled with Figure No. / Graph No. / Table No. and with reference nos. shown in seminar report
- Only brief points are to be highlighted on slides
- Information copied from references shall be numbered with reference number.
- Points are not to be read directly from slide at the time of presentation.
- Presentation shall be based on Figure, Graph, Table, Charts and points etc.
- First slide shall be identical to cover page of report.
- Second slide should contain introduction / abstract of seminar and content of presentation with bullets.
- Third slide shall focus on literature review.
- Fourth slide on wards core content of presentation shall be discussed.
- Slides at the end shall consist of merits, demerits, future scope, conclusion and references.

The oral marks for seminar will be allotted based on the following

1. Seminar Report	05 Marks
2. Literature Review	05 Marks
3. Technical Content	05 Marks
4. Presentation Skill (Aids used)	05 Marks
5. Question Answer	05 Marks
Total	**25** Marks

Course Outcomes:

At the end student will able to

1. Use multiple thinking strategies to examine real-world issues through self learning.
2. Explore creative avenues of expression, solve problems, and make consequential decisions.
3. Developing stage courage and confidence
4. Apply innovative thinking for best presentation.

HSMC-EE-508	Soft skills Personality Development	0L:0T:2P	0 credits

Course Objectives

a) Develop effective communication skills (spoken and written).
b) Develop effective presentation skills.
c) Conduct effective business correspondence and prepare business reports which produce results.
d) Become self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills.
e) Develop all-round personalities with a mature outlook to function effectively in different circumstances.
f) Develop broad career plans, evaluate the employment market, identify the organizations to get good placement, match the job requirements and skill sets.
g) Take part effectively in various selection procedures adopted by the recruiters.

Course Content :

Unit 1. Soft Skills What are soft skills ? – Importance of soft skills , Attributes regarded as soft skills – Soft skills – Social - Soft skills – Thinking - Soft skills – Negotiating – Exhibiting your soft skills – Identifying your soft skills – Improving your soft skills –Exercise : Measure your soft skills

Unit 2 Self-Discovery Importance of knowing yourself - Process of knowing yourself - SWOT analysis - Benefits of SWOT analysis - Using SWOT analysis - SWOT analysis

Unit 3. Developing Positive Attitude Meaning of attitude - Features of attitudes - Attitude and behaviour - Formation of attitudes - Change of attitudes - What can you do to change attitude? - Ways of changing attitude in a person - Attitude in a workplace - The power of positive attitude - Developing positive attitude - Obstacles in developing positive attitude - Staying positive - Examples of positive attitudes - Positive attitude and its results - Staying negative - Examples of negative attitude - Overcoming negative attitude - Negative attitude and its results. Exercise : Measure your attitude

Unit 4. Forming Values - Meaning of value , A core of values - Values relating to education - Values relating to self and others - Values relating to civic

Unit 5. Improving Perception Factors influencing perception - Perceptual process - Improving perception - Perception and its application in organizations. Exercise : Test your perception

Unit 6 Body Language Body talk - Voluntary and involuntary body language - Forms of body language - Parts of body language - Origin of body language - Uses of body language - Body language in building interpersonal relations - Body language in building industrial relations - Reasons to study body language - Improving your body language - Types of body language - Gender differences - Female interest and body

Unit 7 Team Building and Teamwork - Aspects of team building - Skills needed for teamwork - A model of team building - Team Vs Group - Characteristics of effective team - Role of a team leader - Role of team members - Nine persons a successful team should have - Inter-group collaboration - Advantages of inter-group collaboration

Unit 8 Time Management : Examination of Work, Sense of Time Management, Features of Time, Time Management Matrix, Difficulties in time management, Ideal way of spending a day

Unit 9 Stress Management : Meaning of stress, type of stress, effect of stress, Sources of stress, identifying existence of stress, Sign of stress and stress management.

Course Outcomes:

At the end student will able to

1. Effectively communicate through verbal/oral communication and improve the listening skills Write precise briefs or reports and technical documents
2. Actively participate in group discussion / meetings / interviews and prepare & deliver presentations .
3. Become more effective individual through goal/target setting, self motivation and practicing creative thinking.
4. Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.

Reference Books

1. Soft Skills – Know yourself and Know your world by Dr.K.Alex – S.Chand and Publications, New Delhi
2. Presonality development and soft skills –by Barun K Mishra – Oxford University Press.- 2011

PCC-EE-509	NPTEL Course-I	0L:0T:2P	1 credits

Course Objective:

a) Enables the student to directly engage and learn from the best faculty in the country in that particular subject.This strengthens the fundamentals of the student in the course

b) Gives the students the opportunities to explore new areas of interest.

c) Bring out the self-learning initiative of the students

Course Content:

Students have to complete minimum four weeks NPTEL web and video course from Electrical Engineering Department which is available on portal nptel.ac.in. It is preferred that student should attend any one course related to subjects of Fifth semester.

Certification courses are offered twice a year (Jan-Jun, Jul-Dec). Joining a course is free. Learning can be done by watching videos and this is tested by the weekly assignments, which are to be submitted online within the prescribed deadline.

There is a certification examination that the student can take for a nominal fee at the end of the course to earn certificates from the IITs.

To earn credits of this course students have to produce the NPTEL course completion certificate and online submitted assignments to the department before end semester practical examination.

At the end of course

1. NPTEL Issue certificate bear the stamp of CCE,IIT
2. Value addition in student curriculum vitae

PCC-EE-601	Power System-II (operation & Control)	2L:0T:2P	3 credits

Course Objectives:

a) To provide students the knowledge of optimization techniques used in the power system and Load Frequency Control (LFC).
b) To provide a solid foundation in mathematical and engineering fundamentals required to control the governing system in Turbine models.
c) To provide the knowledge of Hydrothermal scheduling, reactive power control.

Course Content:

Module 1: Power Flow Analysis (08 Hrs)

Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications.Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations.Computational Issues in Large-scale Power Systems.

Module 2: Stability Constraints in synchronous grids (08 Hrs)

Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve.Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three--phase fault.Analysis using numerical integration of swing equations (using methods like Forward Euler, Runge-Kutta 4th order methods), as well as the Equal Area Criterion.Impact of stability constraints on Power System Operation.Effect of generation rescheduling and series compensation of transmission lines on stability.

Module 3: Control of Frequency and Voltage (08 Hrs)

Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing.Automatic Generation Control.Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs.

Module 4: Monitoring and Control (08 Hrs)

Overview of Energy Control Centre Functions: SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems.State-estimation.System Security Assessment.Normal, Alert, Emergency, Extremis states of a Power System. Contingency Analysis.Preventive Control and Emergency Control.

Module 5: **Power System Economics and Management (08 Hrs)**

Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition), Demand Side-management, Transmission and Distributions charges, Ancillary Services.Regulatory framework.

Course Outcomes:

At the end student will able to

1. Use numerical methods to analyses a power system in steady state.
2. Understand stability constraints in a synchronous grid.
3. Understand methods to control the voltage, frequency and power flow.
4. Understand the monitoring and control of a power system.
5. Understand the basics of power system economics.

Reference Books:

1. J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1994.

2. O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.

3. A. R. Bergen and V. Vittal, “Power System Analysis”, Pearson Education Inc., 1999.

4. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education, 2003.

5. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, “Electric Power Systems”, Wiley, 2012.

List of Practical’s:

1) Simulation of single area and multi area LFC using MATLAB/ Simulink.

2) Modeling of AVR using MATLAB/ Simulink.

3) Small-signal stability analysis of single machine-infinite bus system using classical machine model. 4) Simulation of IEEE excitation systems.

5) Simulation of turbine and governor modeling.

6) Belgian Case Study: Power Flow Controlling Devices as a Smart and Independent Grid Investment for Flexible Grid Operations.

7) Case study of Real-Time Dynamic Security Assessment of Power Systems.

8) Analysis of Swing Equation Using Numerical Integration.

9) Analysis of Swing Equation Using Forward Euler Method**.(Any Four Problem)**

10) Analysis of Swing Equation Using Forward Runge-Kutta 4^{th} Order Method.**(Any Four Problem)**

PCC-EE-602	Electromagnetic Field	3L:0T:0P	3 credits

Course Objectives:

a) To introduce the basic mathematical concepts related to electromagnetic vector fields
b) To impart knowledge on the concepts of electrostatics, electrical potential, energy density and their applications.
c) To impart knowledge on the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
d) To impart knowledge on the concepts of Faraday's law, induced emf and Maxwell's equations
e) To impart knowledge on the concepts of Concepts of electromagnetic waves and Pointing vector.

Course Content:

Unit 1: Vector analysis: (08 Hours)

Scalars and vectors, Vector algebra, Vector components and unit vectors, Vector field, The Cartesian Coordinate System, Dot, cross products, circular, cylindrical and spherical coordinate systems. Coulomb's Law and electric field intensity, Electric field due to a continuous Volume Charge Distribution, field of a line charge, field of a Sheet of a charge

Unit 2: Electric Flux Density Gauss Law and divergence: (7 Hours)

Gauss's Law and its Applications: to some symmetrical charge distribution and differential volume element, divergence, Maxwell's first equation (electrostatics), the vector operator and the Divergence theorem, Energy and Potential Energy expended in moving a point charge in an electric field, line integral, potential difference and potential, potential gradient, potential field of a point charge and system of charges, dipole, energy density in electrostatic field.

Unit 3: Conductors dielectric and capacitance: (5 Hours)

Current and current density, continuity of current, conductor properties and boundary conditions nature of dielectric, boundary conditions for perfect dielectric, capacitance, and capacitance of two-wire line. Poisson's and Laplace Equations:

Unit 4: Steady Magnetic Field: (08 Hours)

Biot-Savart's law, Amperes circuital law, curls, strokes theorem, magnetic flux and magnetic flux density, scalar and vector magnetic potentials.

Unit 5 : Magnetic forces and inductance: (7 Hours)

Force on moving charge, differential current element, force between differential current element and-ft torque on a closed circuit, nature of magnetic materials, magnetization permeability, magnetic boundary conditions, magnetic circuit, self and mutual inductance.

Unit 6: Time varying field sand Maxwell's equations : (5 Hours)

Faradays law, Maxwell's equations in point form, Maxwell's equations in integral form.

Course Outcomes:

At the end student will able to

1. To understand the basic laws of electromagnetism.
2. To obtain the electric and magnetic fields for simple configurations under static conditions.
3. To analyse time varying electric and magnetic fields.
4. To understand Maxwell's equation in different forms and different media.
5. To understand the propagation of EM waves.

Text / References:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.

2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.

3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.

4. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.

5. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.

6. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.

7. E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press,1966.

PCC-EE-603	Measurement & Instrumentation Laboratory	0L:0T:2P	1credits

Course Objectives:

a) To introduce students to monitor, analyze and control any physical system.
b) To understand students how different types of meters work and their construction
c) To provide a student a knowledge to design and create novel products and solutions for real life problems.
d) To introduce students a knowledge to use modern tools necessary for electrical projects

Course Content:

List of Practical's:-

1. Study of principle of operation of various types of electromechanical measuring Instruments.

2. Measurement of low and medium resistance by volt-ampere method

3 Measurement of resistance using Wheatstone bridge.

4 Measurement of resistance using kelvin's Bridge.

5 Measurement of self-inductance using Anderson's Bridge.

6 Measurement of capacitance using Schering Bridge.

7 Measurement of Earth Resistance by using Earth tester.

8 Measurement of power by using three wattmeter methods.

9. Measurement of power by using two wattmeter method.

10. Measurement of 3-phase reactive power with 2 wattmeter

11. To study the connections and use of Current and potential transformers and to find out ratio error.

12. Determination of frequency and phase angle using CRO.

13 Measurement of unknown voltage using potentiometer.

14. Calibration of single phase energy meter using lab view.

15. Calibration of three phase energy meter using lab view.

16. Measurement of Insulation resistance by using Megger.

17. Verify the relation between the output voltage and temperature by using a RTD (PT 100) thermistor and Thermocouple.

18. Use a Level measuring transducer to measure level and output voltage & verify the characteristics of the transducer.

19**.** Measure output voltage and Displacement in LVDT and draw a graph to verify the characteristics of Output Voltages Vs Displacement.

Course Outcomes:

At the end student will be able to

1. To use the techniques and skills for electrical projects.
2. Design a system, component or process to meet desired needs in electrical engineering.
3. Measurement of R,L,C ,Voltage, Current, Power factor , Power, Energy
4. Ability to balance Bridges to find unknown values.
5. Ability to measure frequency, phase with Oscilloscope
6. Ability to use Digital voltmeters
7. Ability to measure strain, displacement, Velocity, Angular Velocity, temperature, Pressure ,Vacuum, and Flow

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PEC-EE-604(A)	Industrial Electrical System	3L:0T:2P	4 credits

Course Objectives:

a) Introduce various methods of effectively and efficiently utilizing Electrical Energy for different and desired applications
b) Teach the various Electrical Lighting principles and their applications.
c) Impart knowledge on effective utilization of Electrical Drives, Electrical Traction and Electro Mechanical process

Course Content:

Module 1: Electrical System Components (08 Hrs)

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

Module 2: Residential and Commercial Electrical Systems (06 Hrs)

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, Earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, Earthing of commercial installation, selection and sizing of components.

Module 3: Illumination Systems (06 Hrs)

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

Module 4: Industrial Electrical Systems I (08 Hrs)

HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power

factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

Module 5: Industrial Electrical Systems II (06 Hrs)

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Module 6: Industrial Electrical System Automation (06 Hrs)

Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

Course Outcomes:

At the end student will able to

1. Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD.
2. Understand various components of industrial electrical systems.
3. Analyze and select the proper size of various electrical system components.

Reference Books

1. S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating & Costing”, Khannapublishers, 2008.

2. K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 2007.

3. S. Singh and R. D. Singh, “Electrical estimating and costing”, DhanpatRai and Co., 1997.

4. Web site for IS Standards.

5. H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2008.

List of Practical’s: (Draw a layout/diagram on Half Imperial Drawing Sheet)

1) Electrical estimation & design of residential consumers (for flats/Bungalows/Row houses)

2) Electrical estimation & design of Commercial consumers (for Malls/Colleges/Hospitals, Banks)

3) Electrical estimation & design of Agricultural consumers (Pump jets/submersible pump)

4) Electrical estimation & design of small & medium Industrial consumers.

5) Electrical Installation & layout preparation of your college campus.

6) Preparation of a NIT (Notice Inviting Tender)

7) To draw the house wiring diagram for domestic use and estimation of the quantity and cost (CTS, clear, surface conduit and concealed wiring).

8) Power wiring diagram for small workshops having at least 5 motors and estimating cost for conduit type.

9) Power diagram for electrical substations (double feeder) including pole mounted type and estimating cost for it.

10) Layout and connection diagram for overhead lines connection from generator connection to distribution station and estimating cost of materials for the same.

11) Use of lighting arrestors etc. for pole mounted and other sub-stations etc. and estimating cost for it.

Note: Estimations be made for loads up to 100 KVA

PEC-EE-604(B)	PLC&SCADA Application	3L:0T:2P	4 credits

Course Objectives:

a) Gain the Knowledge of various skills necessary for Industrial applications of Programmable logic controller(PLC)
b) Understand the basic programming concepts and various logical Instructions used in Programmable logic controller (PLC)
c) Solve the problems related to I/O module, Data Acquisition System and Communication Networks using Standard Devices.
d) Design and analysis of general structure of an automated process for real time applications using Programmable logic controller (PLC) and SCADA

Course Content:

Module 1:Introduction to PLC (06 Hrs)

Role of automation in Industries, benefits of automation, Necessity of PLC, History and evolution of PLC, Definition, types, selection criterion, Overall PLC system, PLC Input and output modules (along with Interfaces), CPU, programmers and monitors, power supplies, Solid state memory , advantages and disadvantages

Module 2:Programming of PLC (08 Hrs)

Programming equipment, Various techniques of programming, Ladder diagram fundamentals, proper construction of ladder diagram, basic components and their symbols in ladder diagram, MCR (master control relay) and control zones, Boolean logic and relay logic Timer and counter-types along with timing diagrams, shift registers, sequencer function, latch instruction Arithmetic and logical instruction with various examples

Module 3: Advance PLC function (06 Hrs)

Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices, programming ON/OFF Inputs to produce ON/OFF outputs. Analog PLC operation, PID control of continuous processes, simple closed loop systems, problems with simple closed loop systems, closed loop system using Proportional, Integral & Derivative (PID), PLC interface, and Industrial process example.

Module 4: Applications of PLC (08 Hrs)

PLC interface to various circuits : Encoders, transducer and advanced sensors (Thermal, Optical, Magnetic, Electromechanical, Flow, Level sensors) Measurement of temperature, flow, pressure, force, displacement, speed, level Developing a ladder logic for Sequencing of motors, Tank level control, ON OFF temperature control, elevator, bottle filling plant, car parking Motors Controls: AC Motor starter, AC motor overload protection, DC motor controller, Variable speed (Variable Frequency) AC motor Drive.

Module 5: SCADA Systems (08 Hrs)

Introduction, definitions and history of Supervisory Control and Data Acquisition, typical SCADA system Architecture, Communication requirements, Desirable Properties of SCADA system, features, advantages, disadvantages and applications of SCADA. SCADA Architectures (First generation - Monolithic, Second generation - Distributed, Third generation – Networked Architecture), SCADA systems in operation and control of interconnected power system, Power System Automation (Automatic substation control and power distribution), Petroleum Refining Process, Water Purification System, Chemical Plant.

Module 6: SCADA Protocols (06 Hrs)

Open systems interconnection (OSI) Model, TCP/IP protocol, DNP3 protocol, IEC61850 layered architecture, Control and Information Protocol (CIP), Device Net, Control Net, Ether Net/IP, Flexible Function Block process (FFB), Process Field bus (Profibus). Interfacing of SCADA with PLC..

Course Outcomes:

At the end student will able to

1. To develop architecture of SCADA explaining each unit in detail.
2. To develop a software program using modern engineering tools and technique for PLC and SCADA.
3. To apply knowledge gained about PLCs and SCADA systems to identify few real-life industrial applications.

References Books:

1. B. K. Bose, “Modern Power Electronics and AC Drives”, Pearson Education, Asia, 2003.

2. P. C. Krause, O. Wasynczuk and S. D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, 2013.

3. H. A. Taliyat and S. G. Campbell, "DSP based Electromechanical Motion Control", CRC press, 2003.

4. R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, 2009.

List of Practical's:-

[Instructions for conduction of experiments]

All experiments should be conducted. 6 experiments should be on PLC and 5 experiments should be on SCADA.

a. Experiments No. 1 to 5 are compulsory.
b. Any 1 experiment should be conducted from experiment number 6 to 10.
c. Experiments No. 11 to 14 are compulsory.
d. Any 1 experiment should be conducted from experiment number 15 to 18.

1. Interfacing of lamp & button with PLC for ON & OFF operation. Verify all logic gates.

2. Performed delayed operation of lamp by using push button.

3. UP/DOWN counter with RESET instruction.

4. Combination of counter & timer for lamp ON/OFF operation.

5. Set / Reset operation: one push button for ON & other push button for OFF operation.

6. DOL starter & star delta starter operation by using PLC.

7. PLC based temperature sensing using RTD.

8. PLC based thermal ON/OFF control.

9. Interfacing of Encoder with PLC (Incremental/Decremental)

10. PLC based speed, position measurement system.

11. PLC interfaced with SCADA & status read/command transfer operation.

12. Parameter reading of PLC in SCADA.

13. Alarm annunciation using SCADA.

14. Reporting & trending in SCADA system.

15. Tank level control by using SCADA.

16. Temperature monitoring by using SCADA.

17. Speed control of Machine by using SCADA.

18. Pressure control by using SCADA

PEC-EE-605(A)	High Voltage Engineering	3L:0T:2P	4 credits

Course Objective:

a) The course cover the breakdownmechanism in gaseous,liquid and solid insulation
b) Method of generation and measurement of high voltage, impulse voltage and impulse current
c) This course lays a foundation for higher studies in high voltage engineering

Course Content:

Module 1: Breakdown in Gases (06 Hrs)

Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism, Corona discharge

Module 2: Breakdown in liquid and solid Insulating materials (08 Hrs)

Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.

Module 3: Generation of High Voltages (06 Hrs)

Generation of high voltages, generation of high D. C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

Module 4: Measurements of High Voltages and Currents (06 Hrs)

Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.

Module 5: Lightning and Switching Over-voltages (06 Hrs)

Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges. Switching overvoltages, Protection against over-voltages, Surge diverters, Surge modifiers.

Module 6: High Voltage Testing of Electrical Apparatus and High Voltage(08 Hrs)

Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

Course outcomes:

At the end student will able to

1. Understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.
2. Knowledge of generation and measurement of D. C., A.C., & Impulse voltages.
3. Knowledge of tests on H. V. equipment and on insulating materials, as per the standards.
4. Knowledge of how over-voltages arise in a power system, and protection against these over voltages.

Reference Books

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering", McGraw Hill Education, 2013.

2. C. L. Wadhwa, "High Voltage Engineering", New Age International Publishers, 2007.

3. D. V. Razevig (Translated by Dr. M. P. Chourasia), "High Voltage Engineering Fundamentals", Khanna Publishers, 1993.

4. E. Kuffel, W. S. Zaengl and J. Kuffel, "High Voltage Engineering Fundamentals", Newnes Publication, 2000.

5. R. Arora and W. Mosch "High Voltage and Electrical Insulation Engineering", John Wiley & Sons, 2011.

6. Various IS standards for HV Laboratory Techniques and Testing.

List of Practical's:

1. To perform breakdown test on transformer oil and obtain constants of breakdown voltage equation and breakdown strength.

2. Measurement of unknown high a.c. voltage using sphere gap

3. To obtain breakdown strength of composite insulation system.

4. Study of uniform and non-uniform field in breakdown strength of air insulation system.

5. To study surface flashover on corrugated porcelain/polymeric insulation system.

6. To understand basic principle of corona and obtain audible and visible corona inception and extinction voltage under non uniform field.

7. To perform experiment on horn gap arrestor and understand arc quenching phenomenon. 8. To observe development of tracks and trees on polymeric insulation system.

9. Study of output voltage waveform of multistage voltage doublers circuit on CRO.

10. To evaluate power loss under corona at various voltage levels.

11. To perform experiment on rod gap arrestor.

12. To Study effect of barrier on breakdown voltage of air/ transformer oil.

13. Simulation of lightening and switching impulse voltage generator.

14. To perform various HV insulation tests on cables as per IS.

Note:-Industrial visit to high voltage equipment manufacturing industry/EHV substation.

PEC-EE-605(B)	Computer Architecture	3L:0T:2P	4 credits

Course Objectives:

a) How Computer Systems work & the basic principles
b) Instruction Level Architecture and Instruction execution
c) The current state of art in memory system design
d) How I/O devices are accessed and its principles.
e) To provide the knowledge on Instruction Level Parallelism
f) To impart the knowledge on micro programming
g) Concepts of advanced pipelining techniques.

Course Content:

Module1 Functional blocks of a computer: (12 Hrs)

CPU, memory, input-output subsystems, and control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs. **Data representation**: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-andadd, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Module2: Introduction to x86 architecture. (12 Hrs)
CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU. **Memory system design**: semiconductor memory technologies, memory organization. **Peripheral devices and their characteristics**: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Module3: Pipelining: (08 Hrs)
Basic concepts of pipelining, throughput and speedup, pipeline hazards.
Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Module4: Memory organization: (08 Hrs)
Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, and write policies.

Course outcomes:

At the end student will able to

1. Describe the fundamental organisation of a computer system
2. Explain the functional units of a processor
3. Distinguish the organization of various parts of a system memory hierarchy
4. Describe basic concept of parallel computing
5. Describe fundamentals concepts of pipeline and vector processing

Suggested books:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Organization and Embedded Systems", 6th Edition by CarlHamacher, McGraw Hill Higher Education.

Suggested reference books:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

List of practical's:-

1. WAP to add two 8 bit numbers and store the result at memory location 2000.
2. WAP to multiply two 8 bit numbers stored at memory location 2000 and 2001 and stores the result at memory location 2000 and 2001.
3. WAP to add two 16-bit numbers. Store the result at memory address starting from 2000.
4. WAP which tests if any bit is '0' in a data byte specified at an address 2000. If it is so, 00 would be stored at address 2001 and if not so then FF should be stored at the same address.
5. Assume that 3 bytes of data are stored at consecutive memory addresses of the data memory starting at 2000. Write a program which loads register C with (2000), i.e. with data contained at memory address 2000, D with (2001), E with (2002) and A with (2001).
6. Sixteen bytes of data are specified at consecutive data-memory locations starting at 2000. Write a program which increments the value of all sixteen bytes by 01.
7. WAP to add t 10 bytes stored at memory location starting from 3000. Store the result at memory location 300A.
8. Draw the functional block diagram of a single bus **architecture of a computer and describe the function of the** instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
9. **Write** assembly language program for specified microprocessor for computing

   16 bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication).
10. Write a flowchart for Concurrent access to memory and cache coherency in **Parallel Processors** and describe the process.

11. Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU.
12. Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology

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OEC-EE606(A)	Power Plant Engineering	2L:0T:2P	3 credits

Course Objectives:

a) Basic knowledge of Different types of Power Plants, site selection criteria of each one of them
b) Understanding of Thermal Power Plant Operation, turbine governing, different types of high pressure boilers including supercritical and supercharged boilers, Fluidized bed combustion systems.
c) Design of chimney in thermal power plants, knowledge of cooling tower operation, numerical on surface condenser design.
d) Basic knowledge of Different types of Nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.
e) Understanding of Power Plant Economics, Energy Storage including compressed air energy and pumped hydro etc.
f) Discussing environmental and safety aspects of power plant operation

Course Content:

Module 1: Thermal Power Plant (06 Hrs)

Coal based thermal power plants, basic Rankin cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems.

Module 2: Gas Power Plant (06 Hrs)

Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.

Module 3: Nuclear Power Plant (06 Hrs)

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

Module 4: Hydro Power Plant (06 Hrs)

Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems

Module 5: Economics of Power Generation (06 Hrs)

Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

Course Outcomes:

At the end student will able to

1. Student will able to understand power generation scheme.
2. Student will able to design Mechanical and electrical parameters of transmission lines and problems.
3. Student can suggest economical aspect in power supply system.
4. Student will identify problems with tariff system.
5. Student will able to classify different types of sub-stations.

Refrence Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.

2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.

3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

List of Practical:-

1. Interpret the line diagram of Thermal Power Station (T.P.S.) and main cycles & explain working of T. P. S.

2. Prepare technical report of visit to a nearby T.P.S./Prepare a report on thermal power stations in Maharashtra by collecting data from Internet.

3. Study on load curve preparation and its interpretation.

4. Prepare technical report of visit to a nearby H.P.S./Prepare a report on Hydro power stations in Maharashtra by collecting data from Internet.

5. Visit the website of MNRE/GEDA and prepare a report.

6. Draw and Interpret schematic diagram of gas based power plant

7. Study and working of various Equipment's used in Diesel power plant/Diesel power plant

8. Study and working of various Equipment's used in nuclear power plant/Nuclear power plant.

OEC –EE-606(B)	Thermal & Fluid Engineering	2L:0T:2P	3 Credits

Course Objectives:

a) To introduce students the fundamental thermodynamic laws and fluid mechanics physical law

b) Develop the ability to apply these fundamental principles in thermal and fluid energy systems

c) To give the necessary skills to carry out basic design and performance analysis in the area of fluid statics, fluid motion, heat and power exchange in steam and similar power plants, engines and refrigeration systems.

Course Content:

Module 1: introduction to fluid statics (06 Hrs)

Physical properties of fluids: Mass density, specific weight, specific volume, specific gravity, viscosity, surface tension, vapor pressure and their influence on fluid motion. Atmospheric pressure, gauge pressure and vacuum pressure. Measurement of pressure: Piezometers, U-tube and differential manometers – mechanical pressure gauges .Buoyancy, center of buoyancy, stability of floating bodies, metacenter and metacentric height its application in shipping.

Module 2: Fluid Dynamics (06 Hrs)

Various forces acting on a fluid element- Euler's and Bernoulli's equation for flow along a streamline, momentum equation and its applications for pipe bend problem. Closed conduit flow – Reynolds number, Reynolds experiment Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line – hydraulic gradient line. Measurement of flow: Pitot tube, venturimeter, orificemeter ,pitot tube & flow nozzle meter.

Module 3: Hydraulic Turbines & Pumps (06 Hrs)

Classification of turbines – Impulse and reaction turbines, Pelton wheel , Francis turbine and Kaplan turbine – working principlesClassification Pump, working of centrifugal pump, work done monomeric head – losses and efficiencies. Specific speed – pumps in series and parallel. Performance characteristic curves, NPSH. Working of 3.5 .Reciprocating pumps, discharge, slip, percentage slip.

Module 4: Laws of Thermodynamics (06 Hrs)

Introduction of thermodynamics, Review of basic definitions, Zeroth law of thermodynamics Entropy as a property, Clausiusin equality, Principle of increase of Entropy, Change of entropy for an ideal gas and pure substance. Ideal Gas : Ideal Gas definition Gas Laws: Boyle's law, Charle's law, Avagadro's Law, Equation of State, Ideal Gas constant and Universal Gas constant, Ideal gas processes.

Module 5: Properties of Pure Substances &Thermodynamic Vaporcycles (06 Hrs)

Formation of steam, Phase changes, Properties of steam, Use of Steam Tables, Study of P-v, T-s and Mollierdiagram.Vapour Power Cycles, Carnot cycle, Rankine cycle, Comparison of Carnot cycle and Rankinecycle, Efficiency of Rankine cycle. Vapor Compression Cycle and representation of cycle on P-h and T-s diagram, Refrigerating effect, Compressor power and COP

Course Outcomes:

At the end student will able to

1. Develop basic knowledge on Fluid Statistics, Dynamics.
2. Apply principles of fluid mechanics to the operation, design, and selection of Machinery and their components.
3. Understand and apply various laws of thermodynamics to various processes and real Systems.
4. Apply the concept of Entropy, Calculate heat, work and other important thermodynamic Properties for various ideal gas processes.

Reference Book :

1. **Hydraulics and Fluid Mechanics:** -Modi, PN, and Seth, SM; Delhi Standard Publishers Distributors

2. **Hydraulics and Hydraulics Machines:** -Khurmi RS, Delhi S Chand and Co.

3.**Thermal Engineering:** - S. Domkundwar, C. P. Kothandaraman, AnandDomkundwar,,DhanpatRai Publishers

5. **Thermal Engineering: -** R. K. Rajput, Laxmi Publications Pvt. Ltd, New Delhi.

6. **Thermal Engineering: -** B. K. Sarkar, Tata McGraw Hill Publishing Company Ltd. New Delhi.

List of Practical:

1. Determine Pressure & Actual discharge(Q) through pipes
2. Determine pressure changes using manometers.
3. Verify Bernoulli's theorem.
4. Determine Cd, Cc &Cv for orifice
5. Determine discharge by using Venturimeter
6. Calculate discharge by using Orifice meter
7. Calculate velocity & discharge by using Pitot tube
8. Determinemajor frictional losses for circular pipes
9. To Study the pelton wheel turbine.
10. To Study the centrifugal pump
11. To Study the reciprocating pump
12. To Study the One high pressure Boiler.
13. To Study of Barrel Calorimeter.
14. To Study the Boiler Mountings.
15. To Study of Boiler Accessories.
16. Determine dryness fraction of steam
17. Demonstration of Psychometric processes (At least four).

Note:- Experiment to Calculate COP of Simple Vapor Compression Cycle.

HSMC 607	Seminar -IV	0L:0T:2P	1 CREDITS

Course Objectives:

a) To increase competency of the students.
b) Understand more vital issues of electrical engineering.
c) To improve communication skills and stage courage of the students.
d) To understand the ethics of presentation and to get a scope of self improvement..

Course Content:

Note: - Seminar delivered on any relevant topics of Sixth semester or on recent technologies in the field.

Every individual student shall work on a recent topic selected or assigned from any engineering/allied/applied fields for the seminar of academic or industrial interest. It is expected that the student has to collect information on a topic which is allotted by the Guide or not covered in curriculum of the under graduate course. Student has to refer hand book, research journals, reference books, proceeding of conference through library or internet and record of references considered for seminar is to preserved in hard copy or soft copy, which shall be produced at the time of seminar.

The report of seminar should be submitted in printed volume duly certified by guide, HOD and Principal in prescribed format given below. The student should deliver a seminar talk at least for **20 minutes** based on the work done by him/her. The performance will be judged by his guide and another expert appointed by HOD.

INSTRUCTIONS TO PREPARE REPORT AND PPT:-

1. Seminar report shall be typed on A-4 size white bond paper.

2. Typing shall be with line spacing of 1.5using black inkjet print on one side of the paper.

3. Margins

- Left 37.5mm
- Right, Top and Bottom 25mm.

4. Page number - At the bottom center aligned 12 point font size.

5. Header and Footer (12 point font size - Times New Roman)

- Header - Right side at top stating title of the seminar.
- Footer - Right side at bottom stating institute name.

6. Font

- Main title font - 14 point - bold - Times New Roman - Upper case
- Sub title font - 12 point - bold - Times New Roman - Title case
- Text font - 12 point - normal - Times New Roman - Running d) Graph / Figure / Table
- titles - 12 point - normal - Times New Roman - Title case .

7. Graph / Figure / Table: - shall be located at the center along with its title and Graph No. / Figure No. / Table No. If Graph / Figure / Table or any information is copied from any of the references, reference no. is to be shown at the end of its title / statement in square bracket superscripted form

8. Seminar report shall consists of at least following contents

- First page.
- Certificate.
- Acknowledgement.
- Index page (Chapter wise)
- Graph index (Graph no., Title, Page no.)
- Figure index (Figure no., Title, Page no.)
- Table index (Table no., Title, Page no.)
- Introduction /Abstract of seminar.
- Literature review.
- Core content of seminar.
- Merits and demerits of subject.
- Future scope.
- Conclusion.
- References.
- Appendix
- Compact Disc.

9. Format of seminar report:-
a. First page (Title page) and cover of seminar report.

(Institute logo)

Seminar Report

on

"Title of Seminar"

By

Name of student

Submitted in partial fulfillment of the requirement for the degree of

Bachelor of Engineering (Electrical)

Guide Head of Department Principal
(Name) (Name) (Name)

Department of Electrical Engineering

Name of Institute

Year 2018-19.

c. Acknowledgement:- Acknowledgement shall consists of students opinion related to the seminar topic and his gratitude towards his guide, other staff, social members and his friends those who have really helped him to complete seminar report.

d. Chapter Index: - Shall have title as "INDEX" in bold - 14 point aligned at top center and page consisting of table with three columns as Chapter No., Chapter particulars, and Page No. Chapter No. and Page No shall be aligned at center of cell and chapter particulars left aligned in the cell.

e. Graph Index / Figure Index / Table Index: - Shall have title as "GRAPH INDEX / FIGURE INDEX / TABLE INDEX" in bold - 14 point center aligned at top of page. Page consisting of three column table as Graph No. / Figure No. / Table No. in first column, Title of Graph / Figure / Table in second column and Page No. in third column. (Similar to chapter index.)

10. Sketches:-Shall be drawn on separate sheet, center aligned with Figure No. and Title of sketch at its bottom.
11. Table shall preferably be typed in text format only with table no. and its title at the top, centrally aligned.
12. Standard mathematical symbols and notations shall be used.
13. The last item on Index should be references.
14. Compact Disc (C.D.) consisting of soft copy of seminar report, PPT, and supporting literature shall be affixed at back cover of report.
15. Presentation shall be made with help of Power point.

- Preferably each slide shall have plain white or faint yellow or navy blue or maroon colored back ground with contrast matching font.
- Each slide shall be numbered and header - footer shall be added similar to report.
- Figure / Graph / Table shall be labeled with Figure No. / Graph No. / Table No. and with reference nos. shown in seminar report
- Only brief points are to be highlighted on slides
- Information copied from references shall be numbered with reference number.
- Points are not to be read directly from slide at the time of presentation.
- Presentation shall be based on Figure, Graph, Table, Charts and points etc.
- First slide shall be identical to cover page of report.
- Second slide should contain introduction / abstract of seminar and content of presentation with bullets.
- Third slide shall focus on literature review.
- Fourth slide on wards core content of presentation shall be discussed.
- Slides at the end shall consist of merits, demerits, future scope, conclusion and references.

The oral marks for seminar will be allotted based on the following

1. Seminar Report	05 Marks
2. Literature Review	05 Marks
3. Technical Content	05 Marks

4. Presentation Skill (Aids used)	05 Marks
5. Question Answer	05 Marks
Total	**25** Marks

Course Outcomes:

At the end student will able to

1. Use multiple thinking strategies to examine real-world issues through self learning.
2. Explore creative avenues of expression, solve problems, and make consequential decisions.
3. Developing stage courage and confidence
4. Apply innovative thinking for best presentation.

HSMC-EE-608	Technical & Competitive Skills	0L:0T:2P	1 CREDITS

Course Objectives:

a) To familiarize with different competitive exams
b) To improve technical and analytical skill
c) To familiarize with different PG entrance exam

Course Content:

Module 1: Gate Exam Preparation: Orientation of GATE Curriculum for Mechanical Engineering, Providing information regarding literature of GATE Examination.Solving some sample question papers of GATE Examination. Giving information for Use of GATE for Job in PSU,Direct recruitment to Group A level posts in Central government and state Government.

Module 2: Preparation ofEngineering Mathematics andGeneral Aptitude (GA) with Language and Analytical Skills for GATE examination.

Module3 : Information regarding IES Examination and Recruitment procedure of Graduate Engineering students with detail curriculum, Literature and Guidance.

Module 4 : Information regarding Technical MPSC Examination and Recruitment procedure of Graduate Engineering students with detail curriculum, Literature and Guidance.

Module 5 : Technical Post, Curriculum and authentic literature of RRB, BSRB examination

Module 6 : Information Regarding Higher Education in Foreign Universities, Preparation of Pre requirements like SAT,PTE, LSAT,ACT, CAE,CPE GMAT, GRE, IELTS and the TOEFL.

Module 7: Preparation for PG entrance examination – Curriculum and information of entrance examination to IIM and other MBA collages.

Module 8: Information regarding different Scholarship offered For Higher Studies abroad to the Indian students.

Course Outcomes:

At the end student will able to

1. Understand the basic concepts of QUANTITATIVE ABILITY
2. Understand the basic concepts of LOGICAL REASONING Skills
3. Acquire satisfactory competency in use of VERBAL REASONING

4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability
5. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, MPSC, etc.

Reference/Text Books:

1. Quantitative Aptitude for Competitive Examinations by R S Aggarwal
2. Indian Polity for Civil Services Examination by M. Laxmikanth
3. A modern approach to verbal and non verbal reasoning by R S Aggarwal

PCC-EE-609	NPTEL Course-II	0L:0T:2P	1 credits

Course Objective:

d) Enables the student to directly engage and learn from the best faculty in the country in that particular subject.This strengthens the fundamentals of the student in the course

e) Gives the students the opportunities to explore new areas of interest.

f) Bring out the self-learning initiative of the students

Course Content:

Students have to complete minimum four weeks NPTEL web and video course from Electrical Engineering Department which is available on portal nptel.ac.in. It is preferred that student should attend any one course related to subjects of Sixth semester.

Certification courses are offered twice a year (Jan-Jun, Jul-Dec). Joining a course is free. Learning can be done by watching videos and this is tested by the weekly assignments, which are to be submitted online within the prescribed deadline.

There is a certification examination that the student can take for a nominal fee at the end of the course to earn certificates from the IITs.

To earn credits of this course students have to produce the NPTEL course completion certificate and online submitted assignments to the department before end semester practical examination.

Course Outcomes:

At the end of course

1. NPTEL Issue certificate bear the stamp of CCE,IIT
2. Value addition in student curriculum vitae