COURSE CODE AND DEFINITIONS:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Definitions</th>
</tr>
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<tbody>
<tr>
<td>L</td>
<td>Lecture</td>
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<tr>
<td>T</td>
<td>Tutorial</td>
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<td>BSC</td>
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<td>ESC</td>
<td>Engineering Science Courses</td>
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<tr>
<td>HSMC</td>
<td>Humanities and Social Sciences including Management courses</td>
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<tr>
<td>PCC</td>
<td>Professional Core Courses</td>
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<tr>
<td>LC</td>
<td>Laboratory Courses</td>
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<td>MC</td>
<td>Mandatory Courses</td>
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<td>PT</td>
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<td>TH</td>
<td>Theory</td>
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<td>Pr</td>
<td>Practical</td>
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General Notes:
1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.
## Scheme of Studies and Examination
### B.TECH (Electrical Engineering) – 5th Semester
### w.e.f. 2020-21

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
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<th>Examination marks</th>
<th>Total Marks</th>
<th>Credit</th>
<th>Duration of examination in hour</th>
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**Total** | 900 | 25 |

**Note:**

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded ‘F’ grade is required to repeat Practical Training.

**Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.**
List-I

<table>
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<td>PEC-EE-01</td>
<td>Wind and Solar Energy System</td>
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<td>PEC-EE-03</td>
<td>Electrical Drives</td>
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<td>PEC-EE-05</td>
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<td>PEC-EE-07</td>
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<td>OEC-EE03</td>
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<td>OEC-EE05</td>
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<td>4</td>
<td>OEC-EE07</td>
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## Scheme of Studies and Examination

**B.TECH (Electrical Engineering) – 6th Semester**

**w.e.f. 2020-21**

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**Note:**

Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.
### List-III

#### PROGRAMME ELECTIVE (Semester-VI)

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<th>Sr. No</th>
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<td>PEC-EE-06</td>
<td>Power System Protection</td>
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### List-IV

#### PROGRAMME ELECTIVE (Semester-VI)

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<td>PEC-EE-18G</td>
<td>Advance Electric Drives</td>
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<td>PEC-EE-08G</td>
<td>Power Quality and FACTS</td>
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### List-V

#### OPEN ELECTIVE-I [Semester-VI]

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<td>VHDL and DIGITAL DESIGN</td>
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<td>OEC-EE-06</td>
<td>Distributed Energy Integration</td>
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<td>OEC-EE-08</td>
<td>Conventional and Renewable Energy Resources</td>
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<td>OEC-EE-10</td>
<td>Soft Computing</td>
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POWER SYSTEM-I

Course Code: PCC- EE-301  
Category: Program Core Course  
Course title: Power System-I (Theory)  
Scheme: L T P  
3

Course Outcomes:
At the end of this course, students will demonstrate the ability to
- Understand the concepts of power systems.
- Understand the various power system components.
- Evaluate fault currents for different types of faults.
- Understand basic protection schemes and circuit breakers.
- Understand concepts of HVDC power transmission and renewable energy generation.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

Section-B

Section-C
Switchgear and protection: Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes (Over-current, directional, distance protection, differential protection) and their application.

Section-D

Text/References:
Power System-I Laboratory

Class Work: 25
Exam: 25
Total: 50

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<th>Course Code</th>
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<tr>
<td>Scheme</td>
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LIST OF EXPERIMENTS:

(A) Hardware Based:
1. To determine negative and zero sequence reactances of an alternator.
2. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation
3. To study the IDMT over current relay and determine the time current characteristics
4. To study percentage differential relay
5. To study Impedance, MHO and Reactance type distance relays
6. To study ferranti effect and voltage distribution in H.V. long transmission line using transmission line model.
7. To study operation of oil testing set.
8. To understand PV modules and their characteristics like open circuit voltage, short circuit current, Fill factor, Efficiency,
9. To understand I-V and P-V characteristics of PV module with varying radiation and temperature level
10. To understand the I-V and P-V characteristics of series and parallel combination of PV modules.
11. To understand wind energy generation concepts like tip speed, torque and power relationship, wind speed versus power generation

(B) Simulation Based Experiments (using software)
12. To obtain steady state, transient and sub-transient short circuit currents in an alternator
13. To perform symmetrical fault analysis in a power system
14. To perform unsymmetrical fault analysis in a power system

Note:
1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups are strictly discouraged/disallowed.
Control system

<table>
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Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:
At the end of this course, students will demonstrate the ability to
- Understand the modelling of linear-time-invariant systems using transfer function and state-space representations.
- Understand the concept of stability and its assessment for linear-time invariant systems.
- Design simple feedback controllers.

Section-A

Introduction to control problem (4 hours)
Industrial control examples, Mathematical models of physical systems, Control hardware and their models, Transfer function models of linear time-invariant systems.
Feedback Control: Open-Loop and Closed-loop systems, benefits of feedback, block diagram algebra, signal flow graphs.

Time Response Analysis (10 hours)

Section-B

Frequency-response analysis (6 hours)

Section-C

Introduction to Controller Design (10 hours)
Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

Section-D

State variable Analysis (6 hours)

Text/References:
Control Systems Laboratory

Course Code: LC-EE-307
Category: Program Core Course
Course title: Control Systems Laboratory

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Notes:
(i) At least 10 experiments are to be performed by students in the semester.
(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.
(iii) Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS: ANY SIX EXPERIEMENTS
1. To study speed Torque characteristics of
   a) A.C. servo motor       b) DC servo motor.
2. (a) To demonstrate simple motor driven closed loop DC position control system.
   (b) To study and demonstrate simple closed loop speed control system.
3. To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots.
4. To study a stepper motor & to execute microprocessor or computer-based control of the same by changing number of steps, direction of rotation & speed.
5. To implement a PID controller for temperature control of a pilot plant.
6. To study behavior of 1st order, 2nd order type 0, type 1 system.
7. To study control action of light control device.
8. To study water level control using an industrial PLC.
9. To study motion control of a conveyor belt using an industrial PLC.

Software Based (ANY FOUR EXPT.)
10. Introduction to software (Control System Toolbox), Implement at least any
    • Different Toolboxes in software, Introduction to Control Systems Toolbox.
    • Determine transpose, inverse values of given matrix.
    • Plot the pole-zero configuration in s-plane for the given transfer function. Plot unit step response of given transfer function and find peak overshoot, peak time.
    • Plot unit step response and to find rise time and delay time.
    • Plot locus of given transfer function, locate closed loop poles for different values of k.
• Plot root locus of given transfer function and to find out S, Wd, Wn at given root & to discuss stability.

• Plot bode plot of given transfer function and find gain and phase margins Plot the Nyquist plot for given transfer function and to discuss closed loop stability, gain and phase margin.
Microprocessor and Microcontroller

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

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Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Objective:
1. To develop an in-depth understanding of the operation of microprocessors.
2. To master the assembly language programming using concepts like assembler directives, procedures, macros, software interrupts etc.
3. To create an exposure to basic peripherals, its programming and interfacing techniques
4. To understand the concept of Interrupts and interfacing details of 8086.
5. To impart the basic concepts of serial communication in 8086.

Section-A
8086 MICROPROCESSORS
Introduction to 8086 Architecture, Features, Signals, I/O & Memory Interfacing, Addressing Modes, Interrupts, Minimum Mode & Maximum Mode Operation, Instruction Set, Assembly Language Programming.

Section-B
PERIPHERAL DEVICES
Parallel Peripheral Interface (8255), A/D & D/A Interface, Timer / Counter (8253), Keyboard and Display Controller (8279), USART (8251), Interrupt Controller (8259), DMA Controller (8237)

Section-C
INTRODUCTION OF MICROCONTROLLER
Different types of microcontrollers: Embedded microcontrollers, External memory microcontrollers; Processor Architectures: Harvard V/S Princeton , CISC V/S RISC; microcontrollers memory types; microcontrollers features : clocking, i/o pins, interrupts, timers, peripherals.

Section-D
8051 ARCHITECTURE

**Reference Books:**
2. A. V. Deshmukh: Microcontroller (Theory and Application), TMH.
3. D. V. Hall: Microprocessors and Interfacing, TMH.
4. Programming and Customizing the 8051 Microcontroller :Predko ; TMH.
Microprocessor and Microcontroller Lab

Theory : 25
Class Work : 25
Total : 50

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Notes:
(i) At least 10 experiments are to be performed by students in the semester.
(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.
(iii) Group of students for practical should be 15 to 20 in number.

List of Experiments:
1. Write a program using 8085 and verify for:
   a. Addition of two 8-bit numbers.
   b. Addition of two 8-bit numbers (with carry).
2. Write a program using 8085 and verify for:
   a. 8-bit subtraction (display borrow)
   b. 16-bit subtraction (display borrow)
3. Write a program using 8085 for multiplication of two 8-bit numbers by repeated addition method. Check for minimum number of additions and test for typical data.
4. Write a program using 8085 for multiplication of two 8-bit numbers by bit rotation method and verify.
5. Write a program using 8086 for finding the square root of a given number and Verify.
6. Write a program using 8086 for copying 12 bytes of data from source to destination and verify.
7. Write a program using 8086 and verify for:
   a. Finding the largest number from an array.
   b. Finding the smallest number from an array.
8. Write a program using 8086 for arranging an array of numbers in descending order and verify.
9. Write a program using 8086 for arranging an array of numbers in ascending order.
10. Write a program to interface a two digit number using seven-segment LEDs. Use 8085/8086 microprocessor and 8255 PPI.
11. Write a program to control the operation of stepper motor using 8085/8086 microprocessor and 8255 PPI.
12. To study implementation & interfacing of Display devices Like LCD, LED Bar graph & seven segment display with Microcontroller 8051/AT89C51
13. To study implementation & interfacing of Different motors like stepper motor, DC motor & servo Motors.
14. Write an ALP for temperature & pressure measurement
15. Write a program to interface a graphical LCD with 89C51
COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Theory : 75  
Class Work : 25  
Total : 100  
Duration of Exam : 3 Hrs.

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<tr>
<td>Course title</td>
<td>COMPUTER AIDED ELECTRICAL MACHINE DESIGN</td>
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COURSE OUTCOMES:

- To understand the features and limitations of electrical machine design.
- To understand the specified limits for Specific electric and magnetic loading.
- To understand the basic design procedure for transformer, d.c. machine, induction motor and synchronous machine individually.
- To explain the complete detailed design of all static and rotating machine and their performance with problems.
- To understand about the computerization of the design procedure.
- Analyze the design procedure and performance of various algorithms.
- Synthesize efficient algorithm and make a flow chart for all static and rotating machine.
- Analyze the optimization technique and their application to design problem.

SECTION A

FUNDAMENTAL ASPECTS OF ELECTRICAL MACHINE DESIGN: Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques.

BASIC DESIGN PRINCIPLES: Output equation and output coefficient, Specific electric and magnetic loading. Relation between rating and main dimension of rotating machine, Effect of size and ventilation/Factors affecting size of a rotating machine.

SECTION B

DESIGN OF INDUCTION MOTORS: Three Phase Induction Motor: Standard specifications, output equations, choice of specific loadings, main dimensions, conductor size and turns, air gap length, no. of slots, slot design, stator core depth, rotor design, rotor bars & slots area, end rings.

SECTION C

DESIGN OF TRANSFORMER: Output Equations of Single Phase and Three Phase Transformers, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, Main Dimensions - kVA output for single and three phase transformers, Window space factor, Design of core, yoke and winding, overall dimensions.

DESIGN OF SYNCHRONOUS MACHINE: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and
non-salient Pole Rotors. Magnetic Circuit and Field Winding, design difference between turbo alternator & salient pole generators.

SECTION D

DESIGN OF DC MACHINES: Output equation, choice of specific loadings, choice of poles and speed, Design of core length, armature diameter, depth of armature core, air gap length, cross section of armature conductors, armature slots, design of field system field poles, field coils, commutator.


TEXT BOOKS:

REFERENCE BOOKS:
3. Optimization Techniques, S.S. Rao
COMPUTER AIDED ELECTRICAL MACHINE DESIGN LAB

Theory : 25  
Class Work : 25  
Total : 50

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Notes:
(i) At least 10 experiments are to be performed by students in the semester.
(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.
(iii) Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS
1. To study about design factors and its limitations.
2. To study about CAD of rotating electrical machine.
3. To study of computer aided design of transformer.
4. Write a program to measure the main dimension of an induction motor.
5. Write a program for stator design of an induction motor.
6. Write a program for rotor design of an induction motor.
7. Write a program to measure the losses and the efficiency of an induction motor.
8. Write a program to design the armature of a D.C. motor.
9. Write a program to measure the slot design of a synchronous machine.
10. Write a program to measure the core and yoke design of transformer.
11. Write a program to measure the losses in a transformer.

References for software:
1. SPEED
2. MOTORSOLVE
3. FLUX, MAGNET
4. AANSYS RMxprt/Maxwell 2D/3D
5. Motor Design Limited
Wind and Solar Energy Systems

Course Code: PEC-EE-01
Category: PROGRAMM ELECTIVE
Course title: Wind and Solar Energy Systems

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Course Outcomes:
At the end of this course, students will demonstrate the ability to
- Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
- Understand the basic physics of wind and solar power generation.
- Understand the power electronic interfaces for wind and solar generation.
- Understand the issues related to the grid-integration of solar and wind energy systems.

Section -A

Section -B

Section -C
Solar thermal power generation: Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis

Section -D
20
Network Integration Issues: Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behaviour during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

Text / References:
Electric Drives

Course Code: PEC-EE-03
Category: PROGRAMM ELECTIVE
Course title: Electrical Drives
Scheme: L T P
3 - -

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:
At the end of this course, students will demonstrate the ability to
• Understand the characteristics of dc motors and induction motors.
• Understand the principles of speed-control of dc motors and induction motors.
• Understand the power electronic converters used for dc motor and induction motor speed control.

SECTION-A

Electrical drives
Introduction, Classification, advantages, choice of electrical drive machines, status of ac and dcdrives.
DC motor characteristics
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.
Closed-loop control of DC Drive
Control structure of DC drive, inner current loop and outer speed loop, closed-loop speed control of multi-motor drives, microprocessor-based control of electric drives, current controller specification and design, speed controller specification and design.

SECTION-B

Multi-quadrant DC drive
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.

Selection of motor power rating
Heating and cooling, determination of motor rating, continuous, short time and intermittent duty rating, load equalization and determination of moment of inertia of the flywheel.

SECTION-C

Chopper fed DC drive
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.

**Induction motor characteristics**
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.

SECTION-D

**Scalar control or constant V/f control of induction motor**
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.

**Control of slip ring induction motor**
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.

**Text / Reference Books:**
High Voltage Engineering

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

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Objective: To impart knowledge on the following Topics
- Various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination

Section A
Conduction and Breakdown in Gases:

Conduction and Breakdown in Liquid Dielectrics:
Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids.

Breakdown in Solid Dielectrics:
Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown.

Section B
Generation of High Voltages and Currents:
Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators.

Measurement of High Voltages and Currents:

Section C
Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems:
National Causes for Overvoltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems.

**Non-Destructive Testing of Materials and Electrical Apparatus:**
Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.

**Section D**

**HV Testing of Electrical Apparatus:**

**Graduate Attributes (As per NBA)**

**Course outcomes:**

At the end of the course the student will be able to:

- Explain conduction and breakdown phenomenon in gases, liquid dielectrics.
- Analyse breakdown phenomenon in solid dielectrics.
- Explain generation of high voltages and currents.
- Analyse measurement techniques for high voltages and currents.
- Discuss overvoltage phenomenon and insulation coordination in electric power systems.
- Perform non-destructive testing of materials and electric apparatus and high-voltage testing of electric apparatus.

**Reference Books**

HVDC Transmission Systems

Course Code: PEC-EE-07
Category: PROGRAMM ELECTIVE
Course title: HVDC Transmission Systems
Scheme: L T P
3 - -

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Objective: To impart knowledge on the following Topics

- DC power transmission technology
- Analysis of HVDC converters
- Converter and HVDC system control
- Converter faults and protection
- Smoothing reactor and DC line
- Reactive power control
- Component models for the analysis of ac/dc systems
- Power flow analysis in AC/DC systems

Section A

BASIC CONCEPTS

ANALYSIS OF HVDC CONVERTERS

Section B

CONVERTER & HVDC SYSTEM CONTROL
Principal of DC Link Control – Converters Control Characteristics – Firing angle control
Current and extinction angle control – Effect of source inductance on the system; Starting and stopping of DC link; Power Control.

REACTIVE POWER CONTROL IN HVDC
Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies sources of reactive power-AC Filters – shunt capacitors-synchronous condensers.

Section C

POWER FLOW ANALYSIS IN AC/DC SYSTEMS

CONVERTER FAULT & PROTECTION
Converter faults – protection against over current and over voltage in converter station – surge arresters – smoothing reactors – DC breakers – Audible noise-space charge field-corona effects on DC lines-Radio interference.

Section D

HARMONICS
Generation of Harmonics – Characteristics harmonics, calculation of AC Harmonics, Non-Characteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics

FILTERS
Types of AC filters, Design of Single tuned filters – Design of High pass filters.

Course Outcome

After the completion of the course, the students will be able to:

1. Choose intelligently AC and DC transmission systems for the dedicated application(s).
2. Identify the suitable two-level/multilevel configuration for high power converters.
3. Select the suitable protection method for various converter faults.
4. Identify suitable reactive power compensation method.
5. Decide the configuration for harmonic mitigation on both AC and DC sides.

REFERENCES:
ELECTRICAL ENGINEERING MATERIALS

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COURSE OUTCOME:
After the completion of the course, the students will be able to:
- Learn the basics of materials used in electrical engineering.
- Realize the dielectric properties of insulators in static and alternating fields.
- Explain the importance of magnetic properties and superconductivity.
- Explain the behavior of conductivity of metals and classifications of semiconductor material.

SECTION A
Conductivity of Metal: Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, thermionic emission, photo electric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials, thermal properties, thermal conductivity of metals, thermoelectric effects.

SECTION B
Dielectric Properties: Introduction, effect of a dielectric on the behavior of a capacitor, polarization, the dielectric constant of monatomic gases, dielectric losses, significance of the loss tangent, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, ferroelectricity, piezoelectricity

SECTION C
Magnetic properties of Materials: Introduction, Classification of magnetic materials, diamagnetism, paramagnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.

SECTION D
Semiconductors: energy band in solids, conductors, semiconductors and insulators, types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, diffusion, the Einstein relation, hall effect, thermal conductivity of semiconductors, electrical conductivity of doped materials.

REFERENCE BOOKS
Course Code: OEC-EE-04
Category: Open Elective
Course title: Nano Electronics (Theory)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.

Section-I

Section-II
Shrink-down approaches: CMOS scaling: advantages and limitations. Nanoscale MOSFETs, FINFETs, Vertical MOSFETs, system integration limits (interconnect issues etc.)

Section-III
Nanostructure materials, classifications of nanostructure materials, zero dimensional, one dimensional, two dimensional and three dimensional, properties and applications. Characterization techniques for nanostructured materials: SEM, TEM and AFM

Section-IV
Nano electronics devices: Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

Text/Reference
Books:
1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic
Intelligent Instrumentation

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**Course Outcomes:**

At the end of this course, students will demonstrate the ability to

1. The basic characteristic of intelligent instrumentation system includes the knowledge of new sensor technology.
2. Able to understand the data acquisition system.
3. Able to understand the signal amplification & attenuation

**Section-A**

Intelligence, features characterizing intelligence, intelligent instrumentation system: features of intelligent instrumentation, components of intelligent instrumentation, block diagram of intelligent instrumentation.

**Section-B**

Signal amplification & attenuation (OP-AMP based), instrumentation amplifier (circuit diagram, high CMRR & other features), signal linearization (different types such as diode resistor combination, OP-AMP based etc.), bias removal signal filtering (output from ideal filters, output from constant – k filters, matching of filter sections, active analog filters).

**Section-C**

OP-AMP based voltage to current converter, current to voltage conversion, signal integration, voltage follower (pre amplifier), voltage comparator, phase locked loop, signal addition, signal multiplication, signal transmission, description of spike filter.

Smart sensors: Primary sensors, excitation, compensation, information coding/processing, data compensation, standard for smart sensor interface.

**Section-D**

Interfacing instruments and computers: basic issues of interfacing address decoding: data transfer control, A/D convertor, D/A convertors, sample & hold circuit, other interface considerations.

**Text Books:**

1. Principles of measurements and instrumentation by Alan S Morris, PHI
2. Intelligent instrumentation by Bamay, G.C.Prentice Hall

**Reference Books :**

1. Sensors and transducers by Parranabis, PHI
2. Introduction to digital signal processing: MGH
Power Plant Engineering

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

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Course Outcomes:

1. Describe and analyze different types of sources and mathematical expressions related to thermodynamics and various terms and factors involved with power plant operation.
2. Analyze the working and layout of steam power plants and the different systems comprising the plant and discuss about its economic and safety impacts.
3. Able to know about the different types of cycles and natural resources used in power plants and their application.
4. Discuss and analyze the mathematical and working principles of different electrical equipments involved in the generation of power.

Section-A

Coal based thermal power plants, basic Rankine 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.

Section-B

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.

Section-C

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.

Section-D

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

Text Books:
ECONOMICS FOR ENGINEERS

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

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Course Objectives:
1. Acquaint the students to basic concepts of economics and their operational significance.
2. To stimulate the students to think systematically and objectively about contemporary economic problems.

COURSE OUTCOMES:
1. The students will able to understand the basic concept of economics.
2. The student will able to understand the concept of production and cost.
3. The student will able to understand the concept of market.
4. The student will able to understand the concept of privatization, globalization and banks.

UNIT-1
Definition of Economics- Various definitions, types of economics- Micro and Macro Economics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development.
Demand- Meaning of Demand, Law of Demand, Elasticity of Demand- meaning, factors effecting it, its practical application and importance.

UNIT-2
Production- Meaning of Production and factors of production, Law of variable proportions, Returns to scale, Internal and external economies and diseconomies of scale.
Various concepts of cost of production- Fixed cost, Variable cost, Money cost, Real cost, Accounting cost, Marginal cost, Opportunity cost. Shape of Average cost, Marginal cost, Total cost etc. in short run and long run.

UNIT-3
Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features).
Supply- Supply and law of supply, Role of demand & supply in price determination and effect of changes in demand and supply on prices.

UNIT-4
Indian Economy- Nature and characteristics of Indian economy as under developed, developing and mixed economy (brief and elementary introduction), Privatization - meaning, merits and demerits.
Globalization of Indian economy - merits and demerits.

REFERENCES:
3. Dewett K. K., Modern economic theory, S. Chand.
4. H. L. Ahuja., Modern economic theory, S. Chand.
5. Dutt Rudar & Sundhram K. P. M., Indian Economy.
7. Singh Jaswinder, Managerial Economics, dreamtech press.
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Course Outcomes:
At the end of this course, students will demonstrate the ability to;
- Use numerical methods to analyse a power system in steady state.
- Understand stability constraints in a synchronous grid.
- Understand methods to control the voltage, frequency and power flow.
- Understand the basics of power system economics

SECTION-A


Section -B


Section -C

Voltage and Load Frequency Control: Introduction to control of active and reactive power flow, control of voltage, Excitation systems. Introduction to Load Frequency Control and Automatic generation control, Single area and modelling of AGC, Concept of multi area AGC.

Section -D


Text/References:
Notes:
(i) At least 10 experiments are to be performed by students in the semester.
(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.
(iii) Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS:
1. Draw the flow chart and develop the computer program for the formation of the Y Bus of a generalized network.
2. Draw the flow chart and develop the computer program for the formation of the Z Bus of a generalized network.
3. To plot the swing curve and observe the stability.
4. To perform load flow analysis using Gauss Seidel method.
5. To perform load flow analysis using Newton-Raphson method.
6. To study comparison of different load flow methods.
7. To develop the program for stability analysis.
8. To observe transmission losses and efficiency with variations in power for the given example.
9. Simulation study on LFC of two area interconnected power system.
10. Simulation study on voltage control in multi area interconnected power system.
Power Electronics

Course Code: PCC-EE-306
Category: Engineering Science Course
Course title: Power Electronics (Theory)

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Course Outcomes:
At the end of this course students will demonstrate the ability to
- Understand the differences between signal level and power level devices.
- Analyse controlled rectifier circuits.
- Analyse the operation of DC-DC choppers.
- Analyse the operation of voltage source inverters.

Section-A
INTRODUCTION: Role of power electronics, review of construction and characteristics of power diode, Shottky diode, power transistor, power MOSFET, DIAC, Triac, GTO, IGBT & SIT.

Section-B
SCR: construction and characteristics of SCR, Ratings and protections, series and parallel connections, R, RC and UJT firing circuit and other firing circuits based on ICs and microprocessors, pulse transformer and opto-coupler, commutation techniques.

Section-C
THYRISTOR RECTIFIER: Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.
CONVERTERS: One, two, three, six and twelve pulse converters, fully and half controlled converters, load voltage waveforms, output voltage equation, continuous and discontinuous modes of operation, input power factor of converter, reactive power demand, effect of source inductance, introduction to four quadrant / dual converter, power factor improvement techniques, forced commutated converter

Section-D
INVERTERS: Basic circuit, 120 degree mode and 180 degree mode conduction schemes, modified McMurray half bridge and full bridge inverters, McMurray -Bedford half bridge and bridge inverters, brief description of parallel and series inverters, current source inverter (CSI)
CHOPPERS: Basic scheme, output voltage control techniques, one, two, and four quadrant choppers, step up chopper, voltage commutated chopper, current commutated chopper

TEXT BOOK:
2. MH Rashid, “Power Electronics “, PHI

REFERENCE BOOKS :
1. MH Rashid, “Handbook of power electronics “, Elsevier
2. PC Sen, “Power Electronics”, TMH
3. HC Rai, “Power Electronics”, Galgotia
4. GK Dubey, “Thyristorised Power Controllers”, PHI
Power Electronics Laboratory

Class Work: 25
Exam: 25
Total: 50

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Notes:
(iv) At least 10 experiments are to be performed by students in the semester.
(v) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.
(vi) Group of students for practical should be 15 to 20 in number.

List of Experiments
2. Characteristics of IGBT & GTO
3. To study R, RC and UJT firing Circuit with Pulse transformer
4. To study of Firing Circuit based on ICs NE555, 7408 & 3140
5. To Study of Pulse transformer & optocoupler technique
6. To Study of SCR Communication Technique Class A-E.
7. Speed control of small motor using Single Phase Half wave & Full wave fully controlled Converter
8. Speed control of small motor using Single Phase Dual Converter (Continuous and discontinuous Control)
9. Study of Mc Murray - Bed ford Half & Full Bridge Inverter
10. To study Parallel Inverter to drive small AC Induction motor
11. Speed control of a small DC motor using MOSFET based Chopper with output voltage control technique
12. Speed control of small AC induction motor using Single Phase non circulating type bridge by frequency conversion.

Electronics Design (Integrated)
Class Work: 25
Exam: 75
Total: 100

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Notes:
- Understand the practical issues related to practical implementation of applications.
- Choose appropriate components, software and hardware platforms.
- Design a Printed Circuit Board, get it made and populate/solder it with components.
- Work as a team with other students to implement an application.

Section-A
Basic concepts on measurements; Noise in electronic systems; Sensors and signal conditioning circuits

Section-B
Introduction to electronic instrumentation and PC based data acquisition; Electronic system design, Analog system design, Interfacing of analog and digital systems

Section-C
Embedded systems, Electronic system design employing microcontrollers, CPLDs, and FPGAs, PCB design and layout; System assembly considerations.

Section-D
Group projects involving electronic hardware (Analog, Digital, mixed signal) leading to implementation of an application.

Text/Reference Books

*The experiments will be performed on the basis of above contents.

Digital signal processing
Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. To get an introduction of basics like Sampling, Interpolation, Aliasing and operations, Convolution and Correlation.
2. To Study the basics, mathematical analysis and applications of DFT and FFT
3. To study the design and implementation of Digital Filters.
4. To impart practical knowledge of signal processing operations by using software.

UNIT I

Discrete-Time Signals and Systems: Sequences; representation of signals on orthogonal basis; representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.


UNIT II


UNIT III


UNIT IV

Implementation of Discrete Time Systems: Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-
Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects, Parametric and non-parametric spectral estimation. Applications of Digital Signal Processing

**Multirate Digital Signal Processing:** Introduction to multirate digital signal processing, Multi rate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks.

**Text/Reference**

**Books:**

4. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya, TMH
Power system protection

Course Code: PEC-EE-06
Category: Program Elective
Course title: Power system protection (Theory)

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Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the different components of a protection system.
- Evaluate fault current due to different types of fault in a network.
- Understand the protection schemes for different power system components.
- Understand the basic principles of digital protection.
- Understand system protection schemes, and the use of wide-area measurements.

Section A
Introduction and Components of a Protection System

Section B
Introduction to Overcurrent Protection and overcurrent relay co-ordination.

Section C

Section D
System Protection
Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under-voltage and df/dt relays, Out-of-step protection, Synchro-phasors, Phasor Measurement

Text/References:
Advance Electric Drives

Course Code: PEC-EE-18
Category: Program Elective
Course title: Advance Electric Drives (Theory)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the operation of power electronic converters and their control strategies.
- Understand the vector control strategies for ac motor drives
- Understand the implementation of the control strategies using digital signal processors.

Section A

Power Converters for AC drives
PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive.

Section B

Induction motor drives
Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control(DTC)

Section C

Synchronous motor drives
Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.

Permanent magnet motor drives
Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.

Section D

Switched reluctance motor drives
Evolution of switched reluctance motors, various topologies for SRM drives, comparison, Closed loop speed and torque control of SRM.

DSP based motion control
Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control.

Text / Reference Books:
Power quality and FACTS

Course Code | PEC-EE-08
---|---
Category | Program Elective
Course title | Power quality and FACTS (Theory)
Scheme | L | T | P
| 3 | - | -

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes: At the end of this course, students will demonstrate the ability to
1. Understand the characteristics of ac transmission and the effect of shunt and series reactive Compensation.
2. Understand the working principles of FACTS devices and their operating characteristics.
3. Understand the basic concepts of power quality.
4. Understand the working principles of devices to improve power quality.

Section A


Section B

Section C
Application of FACTS: Application of FACTS devices for power-flow control and stability improvement. Simulation example of power swing damping in a single-machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM.

Power Quality Problems in Distribution Systems: Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags,

**Section D**

**DSTATCOM:** Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents. Current Control Techniques in for DSTATCOM.


Text/References
Course Code: OEC-EE03
Category: OPEN ELECTIVE
Course title: VHDL and Digital Design
Scheme: L T P
3 - -

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objective:

1. To understand the modelling & simulation & its role in digital evaluation.
2. To learn basic concepts of VHDL language, its different architecture, designing of various Combinational & sequential circuits.
3. To study various PLDs & detail study of FPGAs and implementation of various combinational & sequential logic circuits on FPGAs.

UNIT-1

INTRODUCTION: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioral dataflow and structural models.

UNIT-2

VHDL STATEMENTS: Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

UNIT -3

COMBINATIONAL & SEQUENTIAL CIRCUIT DESIGN: VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

UNIT-4

DESIGN OF MICROCOMPUTER & PROGRAMMABLE DEVICE: Basic components of a computer, specifications, architecture of a simple microcomputer system, and
implementation of a simple microcomputer system using VHDL Programmable logic devices: ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

REFERENCE BOOKS:
1. Ashenden - Digital design, Elsevier
Distributed Energy Integration

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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

1. To introduce the concept of distributed generation, microgrids, electric vehicles and energy storage.
2. To familiarize the students with renewable generation system modelling and their grid integration issues.
3. To impart an understanding of economics, policies and technical regulations for DG integration.

**Section A**

**Distributed Generation**

Wind/PV System Modelling: Wind/PV variability and uncertainty, Forecasting methods and applications.

**Section-B**

**System studies**
Power flow studies, Fault studies, Stability studies, Transient studies, Inertia and Frequency Response studies.
System balancing & imbalance handling: Flexibility Issues, Ramping issues, Inertia and Frequency Response Issues, Role of storage and DR and related issues, Large scale storage for grid stability / Backup.

**Electric Vehicles**
Technology, Components of EV and their modelling, Charging and Discharging Mechanisms, Driving & Plug-in pattern analysis, Scheduling issues, Challenges in EV integration, Bulk Electric Vehicles, Ancillary Services from EVs.

**Section-C**

**Technical regulations for the interconnection of DGs to the power systems**


Section-D

Economics of DG
Value of power from DGs, Market value of power from DGs, Loss reduction, Investment reduction, Connection costs and charges, Distribution use of system charges, Allocation of losses in distribution networks with DG, Alternative framework for distribution tariff development.

DGs in areas of limited transmission capacity. DGs in distribution networks. Active Management of Distribution systems. Ancillary Services with DGs, Markets for Ancillary Services. DER Management, Virtual Power Plants.

Micro Grids
Concept, Design, Modelling, Operation and Analysis. Role in Energy Reliability, Cold Load Pick Up and Sustainability.

Reference Books:
Conventional and Renewable Energy Resources

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Objective:

- The course will provide understanding of power generation technology using conventional and non conventional energy sources which will be useful for understanding the operation and working of power plants.
- Students will learn basics of Tariff structure for energy production.
- Students will understand the operation, maintenance and working of substations.

Section-A

INTRODUCTION: Energy sources, their availability, recent trends in Power Generation, Amount of generation of electric power from Conventional and non conventional sources of energy in Haryana, India and some developed countries of the world. Interconnected Generation of Power Plants.

Section-B

POWER GENERATION PLANNING: Load forecasting, load curves, load duration curve, Base load and Peak load Power Plants, connected Load, maximum demand, demand factor, Group diversity factor, load factor, significance of load factor, plant factor, capacity factor, selection of unit size, No. of Units, reserves, cost of power generation, Depreciation, tariff.

Section-C

CONVENTIONAL ENERGY SOURCES: Selection of site, capacity calculations, classification, Schematic diagram and working of Thermal Power Stations (TPS), Hydro Electric Plant and Nuclear Power Plant.

NON-CONVENTIONAL ENERGY SOURCES: Selection of site, capacity calculations, Schematic diagram and working of Wind, Solar, fuel cell, Magneto Hydro Dynamic (MHD) system.

Section-D


Course Outcomes:

After learning the course the students should be able to:
1. Describe the working of thermal power station using single line diagram and state the functions of the major equipment and auxiliaries of a TPS.
2. Explain hydro energy conversion process with block diagrams and identify the appropriate site for it.
3. Explain the working of Nuclear power station.
4. Describe the working of Solar Power station and wind power plant.
5. Compare various economic aspects of different types of Tariffs.
6. Classify various substations and describe working of its equipments.
7. Compare various generating systems.

REFERENCES:

### Course Code

**OEC-EE-10**

**Category**

Open Elective

**Course title**

Soft Computing (Theory)

**Scheme**

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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

1. To understand the concepts of soft computing.
2. To introduce the ideas of fuzzy logic, Artificial Neural networks, genetic algorithm.
3. To introduce the concepts of hybrid intelligent systems.
4. To introduce application areas of soft computing and the criteria to select appropriate soft computing

#### Section A

Soft Computing: Introduction, requirement, different soft computing techniques and their characteristics, comparison with hard computing, applications.

#### Section B

Fuzzy sets and Fuzzy logic: Introduction, Fuzzy sets versus crisp sets, properties of fuzzy sets, operations on fuzzy sets, Extension principle, Fuzzy relations, Linguistic variables, linguistic terms, Linguistic hedges, Fuzzy reasoning, Mamdani and TSK fuzzy inference systems, Applications, fuzzy controllers, Theoretical and implementation issues.

#### Section C

Artificial Neural Network: Introduction, comparison with biological neural network, basic models of artificial neuron, different architectures of ANN, Learning techniques, ANN based system modeling, ANN based controller design, theoretical and implementation issues, Applications.

#### Section D

Evolutionary algorithms and hybrid systems: Genetic Algorithm (GA), different operators of GA, convergence of Genetic Algorithm, Particle swarm optimization algorithm, Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design, Fuzzy Logic design, other Applications of GA.

**References:**

ORGANIZATIONAL BEHAVIOUR

Course Code: HSMC-02
Category: HS
Course title: ORGANIZATIONAL BEHAVIOUR

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Course Objectives:

The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

COURSE OUTCOMES:

1. Students will be able to apply the managerial concepts in practical life.
2. The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
3. Students will be able to understand the behavioral dynamics in organizations.
4. Students will be able to understand the organizational culture and change.

UNIT - 1
Introduction of Management: Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Management and social responsibility, difference between management and administration.

UNIT - 2
Introduction of organization:- Meaning and process of Organization, Management v/s Organization;
Fundamentals of Organizational Behavior: Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB.
Individual Processes and Behavior-Personality- Concept, determinants and applications;
Perception- Concept, process and applications, Learning- Concept ,theories ; Motivation- Concept, techniques and importance.

UNIT - 3
Interpersonal Processes- Teams and Groups- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, Conflict- Concept, sources, types, management of conflict; Leadership: Concept, function, styles & qualities of leadership.
Communication – Meaning, process, channels of communication, importance, barriers and overcome of communication.

UNIT - 4
Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior; Organizational culture - Elements, types and factors affecting organizational culture. Organizational change: Concept, types & factors affecting organizational change, Resistance to Change.

REFERENCES:
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.