With effect from the academic year 2021-2022

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Scheme of Instruction

and

Syllabi of

B.E. VII & VIII Semesters

2021-2022

AICTE MODEL CURRICULUM

UNIVERSITY COLLEGE OF ENGINEERING

(AUTONOMOUS)

OSMANIA UNIVERSITY

HYDERABAD – 500 007 TELANGANA

With effect from the academic year 2021-2022

SCHEME OF INSTRUCTION

VII - SEMESTER

B.E. (Electrical & Electronics Engineering)

AICTE Model Curriculum

S. No.	Course Code	Course Title	Scheme of Instruction			Contact Hours / Week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1.	MC902AS	Essence of Indian Traditional Knowledge	3	-	-	3	30	70	-
2.	PC701EE	Power System Operation and Control	3	-	-	3	30	70	3
3.	PC702EE	Utilization of Electrical Energy	3	-	-	3	30	70	3
4.	**Professional Elective– III**		3	-	-	3	30	70	3
	PE731EE	Programmable Logic Controller							
	PE732EE	Linear Integrated Circuits							
	PE733EE	Digital Control Systems							
5.	**Professional Elective– IV**		3	-	-	3	30	70	3
	PE741EE	Digital Signal Processing							
	PE742EE	Electric Machine Design							
	PE743EE	Power Quality Engineering							
6.	**Open Elective – II**		3	-	-	3	30	70	3
	OE701BM	Micro Electro-Mechanical Systems							
	OE702CE	Green Building Technology							
	OE703CS	Information Security							
	OE704CS	Data Base Management Systems							
	OE705EC	Embedded Systems							
	OE706EC	Verilog HDL							
	OE707EC	Satellite Communication and Applications							
	OE708EE	Optimization Techniques							
	OE709EE	Non-Conventional Energy Sources							
	OE710ME	Startup Entrepreneurship							
	OE711ME	Nano Technology							
Practical									
1.	PC751EE	Electrical Simulation Lab	-	-	2	2	25	50	1
2.	PC752EE	Power Systems Lab	-	-	2	2	25	50	1
3.	PW751EE	Major Project Phase-I	-	-	4	4	50	-	2
4.	PW961EE	Summer Internship*	-	-	-	-	50	-	-
			18	**-**	**8**	**26**	**330**	**520**	**19**

*The students have to undergo a Summer Internship of 6 weeks duration after VI semester and credits will be awarded in VII semester after evaluation.

MC902AS

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

(Mandatory Course-II)

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 0

Course Objectives

- The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
- Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic healthcare system.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.
2. Explain holistic life style of yoga science.
3. Understand basic structure of Indian knowledge system.

Course Content

Basic Structure of Indian Knowledge System (i) वेद, (ii) उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्वेद, स्थापत्य आदि) (iii) वेदांग (शिक्षा, कल्प, निरुत, व्याकरण, ज्योतिष छंद), (iv) उपाइग (धर्म शास्त्र, मीमांसा, पुराण, तर्कशास्त्र)

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies

Suggested Books

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, BharatiyaVidya Bhavan
3. Fritzof Capra, Tao of Physics
4. Fritzof Capra, The wave of Life
5. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amakuam
6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
7. GN Jha(Eng. Trans.) Ed. R N Jha, Yoga-darshanam with VyasaBhashya, VidyanidhiPrakasham, Delhi, 2016
8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, VidyanidhiPrakasham, Delhi, 2016
9. P R Sharma (English translation), ShodashangHridayam

PC701EE

POWER SYSTEM OPERATION AND CONTROL

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To understand the concepts and Importance of Load flow studies.
- To study the economic operation of thermal power units.
- To understand the load frequency control mechanism in a power system.
- To analyze angle stability and voltage stability of the power system.
- To study various compensation techniques in a power system.

Course Outcomes: After completion of this course, the students shall be able to:

1. Analyze load flow methods, economic operation and load frequency control of power system.
2. Evaluate the load distribution between generating units economically.
3. Understand the effect of closed loop control of frequency of power system.
4. Determine the stability of power system under various types of disturbances.
5. Understand various compensation methods required in a power system.

UNIT I

Load Flow Studies: Introduction, Bus classification, Nodal Admittance matrix, Static Load flow equations, Gauss Seidel method, Newton Raphson method, Decoupled and Fast decoupled methods of load flow analysis. Comparison of methods.

UNIT II

Economic Operation of Power System: Generator input output curves, Heat rates and incremental cost curves, Economic operation neglecting transmission losses. Loss coefficients, Economic operation including transmission losses.

UNIT III

Load Frequency Control: Mathematical model of speed-governing system, Turbine models. Concept of control area, Flat Frequency control, Flat tie line frequency control, Tie line bias control. Single area load frequency control, Steady state and dynamic responses, Closed loop control, Two area load frequency control.

UNIT IV

Power System Stability: Steady State Stability, Dynamic Stability, Transient Stability, Swing equation, Equal area criterion, Application of equal area criterion, Step-by-Step solution of the swing equation, Factors affecting transient stability. Introduction to voltage stability.

UNIT V

Compensation in Power System: Loading capability, Load compensation, Line compensation, Series compensation, Shunt compensation, FACTS controllers –Principle of Operation of SVC, STATCOM, SSSC, UPFC.

Suggested Reading:

1. C.L.Wadhwa, Electric Power Systems, New Age International (P) Ltd., Third Edition 2002.
2. Nagarath and Kothari, Electrical Power Systems, Tata McGraw Hill Co., Third Edition, 2004.
3. Elgerd 0, Electric Energy System Theory, McGraw Hill,1971.
4. Hingorani, Understanding FACTS, Standard Publishing, New Delhi,2000.
5. Hadi Saadat, Power System Analysis, Tata McGraw-Hill Edition,2002.

PC702EE

UTILIZATION OF ELECTRICAL ENERGY

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To introduce the students and understand Utilization of electrical energy for various applications like industrial heating, welding etc.
- To understand various types of control circuits for three phase induction motors.
- To understand the concept of illumination, and know the applications of various lamps to factory lighting, street lighting etc.
- To understand the basic principle of electric traction including speed-time curves of different traction services.
- To understand systems of train lighting and also various types of batteries.

Course Outcomes: After completion of this course, the students shall be able to:

1. Identify a suitable heating/welding scheme for a given application.
2. Design control circuits for the reliable operation of three phase induction motors.
3. Classify types of electric light sources based on nature of operation and their objectives, performance and reliability.
4. Determine the speed-time characteristics of various traction services and also estimate the energy consumption levels at various modes of operation.
5. Select proper train lighting scheme according to the requirement and analyze various batteries.

UNIT I

Industrial Heating: Advantages and methods of electric heating. Description, operation and performance of resistance ovens, Design of heating element. High frequency heating, Induction Heating, Induction furnaces, Core type, Coreless furnaces, Dielectric heating. Electric Arc furnaces, Direct Arc furnace, Indirect Arc furnaces.

Electric Welding: Classification of Electric welding, welding transformer and its rating, various types of Electric arc welding and electric resistance welding.

UNIT II

Schematic Utilization and Connection Diagrams for Motor Control: Two supply sources for 3 phase Induction motors. Direct reversing, remote control operation, and jogging operating of Induction motor. Contactor control circuit. Push button control stations. Over load relays, limit switches, float switches. Interlocking methods for reversing control.

UNIT III

Illumination: Introduction, nature and production of light, Sensitivity of the eye, Units of light. The inverse square law and cosine law, Solid angle, Lighting calculations, Determination of M.S.C.P, Rousseau's construction, Discharge lamps, Sodium vapour lamps, Mercury vapour lamps, Fluorescent lamp, Starting and power factor corrections, Stroboscopic effects, Neon signs, Application to factory lighting, Street lighting and Flood lighting.

UNIT IV

Electric Traction: System of Electric Traction, Transmission of drive, Systems of track electrification, Traction mechanics, Speed time curves, Tractive effort, Power of Traction motor, Specific energy consumption, Mechanics of train movement, Coefficient of adhesion.

Traction Motors: Desirable characteristics, DC series motors, AC series motors 3-phase induction motors, DC motor series & parallel control, Energy saving.

UNIT V

Train Lighting: Systems of train lighting, Special requirements of train lighting, Methods of obtaining unidirectional polarity, Methods of obtaining constant output, Single battery system, Double battery parallel block system, Principal equipment of double battery system, Coach wiring, Dynamo.

Batteries: Lead acid batteries, SMF batteries, Construction and maintenance, Charging and rating of batteries.

Suggested Reading:

1. Partab H, Art and Science of Utilization of Electric Power, Dhanpat Rai & Sons, 1997.
2. K.B. Raina & S.K. Bhattacharya, Electrical Design, Estimatingand Costing, Wiley Eastern Ltd., 1991.
3. Partab H, Modern Electric Traction, Dhanpat Rai & Sons, 2000.
4. B.L.Theraja, A Text Book of Electrical Technology, S.Chand& Company Ltd, Vol-I.

PE731EE

PROGRAMMABLE LOGIC CONTROLLER

(Professional Elective-III)

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To provide the knowledge of different components used in PLCs such as processor, input/output devices and programmer monitors
- To make the students thorough with ladder programming of PLC.
- To train them how to use timer, counter, register, arithmetic and different conversion systems.
- To give awareness about application of different PLC features in Process control industry.
- To explain the students about different data handling functions of PLC

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand different components of PLC.
2. Construct ladder diagrams for different industry applications.
3. Deal with applications like timer/counter, registers etc.
4. Understand the utility of different features of PLC in process industry.
5. Use data handling function in PLC programming.

UNIT-I

PLC Basics: Definition and History of PLC, PLC advantages and disadvantages, Overall PLC Systems, CPUs and Programmer Monitors, PLC input and output models, Printing PLC Information-Programming Procedures, Programming Equipment, Programming Formats, Proper Construction of PLC Diagrams, Devices to which PLC input and output modules are connected, Input on/off switching devices, Input analog devices, Output analog on/off devices and output analog devices.

UNIT-II

Basic PLC Programming: Programming on/off inputs to produce on/off outputs, PLC input instructions, Outputs, Operational procedures, Contact and coil input/output programming examples, Relation of digital gate logic contact / coil logic, PLC programming and conversion examples, Creating ladder diagrams from process control descriptions, Sequence listings, Large process ladder diagram constructions.

UNIT-III

Basic PLC Functions: General Characteristics of Registers, Module addressing, Holding registers, Input registers, output registers, PLC timer functions, examples of timer functions. Industrial applications, PLC counter functions.

UNIT-IV

Intermediate Functions: PLC Arithmetic functions, PLC additions and subtractions, PLC repetitive clock, PLC Multiplications, Division and Square Root, PLC trigonometric and log functions, Other PLC arithmetic functions, PLC number comparison functions. PLC basic comparison functions and applications, Numbering systems and number conversion functions, PLC conversion between decimal and BCD-Hexadecimals numbering systems.

UNIT-V

Data Handling Functions: The PLC skip and master control relay functions, Jump functions, Jump with non-return, Jump with return. PLC data move Systems, The PLC functions and applications. PLC functions working with bits, PLC digital bit functions and applications, PLC sequence functions, PLC matrix functions.

Suggested Reading:

1. John W. Weff, Ronald A. Reis, *Programmable Logic Controllers*, Prentice Hall of India Private Limited, Fifth edition, 2003.

PE732EE

LINEAR INTEGRATED CIRCUITS
(Professional Elective-III)

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To introduce the basic building blocks of linear integrated circuits.
- To understand the different linear and non-linear applications of op-amp.
- To understand the voltage regulators and active filters by using op-amps.
- To acquire the basic knowledge of special function ICs.
- To understand the concepts of waveform generation using op-amps.

Course Outcomes: After completion of this course, the students shall be able to:

1. Design and use op-amps for various linear and non-linear applications.
2. Design and use voltage regulators and active filters.
3. Design and analyze multivibrator circuits using op-amp
4. Design and analyze the various applications of 555 timer.
5. Ability to design practical circuits that perform the desired operations.

UNIT – l

Operational amplifiers: Characteristics, Open loop voltage gain, Output impedance, Input impedance, Common Mode Rejection Ratio, Offset balancing techniques Slew rate, Frequency response, Basic applications, Inverter summer, Analog integrator, Differentiator, Current to voltage converter, Voltage to current converter, Voltage follower, a.c. amplifier.

UNIT – II

Circuits using Op-amps: Voltage limiter, Clipper and damper, Precision rectifier-full wave and half wave, Peak detector, Comparator, Zero crossing detector, Schmitt trigger, Monostable, astable and bistable multivibrators, Multiplier, Divider, Difference amplifier, Instrumentation amplifier.

UNIT – III

Waveform generation using Op-amps: Sine, Square, Triangular and Quadrature oscillators, 555 timer - Functional diagram, Operation as monostable and astable, Voltage to frequency converter using 555, 565.

UNIT – IV

Voltage regulators using Op-amp: Series voltage regulators, Shunt regulators using Op-amp - Switching regulators using Op-amp, Buck, Boost, Buck-boost regulators, Regulators using IC 723, Dual voltage regulator, Fixed voltage regulators, Current sensing and current fold back protection.

UNIT – V

RC active filters: Butterworth, First order, Second order for low pass, High pass, Band pass, Band reject, Notch, State variable filter, Switched capacitor filter, Universal filter, Power amplifiers, Power boosters, Monolithic power amplifier features.

Suggested Reading:

1. Gayakwad W.A. Op-Amps and Linear Integrated Circuits, 4th Edition, Prentice Hall of India, 2002.
2. Malvino Albert Paul, Electronic Principles, 6th Edition, Tata McGraw Hill, 1999.
3. Roy Choudhury, Shail Jam - Linear integrated Circuits, New Age International, 2nd Edition, 2003.
4. William D. Stanley, OP Amps with Linear Integrated Circuits, Pearson, 2000.

PE733EE

DIGITAL CONTROL SYSTEMS

Professional Elective-III

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To understand fundamentals digital control systems, z-transforms.
- To study state space representation of the control systems, concepts of controllability and observability.
- To determine the stability of digital control systems using different techniques.
- To design of discrete time control systems and compensators.
- To design of state feedback controllers, state observers through various transformations

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the different parts of a digital control systems such as ADC and DAC and evaluate the output of a digital system for a given input.
2. Apply state space analysis to digital control systems
3. Determine the stability of Digital Control Systems using different methods
4. Design digital controllers for physical systems.
5. Design state feedback controller and state observers for the digital control systems.

UNIT-I

Introduction: Introduction, Examples of Data control systems**,** Digital to Analog conversion and Analog to Digital conversion, sample and hold operations.

Z-Transforms: Introduction, Linear difference equations, pulse response, Z-transforms, Theorems of Z- Transforms, the inverse Z-transforms, Modified Z-Transforms. Z-Transform method for solving difference equations; Pulse transforms function) block diagram analysis of sampled data systems, mapping between s-plane and z-plane.

UNIT-II

State Space Analysis: State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and its Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state-space equations. Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function.

UNIT-III

Stability Analysis: Mapping between the S-Plane and the Z-Plane, Primary strips and Complementary Strips, Constant frequency loci, Constant damping ratio loci, Stability Analysis of closed loop systems in the Z-Plane. Jury stability test, Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.

UNIT-IV

Design of Discrete Time Control System: Transient and steady, State response Analysis, Design based on the frequency response method, Bilinear Transformation and Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers.

UNIT-V

State Feedback Controllers & Observers: Design of state feedback controller through pole placement, Necessary and sufficient conditions, Ackerman's formula. State Observers, Full order and Reduced order observers.

Suggested Reading:

1. Discrete-Time Control systems – K. Ogata, Pearson Education/PHI, 2 Edition.
2. Digital Control Systems, V. I. George, C. P. Kurian, Cengage Learning
3. Digital Control Systems, Kuo, Oxford University Press, 2 Edition, 2003.
4. Digital Control and State Variable Methods by M.Gopal, TMH.
5. Digital Control Engineering Analysis and Design M. Sami Fadali Antonio Visioli, AP Academic Press.

PE741EE

DIGITAL SIGNAL PROCESSING

Professional Elective-IV

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To apply classification, characterization, representation and analysis of signals and systems in time and frequency domain.
- To understand Discrete time signals and systems in frequency domain.
- To understand the characteristics of IIR digital filters.
- To understand the Characteristics of FIR digital filters.
- To study the digital signal processor TMS 320C5X and architecture.

Course Outcomes: After completion of this course, the students shall be able to:

1. Acquire the knowledge of - Classification of discrete time signals & discrete time systems, Properties of Z-transforms, Discrete time Fourier transform.
2. Obtain the frequency spectrum of discrete time signals using FFT.
3. Analyze and Design IIR digital filters
4. Analyze the Design FIR digital filters.
5. Explain the Applications of DSP TMS 320C5X.

UNIT- I

Introduction to Digital Signal Processing: Sampling, Quantizing and coding, Classification of discrete time signals & discrete time systems, linear shift invariant systems, Stability and causality, Solution to Linear constant coefficient difference equations.

Z-transforms: Properties, Inverse z-transform, System function, Relation between s-plane andz-plane - Stability in Z-domain, Solution of difference equations using one sided z-transform.

UNIT - II

Frequency Domain Analysis: Discrete time Fourier transform (DTFT), Properties, Frequency domain representation of discrete time signals and systems, DFS, Properties, Frequency domain sampling OFT, Properties, circular convolution, Linear convolution using OFT, Fast Fourier transforms (FFT), Radix-2 decimation in time(DIT) and decimation in frequency(DIF) FFT Algorithms, IDFT using FFT.

UNIT-III

IIR digital filters: Analog filter approximations, Butterworth and Chebyshev filters, Design of IIR Digital filters from analog filters using Bilinear transformation, Impulse invariant and step invariant methods. Realization of IIR filters, Direct form-I, Direct form-II, Cascade and parallel form realizations.

UNIT- IV

FIR digital filters: Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital filters using window techniques, Linear phase realization, Applications of digital signal processing to speech processing.

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion, Implementation of sampling rate conversion.

UNIT-V

Introduction to Digital Signal Processors: Introduction to programmable DSPs, Advantages of Digital signal processors over conventional Microprocessors, Architecture of TMS 320C5X-Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register, Index Register, Auxiliary Register Compare Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, Program controller, Status registers, On- chip memory and On-chip peripherals.

Suggested Reading:

1. Proakis & Manolakis - Digital Signal Processing, Principles, Algorithms and Applications, Prentice Hall of India - 3rd Edition-1994.
2. Opeinheim & Schaffter - Digital Signal Processing, PHI Publications, 2002.
3. SalivahananValluaraj & Gnanapriya - Digital Signal Processing- Tata McGraw Hill, 2001.
4. Anand Kumar.A - Digital Signal Processing - PHI learning Private Ltd. 2013.
5. B.Venkataramani and M. Bhaskar - Digital Signal Processors, Architecture programs and applications, Tata McGraw Hill, 2007.

PE742EE

ELECTRIC MACHINE DESIGN

Professional Elective-IV

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To understand various materials used in electrical systems and the construction and basic design of the electrical machines.
- To understand basic concepts of design of magnetic and thermal circuits, draw the winding diagrams of rotating machines.
- To understand the Design principles of different rotating machines.
- To acquire knowledge of electrical machine parameters such as main dimensions and the design of major parts.
- To study the design optimization of the electrical machine for industrial, agriculture and residential applications.

Course Outcomes: After completion of this course, the students shall be able to:

1. Acquire the knowledge of various electrical materials used in used in design of electrical system.
2. Analyze magnetic, thermal circuits in electrical machines and their design aspects.
3. Understand the importance of cooling and design of cooling system for various electrical machines and also able to know design AC armature windings in rotating machines.
4. Design of rotating machines and transformers.
5. Understand the computer aided design of electrical machines with various methods of approaches and flowcharts.

UNIT- I

Electrical Engineering Materials: Insulating materials: Properties of ideal insulating materials. Classification and types of insulating materials, Gaseous, liquid, Solid, fibrous and mineral insulating materials, Plastic, glass and ceramic materials. Conducting Materials: General properties materials, Super conductors.

Magnetic Materials: Classification of magnetic materials, Soft and hard magnetic materials, sheet, cold rolled steel, solid core and powder core materials.

UNIT II

Magnetic Circuit: Basic principles, magnetic circuit calculation flux density in air-gap and tooth. Carter's coefficient, ampere turns for gap and teeth, real and apparent flux density, magnetic leakage, leakage flux from salient poles, field distribution curves, field turns, armature reaction ampere turns. Reluctance of rectangular slots.

UNIT III

Electrical Circuit: AC Single phase, three phase windings. Mesh and concentric winding, Double layer winding.

Thermal Circuit: Types of enclosures, ventilating and cooling methods in Electrical Machines-Losses, Temperature rise time curve and cooling curve. Rating of electrical machines, calculation for quantity of cooling medium.

UNIT-IV

Transformer Design – Main dimensions-output Equations-Core Design-cooling system design. Design principles of rotating machines: output equations and main dimensions, defining of magnetic loading, design of slot field coils, estimation of air gap lengths.

UNIT-V

Computer Aided Design: Introduction, Advantages of digital computers: computer aided design-different approaches: Analysis method, synthesis method, hybrid method, optimization. General procedure for optimization, variable constraints. Computer aided design of 3 phase induction motor. List of symbols used, general design procedure.

Suggested Reading:

1. A.K. Sawhney, A course in Electrical Machines Design, Dhanpat Rai and Sons,1996
2. R.K. Agarwal,Principles of Electrical Machine Design, ESS Kay Publications, Naisarak, New Delhi,1994
3. V.N.Mittal, Design of Electrical Machines, Standard Publishers and Distributors, New Delhi,1992

PE743EE

POWER QUALITY ENGINEERING

Professional Elective-IV

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To understand the importance of power quality, different power quality issues and their effects in power system network.
- To understand methods of calculating the voltage sag magnitude and duration.
- To understand the types of sags and characterize the voltage sags experienced by machines.
- To acquire knowledge of harmonics, locate sources of harmonics and mitigate harmonics.
- To acquire knowledge of various measuring equipment and understand assessment of PQ measuring data.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the significance of power quality study and identify various power quality disturbances.
2. Write algorithms to calculate voltage sags magnitude and duration in power system.
3. Demonstrate the effect and also analyze the characteristics of voltage sags experienced by ASDs.
4. Evaluate THD and mitigate harmonics in distribution system.
5. Operate and use PQ measuring equipment for assessment of data.

UNIT-I

Introduction: Power Quality (PQ),PQ problems, Sags, Swells, Transients, Harmonics, Interruptions, Flicker, Voltage fluctuations, Notch. Transient Over voltages, Sources of Transient Over voltages.

Wiring and Grounding: Resources, Definitions, Reasons for Grounding, Typical wiring and grounding problems, Solutions to wiring and grounding problems.

UNIT-II

Voltage Sag Characteristics and Analysis: Voltage sag characteristics, Methodology for computation of voltage sag magnitude and occurrence, Accuracy of sag analysis, Duration & frequency of sags, Faults behind transformers, Effect of pre-fault voltage, Simple examples, Voltage dip problems, fast assessment methods for voltage sags in distribution systems.

UNIT-III

PQ in Industry: Voltage tolerance curves of computers, PLCs and process control equipment CBEMA and ITIC curves, Adjustable speed drive (ASD) systems AC and DC, Characterization of voltage sags experienced by three-phase ASD systems, Types of sags and phase angle jumps, Effects of momentary voltage dips on the operation of induction and synchronous motors.

UNIT-IV

Harmonics: Harmonic distortion, Voltage versus current distortion, Harmonics versus Transients, Harmonic Indices, Harmonic sources from commercial loads, Harmonic sources from industrial loads, Locating Harmonic sources, System response characteristics, Effects of Harmonic distortion, Inter harmonics, Devices for controlling harmonic distortion.

UNIT-V

Power Quality Monitoring: Monitoring considerations, Historical Perspective of PQ Measuring Instruments, PQ measurement equipment, Assessment of PQ measurement data, Application of intelligent systems, PQ monitoring standards

Suggested Reading:

1. Math H.J. Bollen, Understanding Power Quality Problems, IEEE Press, 1999.
2. Roger C. Dugan, MarkF. McGranaghan, Surya Santoso, H.Wayne Beaty, Electrical Power Systems Quality, Second Edition, Tata McGraw-Hill Edition.
3. C. Sankaran, Power Quality, CRC Press, 2002.

OE701BM

MICRO ELECTRO-MECHANICAL SYSTEMS

Open Elective-II

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To introduce to basics of Micro-electro-mechanical systems.
- To understand properties of materials involved in MEMS.
- To pertain fabrication methods involved in MEMS manufacturing.
- To apply the concepts for various applications.
- To introduce to basics of Micro-electro-mechanical systems.

Course Outcomes: After completion of this course, the students shall be able to:

1. Elucidate basic concepts involved in MEMS technologies.
2. Realize the properties of various materials involved in MEMS technologies.
3. Apply the concepts and technologies involved in designing of MEMS.
4. Relate different manufacturing processes involved in fabrication of MEMS.
5. Recognize micro sensors, micro actuators and their applications in various fields.

UNIT-I

Introduction to MEMS: What is MEMS, Historical Background, classification, Micro-engineering, importance of micro-engineering. Technological advancements in MEMS, advantages and disadvantages of MEMS.

UNIT II

MEMS materials: Materials used in MEMS. Material properties: electrical, mechanical, thermal, chemical, biological, optical and processing. Reliability issues of materials

UNIT III

Designing of MEMS: Design and analysis process for MEMS. Initial design process, structured design process. Commonly used design flow, structured design flow. Design flow for MEMS cad design. Design and verification flow for integrated MEMS.

UNIT IV

MEMS fabrication Techniques: Photolithography, materials for micromachining, bulk micromachining Surface micromachining, High aspect-ration-micromachining, assembly and system integration.

UNIT V

MEMS structures and devices: Mechanical sensors, mechanical actuators, micro-fluidic devices, optical/photonic micro-systems, biological transducers.

Suggested Reading:

1. Adams TM, Layton RA. Introductory MEMS: Fabrication and applications, 2010.
2. Tobergte DR, Curtis S. "An Introduction to Micro-electro-mechanical Systems Engineering" Second Edition. vol. 53. 2013.
3. Kreith F, Kreider JF., The MEMS Handbook" CRC Press 2002.
4. Reza Ghodssi · Pinyen Lin. "MEMS Materials and Processes Handbook" Springer 2013
5. Gad-el-Hak M. "MEMS applications" 2nd edition, CRC press 2006.

OE702CE

GREEN BUILDING TECHNOLOGY

Open Elective-II

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- Exposure to the green building technologies and their significance.
- Understand the judicial use of energy and its management.
- Educate about the Sun-earth relationship and its effect on climate.
- Enhance awareness of end-use energy requirements in the society.
- Develop suitable technologies for energy management.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the fundamentals of energy use and energy processes in building.
2. Identify the energy requirement and its management.
3. Know the Sun-earth relationship vis-a-vis its effect on climate.
4. Acquaint with the end-use energy requirements.
5. Become familiar with the audit procedures of energy.

UNIT-I

Overview of the significance of energy use and energy processes in building: Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT II

Indoor environmental requirement and management: Thermal comfort - Ventilation and air quality – Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

UNIT III

Climate, solar radiation and their influences: Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT IV

End-use, energy utilization and requirements: Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building - Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer

through the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer

UNIT V

Energy management options: Energy audit and energy targeting - Technological options for energy management.

Suggested Reading:

1. Michael Bauer, Peter Mösle and Michael Schwarz, "Green Building - Guidebook for Sustainable Architecture", Springer, Heidelberg, Germany, 2010.
2. Norbert Lechner, "Heating, Cooling, Lighting - Sustainable Design Methods for Architects", Wiley, New York, 2015.
3. Mike Montoya, "Green Building Fundamentals", Pearson, USA, 2010.
4. Charles J. Kibert, "Sustainable Construction - Green Building Design and Delivery", John Wiley & Sons, New York, 2008.
5. Regina Leffers, "Sustainable Construction and Design", Pearson / Prentice Hall, USA, 2009.
6. James Kachadorian, "The Passive Solar House: Using Solar Design to Heat and Cool Your Home", Chelsea Green Publishing Co., USA, 1997.

OE703CS

INFORMATION SECURITY

Open Elective-II

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To learn legal and technical issues in building secure information systems.
- To provide an understanding of network security.
- To expose the students to security standards and practices.

Course Outcomes: After completion of this course, the students shall be able to:

1. Describe the steps in Security Systems development life cycle(SecSDLC).
2. Understand the common threats and attack to information systems.
3. Understand the legal and ethical issues of information technology.
4. Identify security needs using risk management and choose the appropriate risk control strategy based on business needs.
5. Use the basic knowledge of security frameworks in preparing security blue print for the organization.
6. Usage of reactive solutions, network perimeter solution tools such as firewalls, host solutions such as antivirus software and Intrusion Detection techniques and knowledge of ethical hacking tools.
7. Use ethical hacking tools to study attack patterns and cryptography and secure communication protocols.
8. Understand the technical and non-technical aspects of security project implementation and accreditation.

UNIT-I

Introduction: History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC. Need for Security: Business Needs, Threats, Attacks, and Secure Software Development.

UNIT-II

Legal, Ethical and Professional Issues: Law and ethics in Information Security, Relevant U.S. Laws, International Laws and Legal Bodies, Ethics and Information Security.

Risk Management: Overview, Risk Identification, Risk Assessment, Risk Control Strategies, Selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices, Risk Management discussion Points, Recommended Risk Control Practices.

UNIT-III

Planning for Security: Security policy, Standards and Practices, Security Blue Print, Security Education, Continuity strategies.

Security Technology: Firewalls and VPNs: Physical Design, Firewalls, Protecting Remote connections.

UNIT-IV

Security Technology: Intrusion Detection, Access Control, and other Security Tools: Intrusion Detection and Prevention Systems-Scanning, and Analysis Tools- Access Control Devices.

Cryptography: Foundations of Cryptology, Cipher methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems

UNIT-V

Implementing Information Security: Information security project management, Technical topics of implementation, Non Technical Aspects of implementation, Security Certification and Accreditation.

Security and Personnel: Positioning and staffing security function, Employment Policies and Practices, and Internal control Strategies.

Information Security Maintenance: Security management models, Maintenance model, and Digital Forensics.

Suggested Reading:

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Cengage Learning, 2011.
2. Thomas R Peltier, Justin Peltier, John Blackley, "Information Security Fundamentals", Auerbach Publications, 2010.
3. Detmar W Straub, Seymour Goodman, Richard L Baskerville, "InformationSecurity, Policy, Processes, and Practices", PHI, 2008.
4. Mark Merkow and Jim Breithaupt "Information Security Principle and Practices", Pearson Education, 2007

OE704CS

DATABASE MANAGEMENT SYSTEMS

Open Elective-II

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To introduce three scheme architecture and DBMS functional components.
- To learn formal and commercial query languages of RDBMS.
- To understand the principles of ER modeling and theory of normalization.
- To study different file organization and indexing techniques.
- To familiarize theory of serializability and implementation of concurrency control, and recovery.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the mathematical foundations on which RDBMS are built.
2. Model a set of requirements using the Extended Entity Relationship Model (EER), transform an EER model into a relational model and refine the relational model using theory of Normalization.
3. Develop Database application using SQL and Embedded SQL.
4. Use the knowledge of file organization and indexing to improve database application performance.
5. Understand the working of concurrency control and recovery mechanisms in RDBMS.

UNIT-I

Introduction: Database System Applications, Purpose of Database Systems, View of Values, Nested Sub-queries, Complex Queries, Views, Modification of the Database, Joined Relations Data, Database Languages, Relational Databases, Database Design, Object–based and Semi-structured Databases, Data Storage and Querying, Transaction Management, Data Mining and Analysis, Database Architecture, Database Users and Administrators.

Database Design and the E-R Model: Overview of the Design Process, The Entity Relationship Model, Constraints, Entity-Relationship Diagrams, Entity – Relationship Design Issues, Weak Entity Sets, Extended E-R Features, Database Design for Banking Enterprise, Reduction to Relational Schemas, Other Aspects of Database Design

UNIT – II

Relational Model: Structure of Relational Databases, Fundamental Relational-Algebra Operations, Additional Relational – Algebra Operations, Extended Relational - Algebra Operations, Null Values, Modification of the Databases. Structured Query Language: Data Definition, Basic Structure of SQL Queries, Set Operations, Aggregate Functions.

UNIT – III

Advanced SQL: SQL Data Types and Schemas, Integrity Constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL Features. Relational Database Design: Features of Good Relational Design, Atomic Domains and First Normal Form, Functional-Dependency Theory, Decomposition using Functional Dependencies.

UNIT – IV

Indexing and Hashing: Basic Concepts, Ordered Indices, B+ -tree Index Files, B-tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices. Index Definition in SQL Transactions: Transaction Concepts, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability.

UNIT – V

Concurrency Control: Lock-based Protocols, Timestamp-based Protocols, Validationbased Protocols, Multiple Granularity, Multi-version Schemes, Deadlock Handling, Insert and Delete Operations, Weak Levels of Consistency, Concurrency of Index Structures. Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems.

Suggested Reading:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, Database System Concepts, McGraw-Hill International Edition, 6th Edition, 2010
2. Ramakrishnan, Gehrke, Database Management Systems, McGraw-Hill International Edition, 3rd Edition, 2003
3. Elmasri, Navathe, Somayajulu, Fundamentals of Database Systems, Pearson Education, 4th Edition, 2004

OE705EC

EMBEDDED SYSTEMS

Open Elective-II

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To gain knowledge to design embedded systems.
- To understand the processor selection criteria for Embedded System Design.
- To gain the knowledge of ARM Cortex on Zynq for embedded systems.
- To gain the knowledge of tool chain for embedded systems.
- To understand the importance of RTOS in building real time systems.

Course Outcomes: After completion of this course, the students shall be able to:

1. Design an embedded system.
2. Distinguish between RISC and CISC.
3. Use the ARM Cortex for design of embedded system.
4. Use Embedded Software Development Tools for Designing Embedded System applications.
5. Apply their understanding in building real time systems.

UNIT-I

Introduction To Embedded Systems: The Embedded Design Life Cycle - Product Specification, Hardware/Software Partitioning, Iteration And Implementation, Detailed Hardware (selection of processor) and Software Design, Hardware/Software Integration, Product Testing And Release, Maintenance and Up gradation.

UNIT-II

ARM Embedded Systems: The RISC design philosophy, The ARM design philosophy, ARM processor fundamentals, registers, current program status register, pipeline, exceptions, interrupts, and vector table, core extensions, architecture revisions, ARM processor families.

UNIT-III

Embedded processing with ARM CORTEX on Zynq: Fundamentals of FPGA, types of FPGA, case study of Xilinx FPGA, Processing System, programmable logic, programmable logic interfaces, security, Zynq 7000 family members, Zynq versus standard FPGA, Zynq versus standard processor.

UNIT-IV

Embedded Software Development Tools: Host And Target Machines, Cross Compilers, Cross Assemblers, Tool Chains, Linkers/Locators For Embedded Software, Address Resolution, Locator Maps. Getting Embedded Software Into Target System: PROM programmer, ROM

emulator, In Circuit- Emulators, Monitors, Testing on Your Host Machine - Instruction Set Simulators, Logic Analyzers.

UNIT-V

Introduction to Real Time Operating Systems: Tasks and task states, tasks and Data, Semaphores and shared data. Operating system services: Message queues, mailboxes and pipes, timer functions, events, memory management, Interrupt routines in an RTOS environment.

Suggested Reading:

1. Arnold S Berger, Embedded Systems Design, South Asian edition, CMP Books, 2005.
2. Andrew Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide: Designing and Optimizing System Software , Elsevier, 2004.
3. Louise H Crockett, Ross.A.Elliot et al " The Zynq Book" , Edition 1, Strathclyde academic media, July 2014.
4. David E Simon, "An Embedded software primer", Pearson, 2012.

OE706EC

VERILOG HDL

Open Elective-II

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

1. To familiarize with various modeling styles: structural, dataflow and behavioral of Verilog HDL.
2. To develop combinational and sequential circuits using various modeling styles of Verilog HDL
3. To design and develop Verilog HDL models of data path and control units of Central Processing Unit (CPU)
4. To learn Synthesis and FPGA design flow.
5. To design and develop real time applications: Booth's multiplier, Divider, hardwired control for basic CPU, FIR filter.

Course Outcomes: After completion of this course, the students shall be able to:

1. Implement and distinguish different Verilog HDL modeling styles
2. Construct and analyze Verilog HDL models of combinational and sequential circuits
3. Design and develop Verilog HDL modeling and test bench for digital systems for the given specifications
4. Outline FPGA design flow and timing analysis

UNIT - I

Introduction to HDL: Overview and Importance of HDLs, Differences between HLL, HDL and ALP. Design methodologies, Modules, Lexical Conventions, Number Specifications, Strings, Identifiers and Keywords Data types, System task and compiler Directives, Port declaration and port connection rules

UNIT - II

Structural and Dataflow modeling: gate-level modeling, delays, hazards, dataflow modeling: Continuous Assignments, Delays, Expressions, Operators and Operands, Operator Types and Design Examples

UNIT - III

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, multi-way branching, Loops, Sequential and Parallel blocks, Generate blocks. Combinational, sequential logic modules Simulation: Types of Simulation, Event driven Simulation and Cycle Based Simulation; design examples.

UNIT - IV

Synthesis and Verification: Tasks and Functions: Differences between Tasks and Functions, Tasks and Functions. Verilog HDL synthesis, synthesis, Application Specific IC (ASIC) and Field Programmable Gate Array (FPGA) design flow. Verification: Timing analysis and Test bench design. Design examples.

UNIT - V

Real time implementations: Fixed-Point Arithmetic modules: Addition, Multiplication, Division, Arithmetic and Logic Unit (ALU), Timer, Universal Asynchronous Receiver and Transmitter (UART), DSP modules: FIR and IIR filters, CPU design: Data path and control units.

Suggested Reading:

1. Samir Palnitkar, *"Verilog HDL A Guide to Digital Design and Synthesis,"* 2nd Edition, Pearson Education, 2006.

2. Ming-Bo Lin, "*Digital System Designs and Practices: Using Verilog HDL and FPGA,"* Wiley India Edition, 2008.

3. J. Bhasker, *"A Verilog HDL Primer*," 2nd Edition, BS Publications, 2001.

OE707EC

SATELLITE COMMUNICATION AND APPLICATIONS

Open Elective-II

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- To familiarize with basic concept ts related to satellite Communication.
- To understand Sub-Systems of Satellites and Launches.
- To design the Earth Station antennas.
- To know about the parameters affecting the Satellite System Performance.
- To understand the applications of satellites.

Course Outcomes: Student will be

1. Able to have know ledge about the Satellite communications Principles and Properties.
2. Able to know about the Space craft sub systems and Launch vehicles.
3. Able to design the Satellite Earth station antennas
4. Able to analyze the effects of various parameters on Satellite System performance.
5. Able to understand the applications of Satellite Communication.

UNIT–I

Origin of Satellite communications, A Brief History of Satellite Communication, Basic principles and properties of satellite communication. Earth segment, Space segment, Interpretation of Kepler's Laws.

Orbital Mechanics: The Equation of the Orbit, Describing the Orbit, Locating the Satellite in the Orbit, Orbital effects in communication system Performance: Doppler shift, Range variation, Eclipse and Sun-Transit Outage.

UNIT–II

Space craft sub systems, Equipment Reliability and Space Qualification: Space Qualification, Reliability, and Redundancy, Satellite launch and launch vehicles and Mechanics of Launching a Synchronous Satellite.

UNIT–III

Earth Stations: Earth Station Design for Low System Noise Temperature, Design of large antennas and small earth station antennas. Low noise amplifiers and High-power Amplifiers for Satellite communication.

UNIT–IV

Satellite Link Design: Basic Transmission Theory, System Noise Temperature and G/T ratio: Noise Temperature, calculation of System Noise Temperature, Noise Figure and Noise Temperature, Propagation on Satellite-Earth paths: Attenuation, depolarization,

atmospheric absorption, Tropospheric Multipath effects and Land and Sea Multipath, Multipath Effects in System Design, Faraday rotation in the Ionosphere, Ionospheric scintillations, Rain and ice effects.

UNIT–V

Satellite Navigation Applications: Global and Regional Satellite Navigation Systems-Operating Principles, Advantages, Limitations, Current Status and Applications, Remote Sensing Satellites.

Suggested Readings:

1. Wilbur L. Pitchand and Henri G. Suyderhoud, Robert A. Nelson, "*Satellite Communication Systems Engineering",*2nd edn. 3rd Impression, Pearson Education. 2008.
2. Timothy Prattand Charles Nestian.W, "*Satellite Communication",* John Wiley and Sons, 1988.
3. Tri T. Ha, "*Digital Satellite Communication"*, Tata McGraw-Hill, Special Indian Edition 2009.

OE708EE

OPTIMIZATION TECHNIQUES

Open Elective-II

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To understand the need and basic concepts of operations research and classify the optimization problems.
- To study about the linear programming and non-linear programming concepts and their applications
- To understand various constrained and un-constrained optimization techniques and their applications.
- To understand the concepts and implementation of Genetic Algorithms to get the optimum solutions
- To study the concepts of Metaheuristics Optimization techniques

Course Outcomes: After completion of this course, the students shall be able to:

1. Analyze any problem of optimization in an engineering system and able to formulate a mathematical model to the problem and solving it by the techniques that are presented.
2. Solve problems of L.P. by graphical and Simplex methods
3. Apply various constrained and un-constrained optimization techniques for the specific problems.
4. Could able to implement the Genetic Algorithms to solve the for optimum solution
5. Understands the concepts to use the Metaheuristics Optimization techniques

UNIT-I

Introduction: Definitions, Characteristics, Objective function, Classification of optimization problems, Engineering applications and limitations. Single-Variable Optimization, Multivariable Optimization with No Constraints, Multivariable Optimization with Equality Constraints and Multivariable Optimization with Inequality Constraints: Kuhn–Tucker Condition

UNIT-II

Linear Programming: Definitions and Formulation of the LPP, Construction of L.P. Models, Slack and surplus variables, Standard form, Canonical form and matrix form of LP Problems. Artificial Variables, solution by the Big-M method, Duality principle, Dual problems and numerical problems.

UNIT-III

Random Search Methods concepts: Direct Search Methods - Univariate Method, Gradient of a Function, Indirect Search Methods - Gradient of a Function, Steepest Descent (Cauchy) Method, Newton's Method.

UNIT-IV

Binary Genetic Algorithm: Genetic Algorithms Natural Selection on a Computer, Components of a Binary Genetic Algorithm. Selecting the Variables and the Cost Function. Variable Encoding and Decoding, The Population, Natural Selection, Selection, Mating. Mutations, the Next Generation and Convergence, Components of a Continuous Genetic Algorithm.

UNIT-V

Metaheuristics Optimization: Concepts of Simulated Annealing, Theoretical approaches, Advantages and disadvantages, applications, Ant Colony Algorithms - Introduction, Collective behavior of social insects, Formalization and properties of ant colony optimization.

Suggested Reading:

1. Rao, S.S. (2009). "Engineering Optimization: Theory and Practice." John Wiley & Sons, Inc.
2. Taha, H.A. (2008). "Operations Research, Pearson Education India." New Delhi, India.
3. Randy L. Haupt and Sue Ellen Haupt, "Practical genetic algorithms" second edition, a John Wiley & sons, inc., publication -2004.
4. Sharma J.K. (2013). "Operation Research: Theory and Applications." Fifth Edition, Macmillan Publishers, New Delhi, India.
5. J. Dreo A. Petrowski, P. Siarry E. Taillard. "Metaheuristics for Hard Optimization" Springer.

OE709EE

NON-CONVENTIONAL ENERGY SOURCES

Open Elective-II

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To understand the different types of energy sources
- To Understand the need of non-conventional energy sources and their principles
- To understand the limitations of non-conventional energy sources
- To outline division aspects and utilization of renewable energy sources for diriment application.
- To analyze the environmental aspects of renewable energy resources

Course Outcomes: After completion of this course, the students shall be able to:

1. Know the different energy resources and need of renewable energy resources
2. Understand the concepts of working of fuel cell systems along with their applications
3. Describe the use of solar energy and the various components and measuring devices used in the energy production and their applications
4. Appreciate the need of Wind Energy and their classification and various components used in energy generation and working of different electrical wind energy system
5. Understand the concept of OTEC technology, Biomass energy resources and different types of biogas Plants used in India

UNIT-I

Review of Conventional and Non-Conventional energy sources, Need for non-conventional energy sources Types of Non-conventional energy sources, Fuel Cells, Principle of operation with special reference to H2O2 Cell, Classification and Block diagram of fuel cell systems, Ion exchange membrane cell, Molten carbonate cells, Solid oxide electrolyte cells, Regenerative system, Regenerative Fuel Cell, Advantages and disadvantages of Fuel Cells, Polarization, Conversion efficiency and Applications of Fuel Cells.

UNIT-II

Solar energy, Solar radiation and its measurements, Solar Energy collectors, Solar Energy storage systems, Solar Pond, Application of Solar Pond, Applications of solar energy.

UNIT-III

Wind energy, Principles of wind energy conversion systems, Nature of wind, Power in the Wind, Basic components of WECS, Classification of WECS, Site selection considerations, Advantages and disadvantages of WECS, Wind energy collectors, Wind electric generating and control systems, Applications of Wind energy, Environmental aspects.

UNIT-IV

Energy from the Oceans, Ocean Thermal Electric Conversion (OTEC) methods, Principles of tidal power generation, Advantages and limitations of tidal power generation, Ocean waves, Wave energy conversion devices, Advantages and disadvantages of wave energy, Geo-thermal Energy, Types of Geo-thermal Energy Systems, Applications of Geo-thermal Energy.

UNIT-V

Energy from Biomass, Biomass conversion technologies / processes, Photosynthesis, Photosynthetic efficiency, Biogas generation, Selection of site for Biogas plant, Classification of Biogas plants, Details of commonly used Biogas plants in India, Advantages and disadvantages of Biogas generation, Thermal gasification of biomass, Biomass gasifies.

Suggested Reading:

1. Rai G.D, Non-Conventional Sources of Energy, Khandala Publishers, New Delhi, 1999.
2. M.M.El-Wakil, Power Plant Technology. McGraw Hill, 1984.

OE710ME

STARTUP ENTREPRENEURSHIP

Open Elective-II

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To motivate students to take up entrepreneurship in future.
- To learn nuances of starting an enterprise by creative thinking and shape ideas into reality.
- To understand action driven business plan and learn to prepare project budget.

Course Outcomes: After completion of this course, the students shall be able to:

1. Think creatively and transform ideas into reality.
2. Differentiate market transforming strategy.
3. Create a complete business plan and workout the budget plan.

UNIT-I

Creativity & Discovery Definition of Creativity, self test creativity, discovery and delivery skills, The imagination threshold, Building creativity ladder, Collection of wild ideas, Bench marking the ideas, Innovative to borrow or adopt, choosing the best of many ideas, management of tradeoff between discovery and delivery, Sharpening observation skills, reinventing self, Inspire and aspire through success stories

UNIT II

From Idea to Startup Introduction to think ahead backward, Validation of ideas using cost and strategy, visualizing the business through value profile, activity mapping, Risks as opportunities, building your own road map.

UNIT III

Innovation career lessons Growing & Sharing Knowledge, The Role of Failure In Achieving Success, Creating vision, Strategy, Action & Resistance: Differentiated Market Transforming Strategy; Dare to Take Action; Fighting Resistance; All About the startup Ecosystem; Building a Team; Keeping it Simple and Working Hard.

UNIT IV

Action driven business plan Creating a completed non-business plan (a series of actions each of which moves your idea toward implementation), including a list of the activities to be undertaken, with degrees of importance (scale of 1 to 3, where 1 is ‘most important’). A revision of the original product or service idea, in light of information gathered in the process, beginning to design the business or organization that will successfully implement your creative idea. Preparing an activity map.

UNIT V

Startup financing cycle Preparing an initial cash flow statement, showing money flowing out (operations; capital) and flowing in. Estimate your capital needs realistically. Prepare a bootstrapping option (self-financing). Prepare a risk map. Prepare a business plan comprising five sections: The Need; The Product; Unique Features; The Market; Future Developments. Include a Gantt chart (project plan – detailed activities and starting and ending dates); and a project budget.

Suggested Reading:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project – Planning, Analysis, Selection, Implementation and Review", Tata McGraw-Hill Publishing Company Ltd., 1995.
3. B. Badhai, "Entrepreneurship for Engineers", Dhanpath Rai & Co., Delhi, 2001.
4. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster, 2002.
5. Robert D. Hisrich and Michael P.Peters, " Entrepreneurship", Tata McGRaw Hill Edition, 2002.

OE711ME

NANO TECHNOLOGY

Open Elective-II

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- To familiarize Nano materials and technology.
- To understand Nano structures, fabrication and special Nano materials.
- Course Outcomes:

Course Outcomes: After successful completion of this course, the student will be able to:

1. Apply the nano materials to different industrial applications
2. Explore the nano materials various human applications
3. Design and manufacture nano-material processes

UNIT-I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance of Nano Technology, Bottom-up and Top-down approaches, challenges in NanoTechnology.

UNIT-II

Materials of Nano Technology: Introduction-Si-based materials, Ge-based materials, Smart materials, metals, Ferroelectric materials, Polymer materials, GaAs &InP (III-V) group materials, Nano tribology and Materials, Principles and analytical techniques of XRD, SEM, TEM and STM/AFM.

UNIT-III

Nano Structures: Zero dimensional Nano structure (Nano Particles)- Synthesis procedure, characterization techniques, properties and applications of Nano Particles
One dimensional Nano structures (Nano Wires, Nano Tubes)- Various Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires, Types of Nano Tubes, Synthesis procedure, characterization properties and applications of Nano Tubes.

UNIT-IV

Nano Fabrication: Introduction, Basic fabrication techniques (Lithography, thin film deposition, and doping) MEMS fabrication techniques, Nano fabrication techniques (E-beam Nano-imprint fabrication, Epitaxy and strain engineering, Scanned probe techniques).

UNIT-V

Special Nano Materials: Nano Composites: Introduction, Synthesis procedures, various systems (metal-polymer, metal- ceramics and polymer-Ceramics), Characterization procedures, applications. Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, principles involved, applications.

Suggested Reading:

1. A.K.Bandyopadyay, Nano Materials, New Age Publications, 2007.
2. T. Pradeep, Nano: The Essentials: Understanding Nano science and Nano technology, Tata McGraw-Hill, 2008.
3. Carl. C. Koch, Nano Materials Synthesis, Properties and Applications, Jaico Publishing House, 2008.
4. William Illsey Atkinson, Nano Technology, Jaico Publishing House, 2009.

PC751EE

ELECTRICAL SIMULATION LAB

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 25 Marks *SEE: 50 Marks*
Credits: 1

Simulation experiments should be conducted in the following areas using MATLAB / Simulink (with DSP Tool Box, Control System Tool Box & Power System Tool Box) PSpice/PSCAD / SABER / EDSA/ MOTORPRO / CASPOC / PSSE.

1. Verification of Network theorems
    a. Thevenin's theorem
    b. Super position theorem
    c. Maximum power transfer theorem.
2. Transient responses of Series RLC, RL and RC circuits with Sine and Step inputs.
3. Series and Parallel resonance.
4. Bode plot, Root-Locus plot and Nyquist plot.
5. Transfer function analysis (i) Time response for Step input (ii) Frequency response for Sinusoidal input.
6. Design of Lag, Lead and Lag – Lead compensators.
7. Load flow studies.
8. Fault analysis.
9. Transient stability studies.
10. Generation of Basic signals using DSP.
11. Calculation of DFT using different methods.
12. Design of filters (Low pass filter).
13. Chopper fed dc motor drives.
14. VSI /CSI Fed induction motors drives. Doubly fed Induction motor, PWM.
15. Phase Control I Chopper control on DC motor Drives.
16. Control of BLDC motor.

Note: At least ten experiments should be conducted.

PC752EE

POWER SYSTEMS LAB

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 25 Marks *SEE: 50 Marks*
Credits: 1

List of Experiments

1. Performance characteristics of 3-phase transmission line model
2. Determination of A B C D parameters of 3-phase transmission line model.
3. IDMT Characteristics of an over current (Electromagnetic)Relay.
4. Differential Protection of 1-phasetransformer.
5. Determination of positive, negative, zero sequence impedances of 3-phasetransformer.
6. Determination of positive, negative, zero sequence impedances of 3-phasealternator.
7. Transient stability analysis using MATLAB Simulink
8. Fault analysis on an un-loaded 3-phasealternator.
9. Load Frequency control of a single Area system using MATLAB Simulink
10. Load Frequency control of two area system using MATLAB Simulink
11. Economic load dispatch using power world simulator/software
12. Fault analysis using PSCAD
13. Operating Characteristics of Directional Over Current Relay
14. Characteristics of different relays using relay protection test set.

Note: At least ten experiments should be conducted.

PW751EE

MAJOR PROJECT PHASE - I

Instruction: 4 Periods per week
CIE: 50 Marks
Credits: 2

Course Objectives:

- To enhance practical and professional skills.
- To familiarize tools and techniques of systematic Literature survey and documentation.
- To expose the students to industry practices and team work.
- To encourage students to work with innovative and entrepreneurial ideas.

Course Outcomes: After completion of this course, the students shall be able to:

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems.
2. Evaluate different solutions based on economic and technical feasibility.
3. Effectively plan a project and confidently perform all aspects of project management.
4. Demonstrate effective written and oral communication skills.

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following:

1. Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)
2. Grouping of students (max 3 in a group) Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5^{th}week to the last week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 30 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

- Problem definition and specification
- Literature survey
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity) charts
- Presentation- oral and written.

PW961EE

SUMMER INTERNSHIP

Instruction: 6 weeks
CIE: 50 marks

Course Objectives:

- To give an experience to the students in solving real life practical problems with all its constraints.
- To give an opportunity to integrate different aspects of learning with reference to real life problems.
- To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.

Course Outcomes: At the end of the course, students will be able to

1. Design/develop a small and simple product in hardware or software.
2. Complete the task or realize a prespecified target, with limited scope, rather than taking up a complex task and leave it.
3. Learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to prespecified criteria.
4. Implement the selected solution and document the same.
5. Able to write a technical report and present it to appropriate audience

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Electronics Industry / R & D Organization / National Laboratory for a period of 8 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide. After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department.

Award of sessional are to be based on the performance of the student at the work place to be judged by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will co - ordinate the overall activity of Summer Internship. *Students have to undergo summer internship of 6 Weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester

With effect from the academic year 2021-2022

SCHEME OF INSTRUCTION

VIII - SEMESTER

B.E. (Electrical & Electronics Engineering)

S. No.	Course Code	Course Title	Scheme of Instruction			Contact Hours / Week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1.	**Professional Elective – V**		3	-	-	3	30	70	3
	PE851EE	AI Techniques in Electrical Engineering							
	PE852EE	Smart Grid Technologies							
	PE853EE	Advanced Topics in Power Electronics							
2.	**Professional Elective – VI**		3	-	-	3	30	70	3
	PE864EE	Electric Drives and Static Control							
	PE865EE	Control Systems Design							
	PE866EE	Energy Management Systems							
3.	**Open Elective – III**		3	-	-	3	30	70	3
	OE801BM	Basic Medical Equipment							
	OE802CS	Data Science Using R							
	OE803EC	Mobile Communication							
	OE804EC	Internet of Things and Applications							
	OE805EC	Global and Regional Satellite Navigation System							
	OE806EE	Applications of Electrical Energy							
	OE807ME	Composite Material Applications							
	OE808ME	Industrial Administration and Financial Management							
	OE809CS	Software Engineering							
	OE810CS	Python Programming							
	OE811CS	Cyber Security							
Practical									
1.	PW851EE	Major Project Phase – II / Industrial Internship	-	-	12	12	50	100	6
			9		**12**	**21**	**140**	**310**	**15**

PE 851EE

AI TECHNIQUES IN ELECTRICAL ENGINEERING

Professional Elective- V

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- Introduction of Artificial Intelligent techniques such as Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms.
- Neural Network architecture, learning mechanisms.
- Introducing different components of Fuzzy Logic Controllers such as Fuzzification, Rule base, Inference and defuzzification.
- Different Genetic operators are introduced and how to they help to solve optimization problems is demonstrated.
- Application of AI techniques in solving different Electrical problems.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the how nature inspired algorithms such as Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms solve Engineering problems.
2. Develop Neural Network and algorithms to train them.
3. Develop a fuzzy logic controller by fuzzification, rule base, inference and defuzzification.
4. Develop Genetic algorithm to solve optimization problems.
5. Apply AI techniques to Electrical engineering problems.

UNIT-I

Artificial Neural Networks: Introduction, Models of Neuron Network-Architectures, Knowledge representation, Artificial Intelligence and Neural networks, Learning process, Error correction learning, Hebbian learning, Competitive learning, Boltzmann learning, Supervised learning, Unsupervised learning, Reinforcement learning, Learning tasks.

UNIT-II

ANN Paradigms: Multi-layer perceptron using Back propagation Algorithm (BPA), Self-Organizing Map (SOM), Radial Basis Function Network-Functional Link Network (FLN), Hopfield Network.

UNIT-III

Fuzzy Logic*:* Introduction –Fuzzy versus crisp, Fuzzy sets, Membership function, Basic Fuzzy set operations, Properties of Fuzzy sets, Fuzzy cartesian Product, Operations on Fuzzy relations, Fuzzy logic, Fuzzy Quantifiers, Fuzzy Inference, Fuzzy Rule based system, Defuzzification methods.

UNIT-IV

Genetic Algorithms: Introduction, Encoding, Fitness Function, Reproduction operators, Genetic Modeling, Genetic Operators, Cross over-Single site cross over, Two-point cross over, Multi point cross over, Uniform cross over, Matrix cross over, Cross over Rate-Inversion & Deletion, Mutation operator, Mutation, Mutation Rate-Bit-wise operators, Generational cycle, convergence of Genetic Algorithm.

UNIT-V

Applications of AI Techniques: Load forecasting, Load flow studies, Economic load dispatch, Load frequency control, Single area system and two area system, Small Signal Stability (Dynamic stability), Reactive power control, Speed control of DC and AC Motors.

Suggested Reading:

1. S.Rajasekaran and G.A.V.Pai Neural Networks, Fuzzy Logic & Genetic Algorithms, PHI, New Delhi,2003.
2. Rober J. Schalkoff, Artificial Neural Networks, Tata McGraw Hill Edition,2011
3. P.D.Wasserman; Neural Computing Theory & Practice, Van Nostrand Reinhold, New York,1989.
4. Bart Kosko; Neural Network & Fuzzy System, PrenticeHall,1992
5. D.E. Goldberg, Genetic Algorithms, Addison-Wesley1999.

PE 852EE

SMART GRID TECHNOLOGIES

Professional Elective- V

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To study the components of smart grid and its architecture.
- To understand the measurement and communication technologies in a smart grid environment.
- To acquire the knowledge of working of various renewable energy technologies like micro grids, hybrid electric vehicles.
- To analyze the smart grid using load flows, congestion management studies.
- To understand operation and control mechanisms in smart power systems.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand features of Smart Grid in the context of Indian Grid.
2. Understand operation and importance of WAMS, PMU and AMI.
3. Analyze the effects of Micro grid and electric vehicle operation on the grid.
4. Differentiate the specific complexities introduced by smart grid during its analysis compared to normal power system.
5. Understand how voltage and frequency control are implemented in a smart grid.

UNIT-I

Introduction to Smart Grid: Working definitions of Smart Grid and Associated Concepts, Smart Grid Functions, Comparison of Power Grid and Smart Grid-New Technologies for Smart Grid, Advantages, Present development and international policies in Smart Grid, Indian Smart Grid. Key Challenges for Smart Grid, Architecture of Smart Grid-Description, Components and their functions.

UNIT-II

Smart Grid Communications and Measurement Technology: Communication and Measurement, Wide area measurement System (WAMS), Phasor Measurement Unit (PMU), Phasor Estimation Techniques, Frequency Estimation, Smart Meters, Advanced Metering Infrastructure (AMI).

UNIT-III

Distributed Generation Technologies: Introduction to Renewable Energy Technologies-Micro grids, Storage Technologies, Electric Vehicles and plug-in hybrids, Environmental impact and Climate Change, Economic Issues. Grid integration issues of renewable energy sources.

UNIT-IV

Protection of Smart Grid: Introduction, Islanding, Different islanding scenarios, Major protection issues of stand-alone Micro grid, Impact of DG integration on electricity market, environment, distribution system, communication standards and protocols.

UNIT-V

Smart Power Grid System Control: Load Frequency Control (LFC) in Micro Grid System, Voltage Control in Micro Grid System, Reactive Power Control in Smart Grid. Case Studies and Test beds for the Smart Grids.

Suggested Reading:

1. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press,2013.
2. A Keyhani, M Marwali, Smart power grids, Springer, 201
3. A.G. Phadke and J.S. Thorp, Synchronized Phasor Measurements and their Application, Springer Edition,2010.
4. Nikos Hatziargyriou, Microgrids Architecture and control, Wiley-IEEE Press.
5. Fang Lin Luo, Hong Ye, Renewable Energy Systems, CRC Press.

PE 853EE

ADVANCED TOPICS IN POWER ELECTRONICS

Professional Elective- V

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To understand High efficiency, High reliability, long lifetime, and Fast dynamic response features of advanced power electronic devices.
- To understand Non-linear operation and related losses in the power electronic converters.
- To be aware of application of semiconductor devices in control of electrical energy.
- To study ideal rectifier operation and design.
- To understand the operation of multi-resonant converters and load resonant converters.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand and simulate control circuits of power electronic converters.
2. Get acquaintance with digital logic control concepts required for converter controls.
3. Understand advanced converter topologies operation and area of application.
4. Solve Non-linear switched mode power converters operation issues.
5. Simulate Multi pulse PWM on current source converters.

UNIT-I

Introduction to switches: Advanced Silicon devices - Silicon HV thyristors, MCT, BRT &EST. SiC devices - diodes, thyristors, JFETs & IGBTs. Gallium nitrate devices - Diodes, MOSFETs.

UNIT -II

Pulse Width Modulated Rectifiers: Properties of ideal rectifier, realization of near ideal rectifier, control of the current waveform, single phase and three-phase converter systems incorporating ideal rectifiers and design examples. Non-linear phenomena in switched mode power converters, Bifurcation and Chaos.

UNIT-III

Control of DC-DC converters: State space modeling of Buck, Boost, Buck-Boost, Cuk Fly back, Forward, Push-Pull, Half & Full-bridge converters. Closed loop voltage regulations using state feedback controllers.

Soft-switching DC - DC Converters: zero-voltage-switching converters, zero-current switching converters, multi-resonant converters and load resonant converters.

UNIT-IV

Advanced Converter Topologies: Multi level converters - Cascaded H-Bridge, Diode clamped, NPC, Flying capacitor. Modular Multi-level converters (MMC), Multi-Input DC-DC Converters, Multi pulse PWM current source converters, Interleaved converters, Z-Source converters.

UNIT-V

Control Design Techniques for Power Electronic Systems: Modeling of systems, Digital Controller Design, Optimal and Robust controller Design.

Suggested Reading:

1. Andrzej M Trzynadlowski, Introduction to Modern Power Electronics, John Wiley and sons. Inc, New York,1998
2. L. Umanand, Power Electronics Essentials &Applications, Wiley publishing Company, 1st Edition, 2014
3. B. Jayant Balinga, Advanced High Voltage Power Device Concepts, Springer New York 2011. ISBN978-1-4614-0268-8
4. BIN Wu, High Power Converters and AC Drives, IEEE press Wiley Inter science, John Wiley & sons Inc publication,2006

PE 864EE

ELECTRIC DRIVES AND STATIC CONTROL

Professional Elective- VI

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To understand the concepts and classification of motor-load combination.
- To study the concepts and characteristics of starting and braking methods of DC & AC motors.
- To study the static control methods of DC motor and four quadrant operations by dual converters
- To study the speed control, variable frequency control of induction motor and slip power recovery schemes.
- To study the various modes of Self-controlled and separately controlled synchronous motor drives

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the concepts of electrical drives and analyze the motor-load combination.
2. Analyze the starting and braking techniques of DC and AC motors.
3. Design the drive circuits for single phase and three phase, controlled rectifier fed DC motor drives.
4. Implement speed control for Induction motors using variable frequency sources and slip power recovery schemes.
5. Analyze the various modes of variable frequency control, linear induction motor and Permanent Magnet Synchronous Motor drives.

UNIT-I

Electric Drives: Concept and classification Dynamics of Electrical Drives: Types of loads, Torque characteristics of load. Characteristics of Motor-Load combination, Dynamics of Motor Load combination. Steady-State and Transient stability of Electric Drive. Characteristics of Electric Drives: Modified Speed-Torque characteristics of D.C. Shunt motors, D.C series motors and Induction motors.

UNIT II

Starting of Electric Motors: Methods of Starting Electric Motors, Acceleration time, Energy relations during starting, D. C Shunt & Series motors and Induction motors, Methods to reduce the energy loss duringstarting.

Electric Braking: Types of Braking, Braking of D.C and A.C motors, Energy relation and Dynamics of Braking. Rating of Motors: Heating effects, Load conditions and classes of duty, Determination of power rating. Effect of load inertia and load equalization.

UNIT III

D.C Motor Control: Single-phase controlled rectifier and Chopper circuit arrangement for Continuous armature current operation. Dual converter control, circulating current andNon-Circulating current modes of operation, Principles of closed loop control for D.C drives.

UNIT IV

Induction Motor Control: Speed control of 3 phase Induction motor with A.C voltage regulators, Voltage sources inverters and Cyclo - converters, Static rotor resistance control, Slip power recovery schemes: Static Krammer drive and Scherbius drive, Variable frequency drives.

UNIT V

Synchronous Motor Control: Self-controlled and separately controlled synchronous motors, linear induction motors, Permanent magnet synchronous motor drives and Applications.

Suggested Reading:

1. S.K. Pillai, A First Course in Electrical Drives, New Age International (P) Limited, Publishers,2000.
2. G.K.Dubey, Power Semi-Converter Controlled Drives, Prentice Hall, Eaglewood, liffs,1989.
3. M.D.Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Company Ltd.,2000.
4. Bimal. K. Bose, Modern Power Electronics and AC Drives, Pearson Education Asia, 2002.

PE 865EE

CONTROL SYSTEMS DESIGN

Professional Elective- VI

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- Illustrating the steps involved in the design problem
- Need to design a controller is discussed. Explaining the time domain and frequency domain specifications and their physical relevance
- Design problems are solved in both time domain and frequency domain.
- Design PID controller and their effect on system performance.
- Design in state space: pole placement design and design of state observer.

Course Outcomes: After completion of this course, the students shall be able to:

1. Define a design problem and formulate different steps involved.
2. Understand the time domain and frequency domain specification and their physical relevance
3. Design lead, lag and lead-lag compensators in both time domain and frequency domain
4. Design PID controller for specific problem.
5. Design pole placement through state feedback and state observers.

UNIT-I

Design Specifications: Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

UNIT-II

Design of Classical Control System in the time domain: Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

UNIT-III

Design of Classical Control System in frequency domain: Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.

UNIT-IV

Design of PID Controllers: Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

UNIT-V

Control System Design in State Space: Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle. Various types of non-linearities. Effect of various non-linearities on system performance. Singular points. Phase plot analysis.

Suggested Reading:

1. N. Nise, "Control system Engineering", John Wiley, 2000.
2. J. Nagrath and M. Gopal, "Control system engineering", Wiley, 2000.
3. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
4. Karl Johan Astrom and T. Hagglund, "Automatic Tuning of PID Controllers", Instrument Society of America 2nd Edition, 1995.

PE 866EE

ENERGY MANAGEMENT SYSTEMS

Professional Elective- VI

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To understand the functions of energy management systems.
- To understand the intricacies of power generation scheduling.
- To understand the components, requirements and applications of SCADA.
- To acquire knowledge about functioning of SCADA.
- To study about communication requirements of SCADA.

Course Outcomes: After completion of this course, the students shall be able to:

1. Outline energy management systems and unit commitment and its solution techniques.
2. Discuss power generation scheduling with limited energy.
3. Describe the architecture, functions and applications of supervisory control and data acquisition (SCADA).
4. Apply SCADA in power system automation and communications.
5. Understand SCADA communication requirements and protocols.

UNIT-I

Introduction to Energy Management Systems: Energy management centers: Energy management centers and their functions, architectures, recent developments, characteristics of power generating units and economic dispatch, unit commitment (spinning reserve, thermal, hydro and fuel constraints), solution techniques of unit commitment.

UNIT-II

Power Generation Scheduling: Generation scheduling: Generation scheduling with limited energy, energy production cost models, budgeting and planning, practical considerations, interchange evaluation for regional operations, types of interchanges, exchange costing techniques.

UNIT-III

Introduction to SCADA: Supervisory control and data acquisition - Introduction to supervisory control and data acquisition, SCADA functional requirements and components. SCADA Application: General features, functions and applications, benefits of SCADA, architectures of SCADA, applications of SCADA.

UNIT-IV

Configurations of SCADA: SCADA and power systems: Configurations of SCADA, RTU (remote terminal units) connections, power systems SCADA and SCADA in power system automation.

UNIT-V

SCADA Communication: SCADA communication requirements, SCADA communication protocols: past present and future, structure of a SCADA communications protocol.

Suggested Reading:

1. Handschin E, Energy Management Systems‖, Springer Verlag, 1st Edition, 1990.
2. Handschin E, Real Time Control of Electric Power Systems, Elsevier, 1st Edition, 1972.
3. John D Mc Donald, Electric Power Substation Engineering, CRC press, 1stEdition, 2001.
4. Wood, A J and Wollenberg, B F, Power Generation Operation and Control, John Wiley and Sons, 2ndEdition 2003.
5. Green, J N Wilson, R, Control and Automation of Electric Power Distribution Systems, Taylor and Francis, 1stEdition, 2007.
6. Turner, W C, Energy Management Handbook, Fairmont Pres, 5thEdition, 2004.

OE801BM

BASIC MEDICAL EQUIPMENT

Open Elective-III

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To make the students understand the need for several Biomedical Equipment.
- To make the students understand the operating principles of a wide range of Biomedical Equipment.

Course Outcomes: After completion of this course, the students shall be able to:

1. Learn about various physiological parameters, monitoring and recording.
2. Assess the need and operating principle of equipment used in physiotherapy.
3. Interpret the working principle and operating procedure and applications of Medical Imaging equipment.
4. Perceive the governing principles and functions of critical care equipment.
5. Learn about the various Therapeutic Equipment used for different applications.

UNIT-I

Medical Monitoring and recording: Patient monitoring: System concepts, bedside monitoring systems, central monitors, heart rate and pulse rate measurement. Temperature measurement Blood pressure measurement: Direct and indirect methods. Respiration rate measurement: Impedance pneumograph, Apnoea detectors. Ambulatory monitoring: Arrhythmia monitor,

UNIT-II

Physiotherapy and Electrotherapy Equipment: Diathermy machines -Short wave diathermy, Microwave diathermy and ultrasonic diathermy Electro diagnostic/Therapeutic apparatus: Nerve muscle stimulator, Functional electrical stimulator etc.

UNIT-III

Medical Imaging Equipment: X-Ray machines: Properties and production of X-Rays, X-ray machine, Image Intensifier. X-ray computed tomography: basic principle and construction of the components. Ultrasonic Imaging - Physics of ultrasonic waves, medical ultrasound, basic pulse echo apparatus. Magnetic Resonance Imaging: Principle, Image reconstruction techniques, Basic NMR components, Biological effects, Merits.

UNIT-IV

Critical care Equipment: Ventilators - Mechanics of respiration, artificial ventilators, Positive pressure ventilator, Types and classification of ventilators. Drug delivery system - Infusion pumps, basic components, implantable infusion system, closed loop control in

infusion pump. Cardiac Defibrillators - Need for defibrillators, DC defibrillator, Implantable defibrillators, Defibrillator analyzer.

UNIT-V

Therapeutic Equipment: Cardiac pacemakers - Need for cardiac pacemakers, External and implantable pacemakers, types. Dialysis Machine - Function of kidney, artificial kidney, Dialyzers, Membranes, Hemodialysis machine. Lithotripters - The stone diseases problem, Modern Lithotripter systems, extra corporeal shockwave therapy.

Suggested Reading:

1. R.S.Khandpur, Hand Book of Biomedical Instrumentation, Tata McGrawHill, Second Edition, 2014.
2. John G.Webster, Medical Instrumentation Application and design, Wiley India Edition, 2009.

OE802CS

DATA SCIENCE USING R

Open Elective-III

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To learn basics of R Programming environment: R language, R- studio and Rpackages.
- To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting
- To learn Decision tree induction, association rule mining and text mining Course.

Course Outcomes: After completion of this course, the students shall be able to:

1. Use various data structures and packages in R for data visualization and summarization.
2. Use linear, non-linear regression models, and classification techniques for data analysis.
3. Use clustering methods including K-means and CURE algorithm.

UNIT-I

Introduction To R: Introduction, Downloading and Installing R, IDE and Text Editors, Handling Packages in R. Getting Started with R - Introduction, Working with Directory, Data Types In R, Few Commands for Data Exploration. Loading and Handling Data in R - Introduction, Challenges of Analytical Data Processing, Expression, Variables, Functions, Missing Values Treatment In R, using 'As' Operator to Change the Structure of The Data, Victors, Matrices, Factors, List, Few Common Analytical Tasks, Aggregation and Group Processing ofa Variable, Simple Analysis Using R, Methods for Reading Data, Comparison of R GUI's For Data Input, Using R with Databases and Business Intelligence Systems.

UNIT- II

Exploring Data In R: Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values and Outliers, Descriptive Statistics, Spotting Problems in Data with Visualization.

UNIT- III

Linear Regression Using R:Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption.

Logistic Regression: Introduction, What is Regression? Introduction to Generalized Linear Model, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Model.

UNIT- IV

Decision Tree: Introduction, What Is A Decision Tree? Decision Tree Representation In R, Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search In Decision Tree Learning, Inductive Bias In Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning. Time Series in R:Introduction, What Is Time Series Data, Reading Time Series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models.

UNIT- V

Clustering: Introduction, What Is Clustering, Basic Concepts in Clustering, Hierarchical Clustering, K-Means Algorithm, CURE Algorithm, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism. Association Rules - Introduction, Frequent Item set, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association.

Text Mining: Introduction, Definition of Text Mining, A Few Challenges in Text Mining, Text Mining Verses Data Mining, Text Mining In R, General Architectures of Text Mining Systems, Pre-Processing of Documents In R, Core Text Mining Operations, Using Background Knowledge for Text Mining, Text Mining Query Languages. Mining Frequent Patterns, Associations and Correlations: Basic Concepts and Methods. Frequent Itemset, Closed Item set and Association Rules. Frequent Item set: Mining Methods, Pattern Evaluation Methods, Sentiment Analysis.

Suggested Reading:

1. Data Analytics using R by Seema Acharya. McGraw Hill education.
2. Practical Data Science with R, Nina Zumel and John Mount, Manning Shelter Island.
3. The R book, Crawley, Michael J. John Wiley & Sons, Ltd

OE803EC

MOBILE COMMUNICATION

Open Elective-III

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

1. Understand basics of Cellular systems, their generations and Characteristics of Mobile Communications.
2. Understand the Frequency reuse mechanism for Mobile operations and Co-Channel interference concepts
3. Understand the Mobile signal Coverage in different terrains and Lee models
4. Understand the working of Antennas at Cell-site and at Mobile units.
5. Understand the various Handoff mechanisms and Concept of Dropped calls

Course Outcomes: After completion of this course, the students shall be able to:

1. Able to analyze the various operational features of Mobile Communication Systems
2. Able to deal with the Mobile communication system designs of Frequency re-use and Interference Factors
3. Able to carry out the Design aspects of Mobile signal coverage over different terrains
4. Able to analyze the different Cell-site and Mobile antennas for different applications
5. Able to characterize the Handoffs mechanisms.

UNIT – I

Introduction to Cellular Mobile Communications:

History of Mobile cellular: AMPS system (First-generation systems), Second-generation System, 3G Systems, 4G Systems, 5G Systems, Other Cellular-like Systems, Spectrum allocation, Spectrum Efficiency Considerations.

Basic Cellular systems, Circuit-Switched and Packet-Switched Systems, Performance criteria, Voice quality, Data quality, Picture quality, Service quality and special features.

Uniqueness of Mobile Radio Environment, Description of Mobile Radio Transmission Medium, Model of Transmission Medium, Mobile Fading characteristics, The Radius of Active Scatter region, Delay spread and Coherence Bandwidth, Noise level in Cellular Frequency band

UNIT – II

Frequency Reuse Concept and Cellular System Components:

Concept of Frequency reuse channels, Frequency reuse schemes, Frequency reuse distance, Number of Customers in the System, Co-Channel Interference Reduction Factor, Desired C/I from a Normal case in an Omni-directional antenna System, Handoff mechanism, Cell splitting, Consideration of the Components of Cellular Systems, Antennas, Switching equipment and Data Links.

UNIT – III

Cell Coverage:

General Introduction, Ground Incident angle and Ground Elevation angle, Ground Reflection angle and Reflection point, Obtaining the Mobile Point-to-Point Model (Lee Model), A standard condition, Obtain Area-to-Area Prediction model, The Phase difference between a direct path and ground-reflected path, A general formula for Mobile Radio Propagation.

Propagation over water or Flat open area, Between Fixed stations, Land-to-Mobile transmission over water, Foliage Loss, Propagation in Near-In distance, Long distance propagation, Obtain Path loss from a Point-to-Point Prediction Model in Non-obstructive condition and obstructive condition, Form of a Point-to-Point Model, General Formula and its Merit

UNIT – IV

Cell-Site and Mobile Antennas:

Antennas at Cell-site, Omni directional antennas, Directional antennas, Location antennas, Set-up Channel antennas, Space Diversity Antennas at cell site, Umbrella-Pattern Antennas, Interference reduction antennas, Unique Situations of Cell-Site antennas, Smart antennas, types and applications

Mobile Antennas, Roof-mounted antenna, Glass-Mounted antenna, High-gain antenna, horizontally and vertically oriented Space-Diversity Antennas.

UNIT – V

Handoff and Dropped Calls:

Value of Implementing Handoffs, Types of Handoff, Initiation of Hard Handoff, Delaying a Handoff, Forced Handoffs. Queuing of handoffs, Power difference Handoffs, MAHO and Soft Handoff, Cell-site Handoff only, Intersystem Handoff

Introduction to Dropped Call Rate and Formula of Dropped Call Rate

Suggested Readings:

1. William C.Y.Lee*, "Wireless and Cellular Telecommunications*", 3rd International edition, McGraw Hill, 2006.

2. Theodere S. Rappaport, *"Wireless Communications, Principles and Practice*", 2nd edition, Prentice Hall, 2003.

3. Gordon L. Stuber. "*Principles of Mobile Communications",* 3rd edition, Springer Publications, 2011.

OE804EC

INTERNET OF THINGS AND APPLICATIONS

Open Elective-III

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

1. To introduce the concepts of automation in daily life.
2. To familiarize the concepts of all IoT based communication systems.
3. To understand the importance of cloud technologies in the field of IoT.
4. To get familiar with standard embedded boards like Raspberry Pi.
5. To study a real time system with a view of an application program interface (API).

Course Outcomes: After completion of this course, the students shall be able to:

1. Able to design IoT based solutions for given problem statements.
2. Able to develop programs for Raspberry Pi.
3. Able to demonstrate the functionality of cloud communication.
4. Able to analyze the technologies used in IoT.
5. Able to incorporate multiple sensors to develop an IoT based system.

UNIT- I

Introduction to Internet of Things

Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT,IoT protocols, Logical Design of IoT: IoT functional Blocks, Communication Models, APIs, IoT enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics IoT Applications: Smart Home, Smart Cities, Smart Environment, Smart Energy, Smart Retail and Logistics, Smart Agriculture and Industry, Smart Industry and smart Health (Ref1)

UNIT- II

Internet Principles and communication technology

Internet Communications: An Overview – IP, TCP, IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols – HTTP, HTTPS, Cost Vs Ease of Production, Prototypes and Production, Open Source vs. Closed Source. Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping Hardware platforms – Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling.

UNIT- III

API Development and Embedded programming

Getting started with API, Writing a new API, Real time Reactions, Other Protocols, Techniques for writing embedded code: Memory management, Performance and Battery Life, Libraries, Debugging. Developing Internet of Things: IoT design Methodology, Case study on IoT System for weather Monitoring.

UNIT -IV

IoT Systems - Logical Design using Python

Introduction to Python, Data Types and Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations., Classes, and Python packages for IoT, IoT Physical Devices and Endpoints: Raspberry Pi, Interfaces of Pi, Programming pi with Python - Controlling LED and LDR using Pi with python programming.

UNIT- V

Cloud computing and Data analytics and IoT Product Manufacturing

Introduction to Cloud storage models and Communication APIs, Amazon web services for IoT, Sky net IoT Messaging Platform. Introduction to Data Analytics for IoT (Ref 1). Case studies illustrating IoT Design – Smart Lighting, Weather Monitoring, Smart Irrigation.(Ref 1) Business model for IoT product manufacturing, IoT Startups, Mass manufacturing, Ethical issues in IoT.

Suggested Readings:

1. Vijay Madisetti, Arshdeep Bahga, "*Internet of Things (A Hands-on-Approach)",* VPT Publisher, 1st Edition, 2014
2. Adrian McEwen (Author), Hakim Cassimally", *"Designing the Internet of Things",* Wiley India Publishers
3. Kenneth A Lambert and B.L. Juneja*, "Fundamentals of Python*", Cenage Learning

OE805EC

GLOBAL AND REGIONAL SATELLITE NAVIGATION SYSTEM

Open Elective-III

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To explain the basic principle of GPS and its operation.
- To make the students to understand signal structure.
- To make the students understand the GPS errors.
- Highlight the importance of integrating GPS with other systems.
- To make the students understand about various GRNSS.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the principle and operation of GPS.
2. Understand the GPS Signal structure and services.
3. Understand about various errors.
4. Use of GPS in various fields such as navigation, GIS etc.
5. Understand principle of Operation of various GRNSS.

UNIT-I

Introduction to Satellites, their properties, Orbits and Launch vehicles, Kepler's Laws, GPS fundamentals: Principle of Trilaiteration, Transit, GPS Operating Principle, Architecture: Space, Control and User Segments and its Frequencies.

UNIT- II

GPS Signal structure: C/A and P-Codes, SPS and PPS services, GPS Coordinate Systems: Significance, Types of GPS receivers, Selective Availability, Spoofing and Anti-spoofing.

UNIT- III

GPS Errors: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Multipath; Dilution of Precision (DOP).

UNIT- IV

GPS Modernization: Future GPS satellites, New signals and their benefits, New Control Segment, Principle of operation of DGPS, architecture and limitations, GPS Applications: Surveying Mapping Marine, air and land Navigation, Military and Space Application.GPS Integration with Geographic Information System (GIS), Inertial Navigation System (INS), Pseudolite and Cellular.

UNIT- V

Other GRNSS: GLONASS, GALILEO, QZNSS, CNSS and IRNSS System: Principle of Operation, Features and their Current Status.

Suggested Reading:

1. Ahmed El-Rabbany, "Introduction to GPS", Artech House Publishers, 2/e, Boston 2006.
2. Elliot D Kaplan and Christopher J Hegarty," Understanding GPS principles and applications", Artech House Publishers, 2/e Boston & London 2005.
3. B.Hofmann-Wellenhof, H.Lichtenegger, and J.Collins, "GPS Theory and Practice," Springer Verlog, 5/e, 2008.

OE806EE

APPLICATIONS OF ELECTRICAL ENERGY

Open Elective-III

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To introduce the students and understand Utilization of electrical energy for various applications like industrial heating.
- To understand various techniques of electric welding and types of batteries.
- To understand the concept of illumination, and know the applications of various lamps to factory lighting, street lighting etc.
- To understand the concept of electric traction including speed – time curves of different traction services.
- To understand systems of train lighting.

Course Outcomes: After completion of this course, the students shall be able to:

1. Identify a suitable heating scheme for a given application.
2. Identify proper welding technique and various characteristics of batteries.
3. Classify types of electric light sources based on nature and operation and their objectives, performance and reliability.
4. Determine the speed-time characteristics of various traction services and also estimate the energy consumption levels at various modes of operation.
5. Select proper train lighting scheme.

UNIT-I

Industrial Heating: Advantages and methods of electric heating. Description, operation and performance of resistance ovens, Design of heating element. High frequency heating, Induction Heating, Induction furnaces,Core type, Coreless furnaces, Dielectric heating. Electric Arc furnaces, Direct Arc furnace, Indirect Arc furnaces.

UNIT- II

Electric welding: Classification of Electric welding, welding transformer and its rating, various types of Electric arc welding and electric resistance welding.

Batteries: Lead acid batteries, SMF batteries, Construction and maintenance, Charging and rating of batteries.

UNIT- III

Illumination: Introduction, nature and production of light, Sensitivity of the eye, Units of light. The inverse square law and cosine law, Solid angle, Lighting calculations, Determination of M.S.C.P, Rousseau's construction, Discharge lamps, Sodium vapour lamps,

Mercury vapour lamps, Fluorescent lamp, Starting and power factor corrections, Stroboscopic effects, Neon signs, Application to factory lighting, Street lighting and Flood lighting.

UNIT- IV

Electric Traction: System of Electric Traction, Transmission of drive, Systems of track electrification, Traction mechanics, Speed time curves, Tractive effort, Power of Traction motor, Specific energy consumption, Mechanics of train movement, Coefficient of adhesion.

UNIT – V

Train Lighting: Systems of train lighting, special requirements of train lighting, Methods of obtaining unidirectional polarity, Methods of obtaining constant output, Single battery system, Double battery parallel block system, Principal equipment of double battery system, Coach wiring, Dynamo.

Suggested Reading:

1. Partab H, Art and Science of Utilization of Electric Power, Dhanpat Rai & Sons, 1997.
2. K.B. Raina & S.K. Bhattacharya, Electrical Design, Estimating 1. and Costing, Wiley Eastern Ltd., 1991.
3. Partab H, Modern Electric Traction, Dhanpat Rai & Sons, 2000.
4. B.L.Theraja, A Text Book of Electrical Technology, S.Chand & Company Ltd, Vol-I.

OE807ME

COMPOSITE MATERIAL APPLICATIONS

Open Elective-III

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To know the properties of fiber and matrix materials used in composites, as well as some common manufacturing techniques.
- To know the various moulding process and architecture of composite laminates.
- To know how to estimate the laminate properties from lamina properties.
- To understand the strength of an orthotropic lamina and measurement of basic composite properties.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the distinction of composites, its advantages, classification and applications.
2. Predict the properties of composite lamina and laminate.
3. Understand the testing of composites and design the structure using the appropriate design criteria.

UNIT-I

Introduction to composite materials, general characteristics, Fibres, Matrix materials, interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon fibre composites.

UNIT- II

Molding Processes: hand layup, vacuum molding, compression molding, pultrusion molding, centrifugal molding, filament winding, prepegs and molding compounds and architecture of composite materials: laminates, sandwich composites and other architectures.

UNIT- III

Micromechanics of Composites: Mechanical properties: Production of Elastic constant, micromechanical approach, Halpin-Tsal equations, Transverse stresses. Thermal properties: Hygrothermal stresses, mechanics of load transfer from matrix to fibre.

UNIT- IV

Macromechanics of Composites: Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation.

UNIT- V

Strength of an orthotropic lamina: Maximum stress theory, maximum strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria. Designing with composite materials. Measurement of constituent material propertiesFibre tests, Matrix tests. Measurement of basic composite properties: Tensile test, compressive test, a plane shear test, interlaminar shear test, flexure test.

Suggested Reading:

1. Jones, R.M., "Mechanics of Composite Materials", McGraw Hill Co., 1967.
2. Ronald F. Gibson, "Principles of Composite Materials Mechanics", McGraw-Hill, Inc., 1994.
3. Krishan, K. Chewla, "Composite Material", Springer - verlag, 1987.
4. Carl. T. Herakovich, "Mechanics of Fibrous Composites", John Wiley Sons Inc., 1998.

OE808ME

INDUSTRIAL ADMINISTRATION AND FINANCIAL MANAGEMENT

Open Elective-III

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives

- To understand various types of organizational structures, manufacturing processes and importance of plant layout and the role of scheduling function in optimizing the utilization of resources.
- To understand the importance of quality, inventory control and concepts like MRP I and MRP II.
- To understand the nature of financial management and concepts like breakeven analysis, depreciation and replacement analysis.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the different phases of product life cycle, types of manufacturing systems, plant layout optimization problems and role of scheduling function in better utilization of resources.
2. Understand the different phases of product life cycle, types of manufacturing systems, plant layout optimization problems and role of scheduling function in better utilization of resources.
3. Know the different terminology used in financial management and understand the different techniques of capital budgeting and various types of costs involved in running an industrial organization.

UNIT-I

Types of organizations, organizational structures. Designing Products, Services and Processes: New product design and development. Product life cycle: phasing multiple products. Manufacturing process Technology: Product, job shop, batch, assembly line and continuous process technology; flexible manufacturing systems. Design of Services, service process technology operations capacity; capacity planning decisions, measuring capacity; estimating future capacity needs.

UNIT-II

Locating production and services facilities, effects of location and costs and revenues, factor rating, simple median model (linear programming) Layout planning; process layout; product layout - Assembly lines; line balancing manufacturing cellular layout. Scheduling systems and aggregate planning for production and services; loading assignment algorithm; priority sequencing and other criteria.

UNIT-III

Quality Planning and Control: basic concepts, definitions and history of quality control. Quality function and concept of quality cycle. Quality policy and objectives. Economics of quality and measurement of the cost of quality. Quality considerations in design.

Process control: machine and process capability analysis. Use of control charts and process engineering techniques for implementing the quality plan. Acceptance sampling: single, double and multiple sampling, operating characteristic Curve - calculation of producers risk and consumers risk.

UNIT-IV

Inventory Control: deterministic and stochastic inventory models; variable demand; lead time, specific service level, perishable products and service. Inventory control in application; concepts for the practioners; saving money in inventory systems; ABC classifications. Inventory control procedures; Quantity - reorders versus periodic inventory systems; material requirement planning (MRP); MRP as a scheduling and ordering system; MRP system components; MRP computational procedure; Detailed capacity planning; MRP - limitation and advantages; Manufacturing Resources Planning (MRP-II).

UNIT-V

Elements of cost, overheads, breakeven analysis, depreciation, replacement analysis. Nature of financial management-time value of money, techniques of capital budgeting and method, cost of capital, financial leverage.

Suggested Reading:

1. Buifa and Sarin, "Production and operations management" - Wiley Publications.
2. I.M. Pandey, "Elements of Financial Management" Vikas Publications, New Delhi, 1994.
3. James C. Van Home & John, M. Wachowicz, Jr., "Fundamentals of Financial Management", Pearson Education Asia, 11th ed. 2001.

OE809CS

SOFTWARE ENGINEERING
Open Elective-III

Instruction: 3 Periods per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

COURSE OBJECTIVES:

- To introduce the basic concepts of software development- processes from defining a product to shipping and maintaining that product.
- To impart knowledge on various phases, methodologies and practices of software development.
- To understand the importance of testing in software development and study various testing strategies and software quality metrics.

COURSE OUTCOMES: After completion of this course, the students shall be able to:

1. Acquire working knowledge of alternative approaches and techniques for each phase of software development
2. Acquire skills necessary for independently developing a complete software project
3. Understand the practical challenges associated with the development of a significant software system

UNIT-I

Introduction to Software Engineering:
A generic view of Process: Software Engineering, Process Framework, CMM Process Patterns, Process Assessment.

Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology, Product and Process.
An Agile view of Process: Introduction to Agility and Agile Process, Agile Process Models.

UNIT-II
Software Engineering Principles: SE Principles, Communication Principles, Planning Principles, Modeling Principles, Construction Principles, Deployment.
System Engineering: Computer-based Systems, The System Engineering Hierarchy, Business Process Engineering, Product Engineering, System Modeling.
Requirements Engineering: A Bridge to Design and Construction, Requirements Engineering Tasks, Initiating Requirements Engineering Process, Eliciting Requirements, Developing Use-Cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

UNIT-III

Building the Analysis Model: Requirements Analysis Modeling Approaches, Data Modeling Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling, Creating a Behavioral Model.

Design Engineering: Design within the context of SE, Design Process and Design Quality, Design Concepts, The Design Model, Pattern-based Software Design.

UNIT-IV

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design, Assessing Alternative Architectural Designs, Mapping Data Flow into a Software Architecture.

Modeling Component-Level Design: Definition of Component, Designing Class-based Components, Conducting Component-level Design, Object Constraint Language, Designing Conventional Components.

Performing User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT-V

Software Quality Assurance: Basic Elements, Tasks, Goals and Metrics, Formal Approaches, Statistical Software Quality Assurance, Software Reliability, ISO 9000 Quality Standards, SQA Plan.

Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for O-O Software, Validation Testing, System Testing, The Art of Debugging.

Testing Tactics: Software Testing Fundamentals, Black-box and White-box Testing, Basis Path Testing, Control Structure Testing, O-O Testing Methods, Testing Methods applicable on the Class Level, Inter Class Test Case Design, Testing for Specialized Environments, Architectures and Applications, Testing Patterns.

Product Metrics: Software Quality, A Framework for Product Metrics, Metrics for the Analysis Model, Metrics for the Design Model, Metrics for Source Code, Metrics for Testing, Metrics for Maintenance.

Suggested Readings:

1. Roger S.Pressman,"*Software Enigneering: A Practitioner's Approach*", 7th Edition, McGraw Hill, 2009.
2. Ali Behforooz and Frederick J.Hudson, "*Software Engineering Fundamentals*", Oxford University Press, 1996.
3. Pankaj Jalote, "*AnIntegrated Approach to Software Engineering*", 3rd Edition, Narosa Publishing House, 2008.

OE810CS

PYTHON PROGRAMMING
Open Elective-III

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

COURSE OBJECTIVES:
The main objective is to teach Computational thinking using Python.

- To know the basics of Programming
- To convert an algorithm into a Python program
- To construct Python programs with control structures.
- To structure a Python Program as a set of functions
- To use Python data structures-lists, tuples, dictionaries.
- To do input/output with files in Python.
- To construct Python programs as a set of objects.

COURSE OUTCOMES: After completion of this course, the students shall be able to:

1. Develop algorithmic solutions to simple computational problems.
2. Develop and execute simple Python programs.
3. Develop simple Python programs for solving problems.
4. Structure a Python program into functions.
5. Represent compound data using Python lists, tuples, dictionaries.
6. Read and write data from/to files in Python Programs

UNIT-I

Introduction to Computing and Problem Solving: Fundamentals of Computing – Computing Devices – Identification of Computational Problems – Pseudo Code and Flowcharts – Instructions – Algorithms – Building Blocks of Algorithms.

Introduction to Python Programming: Python Interpreter and Interactive Mode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements, Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: The if, The if…else, The if…else if…else Decision Control Statements, Nested if Statement, The while Loop, The for Loop. The continue and break Statements.

UNIT-II

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list

parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT-III

Files and Exception: Text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings

Dictionaries and Sets: Dictionaries, Sets, Serializing Objects.

UNIT-IV

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance The Polymorphism.

Functional Programming: Lambda. Iterators, Generators, List Comprehensions.

UNIT-V

GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

Suggested Readings:

1. Richard L. Halterman, "*Learning To Program With Python*", Copyright © 2011.
2. Dr. Charles R, "*Python for Everybody, Exploring Data Using Python 3*", Severance. 2016.
3. Gowrishankar S., Veena A, "*Introduction to Python Programming*", CRC Press, Taylor & Francis Group, 2019.
4. Allen B. Downey, "*Think Python: How to Think Like a Computer Scientist*'', 2nd edition, Updated for Python 3,Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/)

OE811CS

CYBER SECURITY

Open Elective-III

Instruction: 3 Periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

COURSE OBJECTIVES:

- Understand the threats in networks and security concepts.
- Apply authentication applications in different networks.
- Understand security services for email.
- Awareness of firewall and its applications.

COURSE OUTCOMES:

After Completion of the course, Student will be able to:

1. Understand the various network threats
2. Analyse the forensic tools for evidence collection
3. Apply the firewalls for threat analysis

UNIT-I

Ethical hacking, Attack Vectors, Cyberspace and Criminal Behaviour, Clarification of Terms, Traditional Problems associated with Computer Crimes, Realms of Cyber world, brief history of the internet, contaminants and destruction of data, unauthorized access, computer intrusions, white-collar crimes, viruses and malicious code, virus attacks, pornography, software piracy, mail bombs, exploitation, stalking and obscenity in internet, Cyber psychology, Social Engineering.

UNIT-II

Introduction to Digital forensics, Forensic software and handling, forensic hardware and handling, analysis and advanced tools, forensic technology and practices, Biometrics: face, iris and fingerprint recognition, Audio-video evidence collection, Preservation and Forensic Analysis.

UNIT-III

Investigation Tools, e-discovery, EDRM Models, digital evidence collection and preservation, email investigation, email tracking, IP tracking, email recovery, searc and seizure of computer systems, password cracking

UNIT-IV

Forensic Analysis of OS artifact, Internet Artifacts, File System Artifacts, Registry Artifacts, Application Artifacts, Report Writing, Mobile Forensic- identification, collection and preservation of mobile evidences, social media analysis, data retrival, Email analysis from mobile phones.

UNIT-V

Ethics, Policies and IT Act

Basics of Law and Technology, Introduction to Indian Laws, Scope and Jurisprudence, Digital Signatures, E Commerce-an Introduction, possible crime scenarios, law coverage, data interchange, mobile communication development, smart card and expert systems Indian Laws, Information Technology Act 2000, Indian Evidence Act, India Technology Amendment Act 2008, Indian Penal Code , Computer Security Act 1987, National Information Infrastructure Protection Act 1996, Fraud Act 1997, Children Online Protection Act 1998, Computer Fraud and Abuse Act 2001, Intellectual Property, IP Theft, Copyright, Trademark, Privacy and Censorship, Introduction to Cyber Ethics, rights over intellectual property, Corporate IT Policy Formulations, Compliance Auditing.

Suggested Readings:

1. Charles P. Fleeger, "*Security in Computing*", Prentice Hall, New Delhi, 2009.
2. Behrouz A.Forouzan, "*Cryptography & Network Security*", Tata McGraw Hill, India, New Delhi, 2009.
3. William Stallings, "*Cryptography and Network Security*", Prentice Hall, New Delhi, 2006.
4. Chalie Kaufman, Radia Perlman, Mike Speciner, "*Network Security: Private Communication in a Public Network*", Pearson Education, New Delhi, 2004.
5. Neal Krawetz, "*Introduction to Network Security*", Thomson Learning, Boston, 2007.
6. Bruce Schneier, "*Applied Cryptography*", John Wiley & Sons, New York, 2004.

PW851EE

MAJOR PROJECT PHASE – II/ INDUSTRIAL INTERNSHIP

Instruction: 12 Periods per week
CIE: 50 Marks *SEE: 100 Marks*
Credits: 6

Course Objectives

- To enhance practical and professional skills
- To familiarize tools and techniques of systematic Literature survey and documentation.
- To expose the students to industry practices and teamwork.
- To encourage students to work with innovative and entrepreneurial ideas.

Course Outcomes: After completion of this course, the students shall be able to:

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems.
2. Evaluate different solutions based on economic and technical feasibility.
3. Effectively plan a project and confidently perform all aspects of project management.
4. Demonstrate effective written and oral communication skills.

The aim of project stage –II is to implement and evaluate the proposal made as part of project stage - II. Students can also be encouraged to do full time industrial internship as part of project stage -II based on the common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of internship candidates from groups made as part of project work-I
2. Re-Allotment of internship students to project guides Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1nd week of VIII-Semester so that students get sufficient time for completion of the project.

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction. Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.