DEPARTMENT OF ELECTRICAL ENGINEERING

Scheme of Instruction
and
Syllabi of

MASTER OF ENGINEERING
(ELECTRICAL ENGG.)

Power Electronic Systems

AICTE Model Curriculum

2019 - 2020

UNIVERSITY COLLEGE OF ENGINEERING

(AUTONOMOUS)

OSMANIA UNIVERSITY
HYDERABAD – 500 007, TELANGANA

UNIVERSITY COLLEGE OF ENGINEERING

Vision

The Vision of the Institute is to generate and disseminate knowledge through a harmonious blending of Science, Engineering and Technology. To serve the society by developing a modern technology in students' heightened intellectual, cultural, ethical and humane sensitivities, fostering a scientific temper and promoting professional and technological expertise.

Mission

- To achieve excellence in Teaching and Research
- To generate, disseminate and preserve knowledge
- To enable empowerment through knowledge and information
- Advancement of knowledge in Engineering, Science and Technology
- Promote learning in free thinking and innovative environment
- Cultivate skills, attitudes to promote knowledge creation
- Rendering socially relevant technical services for the community
- To impart new skills of technology development
- To inculcate entrepreneurial talents and technology appreciation programs
- Technology transfer and incubation

DEPARTMENT OF ELECTRICAL ENGINEERING

Vision

To strive for excellence in education and research; meet the requirement of industry in the field of electrical engineering to serve the nation.

Mission

- To provide knowledge-based technology and service to meet the needs of society in electrical and allied industries.
- To help in building national capabilities for excellent energy management and to explore non-conventional energy sources.
- To create research-oriented culture and to provide competent consultancy.
- To create and sustain environment of learning in which students acquire knowledge and learn to apply it professionally with due consideration of ethical and economic issues.
- To be accountable through self-evaluation and continuous improvement.

M.E. (Electrical Engineering) - Power Electronic Systems

Program Educational Objectives

PEO 1   To develop professional knowledge in the field of power electronics and its applications in power sectors and core industries.

PEO 2   To develop ability and to exhibit creative & critical reasoning skills to comprehend, analyze, design and implement solutions for problems in power electronic converters and special electrical drives.

PEO 3   To enhance the student capacity in pursuing research in emerging areas of power electronic systems.

Program Outcomes

PO 1   An ability to independently carry out research/ investigation and development to solve practical problems.

PO 2   An ability to write and present a substantial technical report/document.

PO 3   The student will be able to apply critical and innovative skills to model design and develop simulation software solutions to solve the problems of power electronic converters and special electrical drives.

PO 4   To develop appropriate power electronic converters for sustainable energy technologies.

PO 5   Students will be able to analyze and design different types of renewable energy generation topologies for various electrical applications.

PO 6   Students will be able to acquire knowledge in state-of-the-art technologies, with effective communication.

SCHEME OF INSTRUCTION AND EXAMINATION
M.E. - Power Electronic Systems

Type of course	Course Code	Course Name	Contact hours per week			Scheme of Examination		Credits
			L	T	P	CIE	SEE	
SEMESTER-I								
Core-I	**EE 301**	Power Electronic Converters	3	0	0	30	70	3
Core-II	**EE 302**	Industrial Controllers	3	0	0	30	70	3
Program Elective-I			3	0	0	30	70	3
Program Elective-II			3	0	0	30	70	3
Mandatory Course	**EE 100**	Research Methodology in Electrical Engineering	3	0	0	30	70	3
Audit-I	**AC 031**	English for Research Paper Writing	2	0	0	30	70	0
	AC 032	Disaster Management						
	AC 033	Sanskrit for Technical Knowledge						
	AC 034	Value Education						
Lab	**EE 351**	Power Electronic Systems Laboratory - I	0	0	3	50	-	1.5
Seminar	**EE 352**	Seminar - I	0	0	3	50	-	1.5
TOTAL			17	-	6	280	420	18
SEMESTER-II								
Core-III	**EE 303**	Advanced Topics in Power Electronics	3	-	-	30	70	3
Core-IV	**EE 304**	Industrial Electronic Systems	3	-	-	30	70	3
Program Elective-III			3	-	-	30	70	3
Program Elective-IV			3	-	-	30	70	3
Audit-II	**AC 035**	Stress Management by Yoga	2	-	-	30	70	0
	AC 036	Personality Development through Life Enlightenment Skills						
	AC 037	Constitution of India						

	AC 038	Pedagogy Studies						
Mandatory Course	**EE 070**	Mini Project	-	-	6	50		3
Lab	**EE 353**	Power Electronic Systems Laboratory - II	-	-	3	50	-	1.5
Seminar	**EE 354**	Seminar - II	-	-	3	50	-	1.5
		TOTAL	**14**	**-**	**12**	**300**	**350**	**18**
		SEMESTER-III						
Program Elective-V			3	-	-	30	70	3
Open Elective	**OE 941**	Business Analytics						
	OE 942	Industrial Safety						
	OE 943	Operations Research	3	-	-	30	70	3
	OE 944	Cost Management of Engineering Projects						
	OE 945	Composite Materials						
	OE 946	Waste to Energy						
	EE 381	Major Project Phase-I	-	-	20	50	-	10
		TOTAL	**6**	**-**	**20**	**110**	**140**	**16**
		SEMESTER-IV						
	EE 382	Major Project Phase-II	-	-	32	-	200	16
		GRAND TOTAL					**1800**	**68**

COURSE INDEX
M.E. - Power Electronic Systems (PES)

EE301

POWER ELECTRONIC CONVERTERS
(Core PES, Program Elective – IDC)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To get insight into power semiconductor switching devices, switching characteristics and the concept of power electronic converters.*
2. *To prepare the students for acquiring the knowledge of different types of power semiconductor devices, rectifier circuits, switched mode converters and pulse width modulated inverters.*
3. *To develop the ability to comprehend, analyze, design various types of switched mode DC-DC converters and pulse width modulated inverters used in variable speed drives*

Course Outcomes

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

1. *Select an appropriate power semiconductor device and design a power converter for the required application.*
2. *Select and design power electronic converters for broad range of energy conversion applications.*
3. *Design the control circuit and the power circuit for a given power converter.*
4. *Use power electronic simulation tools for analyzing and designing power electronic converter circuits.*
5. *Experimentally evaluate the performance of power electronic conversion systems for different types of electrical applications.*

Syllabus Contents

UNIT I
Power Switching Devices – Characteristics: Classification of switches-ideal switches and real switches; Practical power switching devices-uncontrolled switches, semi controlled switches and fully controlled switches; Power diodes, Thyristors, Power transistors - Power BJT, MOSFETS, IGBT static and dynamic characteristics and their applications; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

UNIT II
Rectifiers: Line commutated rectifiers-Diode and Thyristor Rectifiers-Single-phase half-wave, full-wave and semi controlled rectifiers with R-load and highly inductive load; Three-phase half-wave, full-wave and semi controlled bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

PWM rectifiers- Single-phase PWM rectifiers, bridge-connected PWM rectifier: voltage-doubler PWM rectifier, three-phase voltage source PWM rectifier.

UNIT III
DC-DC Converters: Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage across an inductor and average current through a capacitor operating in periodic steady state, power circuit and operation of buck, boost, buck-boost, flyback, forward, push-pull, half-bridge and full-bridge converters in continuous conduction mode, duty ratio control of output voltage.
AC-AC Converter: Power circuit and operation of single-phase AC Voltage Controller with R & RL Load. Basic concepts of Cycloconverter and Matrix converter.

UNIT IV
Single-phase inverter: Power circuit and operation of single-phase voltage source inverter in square wave mode, sinusoidal pulse width modulation (unipolar and bi-polar), relation between modulation index and output voltage. Calculation of performance parameters of inverter.

UNIT V
Three-phase inverter: Power circuit and operation of three-phase voltage source inverter in 180^0 and 120^0 modes, Uni-polar sinusoidal pulse width modulation, relation between modulation index and output voltage and Space vector modulation technique; Elementary operation of CSI, comparison of voltage source inverter and current source inverter.

References

1. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
2. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
3. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.
4. Dr. P.S. Bhimbra, " Power Electronics", Khanna Publishers, 2009.
5. M. H. Rashid, "*Power electronics: circuits, devices, and applications*", Pearson Education India, 2017.

EE302

INDUSTRIAL CONTROLLERS
(Core – PES, Program Elective – IDC)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course objectives

1. *To develop knowledge about 8051 Micro controller and its assembly language programming.*
2. *To be familiarize with LF2407 DSP controller, its architecture, programming, GPIOs, Interrupts, ADC, Event Managers and learn how to produce PWM waveforms.*
3. *To be aware of Programmable Logic Controller and how to develop ladder programs.*

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

1. *Understand the working of 8051 micro controller architecture and its programming.*
2. *Understand the functioning of Digital Signal Processor in LF2407 controller and programming of TMS320C2xx processor.*
3. *Understand the concept of GPIO, interrupts, ADC and programming them.*
4. *Use different resources available in even manager in the application of Electro mechanical motion control such as dead band generation, PWM generation, QEP circuitry etc.*
5. *Develop ladder programs for different industrial PLC applications.*

Syllabus Contents

UNIT I
8051 Microcontroller: Architecture, memory organization, timing and control, parallel ports, timer/counters, serial port and interrupts. Addressing modes and instruction set of 8051 micro controller and its usage.

UNIT II
TMSLF2407 DSP Controller: Introduction, brief introduction to peripherals, types of physical memory, software tools.

C2XX DSP CPU and instruction set:C2xx DSP Core and code generation, mapping external devices to the C2xx DSP core and the peripherals, memory, addressing modes, assembly programming using C2xx DSP instruction set.

UNIT III
GPIO functionality: Pin multiplexing (MUX) and GPIO Overview, multiplexing and GPIO control registers.
Interrupts on the TMS320LF2407: Introduction, Interrupt Hierarchy and its Control Registers.

UNIT IV
ADC: Overview, Operation and programming modes.
Event managers: Overview, Interrupts, Timers, Compare Units, Capture units and QEP circuitry PWM Signal Generation with Event Managers.

UNITV
Programmable Logic Controller (PLC) Basics: Definitions and history of PLCs – Advantages and disadvantage of PLC – overall PLC Systems, CPUs and Programr/ Monitors – Programming procedures – programming equipment – Programming formats Ladder diagrams, Basic PLC programming and Basic PLC functions: Programming on / off inputs to produce on / off outputs, PLC programming examples.

References

1. Kenneth J. Ayala, The Micro Controllers - Architecture, Programming & Applications, Penram International Publishing (India).
2. Hamid A Toliyat, DSP based Electromechanical Motion Control, Steven Campbell 2004, CRC Press.
3. John W. Webb and Roland A. Reis, Programmable Logic Controllers, Prentice Hall India Ltd., Fifth edition, 2003.

EE303

ADVANCED TOPICS IN POWER ELECTRONICS
(Core – PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course objectives

1. *To develop knowledge about advanced* power semiconductor devices
2. *To be familiarize with* ideal rectifier, near ideal rectifiers, bifurcation and Chaos
3. *To be aware of.* Various State space modeling DC-DC converters and Soft-switching
4. Analyze the operation of multi-level inverters and accessing appropriate applications.
5. Design of optimal controllers for Power Electronic Systems and its modeling

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

1. *Select an appropriate power semiconductor device and design a power converter for the required application*
2. *Develop and understand the near ideal rectifier for single phase and three-phase converter systems*
3. *Determine the power circuit configurations to fulfill the required power conversion with applicable constraints*
4. *Design multi-level inverters and DC-DC converters, z-source converters*
5. *Design the control circuit and the power circuit for a given power converter*

Syllabus Contents

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
Advance 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.

References

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. JayantBalinga, 'Advanced High Voltage Power Device Concepts', Springer New York 2011. ISBN 978-1-4614-0268-8
4. BIN Wu, 'High Power Converters and AC Drives', IEEE press Wiley Inderscience, a John wiley& sons Inc. publication 2006

EE304

INDUSTRIAL ELECTRONIC SYSTEMS
(Core – PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To prepare the students as per Industry standard tools to analyze design and develop the Industrial Electronics based systems.*
2. *To provide the students the deeper knowledge in the area related with Industrial Electronics as well as the Automation.*
3. *To develop the ability to exhibit creative skills to comprehend, analyze, design and implement solutions for problems in Industrial applications.*

Course Outcomes:

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

1. *Acquire the knowledge of various types of power supply systems like UPS, power conditioners switched mode supplies.*
2. *Acquire deeper knowledge in the area related with Industrial Electronics as well as the Automation in automatic welding system.*
3. *Apply innovative skills to model design and develop various control systems for Industrial applications.*
4. *Design analyze various types of switched mode power supplies for different types of renewable energy generation topologies and for various electrical applications.*
5. *Analyze, design and develop reactive power compensation techniques in Arc furnace.*

Syllabus Contents

UNIT I
Power Supplies: UPS- Offline, Online & Hybrid types of UPS, Parallel redundancy, Dual redundancy, AC Power conditioner- power supply noise-servo system – servo-controlled voltage stabilizer- AC generator voltage regulator– Constant voltage transformer SMPS - Fly back, feed forward, Push pull and Bridge types.

UNIT II
Automatic Welding System: Physical Description of a wheel welding system Sequence of Operations – Sequence initiation –Interval triggering and gating circuit Interval stepping circuit –Interval time counter –Heat -cool counter –Weld power circuit.

UNIT III
Closed loop Industrial Systems: Thermistor control of quench oil temperature Proportional mode pressure control system Strip tension controller – Edge guide control for a strip

recorder –Control of relative humidity in a textile moisturizing process. Closed loop industrial systems warehouse humidity controller.

UNIT IV

***High Frequency Heating*:** Merits of Induction Heating–Applications of Induction Heating–High Frequency Power Source for Induction Heating–Principle of Dielectric Heating–Theory of Dielectric Heating–Dielectric Properties of a few typical materials–Electrodes used in Dielectric Heating–Method of Coupling of Electrodes to the R.F. Generator–Thermal Losses in Dielectric Heating–Applications of Dielectric Heating.

UNIT V

***Reactive Compensation in Electric Arc Furnace*:** The arc Furnace an Electrical Load – Flicker and Principles of its compensation Thyristor controlled compensators –Saturable Reactor Compensator.

References

1. Maloney Timothy. J, *Industrial Solid-State Electronics*, Prentice Hall International,1986.
2. Krishna Kant, *Computer Based Industrial Control*, Prentice Hall of India, 1997.
3. G.K. Mithal, Dr. Maneesha Gupta, Industrial and Power Electronics, Khanna Publishers, 2007.
4. M.D Singh & Kanchandani. K.B., *Power Electronics*, Tata McGraw Hill.,1998.
5. P.C Sen, *Modern Power Electronics*, S. Chand& Co.

EE102

MACHINE MODELING AND ANALYSIS
(Core – IDC & Program Elective - PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To provide knowledge about the fundamentals of magnetic circuits, energy, force, torque and theory of transformation of three phase variables to two phase variables*
2. *To analyze the steady state and dynamic state operation of DC machine through mathematical modeling and simulation in digital computer.*
3. *To analyze the steady state and dynamic state operation of three-phase induction machines and three-phase synchronous machines using transformation theory based mathematical modeling and digital computer simulation.*
4. *To analyze the linearization of Induction and synchronous machines*

Course Outcomes

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

1. *Develop models for linear and nonlinear magnetic circuits*
2. *Determine the developed torque in an electrical machine using the concepts of field Energy and co-energy and determine the dynamic model of a DC machine*
3. *Determine the dynamic model of an induction machine, instantaneous torque developed in an induction Machine, study control strategies such as vector control and direct torque control*
4. *Determine the torque developed in a salient pole synchronous machine using the Park's transformation and identify contribution of saliency torque- damping and excitation torque*
5. *Obtain Linearized equations for Induction and synchronous machines*

Syllabus Contents

UNIT I
Basic Principles for Electric Machine Analysis: Magnetically coupled circuits, Electromechanical energy conversion, Basic Two pole DC Machine – primitive 2 axis machine – Voltage and Current relationship – Torque equation.

Theory of DC Machines: Mathematical model of separately excited DC Motor, DC Series Motor, DC shunt motor and D.C. Compound Motor in state variable form – Transfer function of the motor.

UNIT II
Reference Frame Theory: Equations of transformation - Change of variables, Stationary circuit variables Transformed to the Arbitrary Reference Frame, commonly used reference frames, Transformation between reference frames, Transformation of a balanced set, Balanced steady state phasor Relationships, Balanced steady state equations, Variables observed from various frames.

UNIT III
Theory of Symmetrical Induction Machines: Voltage and torque equations in machine variables, Equations of transformation for Rotor circuits, Voltage and torque equations in arbitrary reference frame variables, Analysis of steady state operation- state-space model of induction machine in 'd-q' variables, Free Acceleration Characteristics, Dynamic Performance-during sudden changes in load- during a 3 phase fault at the machine terminals.

UNIT IV
Theory of Synchronous Machines: Voltage and Torque equations in machine variables, Stator Voltage equations in Arbitrary Reference Frame Variables, Voltage Equations in Rotor Reference Frame Variables: park's Equations, Torque Equations in Substitute Variables, Analysis of steady state operation, Dynamic performance - During sudden changes in Input Torque - During a 3 phase fault at the machine terminals.

UNIT V
Linearized Machine Equations: Introduction, Machine equations to be linearized Induction machine, Synchronous machine. Linearized machine equations-Induction machines, Synchronous machines. Small-displacement stability-Eigen values, Eigen values of typical Induction machines and synchronous machines.

References

1. Paul C. Krause, Oleg Wasynczuk, Scott D.Sudhoff, "*Analysis of Electric Machinery and drive systems*" John Wiley and Sons, 2 Edition, 2006
2. C.V. Jones, *"Unified Theory of Electrical Machines"* Butterworths Publishers.
3. P.S. Bhimbra, "*Generalized Theory of Electrical Machines"*, Khanna publishers, 2002.
4. J. Meisel, "*Principles of Electromechanical Energy Conversion" McGraw Hill,1966.*

EE402

SPECIAL ELECTRICAL MACHINES
(Program Elective – IDC & PES)

Instruction	*:*	*3 hours per week*
CIE	*:*	*30 Marks*
SEE	*:*	*70 Marks*
Duration of SEE	*:*	*3 Hours*
Credits	*:*	*03*

Course Objectives

1. *To understand the concepts and control strategies of permanent magnet synchronous motors and Brushless DC motors.*
2. *To study the operating principles and control methods of switched reluctance motors.*
3. *To introduce the concepts and control of different types of stepper motors and its applications.*
4. *To analyze the working of linear induction and linear synchronous machines*

Course Outcomes

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

1. *Optimally design magnetics required in special machines-based drive systems.*
2. *Develop new control strategies open and closed loop control for different types of special machines.*
3. *Design and conduct experiments towards research and to solve practical problems*
4. *Develop and analysis of the controllers for special electrical machine.*
5. *Analyze and Design Power converters and control techniques for control of special machines.*

Syllabus Contents

UNIT I
Stepper Motors: Constructional features, Principle of operation, Variable Reluctance (VR) stepping motor-Single Stack, Multi-Stack, Permanent Magnet Step motor, Hybrid Step Motor, Torque Equation Open Loop Drive, Open loop and closed loop control of Step Motor, Applications.

UNIT II
Switched Reluctance Motors: Constructional features, Principle of Operation, Torque equation, Torque-speed characteristics, Power Converter for SR Motor-Asymmetrical converter, DC Split converter, Control of SRM, Rotor Position sensors, Current Controllers, Applications.

UNIT III
Permanent Magnet Synchronous Motor: Permanent magnets and their characteristics, Machine Configurations-SPM, SIPM, IPM and Interior PM with circumferential, Sensorless control, Applications.

UNIT IV

Brushless DC Motor: Construction, Principle of Drive operation with inverter, Torque speed Characteristics, Closed loop control, Sensorless control, Applications.

UNIT V

Linear Induction Motors and Linear Synchronous Motors: Linear induction motor, Construction details, LIM Equivalent Circuit, Steps in design of LIM, Linear Synchronous Motor: Principle and Types of LSM, LSM Control, Applications.

References

1. R.Krishnan*, Electric Motor Drives*, Pearson , 2007
2. B.K.Bose, *Modern Power Electronics and AC Drives*, PHI, 2005
3. Venkataratnam, *Special electrical Machines*, University Press, 2008
4. E.G.Janardanan, *Special Electrical Machines*, PHI, 2014
5. T.J.E.Miller, *Brushless Permanent Magnet and Reluctance Motor Drive*, Clarendon Press, Oxford, 1989

EE403

DIGITAL CONTROL OF POWER ELECTRONICS

(Program Elective – IDC & PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To understand the concept of architecture and peripheral modules of microcontroller, digital signal processors and field programmable gate arrays*
2. *To prepare the students for acquiring the knowledge of Implementing digital processor-based control systems for power electronics*
3. *To know the use of microcontrollers for pulse generation in power converters*
4. *To know the use of field programmable gate arrays for pulse generation in power converters*

Course Outcomes

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

1. *Acquire knowledge in CPU details, addressing modes, interrupt structure, hardware multiplier*
2. *Implement numerical integration methods using digital processor-based control systems.*
3. *Design interfacing applications based on internal peripheral units of PIC microcontrollers and programming them using MPLAB and PICSTART plus*
4. *Write programs using DSP and FPGA boards*
5. *Implement DSP-based electromechanical motion control*

Syllabus Contents

UNIT I
Review of microcontrollers, digital signal processors, architecture and Field Programmable Gate Arrays, Data Representation Integers, Fixed and Floating-point numbers, and Characters. PIC Microcontrollers: Overview of PIC family, PIC Architecture, PIC Assembly Language Programming, RISC Architecture in PIC, Introduction to MPLAB IDE and PICSTART plus – Device Programming using MPLAB and PICSTART plus – generation of firing / gating pulses for typical power converters.

UNIT II
Introduction to the C2xx DSP core and code generation, The components of the C2xx DSP core, Mapping external devices to the C2xx core , peripherals and Peripheral Interface, System configuration registers , Memory , Types of Physical Memory , memory Addressing Modes , Assembly Programming using C2xx DSP, Instruction Set, Software Tools. Pin Multiplexing (MUX) and General Purpose I/O Overview, Multiplexing and General Purpose I/O Control Registers.

UNIT III

Enhanced Pulse Width Modulator (ePWM) Module-Time-Base (TB) Submodule, Counter-Compare (CC) Submodule, Action-Qualifier (AQ) Submodule, Dead-Band Generator (DB) Submodule, PWM-Chopper (PC) Submodule, Trip-Zone (TZ) Submodule, Event-Trigger (ET) Submodule, Applications to Power Topologies- Overview of Multiple Modules, Key Configuration Capabilities, Controlling Multiple Buck Converters With Independent Frequencies, Controlling Multiple Buck Converters With Same Frequencies, Controlling Multiple Half H-Bridge (HHB) Converters ,Controlling Dual 3-Phase Inverters for Motors (ACI and PMSM), Practical Applications Using Phase Control Between PWM Modules, Controlling a 3-Phase Interleaved DC/DC Converter, Controlling Zero Voltage Switched Full Bridge (ZVSFB) Converter.

UNIT IV

Analog-to-Digital Converter (ADC)- ADC Overview, Operation of the ADC, Auto conversion Sequencer Principle of Operation-Sequential Sampling Mode, Simultaneous Sampling Mode, Uninterrupted Autosequenced Mode, ADC Clock Prescaler, ADC Registers.

UNIT V

Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA, Xilinx XC3000 series, Configurable logic Blocks (CLB), Input/Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series – HDL programming – overview of Spartan 3E and Virtex II pro FPGA boards- case study.

References
1. PIC16F87X Datasheet 28/40 – pin 8 bit CMOS flash Microcontrollers, Microchip technology Inc., 2001. and MPLAB IDE Quick start guide, Microchip technology Inc., 2007.
2. John B. Peatman, 'Design with PIC Microcontrollers', Prentice Hall, 2003.
3. MykePredko, 'Programming and customizing the PIC Microcontroller' Tata McGraw-Hill, 3rd Edition, 2008.
4. Hamid.A.Toliyat and Steven G.Campbell " DSP Based Electro Mechanical Motion Control " CRC Press New York , 2004
5. XC 3000 series datasheets (version 3.1). Xilinx,Inc.,USA, 1998
6. XC 4000 series datasheets (version 1.6). Xilinx,Inc.,USA, 1999
7. Wayne Wolf," FPGA based system design ", Prentice hall, 2004

EE404

NEURAL NETWORKS AND FUZZY LOGIC
(Program Elective – IDC & PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To introduce the Neural & fuzzy intelligence*
2. *To study the different models in ANN and their applications*
3. *To familiarize different learning concepts and algorithms of Neural Networks*
4. *To familiarize the fundamentals of Fuzzy Logic required to apply Fuzzy Logic in control, pattern recognition and Planning and Diagnosis.*
5. *To give exposure to Neural Network and Fuzzy Logic applications in Electrical Engineering.*

Course Outcomes

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

1. Explain the basic concepts in Fuzzy and Neural intelligence.
2. *Understand the different Neural network models*
3. *Understand different learning methods and algorithms of Neural Networks.*
4. *Apply the fuzzy concepts in the areas of control, pattern recognition and Planning and Diagnosis*
5. *Apply the knowledge Neural Networks and Fuzzy Logic to different power systems problems.*

Syllabus Contents

UNIT I
Neural and Fuzzy Intelligence: Fuzziness as multi-valence - Bivalent paradoxes as fuzzy midpoints, Sets as points in cubes - Subset hood and probability, The dynamical system approach to machine intelligence, Brain as a dynamical system – Neural networks as trainable dynamical system, Intelligent behavior as adaptive model free estimation, Generalization and creativity - Learning as change-Rules vs. principles - Symbolic vs. numeric processing, Structured numerical estimators

UNIT II
Neural Network Theory: Neurons as functions - Signal monotonicity Biological activities and signals, Neuron fields - Neuronal dynamic systems - Common signal, functions - Pulse coded signal functions, Additional neuron dynamics – Additive neural feedback - Additive activation models Bivalent BAM theorem, Hopfield model

UNIT III

Synaptic Dynamics: Unsupervised learning - Learning laws, Signal Hebbian learning- Competitive learning, Differential Hebbian learning - Supervised learning, The perceptrons – LMS algorithm, Back propagation algorithm - AVQ algorithm, Global stability of feedback neural networks.

UNIT IV

Fuzzy Logic: Fuzzy sets and systems-Geometry of fuzzy sets, Fuzzy entropy theorem-Entropy subset - Hood theorem, Fuzzy& neural function estimators-FAM system Architecture, Uncertainty and estimation - Types of uncertainty – Measure of fuzziness - Classical measures of uncertainty, Measures of dissonance - Confusion
and non-specificity. Fuzzy logic structure, Knowledge base defuzzification, Fuzzy logic in control-Pattern recognition–Planning diagnosis

UNIT V

Fuzzy Logic and ANN Applications: Fuzzy logic application to Induction motor speed control, Flux programming efficiency improvement of induction motor drive, pulsating torque compensation. Neural Network applied to Space Vector PWM, Vector controlled drive feedback signal estimation, model identification and adaptive drive control. Neuro-Fuzzy systems, ANN based Fuzzy inference system (ANFIS)

References

1. Bart Kusko, *Neural Networks and Fuzzy System* - Prentice Hall of India, 1994.
2. B. Yegnanarayana, *Artificial Neural Networks*, PHI Learning 1994.
3. B.K. Bose, Modern Power electronics and AC drives, Prentice Hall PTR, 2002.
4. Timothy J. Ross, *Fuzzy Logic with Engineering Applications*, Wiley.

EE405

POWER ELECTRONIC CONVERTERS FOR RENEWABLE ENERGY
(Program Elective – IDC)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To learn the types of renewable sources such as Wind, solar, hydro and geothermal sources.*
2. *To understand the principle and operation of various DC-DC converters.*
3. *To understand the concepts of grid connected inverters and grid connected issues.*
4. *To understand the principle of operation of doubly fed induction generator with rotor side converter topologies.*

Course Outcomes

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

1. *Understand P-V & I-V characteristics of solar PV and different MPPT Techniques.*
2. *Understands the maximum power point tracking for different Converters.*
3. *Analyze the grid connection issues and different types of transformer less topologies.*
4. *Understand the P-V and I-V characteristics and power extraction of wind energy systems.*
5. *Analyze the different types of wind generators for wind power applications.*

Syllabus Contents

UNIT I
Introduction to renewable sources: world energy scenario, Wind, solar, hydro, geothermal, availability and power extraction. Introduction to solar energy: Photovoltaic effect, basics of power generation, P-V &IV characteristics, effect of insolation, temperature, diurnal variation, shading, Modules, connections, ratings, Power extraction (MPP) tracking and MPPT schemes; standalone systems, grid interface, storage, AC-DC loads.

UNIT II
DC-DC converters for solar PV: buck/boost/buck-boost /flyback /forward/cuk, bidirectional converters, Interleaved and multi-input converters.

UNIT III
Grid connected Inverters: 1ph, 3ph inverters with & without transformers, Heric, H6, Multilevel Neutral point clamp, Modular multilevel, CSI; Control schemes: unipolar, bipolar, PLL and synchronization, power balancing / bypass, Parallel power processing; Grid connection issues: leakage current, Islanding, harmonics, active/reactive power feeding, unbalance.

UNIT IV

Introduction to wind energy: P-V, I-V characteristic, wind power system: turbine generator-inverter, mechanical control, ratings; Power extraction (MPP) and MPPT schemes. Generators for wind: DC generator with DC to AC converters; Induction generator with & w/o converter.

UNIT V

Synchronous generator with back-to-back controlled/ uncontrolled converter; Doubly fed induction generator with rotor side converter topologies; permanent magnet-based generators. Battery: Types, charging discharging. Introduction to AC and DC micro grids.

References

1. SudiptaChakraborty, Marcelo G. Simes, and William E. Kramer. Power Electronics for Renewable and Distributed Energy Systems: A Sourcebook of Topologies, Control and Integration. Springer Science & Business, 2013.
2. Nicola Femia, Giovanni Petrone, Giovanni Spagnuolo, Massimo Vitelli, Power Electronics and control for maximum Energy Harvesting in Photovoltaic Systems,CRC Press,2013.
3. Chetan Singh Solanki, Solar Photovoltaics: fundamentals, Technologies and Applications, Prentice Hall of India, 2011.
4. N. Mohan, T.M. Undeland& W.P. Robbins, Power Electronics: Converter, Applications & Design, John Wiley & Sons, 1989
5. Muhammad H. Rashid, Power Electronics: Circuits, Devices, and Applications, Pearson Education India, 2004
6. E. Guba, P. Sanchis, A. Ursa, J. Lpez, and L. Marroyo, Ground currents in single-phase transformer less photovoltaic systems, Progress in Photovoltaics: Research and Applications, vol. 15, no. 7, 2007.
7. Remus Teodorescu, Marco Liserre, Pedro Rodriguez, Grid Converters for Photovoltaic and Wind Power Systems, John Wiley and Sons, Ltd., 2011.
8. Ali Keyhani, Design of Smart Power Grid Renewable Energy Systems, Wiley IEEE Press,2011.

EE406

POWER QUALITY ENGINEERING
(Program Elective – PS & PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *The importance of power quality, different power quality issues and their effects in power system network.*
2. *Different Methods of calculating the voltage sag magnitude and duration*
3. *Understand the types of sags and characterize the voltage sags experienced by machines*
4. *Know harmonics, locate sources of harmonics and mitigate harmonics*
5. *Fundamental understanding of measuring equipment and assessment of PQ measuring data*

Course Outcomes

After the 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*

Syllabus Contents

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 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 Consideration in Industrial Power Systems: Adjustable speed drive (ASD) systems and applications — Sources of power system harmonics — Mitigation of harmonics — 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

References

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

EE407

STATIC CONTROL OF ELECTRIC DRIVES
(Program Elective – PES)

Instruction	*:*	*3 hours per week*
CIE	*:*	*30 Marks*
SEE	*:*	*70 Marks*
Duration of SEE	*:*	*3 Hours*
Credits	*:*	*03*

Course Objectives

1. *To understand the operation and performance characteristics of various converters such as Semi Converters, Full converters, Dual converters and choppers for control of separately exited and self-excited DC Motors.*
2. *To understand the control of Induction motor drives using scalar control, Vector control and Direct torque control.*
3. *To understand the control of special machines such as BLDC, PMSM, Stepper motor and SRM*

Course Outcomes

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

1. *Identify and Analyze semi converters, full converters, Choppers and Dual converter fed DC Motors to achieve efficient performance for various application.*
2. *Analyze and Design scalar control methods for speed control of induction motor.*
3. *Analyze and Design Vector control methods for speed control of induction motor.*
4. *Analyze and Design Sensor less vector control methods and DTC for speed control of induction motor.*
5. *Analyze and Design Power converters and control techniques for control of special machines.*

Syllabus Contents

UNIT I
DC Motor Control: Operation of Single phase and Three phase Full converter and Semi converter fed dc motors, Speed torque characteristics, Performance characteristics, Dual converter drives, Analysis of four quadrant chopper fed dc drive, Dynamic& Regenerative braking, Closed loop control of phase control and chopper dc drive.

UNIT II
Scalar Control: Stator voltage control, Static rotor resistance control, Slip power recovery schemes, Closed loop control, VSI & CSI fed Induction motor drives, Analysis of stepped and PWM waveform, Harmonic equivalent circuit and motor performance.

UNIT III
Vector Control: DC drive analogy, Equivalent circuit and Principle of Vector control, Direct vector control – Flux & Torque processor using Terminal voltages and Induced emf, Indirect vector control – Flow chart and Implementation.

UNIT IV
Principle of Sensor less vector control: Principle of Space vector Pulse width modulation& control, Direct torque and Flux control - Torque expression with Stator and Rotor fluxes - Control strategy of DTC.

UNIT V
Brushless D.C Motor: Unipolar and Bipolar Brushless D.C motors, Applications, Stepper Motors — Variable reluctance and Permanent magnet stepper motors —Characteristics& Drive circuits, Switched reluctance motor.

References

1. R.Krishnan, *Electric Motor Drives*, Prentice Hall of India Pvt. Ltd., New Delhi,2002.
2. G.K.Dubey, *Fundamentals of Electrical Drives*, Narosa Publishing House, NewDelhi, 1999.
3. W.Shepard, L.N.Hulley and D.T.W.Liang, *Power Electronics and Motor Control*,Cambridge University Press, 1995.
4. B.K.Bose, *Modern Power Electronics and A.C. Drives,* Prentice Hall, 2002.

EE430

POWER ELECTRONIC APPLICATIONS TO POWER SYSTEMS
(Program Elective – Common to PS, IDC & PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To understand the issues involved in existing Power Transmission system*
2. *To be familiar with the Techniques to overcome the problems associated with AC Power Transmission system*
3. *To Understand the control of active and reactive power control using Power electronic converters*

Course Outcomes

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

1. *Know the application of FACTS devices in Power Transmission system.*
2. *Study and apply the power transmission schemes – HVDC Transmission*
3. *Implement the control circuits based on the Controlling parameters of HVDC system*
4. *Select appropriate FACTS controllers depending on application.*
5. *Understand various types of HVDC systems and their advantages.*

Syllabus Contents

UNIT I
*Facts concepts***:** Reactive power control in electrical power transmission, principles of conventional reactive power compensators. Introduction to FACTS, flow of power in AC parallel paths, meshed systems, basic types of FACTS controllers, definitions of FACTS controllers, brief description of FACTS controllers.

UNIT II
Static shunt and series compensators: Shunt compensation - objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators - SVC, STATCOM, SVC and STATCOM comparison. Series compensation - objectives of series compensation, thyristor switched series capacitors (TCSC), static series synchronous compensator (SSSC), power angle characteristics, and basic operating control schemes.

UNIT III
Combined compensators: Unified power flow controller (UPFC) - Introduction, operating principle, independent real and reactive power flow controller and control structure. Interline power flow controller (IPFC), Introduction to Active power filtering, Concepts relating to Reactive power compensation and harmonic current compensation using Active power filters.

UNIT IV

HVDC transmission: HVDC Transmission system: Introduction, comparison of AC and DC systems, applications of DC transmission, types of DC links, Layout of HVDC Converter station and various equipment. HVDC Converters, analysis of bridge converters with and without overlap, inverter operation, equivalent circuit
representation of rectifier and inverter configurations

UNIT V

Control of HVDC system: Principles of control, desired features of control, converter control characteristics, power reversal, Ignition angle control, current and extinction angle control. Harmonics-introduction, generation, ac filters and dc filters. Introduction to multiterminal DC systems and applications, comparison of series and parallel MTDC systems.

References

1. Song, Y.H. and Allan T. Johns, 'Flexible AC Transmission Systems (FACTS)', Institution of Electrical Engineers Press, London, 1999.
2. Hingorani, L. Gyugyi, 'Concepts and Technology of Flexible AC Transmission System', IEEE Press New York, 2000 ISBN –078033 4588.
3. Padiyar, K.R., 'HVDC transmission systems', Wiley Eastern Ltd., 2010.
4. Mohan Mathur R. and Rajiv K. Varma , 'Thyristor - based FACTS controllers for Electrical transmission systems', IEEE press, Wiley Inter science , 2002.
5. Padiyar K.R., 'FACTS controllers for Transmission and Distribution systems' New Age International Publishers, 1st Edition, 2007.
6. Enrique Acha, Claudio R. Fuerte-Esqivel, Hugo Ambriz-Perez, Cesar Angeles Camacho 'FACTS –Modeling and simulation in Power Networks' John Wiley & Sons, 2002.

EE431

RENEWABLE ENERGY SOURCES

(Program Elective – Common to PS, IDC & PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To understand the concepts and Importance of renewable energy sources such as solar, wind, biomass, tidal power.*
2. *To make the students understand the advantages and disadvantages of different renewable energy sources*
3. *To be familiar with the technologies used to generate electrical energy, storage and applications*

Course Outcomes

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

1. *Understand the basic principle of operations of renewable energy sources.*
2. *Understand the applications of renewable energy sources.*
3. *Understand the technology processes of renewable energy sources.*
4. *Understand the technology processes of renewable energy sources*
5. *Study of the applications of renewable energy sources*

Syllabus Contents

UNIT I
Review of Conventional and Non-Conventional energy sources - Need for nonconventional energy sources Types of Non- conventional energy sources – Fuel Cells - Principle of operation with special reference to H2 °2 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 gasifiers.

References

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.

EE432
ELECTRIC AND HYBRID ELECTRICAL VEHICLES
(Program Elective – Common to PS, IDC & PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To understand the basics of electric and hybrid electric vehicles and their working*
2. *To understand the basics of batteries and their role for electric/hybrid vehicle applications*
3. *To obtain the knowledge of various types of electric/hybrid vehicles*
4. *To understand the real time challenges in the implementation of this technology*

Course outcomes

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

1. *Understand basics of electric and hybrid electric vehicles both conceptually and mathematically so that clear understanding from basics physics is achieved.*
2. *Have the knowledge of battery behavior for electric vehicle application.*
3. *Understand different types of Electric/Hybrid vehicles technologies available and their applications.*
4. *Analyze challenges in implementing electric/hybrid vehicle technology by looking into various charging topologies and their impact on distribution systems.*
5. *Analyze various electric drives suitable for hybrid electric vehicles.*

Syllabus Contents

UNIT I
Introduction to Electric Vehicles: Sustainable Transportation - EV System – EV - Advantages - Vehicle Mechanics - Performance of EVs - Electric Vehicle drivetrain - EV Transmission Configurations and components-Tractive Effort in Normal Driving - Energy Consumption - EV Market - Types of Electric Vehicle in Use Today – Electric Vehicles for the Future.

UNIT II
Electric Vehicle Modelling - Consideration of Rolling Resistance – Transmission Efficiency - Consideration of Vehicle Mass - Tractive Effort - Modelling Vehicle Acceleration - Modelling Electric Vehicle Range -Aerodynamic Considerations - Ideal Gearbox Steady State Model - EV Motor Sizing - General Issues in Design.

UNIT III
Introduction to electric vehicle batteries - electric vehicle battery efficiency – electric vehicle battery capacity - electric vehicle battery charging - electric vehicle battery fast charging - electric vehicle battery discharging - electric vehicle battery performance – testing.

UNIT IV
Hybrid Electric Vehicles - HEV Fundamentals -Architectures of HEVs- Interdisciplinary Nature of HEVs - State of the Art of HEVs - Advantages and Disadvantages - Challenges and Key Technology of HEVs - Concept of Hybridization of the Automobile-Plug-in Hybrid Electric Vehicles - Design and Control Principles of Plug-In Hybrid Electric Vehicles - Fuel Cell Hybrid Electric Drive Train Design - HEV Applications for Military Vehicles.

UNIT V
Advanced topics - Battery Charger Topologies, Charging Power Levels, and Infrastructure for Plug-In Electric and Hybrid Vehicles - The Impact of Plug-in Hybrid Electric Vehicles on Distribution Networks –   Sizing Ultra capacitors for Hybrid Electric Vehicles.

References
1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles –Fundamentals, Theory and Design –   Mehrdad Ehsani, Uimin Gao and Ali Emadi - Second Edition - CRC Press, 2010.
2. Electric Vehicle Technology Explained - James Larminie, John Lowry – John Wiley & Sons Ltd, - 2003.
3. Electric Vehicle Battery Systems – Sandeep Dhameja – Newnes - 2002.
4. Hybrid electric Vehicles Principles and applications with practical perspectives Chris Mi, Dearborn - M. Abul Masrur, David Wenzhong Gao - A John Wiley & Sons, Ltd., - 2011.
5. Electric & Hybrid Vehicles – Design Fundamentals-Iqbal Hussain, Second Edition, CRC Press, 2011.
6. Research Papers:
a. The Impact of Plug-in Hybrid Electric Vehicles on Distribution Networks: a Review and Outlook - Robert C. Green II, Lingfeng Wang and Mansoor Alam - 2010 IEEE.
b. Sizing Ultracapacitors For Hybrid Electric Vehicles - H. Douglas P Pillay 2005 IEEE.
c. Review of Battery Charger Topologies, Charging Power Levels, and Infrastructure for Plug-In Electric and Hybrid Vehicles - Murat Yilmaz, and Philip T. Krein, - IEEE transactions on power electronics, vol. 28, no. 5, may 2013.

EE433

MODERN CONTROL THEORY

(Program Elective – Common to PS, IDC & PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To provide the fundamentals required to model a control system in state space and check its controllability and observability.*
2. *To educate the students about non-linear systems behavior and the methods to determine their stability.*
3. *To make then students thorough with Liapunov stability analysis.*
4. *To familiarize the students with the concept of optimal control and how to determine optimum for functional using calculus of variations.*
5. *To introduce the concept of Adaptive control and explain how to design a Model Reference Adaptive System.*

Course Outcomes

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

1. *Model any control system in state space.*
2. *Understand the behavior of nonlinear system and methods of determining stability.*
3. *Determine stability of nonlinear system using Liapunov method.*
4. *Formulate optimal control problem and determine optimum of functionals.*
5. *Understand and design adaptive control problem.*

Syllabus Contents

UNIT I
Review of state variable representation of systems - Controllability and Observability – Model control of single input – single output systems (SISO), Controllable and Observable companion forms – Effect of state feedback on Controllability and Observability, Pole placement by state feedback.

UNIT II
Classification of Non-linearities: Phenomenon exhibited by the nonlinearities – Limit cycles – Jump resonance, Sub-harmonic oscillations – Phase plane analysis – Singular points – Construction of phase plane trajectories – Isocline method – Delta method – Measurement of time on phase plane trajectories.

UNIT III
Concept and definition of stability - Lyapunov stability - Lyapunov's first and second methods - Stability of linear time invariant systems by Lyapunov's second method - Generation of Lyapunov functions- Variable gradient method -   Krasooviski's method.

UNIT IV
Formulation of optimal control problems - Calculus of variations – Fundamental concepts –Functionals – Variation of functionals – Fundamental theorem of calculus of variations - Boundary conditions – Constrained minimization – Dynamic programming – Hamilton Principle of optimality, Jacobi Bellman equation – Potryagins minimum principle.

UNIT V
 Introduction to adaptive control, types of adaptive control systems. Design of model reference adaptive control systems using M/T rule and Lyapunov stability theorem.

References

1. I.J Nagarath ,M.Gopal *Control Systems Engineering,* fifth edition *,* New Age International Publishers, 1984 Wiley Eastern Ltd.
2. Ogata K, *Modern Control Engineering,* Prentice Hall, 1997. Donald E Kirk, optimal control thery An introduction
3. Karl J Astrom Bjronwihenmark, *Adaptive control* second edition – Pearson education.

EE434

RELIABILITY ENGINEERING
(Program Elective – Common to PS, IDC & PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To comprehend the basics of probability distributions & reliability models.*
2. *To model systems with series-parallel block diagrams and state-space diagrams and to understand time dependent and limiting state probabilities using Markov models.*
3. *To understand multi-mode failures of electrical & electronic circuits and their effect on reliability & availability.*
4. *To understand reliability & availability models for generation, transmission and distribution systems and evaluate critical indices.*

Course Outcomes

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

1. *Able to relate the probability concepts and distributions in reliability engineering studies*
2. *Able to draw reliability logic diagram and state-space diagram of engineering systems to evaluate reliability and availability*
3. *Apply multi-mode failures in electrical and electronic circuits*
4. *Model generation and transmission systems for reliability studies.*
5. *Evaluate various reliability indices related to generation, transmission and distribution systems*

Syllabus Contents

Unit I
Discrete & Continuous random variables – Binomial, Exponential &Weibull distributions – Causes of failure – Failure rate & Failure density – Bath tub curve – Reliability & MTTF – Maintainability & Availability – MTBF & MTTR – Reliability block diagram – Series & Parallel systems – Conditional probability - Minimal Cutset
& Tie-set methods

Unit II
Continuous Markov models – State space diagram - Reliability models of single unit, two unit & standby systems – Reliability & Availability models with repair – Frequency of failures – State transition matrix and estimation of MTTF

Unit III

Multi-mode failures - Short circuit & open circuit failures - Resistors & capacitors in series & parallel - Diodes & MOSFETs in series & parallel - Quad system - Reliability Prediction - MIL standards - Parts count technique - Parts stress technique - Reliability, Availability and MTTF evaluation of Power electronic circuits & Drive Systems

Unit IV

Outage definitions – Markov model of Generating plant with identical and nonidentical units – Capacity Outage probability table – Cumulative frequency – LOLE & LOEE – Composite Generation & Transmission systems - Radial configuration – Conditional probability approach

Unit V

Customer oriented, load oriented & energy oriented indices of distribution system – Application to radial systems – Effects of lateral distributer protection, disconnects, protection failures & transferring loads – Parallel & Mesh networks – Dual transformer feeder – Approximate, Network reduction & FMEA methods

References

1. Roy Billinton, R.N. Allan, 'Reliability Evaluation of Engineering Systems', Springer International Edition, Plenum Press, New York, 1992
2. E. Balaguruswamy, 'Reliability Engineering', Tata McGraw Hill Education Pvt. Ltd., 2012
3. Charles E. Ebeling, 'An Introduction to Reliability and Maintainability Engineering', McGraw Hill International Edition, 1997
4. L. Umanand, 'Power Electronics: Essentials & Applications', Wiley, 2009
5. Roy Billinton, R.N. Allan, 'Reliability Evaluation of Power Systems', Springer, 1st Edition, Plenum Press, New York , 1996.

EE435

OPTIMIZATION METHODS

(Program Elective – Common to PS, IDC & PES)

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

Course Objectives

1. *To understand the concepts of single variable and multivariable optimization with and without constraints*
2. *To make the students understand about linear and nonlinear optimization problems.*
3. *To make the students understand about Evolutionary computational techniques*

Course Outcomes

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

1. *Formulate practical problems to mathematical models.*
2. *Solve single, multivariable methods with and without constraints.*
3. *Solve linear and nonlinear optimization problems*
4. *Solve evolutionary computations*
5. *Understand the Advanced topics in optimization and their applications*

Syllabus Contents

UNIT I
Classical Optimization techniques*:* Introduction to optimization and design optimization, optimum design problem formulation, Single variable optimization- Multivariable optimization with and without constraints – Multi variable optimization with inequality constraints – Solution by Lagrangian multipliers - Kuhn-Tucker conditions.

UNIT II
Linear Programming: Formulation and standard form of LP problem, Basic definitions and theorems – Solution of a system of linear simultaneous equations – simplex method and its algorithm – Revised simplex method – Big-M method – Duality in LP and primal dual relations – Dual simplex method.

UNIT III
Non-Linear Programming*:* One dimensional minimization methods – Introduction – Elimination methods – Unrestricted search, Exhaustive search, Dichotomous search, Fibonacci methods. Unconstrained optimization techniques- Univariate and Powell's pattern search method, steepest descent method.

UNIT IV

Evolutionary computations: Introduction – Genetic algorithms – Terminologies and operations of GA – Advanced operators and techniques in GA – Introduction to particle swarm optimization and Ant colony optimization.

UNIT V

Advanced topics in optimization: Fast Multi-swarm Optimization for Dynamic Optimization, Reliability-Based Optimization Using Evolutionary Algorithms, Ant Colony Optimization for Mixed-Variable Optimization Problems, Bacterial Foraging Global Optimization Algorithm.

References

1. Engineering Optimization, Theory and Practice - Singiresu S. Rao, S. S. Rao – Fourth edition – New Age Internationals – 2009.
2. Introduction to Optimum design, Jasbir S. Arora, - Third Edition – Elsevier – 2013.
3. Optimization methods for Engineers, N.V.S. Raju – PHI – 2014.
4. Introduction to Genetic Algorithms, S. N. Sivanandam, S.N Deepa – Spinger – 2013.
5. Reliability-Based Optimization Using Evolutionary Algorithms: IEEE transactions on evolutionary computation, vol. 13, no. 5, October 2009.
6. Ant Colony Optimization for Mixed-Variable Optimization Problems: IEEE Transactions on evolutionary computation, vol. 18, no. 4, august 2014.

EE436

ADVANCED MICROPROCESSORS

(Program Elective – Common to PS, IDC & PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To understand the interfacing circuits for various peripheral applications*
2. *To illustrate the architecture of processor of 8086*
3. *To introduce to the programming and interfacing techniques of 8086*
4. *Apply knowledge of soft skill and other resources to design automated system with programming module*
5. *To introduce the architecture of advanced data processor*

Course Outcomes

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

1. *Design interfacing circuits of various devices with the microprocessor*
2. *Outline the architecture of 8086 processor*
3. *Develop programming skills in assembly language.*
4. *Understand the impact of microprocessor-based system in process of automation.*
5. *Be familiar with the architecture and operation of processor*

Syllabus Contents

UNIT I
Review of Basic I/O Interfaces: Programmable Interval Timer 8253 – Programmable peripheral Interlace 8255 – Programmable Interrupt Controller 8259 Microprocessor 8085 applications.

UNIT II
8086 Architecture: CPU Architecture Machine language instructions – Instruction execution – Timing.

UNIT III
Assembler Language Programming: Incorporating Data Transfer –Branch Arithmetic - Loop -NOP and HLT - Flag manipulation, Logical Shift and Rotate Instructions – Directives and Operators.

UNIT IV

Modular Programming: Linking and Relocation – Stacks – Procedures – Interrupts and Interrupt Routines. Byte and String Manipulation: String instruction – REP Prefix –Text Editor – Table translation.

UNIT V

8087 Numeric Data Processor: NDP – Data types – Processor architecture –Instruction set.

References

1. Liu, Gibson, Microcomputer Systems The 8086/8088 Family, Prentice Hall India, 1986.
2. Ghosh, Sridhar, 0000-8085 introduction to Microprocessors, Prentice HallIndia, 1991.

EE437

PROGRAMMABLE LOGIC CONTROLLERS
(Program Elective – Common to PS, IDC & PES)

Instruction	***:***	***3 hours per week***
CIE	***:***	***30 Marks***
SEE	***:***	***70 Marks***
Duration of SEE	***:***	***3 Hours***
Credits	***:***	***03***

Course Objectives

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

Course Outcomes *After the 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.*

Syllabus Contents

UNIT I
PLC Basics: Definition and History of PLC - PLC advantages and disadvantages - Over all PLC Systems - CPUs and Programr 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 - The 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.

References

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

EE438

DIGITAL SIGNAL PROCESSING
(Program Elective – Common to PS, IDC & PES)

Instruction	*:*	*3 hours per week*
CIE	*:*	*30 Marks*
SEE	*:*	*70 Marks*
Duration of SEE	*:*	*3 Hours*
Credits	*:*	*03*

Course objectives

1. *To gain knowledge about discrete time signal and systems; their representation, operations and properties.*
2. *To understand the importance of frequency domain representation of discrete time signals and calculating DTFT, DFT and FFT.*
3. *To learn to represent discrete time signals and systems in Z-domain and finding solution of difference equations using z-transform.*
4. *To design IIR and FIR filters.*
5. *To familiarize with the digital signal processor TMS320C5X*

Course Outcomes

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

1. *Produce discrete time signals and analyze them and determine discrete time system output for the given discrete time input signals.*
2. *Determine frequency domain representation DTFT, DFT and FFT.*
3. *Use z-transforms effectively in the analysis and solutions of discrete time systems.*
4. *Design IIR and FIR filters.*
5. *Explain the architecture, memory and peripherals of Digital Signal Processor.*

Syllabus Contents

UNIT I
Introduction to Digital Signal Processing: Discrete time signals & sequences - Linear shift Invariant systems - Stability and causality- Linear constant coefficient difference equations - Frequency domain representation of discrete time signals and systems.

UNIT II
Discrete Fourier Series: Properties of Discrete Fourier Series - DFS representation of periodic sequences - Discrete Fourier Transforms- Properties of DFT – Linear convolution of sequences using DFT - Computation of DFT - Fast Fourier Transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms inverse FFT.

UNIT III
Applications of Z-Transforms: Solution of difference equations of digital filters - System function - Stability criterion - Frequency response of stable systems - Realization of digital filters - Direct, Canonic, Cascade & Parallel forms.

UNIT IV

IIR Digital Filters: Analog filter approximations - Butterworth and Chebyshev - Design of IIR Digital filters from analog filters - Bilinear transformation method - Step & Impulse invariance techniques - Spectral Transformations. FIR Digital Filters: Characteristics of FIR Digital Filters - Frequency response - Design of FIR filters using Window Techniques.

UNIT V

Introduction to digital signal processors: TMS320C5X architecture – CALU, ARAU, PLU, MMR, on chip memory, on chip peripherals, Digital signal processing applications.

References

1. Proakis & Manolakis, Digital Signal Processing Principles, P Pub. 1994.
2. Sahivahanam, Valtavaraj & Gnanapariya, Digital Sign Processing, TMGH Pub. 2001.
3. Oppenheim & Sehaffter, Digital Signal Processing, PHI Pub.
4. S.K. Mitra, Digital Signal Processing, TMH, 1996.

EE439

SMART GRID TECHNOLOGY

(Program Elective – Common to PS, IDC & PES)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To introduce the concept of smart grid, difference between conventional grid and smart grid*
2. *To introduce the main components of smart grid*
3. *To introduce microgrids and grid integration issues of renewable energy sources*
4. *To introduce the load frequency control concepts in microgrid*

Course Outcomes

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

1. *Understand advantages of smart grid system.*
2. *Know the key challenges for smart grid.*
3. *Understand the importance of D.C. sources, loads and D.C. grid.*
4. *Analyze the impact of electric vehicles on the grid and grid integration issues of renewable energy sources.*
5. *Understand the control methodologies in operation of smart power systems.*

Syllabus Contents

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. Components and Architecture of Smart Grid-Description.

UNIT II
DC Distribution and Smart Grid: AC Vs DC sources-Benefits of and drives of DC power delivery systems – Powering equipment and appliances with DC-Data centers and information technology loads equipment and appliances with DC-Data centers and information technology loads – Future neighbourhood- Potential future work and research.

UNIT III
Smart Grid Architecture, Smart Grid Communications and Measurement Technology: Communication and Measurement – Monitoring, Phasor Measurement Unit (PMU), Smart Meters, Wide area measurement System (WAMS).

UNIT IV
Renewable Energy and Storage: 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 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.

References

1. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 2013.
2. A.G. Phadke and J.S. Thorp, "Synchronized Phasor Measurements and their Application", Springer Edition, 2010.
3. Iqbal Hussein, "Electric and Hybrid Vehicle: Design fundamentals", CRC Press, 2003.
4. Gilbert M Masters, Renewable and Efficient Electric Power System, Wiley-IEEE Press, 2004.
5. Fereidoon P. Sioshansi, "Smart Grid: Integrating Renewable, Distributed & Efficient Energy", Academic Press, 2012.
6. Jean Claude Sabonnadiere, Nouredine Hadjsaid, "Smart Grids". Wiley-ISTE, IEEE Press, May 2012.

AC 031

ENGLISH FOR RESEARCH PAPER WRITING
(Audit course)

Instruction	*:*	*3 hours per week*
Duration of SEE	*:*	*3 Hours*
SEE	*:*	*70 Marks*
CIE	*:*	*30 Marks*
Credits	*:*	*00*

Course Objectives

1. *Understand that how to improve your writing skills and level of readability*
2. *Learn about what to write in each section*
3. *Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission*

Course Outcomes

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

1. *Plan and prepare paragraphs, avoiding ambiguity*
2. *Writing of abstracts, paraphrasing and plagiarism*
3. *Provide critical and thorough review of literature, discussions and conclusions*
4. *exhibit key skills for writing titles, introduction, abstract.*
5. *Able to show key and necessary skills for paper writing, phrases, results.*

Syllabus Contents

UNIT I
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

UNIT II
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.

UNIT III
Review of the Literature, Methods, Results, Discussion, Conclusions. The Final Check.

UNIT IV
Key skills needed when writing a Title, key skills needed when writing an Abstract, key skills needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT V

Skills needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills needed when writing the Conclusions. Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

References

1. Goldbort R, 'Writing for Science', Yale University Press (available on Google Books), 2006.
2. Day R, 'How to Write and Publish a Scientific Paper', Cambridge University Press, 2006.
3. Highman N, 'Handbook of Writing for the Mathematical Sciences', SIAM. Highman's book, 1998.
4. Adrian Wallwork, 'English for Writing Research Papers', Springer New York Dordrecht Heidelberg London, 2011.

AC 032

DISASTER MANAGEMENT
(Audit course)

Instruction	:	*3 hours per week*
Duration of SEE	:	*3 Hours*
SEE	:	*70 Marks*
CIE	:	*30 Marks*
Credits	:	*00*

Course Objectives

1. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
2. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
3. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.

Course Outcomes

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

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and Humanitarian response
2. Critically evaluate disaster risk reduction and humanitarian response policy and Practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in**.**

Syllabus Contents

UNIT I
Introduction: Disaster Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II
Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem.
Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT III

Disasters Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV

Disaster Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

References

1 R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal Book Company.

2 Sahni, Pardeep et al. (Eds.), "Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.

3 Goel S. L., "Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

AC 033

SANSKRIT FOR TECHNICAL KNOWLEDGE
(Audit course)

Instruction	:	*3 hours per week*
Duration of SEE	:	*3 Hours*
SEE	:	*70 Marks*
CIE	:	*30 Marks*
Credits	:	*00*

Course Objectives

1. *To get a working knowledge in illustrious Sanskrit, the scientific language in the world*
2. *To learn Sanskrit to improve brain functioning and enhancing the memory power*
3. *To learn Sanskrit to develop the logic in mathematics, science & other subjects*
4. *The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient Indian literature*

Course Outcomes

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

1. *Understand basic Sanskrit language*
2. *Understand ancient Sanskrit literature about science & technology*
3. *Develop logic in students, Sanskrit being a logical language*

Syllabus Contents

UNIT-I
• Alphabets in Sanskrit,
• Past/Present/Future Tense,
• Simple Sentences

UNIT-II
• Order
• Introduction of roots
• Technical information about Sanskrit Literature

UNIT-III
• Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

References:

1 "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2 "Teach Yourself Sanskrit" Prathama Deeksha - Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3 "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

AC 034

VALUE EDUCATION
(Audit course)

Instruction	*:*	*3 hours per week*
Duration of SEE	*:*	*3 Hours*
SEE	*:*	*70 Marks*
CIE	*:*	*30 Marks*
Credits	*:*	*00*

Course Objectives

1. *Understand the need and importance of Values for self-development and for National development.*
2. *Imbibe good human values and Morals*
3. *Cultivate individual and National character.*

Course Outcomes

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

1. *Gain necessary Knowledge for self-development*
2. *Learn the importance of Human values and their application in day-to-day professional life.*
3. *Develop overall personality.*

Syllabus Contents

UNIT I
- Values and self-development –Social values and individual attitudes.
- Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles.
- Value judgments

UNIT II
- Importance of cultivation of values.
- Sense of duty. Devotion, Self-reliance. Confidence, Concentration.
- Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism. Love for nature, Discipline.

UNIT III
- Personality and Behavior Development - Soul and Scientific attitude.
- Positive Thinking. Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.

- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.

UNIT IV
- Doing best for saving nature
- Character and Competence –Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality, Nonviolence, Humility, Role of Women.
- All religions and same message.
- Mind your Mind, Self-control.
- Honesty, Studying effectively

References

1   Chakroborty, S.K., *"Values & Ethics for organizations Theory and practice"*, Oxford University Press, New Delhi, 1998.

AC 035

STRESS MANAGEMENT BY YOGA
(Audit course)

Instruction	:	*3 hours per week*
Duration of SEE	:	*3 Hours*
SEE	:	*70 Marks*
CIE	:	*30 Marks*
Credits	:	*00*

Course Objectives

1. *Creating awareness about different types of stress and the role of yoga in the management of stress.*
2. *Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).*
3. *Prevention of stress related health problems by yoga practice.*

Course Outcomes

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

1. *Understand yoga and its benefits.*
2. *Enhance Physical strength and flexibility.*
3. *Learn to relax and focus.*
4. *Relieve physical and mental tension through asanas.*
5. *Improve work performance and efficiency.*

Syllabus Contents

UNIT I
Introduction: Definition of **Stress** – Types of stress: Acute and chronic - Stressors – Definition of **Yoga** from various sources – Types of yoga – Karma yoga, Gnana yoga, Bhakti yoga and Raja yoga – Concept of Bhagavad Geeta - Yoga versus exercise –Basics of Physiology and Psycholoy – Brain and its parts – CNS and PNS – HPA axis – Sympethetic and Para sympethetic nervous systems – Fight and Flight mechanism - Relationship between stress and yoga.

UNIT II
Ashtanga Yoga: Do`s and Don'ts in life: i) **Yam** - Ahinsa, satya, astheya, bramhacharya and aparigraha ii) **Niyam** - Shaucha, santosh, tapa, swadhyay, ishwarpranidhan -iii) **Asana** iv) **Pranayama** v) **Prathyahara** vi) **Dharana** vii) **Dhyana** viii) **Samadhi** – Illustrations of eight steps of Ashtanga yoga.

UNIT III
Asana and Stress: Definition of Asana from Pathanjali – Origin of various names of asanas - Various yoga poses and their benefits for mind & body – Sequence of performing asanas: Standing, sitting, lying down on stomach, lying down on back and inverted postures –

Activation of Annamayakosha – Effect on various chakras, systems and glands thereby controlling the stress levels through the practice of asanas.

UNIT IV
Pranayama and Stress: Definition of pranayama from Shankaracharya -   Regularization of breathing techniques and its effects - Types of pranayama – Heat generating and cold generating techniques – Pranayama versus chakras and systems – Breathing techniques versus seasons - Anger and breathing rate – Activation of pranamayakosha – Pranayama as the bridge between mind and body – Stress control through pranayama.

UNIT V
Dhyana and Stress: Distinction between Dhyana and Dharana– Preparation for Dhyana through prathyahara and dharana – Activation of Vignanamayakosha – Types of mind: conscious, superconscious and subconscious – Activation of manomayakosha through Dhyana – Silencing the mind thereby controlling the stress levels

References

1   '*Yogic Asanas for Group Tarining-Part-I*' : Janardan Swami YogabhyasiMandal, Nagpur

2   "*Rajayoga or Conquering the Internal Nature*" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

3   *"Light on Yoga"* by BKS Iyengar

4   "*The search for happiness and bliss*" by Swami Sarvapriyananda on you tube – https://youtu.be/xfywJTPkw7Y

5   "*Mastering the mind*" by SwaminiVimalananda on you tube - https://youtu.be/EXniWH9DMF8

AC 036

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

(Audit course)

Instruction	:	*3 hours per week*
Duration of SEE	:	*3 Hours*
SEE	:	*70 Marks*
CIE	:	*30 Marks*
Credits	:	*00*

Objectives
1. *To learn to achieve the highest goal happily*
2. *To become a person with stable mind, pleasing personality and determination*
3. *To awaken wisdom in students*

Outcomes

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

1. *Develop their personality and achieve their highest goal of life.*
2. *Lead the nation and mankind to peace and prosperity.*
3. *Practice emotional self-regulation.*
4. *Develop a positive approach to work and duties.*
5. *Develop a versatile personality.*

Syllabus Contents

UNIT I
- Neetisatakam-Holistic development of personality
- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT II

- Approach to day-to-day work and duties.
- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT III

- Statements of basic knowledge.
- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16, 17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:
- Chapter2-Verses 17, Chapter 3-Verses 36, 37, 42,

- Chapter 4-Verses 18, 38, 39
- Chapter18 – Verses 37, 38, 63

References

1   Swami Swarupananda Advaita Ashram "*Srimad Bhagavad Gita",* (Publication Department), Kolkata

2   P.Gopinath, *"Bhartrihari's Three Satakam (Niti-sringar-vairagya*)"*,* Rashtriya Sanskrit Sansthanam, New Delhi

AC 037

CONSTITUTION OF INDIA
(Audit course)

Instruction	*:*	*3 hours per week*
Duration of SEE	*:*	*3 Hours*
SEE	*:*	*70 Marks*
CIE	*:*	*30 Marks*
Credits	*:*	*00*

Course Objectives

1. *Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective*
2. *To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role*
3. *Entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*

Course Outcomes

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

1. *Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*
2. *Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*
3. *Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru*
4. *The eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*
5. *Discuss the passage of the Hindu Code Bill of 1956.*

Syllabus Contents

UNIT I
History of Making of the Indian Constitution:
- History
- Drafting Committee, (Composition & Working)

UNIT II
Philosophy of the Indian Constitution:
- Preamble
- Salient Features

UNIT III
Contours of Constitutional Rights & Duties:
- Fundamental Rights
- Right to Equality
- Right to Freedom

- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

UNIT IV

- Organs of Governance:
- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

UNIT V

- Local Administration:
- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative, CE of Municipal Corporation.
- Panchayati raj: Introduction, PRI: Zila Panchayat.
- Elected officials and their roles, CEO Zila Panchayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy

UNIT VI

- Election Commission:
- Election Commission: Role and Functioning.
- Chief Election Commissioner and Election Commissioners.
- State Election Commission: Role and Functioning.
- Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1 *"The Constitution of India",* 1950 (Bare Act), Government Publication.
2 Dr. S. N. Busi, *"Dr. B. R. Ambedkar framing of Indian Constitution",* 1st Edition, 2015.
3 M. P. Jain, "*Indian Constitution Law",* 7th Edn., Lexis Nexis, 2014.
4 D.D. Basu, *"Introduction to the Constitution of India",* Lexis Nexis, 2015.

AC 038

PEDAGOGY STUDIES
(Audit course)

Instruction	:	*3 hours per week*
Duration of SEE	:	*3 Hours*
SEE	:	*70 Marks*
CIE	:	*30 Marks*
Credits	:	*00*

Course Objectives

1. *To present the basic concepts of design and policies of pedagogy studies.*
2. *To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices and familiarize various theories of learning and their connection to teaching practice.*
3. *To create awareness about the practices followed by DFID, other agencies and other researchers and provide understanding of critical evidence gaps that guides the professional development*

Course Outcomes

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

1. *Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.*
2. *Examine the effectiveness of pedagogical practices.*
3. *Understand the concept, characteristics and types of educational research and perspectives of research.*
4. *Describe the role of classroom practices, curriculum and barriers to learning.*
5. *Understand Research gaps and learn the future directions.*

Syllabus Contents

UNIT I
Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions, Overview of methodology and Searching.

UNIT II
Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education

UNIT III
Evidence on the Effectiveness of Pedagogical Practices: Methodology for the in-depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective

pedagogical practices - Pedagogic theory and pedagogical approaches – Teachers attitudes and beliefs and pedagogic strategies.

UNIT IV
Professional Development: *A*lignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT V
Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment – Dissemination and research impact.

References

1   Ackers J, Hardman F, *"Classroom Interaction in Kenyan Primary Schools, Compare*", 31 (2): 245 – 261, 2001.
2   2. Agarwal M, *"Curricular Reform in Schools: The importance of evaluation*", Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.
3   Akyeampong K, "*Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)",* Country Report 1. London: DFID, 2003.
4   Akyeampong K, Lussier K, Pryor J, Westbrook J, *"Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?"* International Journal Educational Development, 33 (3): 272- 282, 2013.
5   Alexander R J, *"Culture and Pedagogy: International Comparisons in Primary Education",* Oxford and Boston: Blackwell, 2001.
6   Chavan M, Read India: *"A mass scale, rapid, learning to read campaign",* 2003
7   *www.pratham.org/images/resource%20working%20paper%202.pdf.*

OE941

BUSINESS ANALYTICS
(Open Elective)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To understand the role of business analytics within an organization.*
2. *To analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.*
3. *To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.*
4. *To become familiar with processes needed to develop, report, and analyze business data.*
5. *To use decision-making tools/Operations research techniques and manage business process using analytical and management tools.*

Course Outcomes

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

1. *Understand the basic concepts of business analytics.*
2. *Identify the application of business analytics and use tools to analyze business data.*
3. *Become familiar with various metrics, measures used in business analytics.*
4. *Illustrate various descriptive, predictive and prescriptive methods and techniques.*
5. *Model the business data using various business analytical methods and techniques.*

Syllabus Contents

Unit I
Introduction to Business Analytics: Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

Unit II
Descriptive Analytics: Introduction, data types and scales, types of measurement scales, population and samples, measures of central tendency, percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization

Unit III
Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil's coefficient

Unit IV

Decision Trees: CHAID, Classification and Regression tree, splitting criteria, Ensemble and method and random forest. **Clustering**: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, **Prescriptive Analytics** - Linear Programming (LP) and LP model building.

Unit V

Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process, cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox

References

1. U Dinesh Kumar, "Data Analytics", Wiley Publications, 1st Edition, 2017.
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications with SAS", Associate Publishers, 2015.
3. S. Christian Albright, Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", 5th Edition, Cengage, 2015.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview

2. https://nptel.ac.in/courses/110105089/

OE942

INDUSTRIAL SAFETY
(Open Elective)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To understand industrial safety and remember features of factory act 1948.*
2. *Analyze maintenance tools, corrosion preventive measures and fault causes.*
3. *Assess the importance of periodic inspections and maintenance.*

Course Outcomes

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

1. *Understand the necessity of industrial safety and remember features of factory act 1948 for health and safety.*
2. *Analyze the tools used for maintenance.*
3. *Become thorough of the corrosion preventive measures.*
4. *Analyze the causes of faults and draw decision trees.*
5. *Understand importance of periodic maintenance and inspection procedures.*

Syllabus Contents

Unit I
Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit II
Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit III
Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit IV

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

References
 1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
 2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
 3. Pump-hydraulic Compressors, Audels, Mcgraw Hill Publication.
 4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

OE943

OPERATIONS RESEARCH

(Open Elective)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *To understand the dynamic programming to solve problems of discrete and continuous variables*
2. *To apply the concept of non-linear programming and carry out sensitivity analysis*
3. *To understand deterministic and probabilistic inventory control models.*

Course Outcomes

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

1. *apply the dynamic programming to solve problems of discrete and continuous variables*
2. *apply the concept of non-linear programming*
3. *carry out sensitivity analysis*
4. *understand deterministic and probabilistic inventory control models.*
5. *model the real-world problem and simulate it.*

Syllabus Contents

Unit I
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit II
Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit III
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit IV
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit V
Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References
  1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
  2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
  3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
  4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
  5. Pannerselvam, Operations Research: Prentice Hall of India 2010
  6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

OE944
COST MANAGEMENT OF ENGINEERING PROJECTS
(Open Elective)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. *Introduce the concepts of cost management, inventory valuation, decision making*
2. *Fundamentals of cost overruns, project execution and technical activities*
3. *Introduce the concepts of Quantitative techniques for cost management, Linear Programming, PERT/CPM*

Course Outcomes

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

1. *Understand strategic cost management process, control of cost and decision making based on the cost of the project.*
2. *Appreciate detailed engineering activities of the project and execution of projects*
3. *Prepare project report and network diagram*
4. *Plan Cost Behavior, Profit Planning, Enterprise Resource Planning, Total Quality Management.*
5. *Apply various quantitative techniques for cost management*

Syllabus Contents

Unit I
Introduction: Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit II
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram.

Unit III
Project commissioning: mechanical and process Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis.

Unit IV

Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit V

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References
1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

OE945

COMPOSITE MATERIALS
(Open Elective)

Instruction	:	*3 hours per week*
CIE	:	*30 Marks*
SEE	:	*70 Marks*
Duration of SEE	:	*3 Hours*
Credits	:	*03*

Course Objectives

1. To understand the fundamentals of composite materials and the role of matrix and reinforcement.
2. To know the principles of manufacturing composite
3. To understand the strength and failure criteria of lamina and laminate.

Course Outcomes

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

1. Define a composite, identify the matrix and reinforcement and highlighting the features and application of different composite materials.
2. Classify composites, illustrate the mechanical behaviour of composites and predict properties using micromechanics principles.
3. Illustrate the manufacturing of metal matrix composites and outline the properties and applications.
4. Illustrate the manufacturing of Polymer matrix composites and outline the properties and applications.
5. Apply various failure criteria to assess the strength of lamina and laminates.

Syllabus Contents

UNIT I
Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II
Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT III
Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT IV
Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT V
Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

References

1. Material Science and Technology- Vol 13- Composites by R.W. Cahn-VCH, West Germany.
2. Materials Science and Engineering, An Introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley &Sons, NY, Indian edition, 2007.
3. Composite Materials- K. K. Chwala.
4. Composite Materials Science and Applications-Deborah D.L. Chung.
5. Composite Materials Design and Applications-Danial Gay, Suong V. Hoa and Stwphen W. Tsai.

OE946

WASTE TO ENERGY
(Open Elective)

Instruction	***:***	***3 hours per week***
CIE	***:***	***30 Marks***
SEE	***:***	***70 Marks***
Duration of SEE	***:***	***3 Hours***
Credits	***:***	***03***

Course Objectives

1. To know the various forms of waste
2. To understand the processes of Biomass Pyrolysis.
3. To learn the technique of Biomass Combustion.

Course Outcomes

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

1. Understand the concept of conservation of waste
2. Identify the different forms of wastage
3. Chose the best way for conservation to produce energy from waste
4. Explore the ways and means of combustion of biomass
5. Develop a healthy environment for the mankind

Syllabus Contents

Unit I
Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Unit II
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit III
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit IV
Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit V
Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources

and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy program in India.

References
1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

EE 352

SEMINAR – I

Instruction	:	*3 hours per week*
Duration of SEE	:	*--*
SEE	:	*--*
CIE	:	*50 Marks*
Credits	:	*1.5*

Course Objectives

1. *Identify appropriate topic of relevance.*
2. *Update literature on technical articles of selected topic and develop comprehension.*
3. *Prepare a technical report.*
4. *Deliver presentation on specified technical topic.*

Course Outcomes

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

1. *Develop the habit of referring the journals for literature review.*
2. *Understand the gist of the research paper.*
3. *Identify the potential for further scope.*
4. *Present the work in an efficient manner.*
5. *Write the documentation in standard format.*

Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:
1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.

2. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the Department.

Guidelines for awarding marks		
S. No.	**Description**	**Max. Marks**
1	Contents and relevance	10
2	Presentation skills	10
3	Preparation of PPT slides	05
4	Questions and answers	05
5	Report in a prescribed format	20

Note:
1. The seminar presentation should be a gist of at least five research papers from **Peer-reviewed** or **UGC recognised** journals.
2. **The seminar report should be in the following order:** Background of work, literature review, techniques used, prospective deliverables, discussion on results, conclusions, critical appraisal and reference.
3. At least two faculty members will be associated with the seminar presentation to evaluate and award marks.
4. Attendance of all the students for weekly seminar presentations is compulsory. If the student fails to secure minimum attendance as per O.U. rules, the marks awarded in the seminar presentation shall remain void.

EE 354

SEMINAR – II

Instruction	:	*3 hours per week*
Duration of SEE	:	*--*
SEE	:	*--*
CIE	:	*50 Marks*
Credits	:	*1.5*

Course Objectives

1. *Identify appropriate topic of relevance.*
2. *Update literature on technical articles of selected topic and develop comprehension.*
3. *Prepare a technical report.*
4. *Deliver presentation on specified technical topic.*

Course Outcomes

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

1. *Develop the habit of referring the journals for literature review.*
2. *Understand the gist of the research paper.*
3. *Identify the potential for further scope.*
4. *Present the work in an efficient manner.*
5. *Write the documentation in standard format.*

Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:
1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.

2. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the Department.

Guidelines for awarding marks		
S. No.	**Description**	**Max. Marks**
1	Contents and relevance	10
2	Presentation skills	10
3	Preparation of PPT slides	05
4	Questions and answers	05
5	Report in a prescribed format	20

Note:
5. The seminar presentation should be a gist of at least five research papers from **Peer-reviewed** or **UGC recognised** journals.
6. **The seminar report should be in the following order:** Background of work, literature review, techniques used, prospective deliverables, discussion on results, conclusions, critical appraisal and reference.
7. At least two faculty members will be associated with the seminar presentation to evaluate and award marks.
8. Attendance of all the students for weekly seminar presentations is compulsory. If the student fails to secure minimum attendance as per O.U. rules, the marks awarded in the seminar presentation shall remain void.

EE 070

MINI PROJECT

Instruction	*:*	*6 hours per week*
Duration of SEE	*:*	*--*
SEE	*:*	*--*
CIE	*:*	*50 Marks*
Credits	*:*	*1.5*

Course Objectives
1. *To review available literature and formulate structural engineering problems*
2. *To learn the technique of writing reports and prepare presentation*

Course Outcomes

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

1. *Formulate a specific problem and give solution*
2. *Develop model/models either theoretical/practical/numerical form*
3. *Solve, interpret/correlate the results and discussions*
4. *Conclude the results obtained*
5. *Write the documentation in standard format*

Guidelines

- As part of the curriculum in the II- semester of the program each student shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.

- Each student will be allotted to a faculty supervisor for mentoring.

- Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.

- Mini projects shall have inter-disciplinary/ industry relevance.

- The students can select a mathematical modelling based/Experimental investigations or Numerical modelling

- All the investigations should be clearly stated and documented with the reasons/explanations.

- The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and reference

Departmental committee: Supervisor and a minimum of two faculty members

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks: 50		
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Departmental Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

EE 381

MAJOR PROJECT PHASE - I

Instruction	:	*20 hours per week*
Duration of SEE	:	*--*
SEE	:	*--*
CIE	:	*100 Marks*
Credits	:	*10*

Course Objectives

1. *To identify the research problem.*
2. *To perform literature survey.*

Course Outcomes

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

1. *Exposed to self-learning of various topics.*
2. *Learn to survey the literature such as books, journals and contact resource persons for the selected topic of research.*
3. *Learn to write technical reports.*
4. *Develop oral and written communication skills to present.*
5. *Defend their work in front of technically qualified audience*

Guidelines

- The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.

- Seminar should be based on the area in which the candidate has undertaken the dissertation work.

- The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.

- The preliminary results (if available) of the problem may also be discussed in the report.

- The work has to be presented in front of the committee consists of Chairperson-BoS, Osmania University and Head, Supervisor & Project coordinator from the respective Department of the Institute.

- The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks: 100		
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Departmental Committee (Chairperson BoS, Osmania University and Head, Supervisor & Project coordinator from the respective department of the institution)	10	Relevance of the Topic
	10	PPT Preparation
	10	Presentation
	10	Question and Answers
	10	Report Preparation

Note: The Supervisor has to assess the progress of the student regularly.

EE 382

MAJOR PROJECT PHASE - II

Instruction	:	*32 hours per week*
Duration of SEE	:	*--*
SEE	:	*--*
CIE	:	*200 Marks*
Credits	:	*16*

Course Objectives

1. *To identify the research problem.*
2. *To perform literature survey.*

Course Outcomes

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

1. *Use different experimental techniques and will be able to use different software/ computational /analytical tools.*
2. *Design and develop an experimental set up/ equipment/test rig.*
3. *Conduct tests on existing set ups/equipment's and draw logical conclusions from the results after analysing them.*
4. *Either work in a research environment or in an industrial environment.*
5. *Conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.*

Guidelines:

- It is a continuation of Major Project Phase – I started in semester - III.

- The student has to submit the report in prescribed format and also present a seminar.

- The dissertation should be presented in standard format as provided by the department.

- The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.

- The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner and Chairperson BoS, & Head of the department and Supervisor from the Institute.

- The candidate has to be in regular contact with his/her Supervisor / Co- Supervisor

Guidelines for awarding marks in SEE (Semester End Examination):
Max. Marks: 200

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
External Examiner and Chairperson, BoS & Head of the department (All together)	40	Power Point Presentation
	90	Quality of thesis and evaluation
	40	Innovations, application to society and Scope for future study
	30	Viva-Voce