DEPARTMENT OF ELECTRICAL ENGINEERING
UNIVERSITY COLLEGE OF ENGINEERING
OSMANIA UNIVERSITY, HYDERABAD-07

Minutes of the BoS meeting held on 27-04-2022 at 5.00 p.m. on online mode

At the outset the Chairperson, BoS EEE welcomed all the members of BoS Electrical and Electronics Engg., Osmania University for the meeting. The following members are present.

Members Present

S.No	Name	Designation & Organization
1	Prof. G. Yesuratnam,	Head, Department of Electrical Engineering, UCE, OU
2	Prof. E. Vidya Sagar	Chairperson, BoS, EEE & EIE , OU, Hyderabad
3	Prof. M. Manjula	Professor, Dept. of Electrical Engineering, UCE, OU
4	Prof. B. Mangu	Professor, Dept. of Electrical Engineering, UCE, OU
5	Prof. S. Srinivasa Rao	Dept. of Electrical Engineering, NITW,Warangal.
6	Dr. Alivelu Manga Parimi	Dept. of Electrical Engineering, BITS, Hyderabad
7	Sri. T. Srinivas	Director, (Project & IT), TSSPDCL, Hyderabad
8	Dr. B. Somaiah	Scientist-F Research Centre, Imarat DRDO, Hyderabad
9	Head, EED of--	MVSR, METHODIST, MJCET,MECS,STANLEY, DECCAN (EEE& EIE) , LORDS ,ISL & NSAKCET Colleges .

The items mentioned in the agenda were discussed and following resolutions were taken :

1. Scheme and Syllabi of 5^{th} & 6^{th} Semester B.E EEE & EIE Courses
2. Scheme of 7^{th} & 8^{th} Semester B.E EEE & EIE Courses

The following resolutions were taken:

(i) Resolved that the enclosed scheme & Syllabi of B.E V Semester EEE under AICTE New Model scheme be approved.

B.E. (Electrical & Electronics Engineering) V – SEMESTER

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration In Hrs	
Theory Courses										
1	PC415EE	Linear Control Systems	3	-	-	3	30	70	3	3
2	PC416EE	Electrical Measurements and Instrumentation	3	-	-	3	30	70	3	3
3	PC417EE	Signals and Systems	3	-	-	3	30	70	3	3
4	PC418EE	Power Systems – II	3	-	-	3	30	70	3	3
5	PC419EE	Linear Integrated Circuits	3	-	-	3	30	70	3	3
6	PE5 EE	Professional Elective - I	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7	PC459EE	Electrical Machines Lab – II	-	-	2	2	25	50	3	1
8	PC460EE	Electrical Measurements and Instrumentation Lab	-	-	2	2	25	50	3	1
9	PC461EE	Control Systems Lab	-	-	2	2	25	50	3	1
Total			**18**	**-**	**06**	**24**	**255**	**570**	-	**21**

Professional Elective – I		
1	PE501EE	Electrical Machine Design
2	PE502EE	Special Electric Machines
3	PE503EE	Renewable Energy Sources

(ii) **Resolved that the enclosed scheme & Syllabi of B.E VI semester EEE under AICTE New Model scheme be approved**.

B.E. (Electrical & Electronics Engineering) VI – SEMESTER

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration In Hrs	
Theory Courses										
1	HS103CM	Finance and Accounting	3	-	-	3	30	70	3	3
2	PC423EE	Microprocessors and Microcontrollers	3	-	-	3	30	70	3	3
3	PC424EE	Digital Signal Processing and Applications	3	-	-	3	30	70	3	3
4	PC425EE	Switchgear and Protection	3	-	-	3	30	70	3	3
5	PE5__EE	Professional Elective – II	3	-	-	3	30	70	3	3
6	OE6__EE	Open Elective – I	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7	PC462EE	Microprocessors and Microcontrollers Lab	-	-	2	2	25	50	3	1
9	PC463EE	Digital Signal Processing Lab	-	-	2	2	25	50	3	1
10	PW701EE	Summer Internship*	Six Weeks during Summer Vacation							
Total			**18**	**-**	**04**	**22**	**230**	**520**	**-**	**20**

Professional Elective – II		
1	PE504EE	Electric Vehicles
2	PE505EE	High Voltage Engineering
3	PE506EE	Digital Control Systems

Open Elective – I		
1	OE601EE	Electrical Energy Conservation and Safety (Not for EEE & EIE Students)
2	OE602EE	Reliability Engineering (Not for EEE & EIE Students)
3	OE611AE	Basics of Automobile Engineering (Not for Mech./Prod./Auto. Engg. students)
4	OE611ME	Industrial Robotics (Not for Mech./Prod./Automobile Engg. students)
5	OE601EG	Soft Skills & Interpersonal Skills
6	OE602MB	Human Resource Development and Organizational Behaviour
7	OE601LW	Cyber Law and Ethics
8	OE601CS	Operating Systems (Not for CSE Students)
9	OE602CS	OOP using Java (Not for CSE Students)
10	OE601IT	Database Systems (Not for IT Students)
11	OE602IT	Data Structures (Not for IT Students)
12	OE601CE	Disaster Mitigation (Not for Civil Engg. Students)

(iii) **Resolved that the enclosed scheme of B.E VII semester EEE under AICTE New Model scheme be approved**.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Electrical and Electronics Engineering) VII – SEMESTER

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration In Hrs	
Theory Courses										
1	PC428EE	Control of Electric Drives	3	-	-	3	30	70	3	3
2	PC429EE	Power System Operation and Control	3	-	-	3	30	70	3	3
3	PC430EE	Power Electronic Applications to Power Systems	3	-	-	3	30	70	3	3
4	PE5_EE	Professional Elective - III	3	-	-	3	30	70	3	3
5	PE5_EE	Professional Elective - IV	3	-	-	3	30	70	3	3
6	OE6_EE	Open Elective – II	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7	PC465EE	Power Systems Lab	-	-	2	2	25	50	3	1
8	PC466EE	Electrical Simulation Lab	-	-	2	2	25	50	3	1
9	PW702EE	Project Work Phase – I	-	-	6	6	50	-	-	3
10	PW701EE	Summer Internship*	-	-	-	-	50	-	-	1
Total			**18**	**-**	**10**	**28**	**330**	**525**	**-**	**24**

Professional Elective – III & IV		
1	PE507EE	Electrical Distribution Systems
2	PE508EE	Utilization of Electric Energy
3	PE509EE	Power Quality Engineering
4	PE510EE	Energy Management Systems and SCADA

Open Elective – II		
1	OE603EE	Non-Conventional Energy Sources (Not for EEE & EIE Students)
2	OE604EE	Transducers and Sensors (Not for EEE & EIE Students)
3	OE621AE	Automotive Safety and Ergonomics (Not for Mech./Prod./Auto. Engg. students)
4	OE621ME	Entrepreneurship (Not for Mech./Prod./Automobile Engg. students)
5	OE811CE	Green Building Technologies (Not for Civil Engg. Students)
6	OE802CS	Data Science Using R (Not for CSE Students)
7	OE 816 IT	Cyber Security (Not for IT Students)

(iv) **Resolved that the enclosed scheme of B.E VIII semester EEE under AICTE New Model scheme be approved.**

B.E. (Electrical & Electronics Engineering) VIII – SEMESTER

SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Electrical and Electronics Engineering) VIII – SEMESTER

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration In Hrs	
Theory Courses										
1	PE5__EE	Professional Elective – V	3	-	-	3	30	70	3	3
2	PE5__EE	Professional Elective –VI	3	-	-	3	30	70	3	3
3	OE6__EE	Open Elective-III	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
4	PW703EE	Project Work Phase – II	-	-	16	16	50	100	-	8
Total			**09**	**-**	**16**	**25**	**140**	**310**	**-**	**17**

Professional Elective – V & VI		
1	PE511EE	AI Techniques in Electrical Engineering
2	PE512EE	Advances in Power Electronics
3	PE513EE	Grid Integration of Renewable Energy Systems
4	PE514EE	Smart Grid Technology

Open Elective – III		
1	OE605EE	Smart Building Systems (Not for EEE & EIE Students)
2	OE606EE	Programmable Logic Controllers (Not for EEE & EIE Students)
3	OE631AE	Automotive Maintenance (Not for Mech./Prod./Auto. Engg. students)
4	OE631ME	Mechatronics (Not for Mech./Prod./Auto. Engg. students)
5	OE603CE	Road Safety Engineering (Not for Civil Engg. Students)
6	OE604IT	Software Engineering (Not for IT Students)

(v) Resolved to approve the Panel of Examiners/ Paper setters of various programmes and chairperson was authorised to forward to the Controller of Examinations ,OU.

The meeting ended with vote of thanks by the Chairperson to the members of BoS and faculty.

Chairperson BoS
EED, UCE,OU

Syllabus BE (EEE) Sem-V

Course Code	Course Title						Core/Elective
PC415EE	**Linear Control Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The course will introduce the students to

- To develop basic skills of utilizing mathematical tools needed to analyze and design classical linear control systems.
- To understand and develop the state space representation of control systems.

Course Outcomes

After completing this course, the student will be able to:

1. Understand the concept of the terms control systems, feedback, Mathematical modeling of Electrical and Mechanical systems.
2. Explain the time domain and frequency response analysis of control systems.
3. Acquire the knowledge of various analytical techniques used to determine the stability of control systems.
4. Able to understand the importance of design of compensators.
5. Able to demonstrate controllability and observability of modern control systems.

UNIT-I

Introduction to Control Systems: Classification of control systems. Feed-Back Characteristics, Effects of feedback - Mathematical modeling of Electrical and Mechanical systems -Transfer function- Transfer function of Potentiometer, synchro, AC servo motor, DC servo motor - Block diagram reduction technique - Signal flow graph, Mason's gain formula.

UNIT-II

Time Domain Analysis: Standard test signals - Time response of first order systems - Transient response of second order system for unit step input, Time domain specifications - Steady state response - Steady state errors and error constants - Effects of P, PD, Pl and PID controllers.

UNIT-III

Stability Analysis in S-Domain: The concept of stability - Routh's stability Criterion, Absolute stability and relative stability, Limitations of Routh's stability.

Root Locus Technique: The root locus concept, Construction of root loci, Effects of adding poles and zeros on the root loci.

UNIT-IV

Frequency Response Analysis: Introduction to frequency response - Frequency domain specifications - Bode plot - Stability analysis from Bode plots - Determination of transfer function from the Bode Diagram - Polar Plots, Nyquist Plots, Stability Analysis, Gain margin and phase margin.

Control System Design: Introduction - Lag, Lead and Lag-Lead Compensator design in frequency Domain.

UNIT-V

State Space Analysis: Concepts of state, State variables and state model, Derivation of state models of linear time invariant systems - Controllable, Observable and Diagonal state models - State transition matrix - Solution of state equation - Concepts of Controllability and Observability.

Suggested Readings:

1. Nagrath I.J. and Gopal.M, *Control System Engineering*, Wiley Eastern, 2017.
2. B.C.Kuo, *Automatic Control Systems*, Wiley India, 7th Edition, 2002.
3. K. Ogata, *Modern Control System*, Prentice Hall of India, 4th Edition, 2002.
4. N.C.Jagan, *Control Systems,* B.S Publications, 2nd Edition, 2008.
5. Norman S. Nise, *Control Systems Engineering, Bejamin/Cummings Publishing Company, 1995*

Course Code	Course Title						Core/Elective
PC416EE	**Electrical Measurements and Instrumentation**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of this course is to impart knowledge of

- To learn and understand the fundamental concepts, principle of operation and applications of various electrical measuring instruments.
- To understand various types of Bridges in measurement of resistance, inductance, capacitance and frequency.
- To understand the operation and applications of Ballistic Galvanometer, Flux meter and DC/AC Potentiometer.
- To understand the application of CRO for measurement of Amplitude, Phase and frequency of sinusoidal signals.

Course Outcomes

After completing this course, the student will be able to:

1. Choose the suitable instrument like Ammeter, Voltmeter for AC/DC applications.
2. Select suitable Bridge for measurement of electrical parameters and quantities.
3. Use CRO for measurement of Amplitude, Phase and frequency of sinusoidal signals.

UNIT – I

Instruments: Indicating, Recording and Integrating instruments, Ammeter, Voltmeter, Expression for torque of moving coil, moving iron, Dynamometer, induction and electrostatic instruments. Extension of range of instruments, Wattmeter Torque expression for dynamometer instruments, Reactive power measurement.

UNIT II

Meters: Energy meters, single phase and 3-phase, Driving torque and braking torque equations, Errors and testing compensation, Maximum demand indicator, Power factor meters, Frequency meters, Electrical resonance and Weston type of synchro scope, introduction to digital multimeters and digital energy meters.

UNIT III

Bridge Methods and Transducers: Measurement of inductance, capacitance and resistance using Bridges, Maxwell‘s, Hay‘s. bridge, Anderson, Wein, Desauty‘s, Schering‘s bridges, Kelvin‘s double bridge, Megger, Loss of charge method, Wagners earthing device, Transducers - Analog and digital transducers, Strain gauges and Hall effect transducers.

UNIT IV

Magnetic Measurements and Instrument Transformers: Ballistic galvanometer, Calibration by Hibbert‘ s magnetic standard flux meter, Lloyd-Fischer square for measuring iron loss, Determination of B-H curve and Hysteresis loop using CRO, Instrument transformers – Current and potential transformers, ratio and phase angle errors of CT‘s and PT‘s.

UNIT V

Potentiometers: Crompton‘s DC and AC polar and coordinate types, Applications, Measurements of impedance, Calibration and ammeter voltmeter and wattmeters. Use of oscilloscope in frequency, phase and amplitude measurements.

Suggested Readings:

1. Shawney A.K., *Electrical and Electronics Measurements and Instruments,* Dhanpatrai & Sons, Delhi,2012.
2. Umesh Sinha, *Electrical, Electronics Measurement and Instrumentations,* Satya Prakashan, New Delhi.
3. Golding E.W., *Electrical Measurements and Measuring Instruments,* Sir Issac & Pitman & Sons Ltd.,London.
4. U.A.Bakshi, A.V.Bakshi, *Electrical and Electronic Instrumentation,* Technical publications.

Course Code	Course Title						Core/Elective
PC417EE	**Signals and Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The course is introduced

- To understand the classification of continuous-time and discrete-time signals and systems
- To develop ability to solve systems represented by differential equations and difference equations using analytical methods and Laplace and Z-transforms.
- To acquire the knowledge of representing the signals in frequency domain using Fourier series and Fourier transform.

Course Outcomes

After successful completion of the course the students will be able to

1. Classify and analyze the continuous time signals and discrete time signals and systems.
2. Generate discrete time signals through sampling process and reconstruct them.
3. Determine the responses of continuous and discrete-time systems which are represented by differential equations and difference equations.
4. Analyze continuous time systems with the help of Laplace transform and discrete time system with Z-transform.
5. Analyze the continuous and discrete-time systems in frequency domain with the help of Fourier series and Fourier Transform.

UNIT-I

Introduction to continuous time signals: Examples of signals and systems as seen in everyday life in relation to engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time- limited signals; Introduction to discrete-time signals - Sampling and Reconstruction: The Sampling Theorem and its implications. Spectra of sampled signals. Aliasing and its effects. Reconstruction: ideal interpolator, zero-order hold and first-order hold. Classification of discrete time signals.

UNIT-II

Behavior of continuous and discrete-time LTI systems: System properties: linearity: additivity and homogeneity, shift-invariance, causality and stability. Linear time invariant system, properties convolution integral and convolution sum. System representation through differential equations and difference equations.

UNIT-III

Laplace transforms: Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. **Z-transforms:** The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis and solution to difference equations.

UNIT-IV

Frequency domain representation of continuous time signals: Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, properties,

convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality.

UNIT-V

Frequency domain representation of discrete time signals: The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Suggested Readings:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, *Signals and systems*, Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, *Digital Signal Processing: Principles, Algorithms, and Applications*, Pearson, 2006.
1. H. P. Hsu, *Signals and systems*, Schaum's series, McGraw Hill Education, 2010.
2. S. Haykin and B. V. Veen, *Signals and Systems*, John Wiley and Sons, 2007.
3. A. V. Oppenheim and R. W. Schafer, *Discrete-Time Signal Processing*, Prentice Hall, 2009.
4. M. J. Robert, *Fundamentals of Signals and Systems*, McGraw Hill Education, 2007.
5. B. P. Lathi, *Linear Systems and Signals*, Oxford University Press, 2009.

Course Code	Course Title						Core/Elective
PC418EE	**Power Systems – II**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PC408EE	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

To expose the students to:

- The student able to learn and understand the performance analysis of transmission lines and cables.
- To be able to comprehend analysis of symmetrical and unsymmetrical faults in the power system.

Course Outcomes

On successful completion of the course, the students would be able to:

1. Acquire modeling of different short, medium and long transmission lines
2. Understand the impact of different types of faults on overhead transmission lines and calculation of fault currents and their significance.
3. Explain the reasons for voltage variation, importance of maintaining constant voltage in power system and different voltage control methods.
4. Acquire the knowledge of natural impedance of transmission line and significance in the operation of power system network.

UNIT-I

Transmission Line Theory: Performance of short, medium, long lines - Line calculations - Tuned lines, Power circle diagram and their applications. Corona - Causes - Disruptive and Visual critical voltages - Power loss - Minimization of corona effects.

UNIT-II

Symmetrical Faults: Use of per unit quantities in power systems, advantages of per unit system. Symmetrical Three-phase Faults, Transients in RL series circuits - Short circuit currents - Reactance_s of synchronous machines - Symmetrical fault calculations, Short circuit capacity of bus.

UNIT-III

Unsymmetrical Faults: Symmetrical components of unsymmetrical phasors - Power in terms of symmetrical components - Sequence impedance and sequence networks, Sequence networks of unloaded generators - Sequence impedances of circuit elements - Single line to ground, line to line and double line to ground faults on unloaded generator - Unsymmetrical faults of power systems, Open circuit faults.

UNIT-IV

Voltage Control: Phase modifiers, Induction Regulators -Tap changing Transformers, Series and Shunt Capacitors, Reactive Power requirement calculations, Static VAR compensators - Thyristor Controlled reactor, Thyristor switched capacitor.

UNIT-V

Travelling Wave Theory : Causes of over voltages - Travelling wave theory - Wave equation - Open circuited line - The short circuited line - Junction of lines of different natural impedances - Reflection and Refraction Coefficients - Junction of cable and overhead lines - Junction of three lines of different natural impedances- Bewley Lattice diagram.

Suggested Readings:

1. CL Wadhwa - Electrical Power Systems, New Age International, 4th Edition, 2018.
2. Grainger and Stevenson - Power System Analysis, Tata McGraw Hill, 4th Edition, 2003.
3. Nagarath and Kothari - Modern Power System Analysis, Tata McGraw Hill, 4th Edition, 2012.

Course Code	Course Title						Core / Elective
PC419EE	**Linear Integrated Circuits**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To familiarize and able to understand Op-amps.
- To understand the different linear and non-linear applications of op-amp
- To understand the voltage regulators and active filters by using op-amps.

Course Outcomes

1. Design and use op-amps for various linear and non-linear applications.
2. Ability to design and use voltage regulators and active filters

UNIT – I

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

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT – V

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

Suggested Reading:

1. Gayakwad W.A., *Op-Amps and Linear Integrated Circuits*, 4th Edition, Prentice Hall of India, 2015.
2. Malvino Albert Paul, *Electronic Principles*, 6th Edition, Tata McGraw Hill, 1999.
3. Roy Choudhury, Shail Jam, *Linear Integrated Circuits*, New Age International, 2nd Edition,2003.
4. William D. Stanley, *OP Amps with Linear Integrated Circuits*, Pearson, 2000.

Course Code	Course Title						Core / Elective
PE501EE	**Electrical Machine Design (Professional Elective – I)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PC403EE, PC409EE	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To Study the Qualitative & Quantitative analysis of magnetic circuit design, Electrical Circuit Design and Thermal Circuit. Design of Electrical Machine.
- To understand the Design and analysis of different types of windings used for DC/AC machines.
- To understand the Design principles of different rotating machines can be studied.

Course Outcomes

At the end of the course students will be able to

1. Make a choice of material to evolve a particular design problem at hand and make reference to the standards used by the industry
2. Understand the behavior of magnetic materials, thermal performance and rating of machines.
3. Design DC machine along with the materials, ventilation and cooling aspect used in it
4. Design AC machine along with the materials, ventilation and cooling aspect used in it.
5. To make the trials using a computer program and hundreds of design are worked in repetitive manner to evolve a cost optimized design by using computer aided design

UNIT-I

Electrical engineering materials insulating materials: Properties of ideal insulating materials, classification and types of insulating materials, Conducting materials, general properties of Cu, Al and steel, High resistance alloys, carbon and other conducting materials, super conductors-Magnetic materials: classification of magnetic materials, soft and hard magnetic materials, Sheet steel, cold rolled steels, solid core and laminated core materials.

UNIT-II

Magnetic circuit: Basic principles, magnetic circuit calculations, Flux density in air gap and tooth-Carters coefficient, Ampere turns for gap and teeth, real and apparent flux density, Magnetic leakage, armature leakage, leakage flux from salient poles, Field distribution curves, field turns, ampere reaction ampere turns
Thermal circuit: Types of enclosures ventilation and cooling system, Losses, temperature rise time curve, rating of electrical machines, calculation for quantity of cooling medium
Rating of motors: heating effects, load conditions and classes of duty, Determination of power rating.

UNIT-III

DC Machine design: Output equation, main dimensions, Choice of specific magnetic and electric loading, selection of no of poles, Choice of armature core length, armature diameter, Length of air gap, armature design and design of field system.

UNIT-IV

AC machine design: Transformer design, main dimensions, Output equation, core design, cooling system design, 3 Phase Induction motors: output equation, main dimensions, design of stator and rotor, Design of squirrel cage rotor, design of end rings.
Synchronous machine: Output equation, main dimensions, SCR, length of air gap, Selection of armature slots, design of field system and turbo alternators.

UNIT-V

Computer aided design: Introduction, advantages of digital computers, computer aided design- different approaches, Analysis, synthesis and hybrid method, optimization-General procedure for optimization, variable constraints, Computer aided design of 3 phase IM, Lists of symbols used, general design procedure.

Suggested Reading:

1. A.K. Sawhney, A course in Electrical Machines Design, Dhanpat Rai and Sons, 2016.
2. R.K. Agarwal, Principles of Electrical Machines Design, S.K. Kataria& sons, 4th Edition, 2000, NaiSarak, NewDelhi.

Course Code	Course Title						Core / Elective
PE502EE	**Special Electrical Machines (Professional Elective – I)**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PC403EE, PC409EE	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To explain theory of operation and control of switched reluctance motor.
- To explain the performance and control of stepper motors, and their applications.
- To describe the operation and characteristics of permanent magnet dc motor.
- To distinguish between brush dc motor and brush less dc motor.
- To explain the theory of travelling magnetic field and applications of linear motors.

Course Outcomes

1. Explain theory of operation and control of switched reluctance motor.
2. Explain the performance and control of stepper motors, and their applications.
3. Describe the operation and characteristics of permanent magnet dc motor.
4. Distinguish between brush dc motor and brush less dc motor.
5. Explain the theory of travelling magnetic field and applications of linear motors.

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, Double Stator Switched Reluctance Motors and 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.

Suggested Readings:

1. R. Krishnan, *Electric Motor Drives*, Pearson Education, 2015
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,

Course Code	Course Title						Core/Elective
PE503EE	**Renewable Energy Sources (Professional Elective – I)**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To understand the concepts and Importance of renewable energy sources such as solar, wind, biomass, tidal power.
- To make the students understand the advantages and disadvantages of different renewable energy sources.

Course Outcomes

At the end of the course students will be able to

1. Explain the advantages, disadvantages and applications of different conventional and non-conventional sources.
2. Acquire the knowledge of various components, principle of operation and present scenario of different conventional and non-conventional sources.

UNIT-I

Review of Conventional and Non-Conventional energy sources - Need for non-conventional energy sources Types of Non- conventional energy sources - Fuel Cells - Principle of operation with special reference to H2 °2Cell - 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, V-I and P-V curves and the concept of MPPT.

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.

4. John Twidell, Tony Weir, *Renewable Energy Resources,* 3rd Edition, Taylor and Francis.

Suggested Readings:

1. Rai G.D, *Non-Conventional Sources of Energy*, Khandala Publishers, New Delhi, 2011.
2. David M Buchla and Thomas E Kissell ,*Renewable Energy Systems*, 1st Edition by, Pearson India.
3. M.M.El-Wakil, *Power Plant Technology,* McGraw Hill, 1984.
4. John Twidell, Tony Weir, *Renewable Energy Resources,* 3rd Edition, Taylor and Francis.

Course Code	Course Title						Core/Elective
PC459EE	**Electrical Machines Lab - II**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PC409EE	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To learn operation and performance characteristics of induction machines by conductingvarious experiments and tests practically.
- To understand the operation and performance characteristics of synchronous machines by conducting various experiments and tests.

Course Outcomes

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

1. Understand Performance characteristics of single-phase induction motor.
2. Understand the importance of Voltage regulation of an alternator.
3. Explain different methods used to measure the voltage regulation of an alternator.

List of Experiments:

1. No-load test, blocked rotor test and load test on 3-phase induction motor.
2. Speed control of 3-phase induction motor by
   a. Cascade connection
   b. Rotor resistance control
   c. Pole changing
   d. Slip power recovery scheme.
3. Power factor improvement of three phase Induction motor using capacitors.
4. Dynamic braking of 3-phase induction motor.
5. Load characteristics of induction generator.
6. Performance characteristics of single-phase induction motor.
7. Voltage regulation of an alternator by (a) Synchronous impedance method (b) Ampere - turn method(c) Z.P.F. method.
8. Regulation of alternator by slip test.
9. Determination of V curves and inverted V curves of synchronous motor.
10. Power angle characteristics of a synchronous machine.
11. Speed control of BLDC motor.
12. Speed control of SRM motor.

Note: At least ten experiments should be conducted in the Semester.

Suggested Readings:

1. Kothari D.P. & Nagrath I.J., *Electrical Machines*, Tata McGraw Hill, 2017.
2. Bhimbra P.S., *Generalized Theory of Electrical Machines*, Khanna Publications, 2000.
3. Say MG., *The Performance and Design of AC. Machines*, Pitman Publication, 2002.
4. Satish Kumar Peddapelli and Sridhar Gaddam., *Electrical Machines-A PracticalApproach*, De Gruyter Publisher, Germany, 2020.
5. Irving L. Kosow, *Electric Machinery and Transformers*, PPH, Pearson Education, 2nd Edition. 2009.

Course Code	Course Title						Core/Elective
PC460EE	**Electrical Measurements and Instrumentation Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PC416EE	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To train the students for acquiring practical knowledge for measuring resistance, inductance and capacitance using various bridges.
- To train the student for the usage of A.C. and D.C. potentiometers.
- To make the student understand the operation of CRO and its usefulness in finding the amplitude, phase and frequency of waveforms.

Course Outcomes

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

1. Measure the inductance, capacitance and resistance using various bridges.
2. Measure resistance and calibrate ammeter, voltmeters and wattmeter using A.C. and D.C. potentiometers.
3. Have hands on experience on the operation of CRO.

List of Experiments:

1. Measurement of low resistance by Kelvin‘s Double Bridge.
2. Calibration of single-phase energy meter.
3. Measurement of inductance by Maxwell‘s and Anderson‘s bridges.
4. Measurement of capacitance by Desauty‘s and Schering‘s bridges.
5. Measurement of Iron losses by Lloyd, Fishers magnetic square.
6. Measurement of Resistance and calibration of Ammeter using D.C. potentiometer.
7. Calibration of voltmeter and wattmeter using D.C. potentiometer.
8. Measurement of unknown voltage and impedance using A.C. potentiometer.
9. Calculation of iron losses using B-H curve with oscilloscope.
10. Localizing Ground and short circuit faults using Murray loop test and Varley loop test.
11. Measurement of relative permittivity (Ɛr) of a dielectric medium using Schering bridge.
12. Measurement of frequency of unknown sinusoidal signal with CRO.
13. Measurement of phase and amplitude using CRO.
14. Calibration of given power factor meter using calibrated voltmeter, ammeter and wattmeter.

Note: At least ten experiments should be conducted in the Semester.

Suggested Readings:

1. Shawney A.K., *Electrical and Electronics Measurements and Instruments,* Dhanpatrai & Sons, Delhi,2012.
2. Umesh Sinha, *Electrical, Electronics Measurement and Instrumentations*, Satya Prakashan, New Delhi.
3. Golding E.W., *Electrical Measurements and Measuring Instruments,* Sir Issac and Pitman & Sons Ltd.,London

Course Code	Course Title						Core/Elective
PC461EE	**Control Systems Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PC415EE	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To develop transfer function of various control system plants practically by conducting the experiments.
- To understand the various controllers, basic features of PLC
- Programming and control system concepts using MATLAB.

Course Outcomes

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

1. Able to understand Performance of P, PI and PID Controllers.
2. Able to develop PLC programs for certain applications.
3. Acquire the knowledge of Data acquisition system and Industrial process control.

List of Experiments:

1. Characteristics of D.C. and AC. Servomotor and their transfer function.
2. Characteristics of synchros.
3. Frequency response of second order system.
4. Operating characteristics of Stepper motor.
5. Step response of second order system.
6. D.C. Position control system.
7. A.C. Position control system.
8. Performance of P, PI and PID Controller on system response.
9. Design of lag and lead compensation.
10. ON - OFF temperature control systems.
11. Simulation of control system concepts using MATLAB.
12. PLC (Programmable Logic Controller) applications. (a) Bottle filling (b) Speed control of Stepper motor (c) Liquid level control.
13. Data acquisition system and applications.
14. Industrial process control trainer.

Note: At least ten experiments should be conducted in the Semester.

Suggested Readings:

1. Nagrath I.J. & Gopal.M., *Control System Engineering,* Wiley Eastern, 2017.
2. B.C.Kuo, *Automatic Control Systems*, Wiley India, 7th Edition, 2002.
3. K.Ogata, *Modern Control System*, Prentice Hall of India, 4th Edition, 2002.
4. N.C.Jagan, *Control Systems*, B.S Publications, 2nd Edition, 2008.

Syllabus BE (EEE) Sem-VI

SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Electrical and Electronics Engineering) VI – SEMESTER

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration In Hrs	
Theory Courses										
1	HS103CM	Finance and Accounting	3	-	-	3	30	70	3	3
2	PC423EE	Microprocessors and Microcontrollers	3	-	-	3	30	70	3	3
3	PC424EE	Digital Signal Processing and Applications	3	-	-	3	30	70	3	3
4	PC425EE	Switchgear and Protection	3	-	-	3	30	70	3	3
5	PE5_EE	Professional Elective – II	3	-	-	3	30	70	3	3
6	OE6_EE	Open Elective – I	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7	PC462EE	Microprocessors and Microcontrollers Lab	-	-	2	2	25	50	3	1
9	PC463EE	Digital Signal Processing Lab	-	-	2	2	25	50	3	1
10	PW701EE	Summer Internship*	Six Weeks during Summer Vacation							
Total			**18**	**-**	**04**	**22**	**230**	**520**	**-**	**20**

Professional Elective – II		
1	PE504EE	Electric Vehicles
2	PE505EE	High Voltage Engineering
3	PE506EE	Digital Control Systems

Open Elective – I		
1	OE601EE	Electrical Energy Conservation and Safety (Not for EEE & EIE Students)
2	OE602EE	Reliability Engineering (Not for EEE & EIE Students)
3	OE611AE	Basics of Automobile Engineering (Not for Mech./Prod./Auto. Engg. students)
4	OE611ME	Industrial Robotics (Not for Mech./Prod./Automobile Engg. students)
5	OE601EG	Soft Skills & Interpersonal Skills
6	OE602MB	Human Resource Development and Organizational Behaviour
7	OE601LW	Cyber Law and Ethics
8	OE601CS	Operating Systems (Not for CSE Students)
9	OE602CS	OOP using Java (Not for CSE Students)
10	OE601IT	Database Systems (Not for IT Students)
11	OE602IT	Data Structures (Not for IT Students)
12	OE601CE	Disaster Mitigation (Not for Civil Engg. Students)

HS: Humanities and Social Sciences BS: Basic Science ES: Engineering Science
MC: Mandatory Course PC: Professional Core PE: Professional Elective
L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Evaluation (Univ. Exam) EE: Electrical Engg.

awarded in VII–Semester after evaluation.

Course Code	Course Title						Core/Elective
HS103CM	**Finance and Accounting**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The course is introduced

- To provide basic understanding of Financial and Accounting aspects of a business unit
- To provide understanding of the accounting aspects of business
- To provide understanding of financial statements
- To provide the understanding of financial system
- To provide inputs necessary to evaluate the viability of projects
- To provide the skills necessary to analyse the financial statements

Course Outcomes

After successful completion of the course the students will be able to

1. Evaluate the financial performance of the business unit.
2. Take decisions on selection of projects.
3. Take decisions on procurement of finances.
4. Analyse the liquidity, solvency and profitability of the business unit.
5. Evaluate the overall financial functioning of an enterprise.

UNIT-I

Basics of Accounting: Financial Accounting–Definition- Accounting Cycle – Journal - Ledger and Trial Balance-Cash Book-Bank Reconciliation Statement (including Problems)

UNIT-II

Final Accounts: Trading Account-Concept of Gross Profit- Profit and Loss Account-Concept of Net Profit-Balance Sheet (including problems with minor adjustments)

UNIT-III

Financial System and Markets: Financial System-Components-Role-Considerations of the investors and issuers- Role of Financial Intermediaries. Financial Markets-Players- Regulators and instruments - Money Markets Credit Market- Capital Market (Basics only)

UNIT-IV

Basics of Capital Budgeting techniques: Time Value of money- Compounding- Discounting- Future Value of single and multiple flows- Present Value of single and multiple Flows- Present Value of annuities-Financial Appraisal of Projects– Payback Period, ARR- NPV, Benefit Cost Ratio, IRR (simple ratios).

UNIT-V

Financial statement Analysis: Financial Statement Analysis- Importance-Users-Ratio Analysis-liquidity, solvency, turnover and profitability ratios.

Suggested Readings:

1. Satyanarayana. S.V. and Satish. D., Finance and Accounting for Engineering, Pearson Education.
2. Rajasekharan, Financial Accounting, Pearson Education.
3. Sharma.S.K. and Rachan Sareen, Financial Management, Sultan Chand.
4. Jonathan Berk, Fundamentals of Corporate Finance, Pearson Education.
5. Sharan, Fundamentals of Financial Management, Pearson Education.

Course Code	Course Title						Core / Elective
PC429EE	**Switchgear and Protection**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To be able to understand the need of protection in power system and protection with conventional and static relays.
- To understand the protection of transformers, generators and need of circuit breakers.

Course Outcomes

At the end of the course students will be able to

1. Acquire the knowledge of construction, working principles of different electromagnetic and static relays used to protect generators, transformers, transmission lines and distribution feeders.
2. Analyze the Characteristics of over current, over voltage, distance and differential relays and also their applications in power system networks.
3. Explain the working principle. Construction, rating and applications of different types of circuit breakers used in power system networks.
4. Understand the construction details, advantages, disadvantages of Gas Insulation substations.

UNIT- I

Introduction to Protective Relays: Need for protection - primary protection - backup protection Zones of protection - Definitions of relay pick up and reset values - Classification of relays - Operating principles and construction of Electromagnetic and Induction type relays. Over current relay - Over voltage - Directional relay - Universal relay torque equation. Over current protection for radial feeder and ring mains - Protection of parallel lines - Relay settings for over current relays Earth fault and phase fault protection.

UNIT - II

Static Phase and Amplitude Comparators: Characteristics of dual input comparators. Static Relays - Instantaneous over current relay - Definite time over current relay - Inverse time over current relay - Directional over current relay (Block diagram approach only) Distance protection - Characteristics of 2- input distance relays on the RX diagram - Input characteristics for various types of distance relays - 3-step distance relays, Microprocessor based / numerical over current, over voltage, under voltage relay (block diagram).

UNIT- III

Transformer and Generator Protection: Differential relays - Percentage differential relays protection of generator and transformer using percentage differential relays, Split phase protection, Overheating, Loss of excitation - Protection of transformers against magnetizing inrush - Buchholz relay - Protection of earthing transformers.

UNIT-IV

Circuit Breakers : Need for circuit breakers, Parts of circuit breaker trip coil circuit- Arc properties - Principles of arc quenching - Theories, Recovery and restriking voltages - Rating of circuit breakers – Rated symmetrical and asymmetrical breaking current - Rated making current - Rated capacity, Voltage and frequency of circuit breakers, Auto re-closure-duty cycle, Current chopping - Resistance switching - Derivations of RR'RV - Maximum RRRV, Recovery voltage, Problems - Types of circuit breakers - Oil, Minimum oil, Air, Air blast, SF
, Vacuum and miniature circuit breakers, Testing of circuit breakers.

UNIT-V

Gas Insulated Substations and Over Voltage Protection: Constructional details (components), Merits and demerits, Protection of lines against direct lightning strokes – ground wires - Protection angle

Protection zone - Tower footing resistance and its effects - Equipment protection assuming rod gaps, arcing horns - Different types of lightning arresters - their construction Surge absorbers - Peterson coil - Insulation coordination.

Suggested Reading:

1. Wadhwa C.L, *Electrical Power System*, Wiley Eastern Ltd., 2022.
2. Badriram, Viswakarma, *Power System Protection and Switchgear*, Tata McGraw Hill, 2003.
3. Sunil S. Rao, *Switchgear and Protection*, Khanna Publications, 2000.
4. M.S. Naidu, *Gas Insulated Substations*, I.K. int. Publishing House Pvt. Ltd. -2008.

Course Code	MICROPROCESSOR AND MICROCONTROLLERS						Core/Elective
PC423EE	(Common to EEE and EIE						Core
Prerequisite	L	T	D	P	CIE	SEE	Credits
-	3	0	0	0	30	70	3

Course Objectives
To be able to understand in details about 8086 microprocessor architecture, programming and interfacing
To be able to understand about 8051 microcontroller architecture, and programming

Course outcomes
At the end of the course students will be able to
Acquire the knowledge of architecture of 8086, writing assembly language programming for different applications
Explain types of microcontrollers and their applications

UNIT-I
Microprocessor: Architecture of 8086 – Segmented memory, Addressing modes, Instruction set, Minimum and maximum mode operations.

UNIT-II
Introduction to Programming: Assembly language programming, Assembler directives, Simple programs using assembler, Strings, Procedures, Macros timing.

UNIT-III
Interfacing to Microprocessor: Memory and I/O interfacing, A/D and D/A interfacing, 8255(PPI), Programmable Internal Timer (8253), Keyboard and display interlace, Interrupts of 8086.

UNIT-IV

Micro Controller Architecture: Types of Micro Controllers, 8051 MC – Architecture input/output pins, Ports and circuits, Internal and external memories, counters and timers, serial data input/output, Interrupts & timers.

UNIT-V
Introduction to Programming: Basic Assembly language programming, instruction cycle, Addressing modes, 8051 instruction set, Classification of instructions, Simple programs.

Suggested Reading:
1. Douglas, V. Hall microprocessors and Interfacing- Tata McGraw Hill-Revised 2nd Edition, 2017.
2. Krishna Kant – microprocessors and Microcontrollers – Architeture, Programming and System Design 8085, 8086, 8051, 8096, Prentice-Hall india-2007.
3. Kenneth. J. Ayala – The 8051 Microcontroller Architecture Programming and Applications", Thomson publishers, 2nd Edition, 2007.
4. Waiter A. Triebel & Avtar Singh – The 8088 and 8086 Microprocessor – Pearson Publishers, 4th Edition, 2007.

Course Code	Course Title						Core / Elective
PC424EE	**Digital Signal Processing and Applications**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To be able to understand and apply classification: characterization, representation and analysis of signals and systems in time and frequency domain.
- To understand the principle and design of digital filters and to introduce digitalsignal processor and their architecture.

Course Outcomes

At the end of the course students will be able to

1. Acquire the knowledge of - Classification of discrete time signals & discrete time systems, Properties of Z-transforms, Discrete time Fourier transform.
2. Analyze the Characteristics of IIR digital filters, FIR digital filters.
3. Explain the Advantages of Digital signal processors over conventional Microprocessors.

UNIT- I

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

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

UNIT - II

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

UNIT-III

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

UNIT- IV

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

UNIT-V

Introduction to Digital Signal Processors: Introduction to programmable DSPs -Advantages of Digital signal processors over conventional Microprocessors - Architecture of TMS 320C5X.

Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register, Index Register, Auxiliary Register Compare Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, Program controller, Status registers, on- chip memory and On-chip peripherals.

Suggested Readings:

1. Proakis & Manolakis, *Digital Signal Processing, Principles, Algorithms and Applications*, PHIPublications, 3rd Edition, 2014.
2. Opeinheim and Schaffter, *Digital Signal Processing*, PHI Publications, 2002.
3. Salivahanan Valluaraj and Gnanapriya, *Digital Signal Processing,* Tata McGraw Hill, 2001.
4. Anand Kumar.A, *Digital Signal Processing*, PHI learning Private Ltd, 2013.
5. B.Venkataramani and M. Bhaskar, *Digital Signa*$_{8}l_{1}$*Processors, Architecture Programsand Applications*, Tata McGraw Hill, 2007.

Course Code	Course Title						Core/Elective
PE504EE	**Electric Vehicles (Professional Elective – II)**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Know the history of electric hybrid electric vehicles (EV & HEV) and emphasize the need and importance of EV-HEV for sustainable future.
- Introduce the fundamental concepts and principles of electric and hybrid electric vehicles drive train topologies
- Develop a thorough understanding of the key elements of EV/HEV: Electric Machines for Propulsion Applications and Energy Sources.

Course Outcomes

At the end of the course students will be able to

1. To identify and describe the history and evolvement of electric & hybrid electric vehicles to emphasize on the need and importance of EV/HEV for sustainable future.
2. To identify and describe the principles of various EV/HEVs drive train topologies along with their power flow control and fuel efficiency estimation.
3. To design and select electric propulsion system components for EV/HEV drives suitability for the desirable performance and control.
4. To compare and evaluate various energy sources and energy storage components for EV and HEV applications.

UNIT-I

Introduction : Basics of vehicles mechanisms, history of electric vehicles (EV) and hybrid electric vehicles (HEV), need and importance of EV and HEV, Power/Energy supplies requirements for EV/HEV applications,vehicle power source characterization, and transmission characteristics. Vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

UNIT II

Drive-Train Topologies: Review of electric traction, configuration of HEV: Series, Parallel, Series -Parallel and Complex configurations, basics of hybridtraction system, various hybrid drive-train topologies, power flow control in drive-train topologies, fuel efficiency analysis.

UNIT III

Electrical Machines and Power Converters for Hybrid and Electric Vehicles: Electric system components for EV/HEV, suitability of DC and AC machines for EV/HEV applications, AC and DC Motor drives. Permanent magnet and switch reluctance machines, configuration and control of drives. Power Converters- Converters for EV and HEV applications.

UNIT IV

Energy Sources for EV/HEV: Requirements of energy supplies and storage in EV/HEV, Review of batteries, fuel cells, flywheels and ultra-capacitors as energy sources for EV/HEV, characteristics and comparison of energy sources for EV/HEV, hybridization of different energy sources.

UNIT V

Electric Vehicles Charging Station: Type of Charging station, Selection and Sizing of charging station, Components of charging Station and Single line diagram of charging station. Contactless inductive charging- Stationary Inductive charging, resonant and compensation circuit topologies.

Suggested Readings:

1. James Larminie, John Lowry, *Electric Vehicle Technology Explained*, Wiely, USA, 2012.
2. Chris Mi, M. Abdul Masrur, David Wenzhong Gao, *Hybrid Electric Vehicles: Principles andApplications with Practical Perspective*, Wiely, 2011.
3. Iqbal Hussain, *Electric & Hybrid Vehicles – Design Fundamentals*, 2nd Edition, CRC Press, 2011.
4. Simora Onori, *Hybrid Electric Vehicles Energy Management Strategies*, Springer.

Course Code	Course Title						Core / Elective
PE505EE	**High Voltage Engineering (Professional Electives-II)**						**Elective**
Prerequisites	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To understand the concepts of Conduction and Breakdown of Gaseous Insulating Materials.
- To make the students understand the Generation, Measurement and Testing of High Voltage DC, AC & impulse Currents.

Course Outcomes

The students will be able to:

1. Explain the fundamentals of conduction and breakdown in various solid, liquid and gaseous insulating materials.
2. Able to design the circuits used in high voltage AC, DC generation, measurement and testing.
3. Able to understand the significance of standard impulse wave shapes and radio interference measurement.

UNIT-I

Conduction and Breakdown of Gaseous Insulating Materials: Ionization processes and current growth -- Townsend‘s criterion for breakdown - Breakdown in electronegative gases - Time lags for breakdown - Paschen‘s law - Corona discharges - Breakdown in non-uniform fields - Practical considerations for selectinggases for insulation purposes.

UNIT-II

Conduction and Breakdown in Liquid and Solid Dielectrics: Various mechanisms of breakdown in liquiddielectrics - Liquid dielectrics used in practice- Various processes - Breakdown in solid dielectrics- Solid dielectrics used in practice.

UNIT-III

Generation of High Voltages and Currents: Generation of high D.C voltages using voltage multiplier circuits - Van de Graff generator. Generation of high alternating voltages using cascade transformers- Production of high frequency A.C high voltages - Standard impulse wave shapes - Marx circuit - Generationof switching surges - Impulse current generation - Tripping and control of impulse generators.

UNIT-IV

Measurement of High Voltages and Currents: High D.C voltage measurement techniques - Methods of measurement for power frequency A.C voltages - Sphere gap measurement technique - Potential divider orimpulse voltage measurements -Measurement of high D.C, A.C and Impulse currents - Use of CRC for impulse voltage and current measurements.

UNIT-V

High Voltage Testing: Tests on insulators - testing on bushings - Testing of isolators and circuit breakers -Cable testing of transformers Surge diverter testing - Radio interference measurement - Use of I.S.S. for testing.

Suggested Reading:

1. M.S. Naidu and V. Kamaraju, *High Voltage Engineering,* Tata McGraw Hill, 1985.
2. E. Kuffel and M. Abdullah, *High Voltage Engineering,* Pergamon Press, 1970.

Course Code	Course Title						Core / Elective
PE506EE	**Digital Control Systems (Professional Electives-II)**						**Elective**
Prerequisites	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PC415EE	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To impart knowledge in the significance and features of design of discrete- time control system.
- To review on the different transform techniques for digital control system design.
- To impart knowledge on the techniques to analyse the system performance in the discrete-time domain.
- To impart knowledge in discrete state space controller design.

Course Outcomes

After completing this course, the student will be able to

1. Understand the various issues related to digital control systems such as effects of sampling and quantization, discrete time signals and models.
2. Represent a discrete-time control system using state space technique.
3. Design discrete control systems via pole placement.
4. Design observers for discrete control systems.
5. Analyse the stability of a discrete-time control system.

UNIT-I

Introduction to digital control Configuration of basic digital control system: discrete transfer function, discrete model sampled data systems using z- transform, transfer function model, signal analysis and dynamic response, zero-order hold equivalent, introduction to first-order-hold equivalent, transformation between splane, z-plane and w-plane, z-Domain description of sampled continuous-time systems. Controller design Controller Design using transform techniques: Root locus and frequency domain analysis compensator design.

UNIT-II

State space theory Control system analysis using state variable method: vector and matrices, state variable representation, conversion of state variable to transfer function and vice versa, conversion of transfer function to canonical state variable models, system realization, solution of state equations. Solution of discrete-time state equation. Computational methods.

UNIT-III

State space design using state-space methods: controllability and observability, control law design, pole placement, pole placement design using computer aided control system design (CACSD).

UNIT-IV

Observer design: Full order and reduced order discrete observer design - Kalman filter and extended Kalman filter design.

UNIT-V

Stability improvement by state feedback: Stability analysis and Jury‘s stability criterion, Lyapunov stability analysis to linear systems and discrete systems, Stability Improvement by state feedback.

Suggested Readings:

1. K. Ogata, *Discrete Time Control Systems*, Prentice Hall India, 2nd edition, 2005.
2. M. Gopal, *Digital Control and State Variable Methods*, Tata McGraw Hill, 4th edition., 2017.
3. R. Isermann, *Digital Control Systems* Vol 1&2, Springer-Verlag, 1991.
4. B. C. Kuo, *Digital Control System*, Oxford University Press, 2nd edition., 2007

Course Code	Course Title						Core/Elective
OE601EE	**Electrical Energy Conservation and Safety (Open Elective-I)**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To understand the concepts of basic energy and various forms of energy.
- To understand the energy management and need of energy audit.
- To understand the energy efficiency technologies.

Course Outcomes

At the end of the course students will be able to

1. Understand the current energy scenario and importance of energy conservation.
2. Understand the concepts of energy management.
3. Understand the methods of improving energy efficiency in different electrical systems.
4. Understand the concepts of different energy efficient devices.

UNIT-I

Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

UNIT-II

Basics of Energy and its various forms: Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT-III

Energy Efficiency in Electrical Systems: Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

UNIT-IV

Energy Efficient Technologies in Electrical Systems: Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

UNIT-V

Electrical Safety: Physiological effects of Electricity, Important Susceptibility parameters, Distribution of Electric Power, Macro shock hazards, Micro Shock hazards, Electrical - Safety codes and Standards, Basic Approaches to protection against shock, Protection: Power distribution, Protection: Equipment Design, Electrical Safety Analyzers, Testing the Electrical System. Test of Electric Appliances.

Suggested Readings:

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1,General Aspects (available online).
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3,Electrical Utilities (available online).
3. S. C. Tripathy, *Utilization of Electrical Energy and Conservation*, McGraw Hill, 1991.
4. Success stories of Energy Conservation by BEE8,9New Delhi (www.bee-india.org).

Course Code	Course Title						Core/Elective
OE602EE	**Reliability Engineering (Open Elective-I)**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To understand the concepts of different types of probability distributions. importance of reliability evaluation of networks.
- To make the students understand about Reliability, availability model of Power Systems and markov modeling of Power Plants. with identical and nonidentical units.

Course Outcomes

At the end of the course students will be able to

1. Understand the meaning of discrete and continuous random variables and their significance, causes of failures of a system.
2. Acquire the knowledge of different distribution functions and their applications.
3. Able to develop reliability block diagrams and evaluation of reliability of different systems.

UNIT-I

Discrete and continuous random variables. Probability density function and Cumulative distribution function. Mean and variance. Binomial, Poisson, Exponential and WeibulI distributions.

UNIT-II

Failure and causes of failure. Failure rate and failure density. Reliability function and MTTF. Bath tub curve for different systems. Parametric methods for above distributions. Non - Parametric methods from field data.

UNIT-III

Reliability block diagram. Series and parallel systems. Network reduction technique, Examples. Evaluation of failure rate, MTTF and reliability, Active and Standby Redundancy, r out of n configuration. Non-series – parallel systems. Path based and cut set methods.

UNIT - IV

Availability, MTTR and MTBF, Markov models and State transition matrices. Reliability models for single component. two components, Load sharing and standby systems. Reliability and availability models of two unit parallel systern with repair and standby systems with repair.

UNIT – V

Repairable Systems. maintainability. Preventive maintenance, Evaluation of reliability and J1TTF. Overhauling and replacement. Optimum maintenance policy. Markov model of a power plant with identical units and non-identical units. Capacity outage probability table. Frequency of failures and Cumulative frequency.

Suggested Readings:

1. Charles E. Ebeling, *Reliability and Maintainability Engineering*, McGraw Hill International Edition, 2017.
2. Balaguruswamy, *Reliability Engineering*, Tata McGraw Hill Publishing Company Ltd, 1984.
3. R.N. Allan, *Reliability Evaluation of Engineering Systems*, Pitman Publishing, 1996.
4. Endrenyi, *Reliability Modeling in Electric Power Systems,* John Wiley & Sons, 1978.

BASICS OF AUTOMOBILE ENGINEERING

OE 611
AE

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. Understand the Working of Fuel, Ignition, and cooling Systems
2. Understand the Working of Lubrication and Electrical Systems.
3. Understand the Working of transmission, Suspension, Steering and Braking Systems
4. To provide broad introduction to Alternative Energy Sources, Euro norms and Bharat Norms

Outcomes:

1. Generalize the different types of automobiles and engine components
2. Differentiate the Fuel system and electrical system
3. Describe and differentiate the Transmission Systems
4. To identify different components and working of Steering, Brakes and Suspension systems
5. Adapt techniques, skills and modern engineering tools necessary to control the pollution

UNIT – I

***Vehicle Structure and Engines*:** Types of Automobiles, Vehicle Construction, Chassis, Frame and Body , Components of Engine , Cooling and Lubrication systems in Engine, Turbo Chargers, Engine Emission Control by 3 Way Catalytic Controller, Electronic Engine Management System.

UNIT – II

Engine Auxiliary Systems:Carburettor working principle, Electronic fuel injection system, single-point and Multi-Point Injection Systems, Electrical systems, Battery, generator, Starting Motor and Lighting and Ignition.

UNIT – III

Transmission Systems-Clutch: *Types* and Construction, Gear Boxes-Manual and Automatic, , Over Drives, Transfer Box Fluid flywheel Torque convertors, Propeller shaft – Slip Joint – Universal Joints, Differential and Rear Axle, Hotchkiss Drive and Torque Tube Drive.

UNIT – IV

Steering, Brakes and Suspension:Wheels and Tires – Wheel Alignment Parameters, Steering Geometry and Types of steering gear box, Power Steering, Types of Front Axle – Suspension systems. Braking Systems, Types and Construction, Antilock Braking System.

UNIT – V

Alternative Energy Sources*:* Use of Natural Gas, LPG, Biodiesel, Gasohol and Hydrogen in Automobiles, Electric and Hybrid Vehicles, Fuel Cells. Euro and Bharat Norms. Recent trends.

Suggested Reading:

1 Crouse & Anglin, ‘Automotive Mechanics‘ Tata McGraw Hill, Publishing Co., Ltd., New Delhi, Tenth edition - 2004.
2 Kirpal Singh, ‒Automobile Engineering‖, Vol I & II Standard Publishers, Delhi.
3 Joseph Heitner, _Automotive Mechanics‘, Affiliated East West Pvt., Ltd
4 C.P. Nakra, ‒Basic Automobile Engineering‖, Dhanpat Rai Publishing Co.(P) Ltd., New Delhi, 2003

INDUSTRIAL ROBOTICS

OE 611ME

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

1. To familiarize the student with the anatomy of robot and theirapplications.
2. To provide knowledge about various kinds of end effectorsusage.
3. To equip the students with information about various sensors used in industrialrobots.
4. To make the student understand the importance of spatial transformation of robots using forward and inversekinematics.
5. To specify and provide the knowledge of techniques involved in robot vision inindustry.
6. To equip students with latest robot languages implemented in industrialmanipulators.

Outcomes:

Student will be able to

1. Able to demonstrate knowledge of the relationship between mechanical structures of industrial robots and their operational workspace characteristics and have an understanding of the functionality and limitations of robot actuators andsensors.
2. Able to demonstrate an ability to apply spatial transformation to obtain forward/Inverse kinematics equation of robot manipulators using analytical/numerical/simulationtools.
3. Able to apply knowledge and choose the best & economically suitable sensors/end effectors required for specificapplications.
4. Able to understand the importance of robot vision and apply the learnt techniques to get the required information from inputimages.
5. Able to design and develop a industrial robot for a given purposeeconomically.
6. Appreciate the current state and potential for robotics in new applicationareas.

UNIT – I

Introduction to Robotics: Basic structure of Robots. Degree of freedom of Robots, Work envelope, Classification of Robots based on Drive Technology, Work-Envelope and motion control methods. Application of Robots in Industry, Repeatability, Precision and Accuracy as applied to Robots, Specifications of robots used for various applications. End effectors, Grippers: Mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers, RCC grippers, Two fingered and three fingered grippers, internal grippers and external grippers, Selection and design considerations.

UNIT – II

Requirements of a Sensor: Principles and Applications of the following types of sensors- Position of sensors (Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic position sensors), Range sensors (Triangulation principle, Structured, Lighting approach, Time of flight range finders, Laser range meters), Proximity sensors (Inductive, Hall effect, Capacitive, Ultrasonic and Optical proximity sensors), Touch sensors (Binary sensors, Analog sensors), Wrist Sensors, Compliance Sensors, Slip Sensors.

UNIT – III

Kinematic Analysis of Robots: Rotation matrix. Homogeneous transformation matrix, Denavit&Hartenberg representation, Euler and RPY angles representation. Representation of absolute position and orientation in terms of joint parameters, Direct Kinematics of manipulators, Inverse kinematics of Robot arm for position and orientation. Redundancy in Robots, Static force analysis

UNIT – IV

Introduction to Techniques used in Robot Vision: Image acquisition, illumination techniques,imaging geometry, basic relationship pixels, prep[9.2]rocessing, segmentation & description of 3- dimensional structures, their recognition and interpretation. Types of Camera, frame grabbing,sensing and digitizing image data, Signal conversion, Image Storage, Lighting techniques, Image processing and analysis, Data reduction, Segmentation, Feature extraction, Object recognition,and various algorithms, Applications, Inspection, identification, visual serving and navigation.

UNIT – V

Robot Programming Languages: Characteristics of robot level languages, task level languages. Teach pendant programming, Lead through programming, Robot programming languages, VAL programming, Motion commands, Sensor commands. End effecter commands, Simple programs. RGV, AGV, Implementation of robots in industries, various steps, Safety considerations for robot operations. Economic analysis of robots, Pay back method, EUAC method and Rate of return method.

Suggested Readings:

1. Groover M P, "Industrial Robotics", McGraw Hill Publications, 1999.
2. Fu. K.S., Gon Zalez R.C., Lee C.S.G. "Robotics, Control-sensing vision and Intelligence", McGraw Hill, Int. Ed., 1987.
3. Spong and Vidyasagar, "Robot Dynamics & Control", John Wiley and Sons, Ed.,1990.
4. Mittal and Nagrath, "Industrial Robotics", Tata McGraw Hill Publications, 2004.
5. Saha&Subirkumarsaha, _Robotics', TMH, India.

SOFT SKILLS AND INTERPERSONAL SKILLS

OE 601 EG

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. Learn conversational skills
2. Learn reading strategies
3. Learn time management
4. Learn stress management
5. Learn career planning

Outcomes:

Student will be able to

1. Express conversational skills
2. Specify reading strategies
3. Perform time management
4. Perform stress management
5. Explore career planning

UNIT – I
Conversation skills, Listening dialogues from TV/radio/Ted talk/Podcast Group discussion Interview skills, Making presentation Listening to Lectures and News Programmes, Listening to Talk show Watching videos on interesting events on Youtube,
UNIT – II
Reading different genres of tests ranging from newspapers to philosophical treatises Reading strategies – graphic organizers, Reading strategies – summarizing Reading strategies – interpretation, Reports Cover letter, Resume,
UNIT – III
Writing for publications, Letters, Memos, Emails and blogs Civil Service (Language related), Verbal ability Motivation, Self image Goal setting, Managing changes
UNIT – IV

Time management, Stress management
Leadership traits
Team work
Career and life planning.

UNIT – V

Multiple intelligences
Emotional intelligence
Spiritual quotient (ethics)
Intercultural communication
Creative and critical thinking
Learning styles and strategies

Suggested Readings:

1. Business English Certificate Materials, Cambridge University Press.
2. Graded Examinations in Spoken English and Spoken English for Work downloadable materials from Trinity College, London.
3. International English Language Testing System Practice Tests, Cambridge University Press.
4. Interactive Multimedia Programs on Managing Time and Stress.
5. Personality Development (CD-ROM), Times Multimedia, Mumbai.
6. Robert M Sherfield and et al. ‑Developing Soft Skills‖ 4th edition, New Delhi: Pearson Education, 2009.

Web Sources:

1. http://www.slideshare.net/rohitjsh/presentation-on-group-discussion
2. http://www.washington.edu/doit/TeamN/present_tips.html
3. http://www.oxforddictionaries.com/words/writing-job-applications
4. http://www.kent.ac.uk/careers/cv/coveringletters.htm
5. http://www.mindtools.com/pages/article/newCDV_34.htm

HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOR

OE 602 MB

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. Understand management process and functions
2. Comprehend decision making and negotiations
3. Learn psychological contract
4. Study the models of organization behaviour
5. Managing stress and counseling

Outcomes:

Student will be able to

1. Explain various facets of management
2. Elaborate on ways of making decision
3. Elucidate different motivation content theories
4. Describe approaches to leadership
5. Suggest methods for stress management and counseling

UNIT – I

Management Process and Functions, Scientific and Modern Management, 3D Model of Managerial Behavior - MBO - MBWA - Line and Staff - The Peter's Principle - Parkinson's Law - Approaches to Organization Structure-Management - Classical, Human Relations, Systems and Contingency Approaches, Hawthorne's Experiments - Human Engineering.

UNIT – II

Decision Making and Negotiations: Approaches to Decision making - Rational, Behavioral, Practical, and Personal Approaches - Open and Closed Models of Decision Making, Types and steps in planning, Authority, Responsibility, Centralization, Decentralization and Recentralization, Bureaucracy.

UNIT – III

Psychological contract - Personality Traits, Big 5 personality traits, MBTI inventory, the Process of Perception - Perceptual distortions and errors, Kelly's personal construct Theory, Motivation-Content Theories: Maslow, Alderfer, Herzberg, McCleland. Process Theories: Vroom, Potter and Lawler, Equity Theory - Goal Theory - Attribution Theory.

UNIT – IV

Models of Organization Behavior - Autocratic, Custodial, Supportive, Collegial and System Models, Transactional Analysis, Johari Window. Group Dynamics: Typology of Groups - Conflicts in groups - The nature, of conflict - Reactions to conflict - A model of conflict. Trait and Behavioral Approaches to Leadership, Managerial Grid, Path-Goal Theory, Vroom's Decision Tree Approach to Leadership - Hersey and Blanchard Model.

UNIT – V

Organization Design, Organization culture and organization climate, Stress Management and Counseling, Management of change and organization development. Communication - Emerging aspects of OB.

Suggested Readings:

1. Harold Koontz and Heinz Weihrich, *Essentials of Management*, 9th Edition, McGraw Hill Education, 2015.
2. Curtis W. Cook and Phillip L. Hunsaker, *Management and Organizational Behavior,* 3rd Edition, McGraw-Hill,2010.

CYBER LAW AND ETHICS

OE 601 LW

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To familiarize various Cyber laws and IT Acts
2. To give cyber security regulations and forensics
3. To study the risk managements and code of ethics

Outcomes:

Student will be able to

1. Understand the various Cyber laws and IT Acts
2. Learn the cyber security regulations and forensics
3. Analyse the risks and assessment of implications and code of ethics

UNIT – I

Cyber laws and rights in today's digital age: IT Act, Intellectual Property Issues connected with use and management of Digital Data The similar Acts of other countries

Information Warfare*:* Nature of information warfare, including computer crime and information terrorism; Threats to information resources, including military and economic espionage, communications eavesdropping, computer break-ins, denial-of-service, destruction and modification of data, distortion and fabrication of information, forgery, control and disruption of information How, electronic bombs, and sops and perception management.

UNIT – II

Cyberspace and the Law & Cyber Forensics*:* Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing

UNIT – III

Legal, Ethical, and Professional Issues in Information Security Ethical Component in Information System, Codes of Ethics, Certification Security Analysis: Risk Management, Identifying and assessing risk, and Controlling Risk.

UNIT – IV

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing.

UNIT – V

Security risks and perils for organizations, social computing and the associated challenges for organizations. Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

Suggested Readings:

1. Nina Godboleand Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley 2017
2. 1. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, 2018.

OPERATING SYSTEMS

OE 601 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To understand CPU, Memory, File and Device management
2. To learn about concurrency control, protection and security
3. To gain knowledge of Linux and Windows NT internals

Outcomes:

Student will be able to

1. Explain the components and functions of operating systems
2. Analyze various Scheduling algorithms
3. Apply the principles of concurrency
4. Compare and contrast various memory management schemes
5. Perform administrative tasks on Linux Windows Systems

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Threads, Inter process communication. CPU scheduling algorithms, Process synchronization, Critical section problem, Semaphores, Monitors.

UNIT-II

Memory management, Swapping, Contiguous allocation, Paging, Static and Dynamic partitions, Demand paging, Page replacement algorithms, Thrashing, Segmentation, Segmentation with paging. File system interface: File concepts, Accessmethods and protection. File system implementation: File system structure, Allocation methods, Directory implementation. **UNIT-III**

Deadlocks: Necessary conditions, Resource allocation graph, Methods for handling deadlocks, Prevention, Avoidance, Detection and Recovery. Protection: Goals, Domain of protection, Access matrix. Security: Authentication, Threat monitoring, Encryption.

UNIT-IV

Device Management: Disk scheduling methods, Disk management, Device drivers and interfaces, CPU- Device interactions, I/O optimization.

UNIT-V

Case Studies:

The Linux System–Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process communication

Windows NT – General Architecture, The NT kernel, The NT executive.

Suggested Reading:

1. Abraham Silberschatz, Peter B Galvin, Operating System Concepts, Addison Wesley, 2006
2. William Stallings, Operating Systems-Internals and Design Principles, 5th edition, PHI, 2005
3. Andrew S Tanenbaum, Modern Operating Systems, 4th edition, Pearson, 2016

OOP USING JAVA

OE 602 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To introduce fundamental object oriented concepts of Java programming Language suchas classes, inheritance, packages and interfaces
2. To introduce concepts of exception handling and multi-threading
3. To use various classes and interfaces in java collection framework and utility classes To understand the concepts of GUI programming using AWT controls
4. To introduce Java I/O streams and serialization

Outcomes:

Student will be able to

1. develop java applications using OO concepts and packages write multi threaded programs withsynchronization
2. implement real world applications using java collection frame work and I/O classes
3. write Event driven GUI programs using AWT/Swing

UNIT – I

Object Oriented System Development: understanding object oriented development, understandingobject oriented concepts, benefits of object oriented development.

Java Programming Fundamentals: Introduction, overview of Java, data types, variables and arrays,operators, control statements.

UNIT – II

Java Programming OO concepts: classes, methods, inheritance, packages and interfaces. ExceptionalHandling, Multithreaded Programming

UNIT – III

I/O Basics, Reading Console Input and Output, Reading and Writing Files, Print Writer Class, String Handling

Exploring Java.Lang, Collections Overview, Collection Interfaces, Collection Classes, Iterators, Random Access Interface,Maps, Comparators, Arrays, Legacy Classes and Interfaces, String Tokenizer

UNIT – IV

Introducing AWT working With Graphics: AWT Classes, Working with Graphics

.**Event Handling**: Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, Source of Events, EventListener Interfaces

AWT Controls: Control Fundamentals, Labels, Using Buttons, Applying Check Boxes, CheckboxGroup, Choice Controls,Using Lists, Managing Scroll Bars, Using TextField, Using TextArea, Understanding Layout Managers, Menu bars and Menus, Dialog Boxes, FileDialog,Handling events by Extending AWT Components, Exploring the controls, Menus andLayout Managers.

UNIT – V

Java I/O Classes and Interfaces, Files, Stream and Byte Classes, Character Streams, Serialization.

Suggested Readings:

1. Herbert Schildt, The Complete Reference JAVA, Tata McGraw Hill, 7thEdition, 2005
2. James M Slack, Programming and Problem Solving with JAVA, Thomson learning, 2002
3. C.Thomas Wu, An Introduction to Object-Oriented Programming with Java, Tata McGraw Hill,5thEdition, 2005.

OE 601 IT

DATABASE SYSTEMS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To understand the basic concept of DBMS
2. To learn to design, develop and query the database
3. To learn database administration and transaction processing

Outcomes:

Student will be able to

1. Apply the basic concept of DBMS
2. Design, develop and query the database
3. Develop database administration and transaction processing methods

UNIT – I

Data and Data Management: Role of Data and Databases
Database and Database Management System: Key Database concepts-Basic Database Models-Database Components
Data Modeling: Database Design-Relational Database Models- Relationships-Comparing Data Models

UNIT – II

SQL language: SQL features- command basics-SELECT Fundamentals-Operators and Functions-DDL Commands-DML Commands.
Data Access and Manipulation: SELECT statement Advanced Syntax-Joins and Sub Queries.
SQL Procedures: SQL procedures and Functions-Triggers

UNIT – III

Designing a Database: Designing Relational Tables-Comparing Relational Designs-Normalizing Data.
Implementing a Database: Physical Design and Implementation- Adjusting Design to the Real World-Implementing Database Objects.

UNIT – IV

Improving Data Access: Performance Rollbacks-Using Indexes and Views-Using Programmable objects.
Database Administration: Need for Administration-Administration Responsibilities-Management Task.

UNIT – V

Transactions and Locking: Transaction Basics-Managing Concurrency control-SQL server transaction management.
Database Access and Security: Database Connections-Managing Access Control-Protecting data.

Suggested Readings:

1. Mark L. Gillenson, Paulraj Ponniah., ‖*Introduction to Database Management*‖, John Wiley & Sons Ltd, 2008.
2. Lee Chao, ―*Database Development and Management*‖, Auerbach Publications, 2006.
3. Rob Coronel, ―Database Systems: Design, Implementation & Management‖ Thomson Course Technology, 2000.

DATA STRUCTURES

OE 602 IT

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

1. To develop proficiency in the specification, representation, and implementation of abstract data types and data structures.
2. To discuss the linear and non-linear data structures and their applications.
3. To introduce the creation, insertion and deletion operations on binary search trees and balanced binary search trees.
4. To introduce various internal sorting, searching techniques and their time complexities

Outcomes:

Student will be able to

1. Implement linear, non-linear data structures and balanced binary trees
2. Understand the basic data structures arrays and linked lists.
3. Analyse time complexity of both iterative and recursive functions.
4. Define ADT necessary for solving problems based on Stacks and Queues.
5. Develop solutions using binary trees, advanced search trees, tries and graphs.
6. Use hash functions and handle collisions.

UNIT – I

Performance and Complexity Analysis: Space complexity, Time complexity, Asymptotic notation (big-Oh), complexity analysis examples.
Linear list-array representation: vector representation, multiple lists single array.
Linear list-linked representation: singly linked lists, circular lists, doubly linked lists, Applications (polynomial arithmetic).
Arrays and matrices: row and column major representations, special matrices, sparse matrices.

UNIT – II

Stacks: Array representation, linked representation, applications (recursive calls, infix to postfix, postfix evaluation).
Queues: Array representation, linked representation.
Skip lists and Hashing: skip lists representation, hash table representation, application- text compression.

UNIT – III

Trees: Definitions and properties, representation of binary trees, operations, binary tree traversal.
Binary Search Trees: Definitions, and Operations on binary search trees.
Balanced Search Trees: AVL trees, and B-trees.

UNIT – IV

Graphs: Definitions and properties, representation, graph search methods (Depth First Search and Breadth First Search)
Application of Graphs: shortest path algorithm (Dijkstra), minimum spanning tree(Prim‘s and Kruskal's algorithms).

UNIT – V

Sorting and Complexity Analysis: Selection sort, Insertion sort, Quick sort, Merge sort, Closest pair of points, and Heap sort.

Suggested Readings:

1. Sartaj Sahni, –*Data Structures--Algorithms and Applications in C++*‖ 2nd Edition, Universities Press (India) Pvt. Ltd., 2005.
2. Mark Allen Weiss, "*Data Structures and Problem Solving using C++″* Pearson Education International, 2003.
3. Michael T. Goodrich, Roberto Tamassia, David M. Mount –*Data Structures and Algorithms in C++*", John Wiley & Sons, 2010.

DISASTER MITIGATION

OE 601 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1) To impart knowledge of the basic principles of disaster management.
2) To give knowledge of the various types of disasters.
3) To understand the disaster management cycle and framework.
4) To become aware of the disaster management systems in India.
5) To become aware of the applications of the latest technologies in disaster management

Outcomes:

After completing this course, the student will be able to

1) Define and explain the terms and concepts related to disaster management.
2) Describe the various categories of disasters and their specific characteristics.
3) Explain the pre-disaster, during disaster and post-disaster measures and framework
4) Describe the disaster management acts and frameworks specific to India
5) List and explain the various technological applications to aid disaster management.

UNIT-I

Introduction: Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, and Capacity – Disaster and Development, and disaster management.

UNIT-II

Disasters: Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.

UNIT-III

Disaster Management Cycle and Framework: Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness.

During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation.

Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR.

UNIT-IV

Disaster Management in India: Disaster Profile of India – Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter Governmental Agencies.

UNIT-V

***Applications of Science and Technology for Disaster Management*:** Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non-Structural Mitigation of Disasters S&T Institutions for Disaster Management in India.

Suggested Reading:

1. Rajib, S and Krishna Murthy, R. R, *Disaster Management Global Challenges and LocalSolutions*‖ CRC Press, 2009.
2. Navele, P & Raja, C. K, *Earth and Atmospheric Disasters Management, Natural and Manmade. B. S. Publications.2009*
3. Battacharya, T., *Disaster Science and Management*. Tata McGraw hill Company, 2017
4. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
5. *An overview on natural & man-made disasters and their reduction*, R K Bhandani, CSIR, NewDelhi
6. Encyclopedia of disaster management, Vol I, II and IIIL Disaster management policy andadministration, S L Goyal, Deep & Deep, New Delhi, 2006
7. Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur
8. *Disaster Management Act 2005*, Publisher by Govt. of India
9. *Publications of National Disaster Management Authority (NDMA) on Various Templates andGuidelines for Disaster Management*
10. National Disaster Management Policy, 2009, Govt. of India
11. Jagbir singh, Disaster management–Future challenges and opportunities, I.K. International publishing house, 1st edition, 2007.
    Coppala P Damon, Introduction to International Disaster management, Butterworth-Heinemann, 2015.

Course Code	Course Title						Core/Elective
PC463EE	**Digital Signal Processing Lab (Common to EEE and EIE)**						**Core**
Prerequisite	L	T	D	P	CIE	SEE	Credits
PC424EE	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives:

- To prepare the students
- To develop MATLAB code to generate different discrete signals and perform basic operations.
- To develop MATLAB code to convert continuous to discrete by DFT and FFT computations. to obtain Convolution of sequences and sampling theorem.
- To develop MATLAB code to design FIR and IIR filters.
- To use DSP kit and CCS, write code to obtain convolution of sequences, design of FIR and IIR filters, compute DFT and FFT algorithms, Impulse response and generate basic waves

Course Outcomes:

On successful completion of this course student will be able to

1. Compute and write MATLAB code to generate basic waves and perform basic operations on them.
2. Compute and write MATLAB code to apply sampling theorem, to obtain convolution and compute DFT and FFT.
3. Compute and write MATLAB code to design FIR and IIR filters.
4. Compute and write MATLAB code to obtain convolution of sequences, Design of FIR and IIR filters, compute DFT and FFT algorithms, Impulse response and generate basic waves using DSP kit

List of Experiments

1. Generation of different discrete signal sequences and Waveforms.
2. Basic Operations On Discrete Time Signals
3. DFT Computation and FFT Algorithms.
4. Verification of Convolution Theorem.
5. Verification of sampling theorem.
6. Design of Butterworth and Chebyshev LP and HP filters.
7. Design of LPF using Rectangular, Hamming and Kaiser Windows.
8. To perform linear and circular convolution for the given sequences.
9. Design and implementation of FIR and IIR filter.
10. Computation of DFT using DIT and DIF algorithm.
11. Generation of basic waves.
12. Impulse response.

Note: At least ten experiments should be conducted in the Semester

Course Code	Course Title						Core/Elective
PC465EE	MICROPROCESSOR AND MICROCONTROLLERS Lab (Common to EEE and EIE						Core
Microprocessor & Microcontrollers	L	T	D	P	CIE	SEE	Credits
-	-	-	-	2	25	50	1

Course Objectives

- To introduce the architecture of 8, 16 and 32 bit microprocessor and microcontroller
- To impart microcontroller programming skills in students
- To familiarize the students with data transfer and interrupt services

Course outcomes

After completing this course, the student will be able to

1. Apply the design concepts for development of a process and interpret data.
2. Demonstrate knowledge of programming environment, compiling, debugging, linking and executing variety of programs
3. Demonstrate documentation and presentation of the algorithms/flowcharts /programs in a record form.
4. Validate the process using known input-output parameters

List of Experiments:

For 8086

Section 1: Using MASM/TASM

1. Programs for signed/unsigned multiplication and division
2. Programs for finding average of N 16-bit numbers
3. Programs for finding the largest number in an array
4. Programs for code conversion like BCD numbers to 7-segment
5. Programs for compute factorial of a positive integer number\

Section 2: Using 8086 Kit (Interfacing)

1. 8279 – Keyboard Display: Write a small program to display a string of characters.
2. 8255 – PPI: Write ALP to generate triangular wave using DAC
3. 8253 – Timer/Counter: Application of different modes
4. 8251- USART: Write a program in ALP to establish communication between two processors
5. Traffic Signal Controller

For 8051:

Section 3: Using 8051 Kit (Sample Programs)

1. Data Transfer – Block move, Exchange, sorting, Finding largest element in an array.
2. Arithmetic Instructions: Multibyte operations
3. Boollean & Logical Instructions (Bit manipulations)
4. Programs to generate delay, programs using serial port and on-Chip timer/Counter.
5. Use of JUMP and CALL instructions.

Section 3: Program Development using 'C' cross compiler for 8051

1. Square Wave Generation using timers
2. Interfacing of keyboard and 7-segment display module
3. ADC interfacing for temperature monitoring
4. DAC interfacing for Generation of Sinusoidal wave
5. Stepper motor control (clockwise, anticlockwise and in precise angles)

Note: At least five experiments for 8085 and at least five experiments for 8051.

Course Code	Course Title						Core / Elective
PW701EE	**Summer Internship**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**Six Week during Summer Vacation**				**50**	**-**	**1**

Course Objectives

- Produce an accurate record of work performed during the Internship/Co-op
- Apply engineering knowledge to a problem in industry
- Produce a technical report
- Discuss work in a team environment, if relevant to the project
- Conduct herself/himself responsibly, safely, and ethically in a professional environment

Course Outcomes

After completing this course, the student will be able to

1. Get Practical experience of software design and development, and coding practices within Industrial/R&D Environments.
2. Gain working practices within Industrial/R&D Environments.
3. Prepare reports and other relevant documentation.

Summer Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch of three students will be attached to a person from the Government or Private Organisations/Computer Industry/Software Companies/R&D Organization for a period of 4-6 weeks. This will be during the summer vacation following the completion of the III-year Course. One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry co- ordinate (person from industry).

The course schedule will depend on the specific internship/training experience. The typical time per topic will vary depending on the internship

- Overview of company/project
- Safety training
- Discussions with project teams
- Background research, review of documents, white papers, and scientific papers
- Planning, designing, and reviewing the planned work
- Executing the plans
- Documenting progress, experiments, and other technical documentation
- Further team discussions to discuss results
- Final report writing and presentation

After the completion of the project, each student will be required to:

1. Submit a brief technical report on the project executed and
2. Present the work through a seminar talk (to be organized by the Department)

Award of sessionals are to be based on the performance of the students at the workplace and awarded by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (50 Marks). One faculty member will co-ordinate the overall activity of Industry Attachment Program.

Note: Students have to undergo summer internship of 4-6 weeks at the end of semester VI and credits will be awarded after evaluation in VII semester.