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

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Electronics and Instrumentation 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	PC440EE	Biomedical Instrumentation	3	-	-	3	30	70	3	3
5	PC441EE	Electronic Instrumentation Systems	3	-	-	3	30	70	3	3
6	PE55_EE	Professional Elective - I	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7	PC460EE	Electrical Measurements and Instrumentation Lab	-	-	2	2	25	50	3	1
8	PC461EE	Control Systems Lab	-	-	2	2	25	50	3	1
Total			**18**	**-**	**04**	**22**	**230**	**520**	**-**	**20**

Professional Elective – I		
1	PE551EE	Principles of Communication Engineering
2	PE552EE	Advanced Sensors

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.

Note:

1. Each contact hour is a clock hour.
2. The duration of the practical class is two hours, however it can be extended wherever necessary, toenable the student to complete the experiment.

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

SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Electronics and Instrumentation 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	PC442EE	Process Control	3	-	-	3	30	70	3	3
5	PE55_EE	Professional Elective – II	3	-	-	3	30	70	3	3
6	OE60_EE	Open Elective – I	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7	PC463EE	Digital Signal Processing Lab	-	-	2	2	25	50	3	1
8	PC464EE	Process Instrumentation Lab	-	-	2	2	25	50	3	1
9	PW701EE	Summer Internship*	Six Weeks during Summer Vacation							
Total			**18**	**-**	**04**	**22**	**230**	**520**	**-**	**20**

Professional Elective – II		
1	PE553EE	Piping and Instrumentation Diagrams
2	PE554EE	Instrumentation in Aerospace and Navigation
3	PE555EE	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)

CIE: Continuous Internal Evaluation SEE: Semester End Evaluation (Univ. Exam) EE: ElectricalEngg.ote:

1. Each contact hour is a clock hour.
2. The duration of the practical class is two hours, however it can be extended wherever necessary, toenable the student to complete the experiment.
3. The students have to undergo a Summer Internship of six-week duration after VI–Semester and creditswill be awarded in VII–Semester after evaluation.

(iii) Resolved that the enclosed scheme of B.E VII Semester EIE under AICTE New Model scheme be approved.

SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Electronics and Instrumentation 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	PC443EE	Virtual Instrumentation	3	-	-	3	30	70	3	3
2	PC444EE	Opto-Electronic Instrumentation	3	-	-	3	30	70	3	3
3	PC445EE	Analytical Instrumentation	3	-	-	3	30	70	3	3
4	PE55_EE	Professional Elective - III	3	-	-	3	30	70	3	3
5	PE55_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	Microprocessors and Microcontrollers Lab	-	-	2	2	25	50	3	1
8	PC467EE	Instrumentation 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**	**305**	**570**	**-**	**24**

Professional Elective – III & IV		
1	PE556EE	Automation in Process Control
2	PE557EE	Instrumentation and Control in Petrochemical Industry
3	PE558EE	Building Management System and Automation
4	PE559EE	Software Design Tools for Sensing and Control

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 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 EIE under AICTE New Model scheme be approved.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Electronics and Instrumentation 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	PE56_EE	Professional Elective – V	3	-	-	3	30	70	3	3
2	PE56_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	PE560EE	Neural Networks and Fuzzy Logic
2	PE561EE	Instrumentation for Agricultural and Food Processing Industries
3	PE562EE	Digital Image Processing
4	PE563EE	Power Plant Design and Safety Management
5	PE563EE	Advanced Programmable Logic Controller

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	OE821CE	Road Safety Engineering (Not for Civil Engg. Students)
6	OE822IT	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 (EIE) 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 linearcontrol 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 Electricaland 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 controlsystems.
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 andrelative stability, Limitations of Routh's stability.

Root Locus Technique: The root locus concept, Construction of root loci, Effects of adding poles and zeros onthe 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 timeinvariant 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 variouselectrical 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.

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 amplitudemeasurements.

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 equationsusing analytical methods and Laplace and Z-transforms.
- To acquire the knowledge of representing the signals in frequency domain using Fourier series andFourier 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 seriesand 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
PC440EE	**Biomedical Instrumentation**						**Core**
Prerequisite	L	T	D	P	CIE	SEE	Credits
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

- To provide students with an understanding of various medical instruments and latest techniques usedin the hospital for diagnostic purpose.
- To learn and understand electrical hazards of medical instruments and patient‘s safety.

Course Outcomes:

On successful completion of this course student will be able to

1. Describe different general devices used in biomedical applications.
2. Explain instruments for recording Bio-potentials.
3. Explain different techniques and related instruments for measuring blood pressure, blood flow andheart sounds.
4. Describe radiography and explain recent biomedical instruments.
5. Describe electrical hazards, safety in hospital design.

UNIT-I

Introduction to Bio-medical Instrumentation: General Characteristics of medical instrumentation like linearity, range, frequency response, signal to noise ratio and stability. Amplifiers for Bio-medical Applications: Differential, Carrier amplifiers. Recorders and display devices for Bio-Medical applications. General features of ink-jet, Thermo-sensitive and optical recorders. General features of display devices for bio-signals. Data- acquisition and display using microcomputers.

UNIT-II

ECG recording system: Block Schematic diagram of ECG machine, Amplifiers and circuits for ECG, ECG Leads, Noise problems and their elimination.
Electro-encephalography: Block schematic diagram of ECG recording system, General features of different blocks, Specification of ECG amplifiers, Qualitative requirements. 10 -20 electrode system, Resting Rhythmsand sleep stages.
Electro Myography: Block schematic diagram of EMG recording system. EMG amplifiers. Design considerations of EMG amplifiers. Data display for EMG.

UNIT-III

Blood pressure and Blood Flows: Electronic Techniques for indirect and direct measurement of blood pressure. Measurement of blood flow by Electromagnetic, Doppler and Plethysmo-graphic methods.
Phonocardiography: Origin of heart sounds, Phonocardiography instrumentation consisting of microphone, filters and signal conditioners.

UNIT-IV

Introduction to Radiography: Physical properties of X-Rays, Principles of generation of X-Rays. Radiation energy distribution, Collimators and grids, Fluoroscopy, Image intensifiers.
Recent Trends: Medical imaging, X-rays, laser applications, ultrasound scanner, echo cardiography, CT scan MRI/NMR, cine angiogram, Colour Doppler systems, Holter monitoring, endoscopy.

UNIT-V

Electrical hazards during Bio-electric monitoring: Safety, Codes, Standards, Micro and Macro shock and their physiological effects. Leakage currents and protection by use of isolation transformers, Equipotential grounding and earth free monitoring.

Electrical factors in Hospital Design: Electrical power supply systems in a Hospital building. Proper installation and grounding for providing safe patient electrical environment.

Suggested Reading:

1. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, *Biomedical Instrumentation and Measurements*,2nd Edition, Prentice Hall, New Delhi, 1998.
2. John G. Webstar, *Medical Instrumentation -Application & Design*, John Wiley & Sons Inc., 3rd Edition,2003.
3. R.S. Khandpur, *Hand Book of Biomedical Instrumentation*, Tata McGraw Hill Publishing CompanyLtd., 2nd Edition, New Delhi, 2003
4. Joseph J.Carr and John M.Brown, *Introduction to Biomedical Equipment Technology*, PearsonEducation, 2001.
5. L. A. Geddes, *Principles of Applied Bio-Medical Instrumentation*, John Wiley and Sons, New York,USA, 1975.
6. Geddes L. A. and Baker L. E., *Principles of Applied Biomedical Instrumentation*, 3rd Edition, JohnWiley, New York, 1989.
7. Richard Aston, *Principles of Bio-medical Instrumentation and Measurement*, Merril PublishingCompany, New York, 1990.

Course Code	Course Title						Core / Elective
PC441EE	**Electronics Instrumentation Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To learn the properties, construction, operation & applications of Electronic Instrumentation Systems
- To learn the signal analyzers and computer-controlled test systems involved in a digital instrument.
- To develop the ability of designing and using an Electronic Instrument system to Measure, Display &Record various electronic Parameters

Course Outcomes

On successful completion of this course student will be able to:

1. Describe the interfacing of transducers with various amplifiers & Data convertors.
2. Explain operation & features of different types of Digital voltmeters and multimeters.
3. Explain working operation of various Wave analyzers required for an instrumentation system.
4. Describe a Computer controlled testing system for interfacing & testing electronic instruments
5. Express various techniques involved in digital instrumentation using Analog & Digital CROs.

Unit-I Analog and Digital Measuring System

Interfacing Active and Passive Transducers, Amplifiers: Instrumentation amplifier (Fixed and Programmabletypes and specifications), Isolation amplifiers (Types and specifications).

Digital to analog converters (DAC): R-2R ladder and Inverted ladder DACs. Main DAC specifications. **Analog to Digital Converters (ADC)**: Parallel (Flash) ADC, successive approximation ADCs, Microprocessor compatibility and Dual slope ADC, Principal specifications of ADC.

Unit II Digital Voltmeter and Multimeters

Simple D.C Voltage attenuator, Current to Voltage converter, Resistance to Voltage Converter, Automatic ranging and Automatic zeroing RMS detector in DMM, RMS and True RMS, Digital Frequency and Time measurements, Frequency Measurements, Frequency ratio Time Interval and Pulse width Measurements, Scaling and Checking modes. Counting errors, Input signal conditioning, Trigger level, Hysteresis.

Unit III Signal Analysis

Wave and signal Analysers with Applications. Harmonic Distortion Analysers: harmonic distortion, heterodyne harmonic Analyser or Wave meter, Tuned circuit, Fundamental Suppression. Spectrum Analysis: Block Diagram, Phase locked circuit for the local oscillator, successive Limiting type, Log IF amplifier.

Unit IV: Computer Controlled Test Systems:

Testing an Audio amplifier, Radio Receiver instruments used in computer-controlled instrumentation, Frequency counter, Synthesized signal generator, IEEE 488 Bus Bus, Relay switched attenuator, IEEE 488 Electrical Interfacing.

Unit V: Oscilloscope and Mixed Signals:

CRO-Block Diagram, Basic Concepts, Vertical amplifier, Time Base, Trigger Delay line and their role in a CRO. Digital storage Oscilloscope, Magnetic Recorders, Digital Interface for Programmable Instrumentation, Description and Sample examples of Automatic Instrumentation. Basic Problems on CRO for Sensitivity & Deflection.

Suggested Reading:

1. H.S.Kalsi , *Electronic Instrumentation* ,Tata McGraw Hill second edition 2004
2. Helfrick & Copper, *Modern Electronic Instrumentation & Measurement Techniques* ,Prentice Hall ofIndia ,2002
3. A.K.Sawhney, *Electrical and Electronic measurements and Instrumentation*, 8th edition, 2007, DhanpatRai Publishers
4. A.J Bouwens , *Digital Instrumentatio*n ,McGraw Hill International Edition ,1995

Course Code	Course Title						Core / Elective
PE551EE	**Principle of Communication Engineering (Professional Elective-I)**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To introduce the principles of analog communication systems involving different modulation and demodulation schemes
- To introduce the principles of digital communication systems involving different modulation and demodulation schemes

Course Outcomes

At the end of the course students will be able to

1. Develop an understanding of need for modulation and generation & detection of Analog modulation techniques
2. Explore AM and FM Super heterodyne receiver working principle
3. Discuss the techniques for generation and detection of pulse Analog modulation techniques
4. To understand the basic operation involved in PCM like sampling, quantization & encoding and are ableto calculate and derive entropy and channel capacity
5. To compare different communication system with various modulation techniques in the presence ofnoise by analytically

UNIT-I

AM Modulation: AM, generation of AM waves, demodulation, DSBSC, SSB, VSB, FDM, AM receivers,Optical Communication, Microwave communications and Satellite Communications.

UNIT-II

Phase Modulation: Phase and Frequency modulation, Single-tone, narrow band, wide band and multi tone FM,generation and demodulation of FM, FM receivers.

UNIT-III

Pulse Analog Modulations: Sampling theorem, Time Division Multiplexing, PAM, Pulse time modulation.

UNIT-IV

Pulse Digital Modulations: PCM, Measure of Information, Channel capacity, DPCM, DM, Digitalmultiplexers.

UNIT-V

Noise Analysis: SNR, Noise in AM and FM receivers, Noise in FM reception, FM Threshold effect, Pre- emphasis and de-emphasis, Noise in PCM system, Destination SNR in PCM system with quantization and channel noise, output SNR in DM system.

Suggested Reading:

1. S.Haykin, *Communication Systems*, 4th Edition, John Wiley & Sons, 2000.
2. H.Taub & D.Schilling, *Principles of Communication System*, 3rd Edition, Tata McGraw Hill,2007
3. J.S.Beasley&G.M.Miler, *Modern Electronic Communication*, 9th Edition, Prentice-Hall, 2008.

Course Code	Course Title						Core / Elective
PE552EE	**Advanced Sensors (Professional Elective-I)**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To introduce the principles of Advanced sensors
- To introduce the construction and applications of Advanced sensors

Course Outcomes

At the end of the course students will be able to

1. Develop an understanding of need multi sensor and recent trends in technology
2. Explore Smart sensors working principle
3. Discuss the techniques for MEMS, NANO and Chemical sensors techniques
4. To understand the basic operation involved in Robotics, fiber optics and Boi sensors

UNIT-I

Introduction to Multi-sensor: Data fusion Techniques, Application of Data Fusion, Process models for Data Fusion, Limitation of Data Fusion system.

Recent trends in sensor technology: Introduction, film sensors, thick film sensors, Thin film sensors, semiconductor IC technology-standard methods

UNIT-II

Smart Sensors: Introduction, Primary sensors, Excitation, Amplification, Filters, Converters, Compensation, Nonlinearity, Approximation and regression, Noise and interference, response time, drift, cross-sensitivity, Information Coding/Processing, Data communication, standards for smart sensor interface, the Automation.

UNIT-III

MEMS/NANO: Micro electromechanical systems (MEMS), Micromachining, Biomedical Applications, Nano- sensors, Carbon Nanotubes.

Chemical Sensors: Introduction, semiconductor gas detectors, Ion Selective electrodes, Conductometric sensors, Mass sensors.

UNIT-IV

Robotics sensors: Introduction, characteristics, types of sensors, touch or tactile sensors, binary and analog sensors, proximity sensors, types of proximity sensors, contact and non-contact proximity sensors, robotic vision..

UNIT-V

Fiber optic sensors: Fiber optic sensors for the measurement of temperature, Pressure, displacement, turbidity, pollution.

Biosensors: Enzyme sensors, Cell based biosensors using Microelectrodes, Biosensors in Food Analysis.

Suggested Reading:

1. Pallas-Areny R and Webster JG, *Sensors and Signal Conditioning*‖ Wiley India.
2. Gardener, *Micro sensors, MEMS and Smart Devices*, Wiley India.
3. Khazan AD, *Transducers and their Elements – Design and Applications*, Prentice Hall.
4. Patranabis D, *Sensors and Transducers,* Prentice Hall.
5. Middlehook S and Audet SA, *Silicon Sensors,* Academic Press.
6. Dorf RC, *Sensors, Nanoscience, Biomedical Engineering and Instruments*, CRC Press.
7. Zanger H and Zanger C, *Fiber Optics Communication and Other Applications*, Macmillan publishing
8. Joshi RM, *Biosensors*, ISHA Books.
9. Webster JG, *Medical Instrumentation, Application and Design*, Wiley India.

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,2000.
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, 2003.
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.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Electronics and Instrumentation 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	PC442EE	Process Control	3	-	-	3	30	70	3	3
5	PE55_EE	Professional Elective – II	3	-	-	3	30	70	3	3
6	OE60_EE	Open Elective – I	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7	PC463EE	Digital Signal Processing Lab	-	-	2	2	25	50	3	1
8	PC464EE	Process Instrumentation Lab	-	-	2	2	25	50	3	1
9	PW701EE	Summer Internship*	Six Weeks during Summer Vacation							
Total			**18**	**-**	**04**	**22**	**230**	**520**	**-**	**20**

Professional Elective – II		
1	PE553EE	Piping and Instrumentation Diagrams
2	PE554EE	Instrumentation in Aerospace and Navigation
3	PE555EE	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.

Note:

4. Each contact hour is a clock hour.
5. The duration of the practical class is two hours, however it can be extended wherever necessary, toenable the student to complete the experiment.
6. The students have to undergo a Summer Internship of six-week duration after VI–Semester and creditswill be awarded in VII–Semester after evaluation.

Syllabus BE (EIE) Sem-V

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	MICROPROCESSOR AND MICROCONTROLLERS						Core/Elective
PC423EE	(Common to EEE and EIE						Core
Prerequisite	L	T	D	P	CIE	SEE	Credits
-	3		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, 2006.
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.
5. A.K. Ray and Bhurchandi, *Advanced Microproc7e2ssors and Peripherals,* Tata McGraw Hill, 2003.

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	1	-	-	**30**	**70**	**3**

Course Objectives

- To be able to understand and apply classification: characterization, representation and analysisof 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 constantcoefficient 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-2decimation 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 usingwindow 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 RegisterCompare 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*, PHI Publications, 3rd Edition, 1994.
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*$_7$*l*$_3$*Processors, Architecture Programsand Applications*,Tata McGraw Hill, 2007.

Course Code	Course Title						Core / Elective
PC442EE	**Process Control**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To introduce dynamics of various processes
- To impart knowledge on basic control actions, the effect of various control actions and tuningtechniques of controllers
- To impart knowledge on the final control elements.
- To give an introductory knowledge on Programmable Logic Controller (PLC) and their Programminglanguage

Course Outcomes

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

1. Describe elements in process control loop and write a mathematical model for processes.
2. Explain various control modes and realize different electronic controllers.
3. Discuss effects of the closing of the loop with different controllers and estimate controller parametersby using various tuning methods.
4. Explain different final control elements in the process control systems.
5. Describe the nature of programmable logic controller (PLC) and develop PLC programs by usingladder diagram logic for process control applications

UNIT-I

Process characteristics: Process variables, Process degrees of freedom, Characteristics of physical systems, Elements of process dynamics, Liquid processes, Gas processes, Flow processes, Thermal processes, Dead time, Thermal element lag, Pressure element lag.

UNIT-II

Controller characteristics: Automatic controller, Proportional control, Integral control, Proportional integral control, Proportional derivative control, PID control action, Two position control, Single speed floating control, Electronic controllers, Two position floating controller.

UNIT-III

Closed loop in Automatic control: Effect of closing loop, Proportional control, Integral control, PI control, Derivative control, Static error offset, Velocity error, Ziegler Nichols methods, Two- position control, Single speed floating control.

UNIT-IV

Final control elements: Electrical Actuators, Pneumatic Actuators, Hydraulic Actuators, Valve accessories: Pneumatic valve positioner, Valve limit switches, Solenoid valves, Valves: Selection, Performance, sizing and characteristics.

UNIT-V

Discrete state Process Control: Introduction, Relay controllers and Ladder diagrams, Elements, Examples. Programmable Logic Controllers (PLCs): Introduction, PLC design, PLC operation, Programming, PLC software functions with examples.

Suggested Reading:

1. Eckman D. P, *Automatic Process Control*, Wiley Eastern, 1975.
2. Majumdar S.R, *Pneumatic System*, Tata McGraw, 1995.
3. Curtis D.Johnson, *Process Control & Instrumentation Technology*, 7th Edition, Pearson Education.
4. Bela G.Liptak, *Instrument Engineer's Handbook -Process Control*, 3rd Edition, Gulf publications.

Course Code	Course Title						Core / Elective
PE553EE	**Piping and Instrumentation diagrams (Professional Electives-II)**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Identify ISA symbols and interpret basic flow sheets layout principles.
- Exhibit comprehension of instrumentation/flow diagram relationships and flow sheet/plot plans/piping/ interrelationship.
- Prepare flow sheets (process and mechanical) diagrams and P&IDs.
- To provide knowledge on risk, hazard and their assessment techniques in Industry
- To provide knowledge on Safety in Instrumentation & Control Systems

Course Outcomes:

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

1. Understanding of P&I Diagrams, standards involved and its preparation.
2. Awareness on the different fittings used for instruments installation and various softwares used for the preparation of P&IDs.
3. Understanding of Process safety, Safety Management Systems and instrumentation system design for hazardous applications.

UNIT – I

P&I Diagram objectives. Industry Codes and Standards. Government regulations, Engineering drawings: Block flow diagram (BFD), Process flow diagram (PFD), PFD symbols, Piping and instrumentation diagrams, P&ID symbols. Line numbering, Valve numbering, Equipment identification.

UNIT – II

Interpreting P&IDs – equipment: Valves, Vessels, Pumps, Heat exchangers, Compressors, Equipment labeling and identification, KKS numbering system, Smart P&IDs, Softwares used in preparation of P&IDs. Binary logic diagrams and Analog Loop diagrams for simple applications.

UNIT – III

Instrument connections: Pipe and pipe fittings, Flanged pipe fittings, Tape red thread pipe fittings, Parallel thread, pipe fittings, Sanitary pipe fittings, Tube and tube fittings, Compression tube fittings, Common tube fitting types and Bending instrument tubing, Instrument installation diagram.

UNIT – IV

Safety in Instrumentation & Control Systems: Hazardous Area & Material classification as per NEC Standards, Explosion Proof Housing, Encapsulation, Sealing, & Immersion, Purging systems. Intrinsic Safety: - Definition, Designing for intrinsic Safety, Isolation or Encapsulation (Series & Shunt Protective elements, & Zener barrier)

UNIT – V

Process safety and Safety Management Systems: Introduction to process safety, risk, risk terminologies, consequence and risk, risk measurement, Process Hazard Analysis (PHA), Hazard and operability study (HaZOp),Safety Integrity Level (SIL), Introduction to IEC61511 standard for Functional safety, protection layers, Safety Instrumented System: function, architecture, safety life cycle, Application of safety system

Suggested Reading:

1. Frederick, Meier and Clifford Meier, *Instrumentation and Control System Documentation*, ISA Publisher.,2nd Edition.
2. N.E. Bhttiha, *The Management Of Control System: Justification and Technical Auditing,* , ISA.
3. Mannan S., *Lee's Loss Prevention in the Process Industries*, Vol.I, 3rdEd., ButterworthHeinemann, 2004.
4. Mannan S., *Lee's Loss Prevention in the Process Industries*, Vol.II & III, 3 rd Ed., ButterworthHeinemann, 2005.
5. Dave Macdonald, *Practical Industrial Safety, Risk Assessment and Shutdown Systems*, Elsevier, 2004.
6. American Society of Mechanical Engineers (ASME)

Course Code	Course Title						Core / Elective
PE554EE	**Instrumentation in Aerospace and Navigation (Professional Electives-II)**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- .To expose the students to the field of aerospace engineering
- To impart basic knowledge of its navigation instrumentation

Course Outcomes

At the end of the course students will be able to

1. To understand the basics of aerospace and navigation
2. To know the technical aspects of this subject
3. To know about various troubles in aircrafts

UNIT-I: Introduction to Aviation

History of aviation and space flight- anatomy of airplane and space vehicle with emphasis on control surfaces- airfoil nomenclature-basics of aerodynamics to illustrate lift and drag, types of drag, finite wings, swept wings, flaps-Airplane performance-thrust, power, rate of climb, absolute and service ceiling-range and endurance.

UNIT-II Aircraft Instrumentation

Basic engine instruments-capacitive fuel content-gauges, standard atmosphere, altimeters, aneroid-radio altimeters. Aircraft compass-remote indicating magnetic compass-rate of climb indicator-pilot static system-air speed indicator-mach meters-integrated flight instruments-flight testing-recording of flight tests.

UNIT-III- Radio Navigation Aids

Automatic direction finder-distance measuring equipments-instrument landing system- visual omni range-radar- optical instruments-engine instruments and control-pressure measurements-thermal meter control-tachometer- accelerometer-smoke and fire detection-propeller controls –twin blade control-cabin pressure and temperature.

UNIT-IV: Satellite and Space Vehicle Instrumentations

Satellite and space vehicle instrumentation-propulsion controls-sun sensors-horizon sensors-star tracker- stabilization controls

UNIT-V: Electrical Troubles

Hydraulic systems trouble-landing gear troubles-cabin conditioning troubles-indication of unsafe canopy-boeing condition-radio troubles-separate generator-system troubles-trouble indicator light-advantages of instrument flag- black box and its use.

Suggested Reading

1. John D Anderson JR, *Introduction to Flight*, Mc Graw Hill.
2. Pallett E.G.H, *Aircraft Instrumentation and Integrated Systems*\|, Longman scientific and Technical,1992
3. Nagaraja N.S, *Elements of Electronic Navigation*, Mc Graw Hill , New Delhi 1975

Course Code	Course Title						Core / Elective
PE555EE	**Digital Control Systems (Professional Electives-II)**						**Elective**
Prerequisites	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Control System	**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, 3rd edition., 2008.
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 efficientmotors.

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.

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors

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. Book-1, General Aspects (available online).
2. Guide books for National Certification Examination for Energy Manager / Energy AuditorsBook-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 BEE, New Delhi (www.bee-india.org).

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors

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 ofreliability evaluation of networks.
- To make the students understand about Reliability, availability model of Power Systems andmarkov 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 WeibuII 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 InternationalEdition, 1997.
2. Balaguruswamy, *Reliability Engineering*, Tagtoa 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 – Suspensionsystems. 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 611 ME

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 ofindustrial 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 forceanalysis

UNIT – IV

Introduction to Techniques used in Robot Vision: Image acquisition, illumination techniques, imaging geometry, basic relationship pixels, preprocessing, 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 hoursCIE: 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/PodcastGroup discussion
Interview skills, Making presentation
Listening to Lectures and News Programmes, Listening to Talk showWatching videos on interesting events on Youtube,

UNIT – II

Reading different genres of tests ranging from newspapers to philosophical treatisesReading strategies – graphic organizers, Reading strategies – summarizing
Reading strategies – interpretation, ReportsCover letter, Resume,

UNIT – III

Writing for publications, Letters, Memos, Emails and blogsCivil 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 hoursCIE: 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 ofManagerial 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 andCounseling, 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 OrganizationalBehavior,* 3rd Edition, McGraw-Hill,2010.

CYBER LAW AND ETHICS

OE 601 LW

Instruction: 3 periods per week *Duration of SEE: 3 hoursCIE: 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 withuse and management of Digital Data The similar Acts of other countries

Information Warfare*:* Nature of information warfare, including computer crime and informationterrorism; 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 Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley 2017
2. 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 hoursCIE: 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, Access methods 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, Memorymanagement, 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 hoursCIE: 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 Tounderstand 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 programswith synchronization
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, StringHandling

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, Event Listener Interfaces

AWT Controls: Control Fundamentals, Labels, Using Buttons, Applying Check Boxes, Check box Group, Choice Controls, Using Lists, Managing Scroll Bars, Using Text Field, Using Text Area, Understanding Layout Managers, Menu bars and Menus, Dialog Boxes, File Dialog, Handling events byExtending AWT Components, Exploring the controls, Menus and Layout 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.

DATABASE SYSTEMS

OE 601 IT

Instruction: 3 periods per week *Duration of SEE: 3 hoursCIE: 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 DataModels

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 RealWorld-Implementing Database Objects.

UNIT – IV

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

UNIT – V

Transactions and Locking: Transaction Basics-Managing Concurrency control-SQL servertransaction management.
Database Access and Security: Database Connections-Managing Access Control-Protectingdata.

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 hoursCIE: 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, Asymptoticnotation (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- textcompression.

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 Searchand Breadth First Search)
Application of Graphs: shortest path algorithm (Dijkstra), minimum spanning tree(Prim‘s andKruskal'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 hoursCIE: 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, andCapacity – 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, RawatPublishers, 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. Internationalpublishing 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	**0**	**0**	**0**	**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. toobtain 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 IIRfilters, 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 onthem.
2. Compute and write MATLAB code to apply sampling theorem, to obtain convolution andcompute 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
PC464EE	**Process Instrumentation Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PC442EE	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To experimentally verify the principle and characteristics of various controllers.
- To learn and understand the closed loop systems with various controller.

Course Outcomes

1. Explain the characteristics and significance of final control elements
2. Tune the controllers and improve the performance of the process
3. Implement control system using PLC in Process automation

List of Experiments:

1. Calibration of Current to Voltage and Voltage to Current Converter
2. Calibration of Current to Pressure and Pressure to Current Converters
3. Calibration of Temperature Control loop
4. Calibration of Pressure Control loop
5. Calibration of Flow Control loop
6. Calibration of Level Control loop
7. Application of PLC in Process Control
8. Tuning of Control Modes (P, PI, PID)
9. Study of Control Value Characteristics
10. Calibration of Pressure Gauge by using Dead Weight Tester
11. Application of Solenoid Valve in Process Control
12. Ratio Control System
13. Study of Interacting & Non-Interacting Systems
14. Calibration of Pneumatic Amplifier
15. Hydraulic logic Controllers – AND, OR, NOR, NAND Gates & Inverters
16. Measurement of Voltage, Temperature, Pressure & Flow using Hall Effect Sensors

Note: At least 10 experiments should be conducted in the semester

Suggested Readings:

1. G. Stephanopoulos, *Chemical Process Control-An Introduction to Theory and Practice,* Prentice Hall ofIndia, New Delhi, 2nd Edition, 2005.
2. D.R. Coughanowr, *Process Systems Analysis and Control*, McGraw Hill, Singapore, 2nd Edition, 1991.
3. B.W. Bequette, *Process Control Modeling, Design and Simulation*, Prentice Hall of India

Course Code	Course Title						Core / Elective
PC701EE	**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 topicwill 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