THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

COURSES SCHEME

&

SYLLABUS

FOR

B.E.

ELECTRONICS (INSTRUMENTATION AND CONTROL)

2018

GROUP-A

B.E. Electronics (Instrumentation and Control) 2017 Courses Scheme (1st - 4th Year)

S. No	Course No.	Semester - I	L	T	P	Cr
1	UPH004	APPLIED PHYSICS	3	1	2	4.5
2	UTA017	COMPUTER PROGRAMMING - I	3	0	2	4.0
3	UEC001	ELECTRONIC ENGINEERING	3	1	2	4.5
4	UTA015	ENGINEERING DRAWING	2	4	0	4.0
5	UHU003	INTRODUCTION TO PROFESSIONAL COMMUNICATION#	2	0	2	3.0
6	UMA003	MATHEMATICS-I	3	1	0	3.5
		Total	16	7	8	23.5

S. No	Course No.	Semester - II	L	T	P	Cr
1	UCB008	APPLIED CHEMISTRY	3	1	2	4.5
2	UTA018	OBJECT ORIENTED PROGRAMMING	3	0	2	4.0
3	UEE001	ELECTRICAL ENGINEERING	3	1	2	4.5
4	UEN002	ENERGY AND ENVIRONMENT	3	0	0	3.0
5	UTA013	ENGINEERING DESIGN PROJECT-I (6 Self-Effort Hours) (Mangonel)	1	0	2	5.0
6	UMA004	MATHEMATICS-II	3	1	0	3.5
7	UES009	MECHANICS ^	2	1	2^	2.5
		Total	18	4	8	27.0

^ Only one Lab session per semester

S. No	Course No.	Semester - III	L	T	P	Cr
1	UTA014	ENGINEERING DESIGN PROJECT-II (6 Self-Effort Hours) (Buggy)	1	0	4	6.0
2	UTA002	MANUFACTURING PROCESSES	2	0	3	3.5
3	UMA031	OPTIMIZATION TECHNIQUES	3	1	0	3.5
4	UES010	SOLIDS AND STRUCTURES *	3	1	2	4.5
5	UES011	THERMO-FLUIDS *	3	1	2	4.5
6	UEE503	NETWORK ANALYSIS AND SYNTHESIS	3	1	0	3.5
7	UEI407	SIGNALS AND SYSTEMS	3	1	0	3.5
		Total	18	5	11	29.0

* The lab sessions will be on every alternate week

S. No	Course No.	Semester - IV	L	T	P	Cr
1	UES012	ENGINEERING MATERIALS	3	1	2	4.5
2	UMA007	NUMERICAL ANALYSIS	3	1	2	4.5
3	UEI408	ANALOG DEVICES AND CIRCUITS	3	1	2	4.5
4	UCS613	DATA STRUCTURES AND ALGORITHMS	3	0	2	4.0
5	UEI409	DIGITAL SIGNAL PROCESSING AND APPLICATIONS	3	0	2	4.0
6	UEI403	ELECTRICAL AND ELECTRONIC MEASUREMENTS	3	1	2	4.5
		Total	18	4	12	26.0

S. No	Course No.	Semester - V	L	T	P	Cr
1	UEI608	BIO-MEDICAL INSTRUMENTATION	3	0	2	4.0
2	UEI501	CONTROL SYSTEMS	3	1	2	4.5
3	UEI301	DIGITAL ELECTRONICS	3	1	2	4.5
4	UEI610	FUNDAMENTALS OF MICROPROCESSORS AND MICROCONTROLLERS	3	0	2	4.0
5	UTA012	INNOVATION AND ENTREPRENEURSHIP (with 5 Self effort hours)	1	0	2	4.5
6	UEI507	SENSORS AND SIGNAL CONDITIONING	3	1	2	4.5
		Total	16	3	12	26.0

S. No	Course No.	Semester - VI	L	T	P	Cr
1	UEI893	CAPSTONE PROJECT (START)with 4 self effort hours	0	0	2	0.0
2	UEE609	ELECTRICAL MACHINES AND DRIVES	3	1	2	4.5
3	UHU005	HUMANITIES FOR ENGINEERS	2	0	2	3.0
4	UEI601	INDUSTRIAL INSTRUMENTATION	3	1	2	4.5
5	UEE504	POWER ELECTRONICS	3	1	2	4.5
6	UEI605	PROCESS DYNAMICS AND CONTROL	3	0	2	4.0
7		ELECTIVE-I	3	1	0	3.5
		Total	17	4	12	24.0

S. No	Course No.	Semester – VII	L	T	P	Cr
1	UEI401	ARTIFICIAL INTELLIGENT TECHNIQUES AND APPLICATIONS	3	1	2	4.5
2	UEI801	ADVANCED PROCESS CONTROL	3	1	2	4.5
3	UEI893	CAPSTONE PROJECT(COMPLETION) with 8 self effort hours	0	0	2	8.0
4	UEI701	DATA ACQUISITION AND SYSTEM DESIGN	3	0	2	4.0
5	UEI718	VIRTUAL INSTRUMENTATION	2	0	3	3.5
6		ELECTIVE-II	3	1	2	4.5
		Total	14	3	13	29.0

S. No	Course No.	Semester – VIII	L	T	P	Cr
1	UEI892	PROJECT SEMESTER	-	-	-	20
		OR				
1	UEE806	ALTERNATE SOURCES OF ENERGY	3	0	2	4
2	UEI894	DESIGN PROJECT	-	-	-	13
3	UEI805	ENVIRONMENTAL INSTRUMENTATION	3	0	0	3
		Total	6	0	2	20
		OR				
1	UEI895	START- UP SEMESTER	-	-	-	20
		Total				

List of Elective

Elective–I

SR. NO.	Course No.	TITLE	L	T	P	CR
1	UEI624	REHABILATIVE ENGINEERING	3	1	0	3.5
2	UEI831	BIO-SENSOR AND MEMS	3	1	0	3.5
3	UEE507	ENGINEERING ELECTROMAGNETICS	3	1	0	3.5
4	UEI833	OPTICAL INSTRUMENTATION	3	1	0	3.5
5	UEI847	ROBOTICS AND AUTOMATION	3	1	0	3.5
6	UEI841	ADVANCED CONTROL SYSTEMS	3	1	0	3.5
7	UEI625	ANALOG AND DIGITAL COMMUNICATION	3	1	0	3.5

Elective–II

SR. NO.	Course No.	TITLE	L	T	P	CR
1	UEI720	ANALYTICAL INSTRUMENTATION	3	1	2	4.5
2	UEI721	DIGITAL IMAGE PROCESSING	3	1	2	4.5
3	UEI723	EMBEDDED SYSTEMS DESIGN	3	1	2	4.5
4	UEC622	DSP PROCESSORS	3	1	2	4.5
5	UEI724	COMPUTER ARCHITECTURE AND OPERATING SYSTEM	3	1	2	4.5

TOTAL CREDITS: 204.5

UEE503 NETWORK ANALYSIS AND SYNTHESIS

L	T	P	Cr
3	1	0	3.5

Course Objective: To make the students understand concepts of graph theory, two port networks, and network synthesis. To provide familiarity with different network theorems. To explain passive network synthesis.

Graph theory: Graph, Tree and link branches, Network matrices and their relations, Choice of linearly independent network variables, Topological equations for loop current and topological equation for nodal voltage, Duality

Network Theorems: Source transformation, Superposition Theorem,Thevenin's theorem, Norton's theorem, Millman's theorem, Reciprocity theorem and Maximum power transfer theorem as applied to A.C. circuits, Compensation theorem, Tellegen's theorem and their applications.

Two Port Networks: Two port network description in terms of open circuits impedance, Short circuit admittance, Hybrid and inverse hybrid, ABCD and inverse ABCD parameters, Inter-connection of two port network, Indefinites admittance matrix and its applications

Network Functions: Concepts of complex frequency, Transform impedance, Networks function of one port and two port network, concepts of poles and zeros, property of driving point and transfer function.

Passive Network Synthesis: Introduction, Positive Real Functions **:** Definition, Necessary and sufficient conditions for a function to be positive real, Elements of circuit synthesis, Foster and Cauer forms of LC Networks, Synthesis of RC and RL networks.

Course Learning Outcomes (CLO): After the completion of the course student will be able to

1. Describe various laws and theorems related to electric networks.
2. State the concept of two port networks.
3. Familiarise with network synthesis.
4. Elucidate Foster and Cauer forms of LC Networks
5. Interpret passive network synthesis

Text Books:

1. *Hayt, W., Engineering Circuit Analysis, Tata McGraw–Hill (2006).*
2. *Hussain, A., Networks and Systems, CBS Publications (2004).*
3. *Valkenberg, Van, Network Analysis, Prentice–Hall of India Private Limited (2007).*
4. *Gayakwad, A. Op-Amps and Linear Integrated Circuits, Prentice–Hall of India (2006).*

Reference Books:

1. *Chakarbarti,A., Circuit Theory, DhanpatRai and Co. (P) Ltd. (2006).*
2. *Roy Chowdhuary, D., Networks and Systems, New Age International (P) Limited, Publishers (2007).*
3. *Sudhakar, A., Circuits and Networks, Tata McGraw–Hill (2006).*
4. *Suresh Kumar, K.S. Electrical circuits and Networks, Pearson Education, (2009).*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	30
2	EST	45
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UEI407 SIGNALS AND SYSTEMS

L	T	P	Cr
3	1	0	3.5

Course Objectives: To introduce the basic concepts and processing of analog and digital signals.
Introduction: Signals and Systems, Classification of signals, Continuous time signals and its classifications, Standard continuous time signals, Classification of continuous time systems, Discrete time signals and its classifications, Concept of frequency in discrete time signals, Standard discrete time signals, Discrete time systems, Classification of discrete time systems, Nyquist rate, Sampling theorem, Aliasing, Convolution, Correlation.
Fourier Transform: Introduction, Condition for existence of Fourier Integral, Fourier Transform and its properties, Energy density and Power Spectral Density, Nyquist Theorem, System Analysis using Fourier Transform.

Laplace Transform: Introduction, The Laplace Transform, Laplace Transform of some common signals, Properties of the Laplace Transform, The Inverse Laplace Transform, the unilateral Laplace Transform

Z Transform: Introduction, Region of Convergence(ROC), Properties of z transform. Initial value theorem, Final Value theorem, Partial Sum, Parseval's Theorem, z transform of standard sequences, Inverse z transform, Pole Zero plot, System function of LTI system, Causality and Stability in terms of z transform.
Random Signals: Introduction, Probability, Random variables, Gaussian distribution, Transformation of random variables, random processes, stationary processes, Correlation and Covariance Functions.
Course Learning Outcomes (CLO): After the completion of the course student will be able to

1. Apply sampling theorem for different applications
2. Solve problems related to Fourier transforms
3. Apply Fourier transforms for different applications
4. Apply z-transform and Laplace transform for system characterization
5. Elucidate the concepts of random signals

Text Books:

1. *Oppenheim, A.V. and Willsky, A.S., Signals and Systems, Prentice Hall of India (1997).*
2. *Proakis, J.G. and Manolakis, D.G., Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall (2007).*

Reference Books:

1. *Lathi, B.P., Signal Processing and Linear System, Oxford University Press (2008).*
2. *Roberts, M.J., Fundamentals of Signals and Systems, McGraw Hill (2007).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UEI408 ANALOG DEVICES AND CIRCUITS

L	T	P	Cr
3	1	2	4.5

Course Objective: To enhance comprehension capabilities of students through understanding of analog electronic devices, BJT, FET and working of power supplies, amplifiers, oscillators and wave shaping circuits.

P-N Junctions: Diode applications: Limiting and Clamping Circuits, Voltage multipliers, Special diode types-Varactor, light emitting diodes, photo diode.

Bipolar Junction Transistors (BJT): Different configurations and their static characteristics, Operating point and stability in transistor biasing circuits, The Ebers moll model, Thermal Runaway, CE configuration as two port network: h–parameters, h–parameter equivalent circuit.

The Transistor at High Frequencies: The Hybrid-pi (II) Common-emitter Transistor Model, Hybrid-II conductances, The Hybrid-II Capacitances, The CE short-circuit current gain, Current gain with resistive load, Single-stage CE transistor amplifier response, The gain-bandwidth product, Emitter follower at high frequencies

Transistors Amplifier: Multistage Amplifier: Classification of amplifiers, Analysis of transistor amplifier using h – parameter, Frequency response of single stage RC coupled CE amplifier, Effect of an emitter Bypass capacitor on low-frequency response, Feedback Amplifiers: Classification of amplifiers, Positive and negative feedback, Effect of feedback on gain, input and output impedances.

Field-Effect Transistors (FET): Structure and working of JFET and MOSFET, output and transfer characteristics, FET as voltage variable resistor and MOSFET as a switch. Biasing the FET, The FET small signal model, the low-frequency common-source and common-drain amplifiers

Oscillator Circuits: Condition for sustained oscillation, R-C phase shift, Wien Bridge, Hartley, Colpitts and Crystal Oscillators, Frequency stability, Multivibrators, High pass and low pass filters using R-C Circuits and R-L, R-L-C Circuits, Attenuators, Clamping Circuit theorem, Schmitt Trigger, Comparator.

Text Books

1. *Boylestad R. L., Electronic Devices and Circuit Theory, Pearson Education (2007) 9thed.*
2. *Millman, J. and Halkias, C.C., Integrated Electronics, Tata McGraw Hill (2006).*

Reference Books

1. *Neamen, Donald A., Electronic Circuit Analysis and Design, McGraw Hill (2006) 3rd ed.*
2. *Sedra A. S. and Smith K. C., Microelectronic Circuits, Oxford University Press (2006) 5th ed.*

Course Learning Outcomes (CLO): After the completion of the course the students will be able to:

1. Differentiate between different of diodes on the basis of their working principle.
2. Elucidate the working principle of BJT and FET
3. Explain the analysis of transistor amplifier using h-model and analyse the effect of feedback on amplifiers.
4. Design the oscillator circuit.

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEI409 DIGITAL SIGNAL PROCESSING AND APPLICATIONS

L	T	P	Cr
3	0	2	4.0

Course Objective: To understand the basic concepts and techniques for digital signal processing, familiarization with DSP concepts by studying the design of different digital filters and transform-domain processing.

Introduction: Review of Discrete Time Signals and Systems and z-Transforms, Solution of Difference Equations Using One-sided z-Transform, Frequency domain Characteristics of LTI Systems, LTI Systems as Frequency-Selective Filters.

Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT): Discrete Fourier Transform and its Properties, Divide and Conquer Approach, Decimation in Time and Decimation in Frequency FFT Algorithms.

Digital Filter Structure: Describing Equation of digital filter, Structures for FIR Systems: Direct Form Structure, Cascade Form Structure, Structure for IIR Systems: Direct Form Structures, Cascade Form Structure, Parallel Form Structure and Lattice Structure.

Design of Digital Filters: Causality and its Implications, Difference between analog filters and digital filters, FIR filter design using windows, Design of IIR filters from analog filters using: Approximation of Derivatives, Impulse Invariance and Bilinear Transformation, Frequency transformations.

Analysis of Finite Word length Effects: Introduction, The quantization process and errors, Analysis of coefficient quantization effects in FIR filters, A/D noise analysis, Analysis of arithmetic round off errors, Limit cycles in IIR filters,

Laboratory work: Convolution and correlation, Solution of difference equations using z- Transform and Fourier tools, FFT and spectrum analysis, design of high pass, low pass, band pass and band stop FIR filter using window method, design of IIR filter using Matched Z Transform (MZT), Bilinear Z Transform (BZT), Pole Zero Placement and Impulse Invariant methods.

Course Learning Outcomes (CLO): After the completion of the course student will be able to

1. Analyze the signals in time and frequency domain
2. Apply the transformation tools on signals and systems and analyze their significance and applications.
3. design the structures of different types of digital filters
4. design various digital filters and analyze their frequency response
5. Analyse finite word length effects.

Text Books

1. *Proakis, J.G. and Manolakis, D.G., Digital Signal Processing, Prentice Hall of India Private Limited (2006).*
2. *Rabiner, C.R. and Gold, B., Theory and Applications of Digital Signal Processing,Prentice Hall of India Private Limited (2000).*

Reference Books:

1. *Antonion, A., Digital Filters: Analysis Design and Application, Prentice Hall of India Private Limited (1999).*
2. *Oppenhein, A.V. and Schafer, R.W., Digital Signal Processing, Prentice Hall of India Private Limited (1998).*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	25
2	EST	40
3	Sessional	35

UEI403 ELECTRICAL AND ELECTRONIC MEASUREMENTS

L	T	P	Cr
3	1	2	4.5

Course Objectives: To understand concepts of various electrical and electronic measuring instruments. To familiarize with different electromechanical and electronic instruments. To introduce instruments for power and energy measurements. To explain instrument transformers and magnetic measurements. To be able to measure different physical parameters with the help of AC bridges.

Electrical Standards: Standards of e.m.f. and resistance, Frequency dependence of resistance, Inductance and Capacitance, Time and frequency standards.

Electromechanical Indicating Instruments: PMMC galvanometer, Ohmmeter, Electrodynamometer, Moving iron meter, Rectifier and thermo-instruments, Comparison of various types of indicating instruments.

Power and Energy Measurement: Electrodynamometer type of wattmeter and power factor meter, Power in poly phase system: two wattmeter method, Single-phase induction and Electronic energy meters.

Instrument Transformers: Current & Voltage transformers, Constructional features, Ratio & Phase angle errors.

Magnetic Measurements: Determination of B-H curve and hysteresis loop, Measurement of iron losses with Llyod Fisher square.

Bridge Measurements: AC bridges: Applications and conditions for balance, Maxwell’s bridge, Hay’s bridge, Schering bridge, Wien’s bridge, De Sauty’s bridge, Insulation testing, Ground resistance measurement, Varley and Murray loop test.

Electronic Instruments: Electronic multimeter, Digital voltmeters, General characteristics ramp type voltmeter, Quantization error, Digital frequency meter/Timer, Q meter and its applications, Distortion meter, Wavemeter and Spectrum Analyzer, Block diagram and Applications of oscilloscopes, Storage type digital oscilloscopes.

Laboratory Work: Experiments around sensitivity of wheat stone bridge, Comparison of various types of indicating instruments, Single-phase induction type energy meter, AC bridges, Measurement of iron losses with Llyod Fisher square, Storage type digital oscilloscopes.

Project: Development of power supplies using transformers.

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. Explain the working of different electromechanical indicating instruments.
2. Elucidate the concept of several AC bridges for inductance and capacitance
3. Describe basic working of instrument transformers.
4. Measure power and energy with the help of wattmeter and energy meter.
5. Describe the construction and working of various electronic instruments.

Text Book:

1. *Golding, E.W., and Widdis, F.C., Electrical Measurements and Measuring Instruments, Pitman (2003).*
2. *Helfrick, A.D., and Cooper, W.D., Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India (2007).*

Reference Books:

1. *Kalsi, H.S., Electronic Instrumentation, Tata McGraw-Hill (2007).*
2. *Nakra, B.C., Chaudhry, K.K., Instrumentation Measurement and Analysis, Tata McGraw-Hill (2003).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEI608 BIO-MEDICAL INSTRUMENTATION

L	T	P	Cr
3	0	2	4.0

Course Objectives: The objective of this course is to introduce student to basic biomedical engineering technology and introduce different biological signals, their acquisition, measurements and related constraints.

Introduction of Bio-medical Instrumentation, Sources of Bioelectric Potentials and Electrodes: Introduction to man-instrument system, components of the man-instrument system, Physiological system of the body, Problems encountered in measuring a living system. Resting and action potentials, Propagation of action potentials, Bioelectric potentials, Biopotential electrodes, Biochemical transducers. Review of transducers

Cardiovascular System and Measurements: The heart and cardiovascular system, ECG, blood pressure and its measurement, respiration and pulse rate, characteristics and measurement of blood flow meter, cardiac output, phethysmography, pacemaker, defibrillators, heart sounds and its measurement,

Respiratory and Neuro-muscular System: The physiology of the respiratory system, test and instrument for the mechanics of breathing, the somatic nervous system, EEG, EMG and GSR.

Measurement and Recording of Non-invasive Diagnostic Instrumentation, Patient Care and Electrical Safety: Principle of ultrasonic measurement, ultrasonic, thermography, elements of intensive care monitoring, X-ray, CT – Scan and MRI, tonometer, dialysis**,** diathermy, Shock hazards from electrical equipment.

Laboratory work: Study the variance in pulse rate of subject in a batch, use Spiro meter on the subject, auditory system check-up using Audiometer, Measurement of Heart Rate using Stethoscope, Blood pressure using Sphygmomanometer, Pulse Rate and SpO_2 using Pulse Oximeter, Skin Conductance and Skin Potential using Galvanic Skin Response Module, Pulse Rate using Polyrite machine, Respiration Rate using Polyrite. Electromygram test using EMG biofeedback Trainer.

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. differentiate and analyse the biomedical signal sources.
2. elucidate cardiovascular system and related measurements.
3. explain the respiratory and nervous systems and related measurements
4. measure non-invasive diagnostic parameters.
5. Describe diagnostic instrumentation

.

Text Books:

1. *Cromwell, L. and Weibell, F.J. and Pfeiffer, E.A., Biomedical Instrumentation and Measurement, Dorling Kingsley (2006) 2nd ed.*
2. *Carr, J.J. and Brown, J.M., Introduction to Biomedical Equipment Technology, Prentice Hall (2000) 4th ed.*

Reference Books:

1. *Geddes, L.A., and Baker, L.E., Principles of Applied Biomedical Instrumentation, Wiley InterScience (1989) 3rd ed.*
2. *Khandpur, R.S., Handbook of Biomedical Instrumentation, McGraw Hill (2003) 2nd ed.*
3. *Webster, J.G., Medical Instrumentation Application and Design, John Wiley (2007) 3rd ed.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	40
3.	Sessional (May include Assignments//Quizes/Lab Evaluations)	35

UEI501 CONTROL SYSTEMS

L	T	P	Cr
3	1	2	4.5

Course Objectives: To understand concepts of the mathematical modeling, feedback control and stability analysis in Time and Frequency domains. The concept of time response and frequency response of the system will be studied.

Basic Concepts: Historical review, Definitions, Classification, Relative merits and demerits of open and closed loop systems, Linear and non-linear systems, Transfer function, , Block diagrams and signal flow graphs.

Components: D.C. and A.C. Servomotors, D.C. and A.C. Tachogenerators, Potentiometers and optical encoders, Synchros and stepper motors

Analysis: Steady-state errors and error constants, Concepts and applications of P, PD, PI and PID types of control.

Stability: Definition, Routh-Hurwitz criterion, Root locus techniques, Nyquist criterion, Bode plots, Relative stability, Gain margin and phase margins.

Compensation: Lead, Lag and lag-lead compensators, Design of compensating networks for specified control system performance.

State Space Analysis: Concepts of state, State variables and state models, State space equations, Transfer function, Transfer model, State space representation of dynamic systems, State transition matrix, Decomposition of transfer function, Controllability and observability.

Laboratory : Linear system simulator, Compensation design, D.C. position control and speed control, Synchro characteristics, Servo demonstration, Stepper motor, Potentiometer error detector, Rate control system, Series control system, Temperature control system.

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. develop the mathematical model of the physical systems.
2. analyze the response of the closed and open loop systems.
3. analyze the stability of the closed and open loop systems.
4. design the various kinds of compensator.
5. develop and analyze state space models

Text Books:

1. *Gopal, M., Digital Control System, Wiley Eastern (1986).*
2. *Nagrath, I.J. and Gopal, M., Control System Engineering, New Age International (P) Limited, Publishers (2003).*
3. *Ogata, K., Modern Control Engineering, Prentice–Hall of India Private Limited (2001).*

Reference Books:

2. *Kuo, B.C., Automatic Control System, Prentice–Hall of India Private Limited (2002).*
3. *Sinha, N.K., Control System, New Age International (P) Limited, Publishers (2002).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessional (May include Assignments//Quizes/Lab Evaluations)	40

UEI301 DIGITAL ELECTRONICS

L	T	P	Cr
3	1	2	4.5

Course Objectives: To familiarize the student with the analysis and design of various digital circuits including combinational and sequential circuits.

Introduction: Difference between analog and digital systems, Advantages and Disadvantages of digital system. Binary codes: Weighted and non-weighted codes, Sequential codes, Self-complementing codes, Excess-3 code, Gray code, Error-detecting codes, Error-correcting codes, Hamming code.
Minimization Techniques: Introduction, Simplification of Boolean functions by Boolean algebra, The map method up to five variable, Quine McClusky method.
Combinational Circuits: Introduction, Logic Gates: Basic gates, Universal gates, Derivation of other gates from universal gates, Half adder, Full adder, Parallel Binary adder, Serial adder, BCD adder, Half and full subtractor, Magnitude comparators, Parity Generators/checkers, Encoders, Priority encoder, Decoders, Multiplexer as function generator, Demultiplexer, Using combinational modules to design digital systems.
Sequential Circuits: Introduction, latches, Flip-flops: Types, Their conversions and applications, Registers: Serial/Parallel in/out, Bidirectional, Universal shift register, Counters: Synchronous, Asynchronous, Decade, Binary, Modulo-n, Shift register counters.
Asynchronous Sequential Logic: Analysis Procedure, Design procedure, reduction of state and flow table, race free state assignments, hazards, Design of Asynchronous sequential circuits.
Converters: Digital to Analog conversion, R-2R ladder DAC, Weighted Resistor DAC, Analog to Digital (A/D or ADC) conversion, Flash type, Counter type ADC, Dual-slope ADC, Successive approximation type ADC.
Memories: Memory Units, Memory Addressing, Introduction and classification of ROM, Static and Dynamic RAM, Flash memory, Memory Expansion, FIFO Memory, LIFO Memory.
Logic circuits: Introduction, Specification terminology: Fan out, Unit load, Current and voltage parameters; DTL, TTL, ECL, MOS, CMOS logic families and their comparison, Tristate Logic.
Laboratory Work:
To consider various important codes and the logic for converting from one to another, 74146, 7476, 7483, 7485, 7490, 7492, 7495, 74121, 74123, 74126, 74151, 74163, 74180, 74181, 74190, 74192, 74195, 74196, Shift register and binary counting using JK flip flop, asynchronous/synchronous up/down counters, Variable modulus counters
Course Learning Outcome (CLO): After the completion of the course student will be able to :

1. Differentiate between different number systems and various codes
2. Apply minimization techniques for the simplification of Boolean functions
3. Design the combinational and sequential circuits.
4. Compare the different analog to digital converters.
5. Elucidate the concept of memories and logic circuits

Text Books:

1. *Floyd, T.L. and Jain, R. P., Digital Fundamentals, Pearson Education (2008).*
2. *Tocci, R. and Widmer, N., Digital Systems: Principles and Applications, Pearson Education (2007).*

Reference Book:

3. *Mano, M. M. and Ciletti, M., Digital Design, Pearson Education (2008).*
4. *Kumar, A., Fundamentals of Digital Circuits, Prentice Hall (2007).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

6.

UEI610 FUNDAMENTALS OF MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	Cr
3	**0**	**2**	**4.0**

Course Objectives: To make the students able to understand microprocessors and microcontroller and their applications.

INTEL 8085 Microprocessor: Evolution of microprocessor, Types of various architectures; Harvard and Von-Neumann, RISC and CISC, Pin Functions, Architecture, Addressing Modes, Instruction Set, Timing Diagrams, Interrupts, Programming Examples, Direct Memory Access, I/O Mapping.

Introduction to 8051 Microcontroller: Difference between microprocessor and microcontroller, 8051-architecture and pin diagram, Registers, Timers Counters, Flags, Special Function Registers, Addressing Modes, Data types, instructions and programming, Single bit operations, Timer and Counter programming, Interrupts programming, Serial communication, Memory accessing and their simple programming applications.

Hardware interfacing: I/O Port programming, Bit manipulation, Interfacing to a LED, LCD, Keyboard, ADC, DAC, Stepper Motors and Sensors.

Introduction to latest 16 bit processor and their applications

Laboratory work: Introduction IDE like Keil/EdSim/UMPS etc., Programming examples of 8085, Programming and Application development around 8051 microcontroller, Interfacing to LED, LCD, Keyboard, ADC, DAC, Stepper Motors and sensors etc.

Course Learning Outcome (CLO):

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

1. Elucidate the architecture and addressing modes of 8-bit microprocessor.
2. Elucidate the architecture and addressing modes of 8051 microcontroller.
3. Perform assembly language programming for microprocessors and microcontrollers for the given application.
4. Use hardware interfacing of 8051 to develop solutions of real world problems.

Text Books:

1. *Gaonkar, R. S., The 8085 Microprocessor- Architecture, Programming and Interfacing, Penram International Publishing (India) Pvt. Ltd. (2004).*
2. *Ayala, K.J., The 8051 Microcontroller Architecture, Programming and applications, Penram International Publishing (India) Pvt. Ltd. (2007).*
3. *Mazidi, M.A., The 8051 Microcontroller and Embedded System, Pearson Education (2008).*

Reference Books:

1. *Brey, B.B., The INTEL Microprocessors, Prentice–Hall of India Private Limited (2002).*
2. *Predko, M., Customizing The 8051 Microcontroller, Tata McGraw–Hill (2002).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	40
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	35

UEI507 SENSORS AND SIGNAL CONDITIONING

L	T	P	Cr
3	1	2	4.5

Course Objectives: To introduce the basics of measurements. To elucidate sensors and signal conditioning circuits. To introduce different error analysis methods. To familiarize with different sensors and transducers. To explain signal conditioning circuits.

Introduction: Definition, Application and types of measurements, Instrument classification, Functional elements of an instrument, Input-output configuration of measuring instruments, Methods of correction for interfering and modifying inputs, Standards, Calibration, Introduction to Static characteristics and Dynamic characteristics, Selection of instruments, Loading effects.

Error Analysis: Types of errors, Methods of error analysis, Uncertainty analysis, Statistical analysis, Gaussian error distribution, Chi-Square test, Correlation coefficient, Student's t-test, Method of least square, Curve fitting, Graphical analysis, General consideration in data analysis, Design of Experiment planning.

Sensors/Transducers: Definition, Types, Basic principle and applications of Resistive, Inductive, Capacitive, Piezoelectric and their Dynamic performance. Fiber optic sensors, Bio-chemical sensors, Hall-Effect, Photoemissive, Photo Diode/ Photo Transistor, Photovoltaic, LVDT, Strain Gauge Digital transducers: Principle, Construction, Encoders, Absolute and incremental encoders, Silicon micro transducers.

Signal Conditioning: Operational Amplifiers: application in instrumentation, Charge amplifier, Carrier amplifier, Introduction to active filters, Classification, Butterworth, Chebyshev, Couir filters, First order, Second order and higher order filters, Voltage to frequency and frequency to voltage converters.

Laboratory Work:
Measurement of Linear Displacement, Angular displacement, Temperature, Light intensity, Capacitance, Resistance, Inductance.

Course Learning Outcomes (CLO): After the completion of the course student will be able to:
1. Apply different methods for the measurement of length and angle
2. Elucidate the construction and working of various industrial parameters / devices used to measure pressure, sound and flow
3. Explicate the construction and working of various industrial parameters / devices used to measure temperature, level, vibration, viscosity and humidity
4. Ability to analyse, formulate and select suitable sensor for the given industrial applications
5. Describe signal conditioning circuits

Text Books:
1. *Doebelin, E.O. and Manic, D.N., Measurement Systems: Applications and Design, McGrawHill (2004).*
2. *Sawhney, A.K. and Sawhney, P., A Course in Electrical and Electronic Measurements and Instrumentation, DhanpatRai (2008).*

Reference Books:
1. *Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India (2003).*
2. *Nakra, B.C. and Chaudhry, K.K., Instrumentation, Measurement and Analysis, TMH (2003).*
3.

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEE609 ELECTRIC MACHINE AND DRIVES

L	T	P	Cr
3	1	2	4.5

Course Objectives: In this course we will cover fundamental electromechanical, power electronic, and control theory in the context of electric drive systems. The capabilities and limitations of different types of electric machines in various drive applications will also be addressed.
Fundamentals of electromechanical devices:flux linkage/current relationships, concept of energy and co-energy, calculation of forces and torques.

Power Electronic Converters: voltage control using uncontrolled switches, controlled rectification, inversion, voltage controllers, converter waveforms, acoustic noise and cooling

Control Theory: Importance of Feedback control, requirement of feedback loops in drive applications, current-limit control, speed, torque and position control for electric drives, concept of PLL in speed control application.

DC Motor Drives: EMF and torque production of DC motor, dc motor types, transient and steady-state characteristics, four quadrant operation, thyristor and chopper fed dc motor drives.

Induction Motor Drives:concept of rotating magnetic field and torque production, motor types, torque-speed and torque-slip characteristics, methods of starting of squirrel cage motors, generating and braking modes, speed control using stator voltage control, variable frequency operation, rotor resistance control and slip power recovery schemes.

Motor/Drive Selection:power ratings and capabilities, drive characteristics, load requirements and general application considerations.

Laboratory work: The lab will consist of giving the students hands-on experience with electric machines (AC and DC), power electronic circuitry, and control algorithms for electric drives.

Course Learning Outcomes: After the completion of the course student will be able to:

1. derive expressions for forces and torques in electromechanical devices
2. understand how power electronic converters and inverters operate
3. possess an understanding of feedback control theory
4. analyze and compare the performance of DC and AC machines in various drive applications
5. design controllers for electric drives which achieve the regulation of torque, speed, or position in the above machines.

Text Books:

1. *Dubey, G.K., Fundamentals of Electric Drives, Narosa Publications (2001).*
2. *Mohan, N., Electric Drives: An Integrative Approach. MNPERE, (2001).*
3. *Krishnan, R., Electric Motor Drives: Modeling, Analysis, and Control. Prentice Hall, (2001).*

Reference Books:

1. *Hughes, A. and Drury, B., Electric Motors and Drives: Fundamentals, Types and Applications, Newnes,4th Ed., (2014).*
2. *Sharkawi, Mohammed.A.El, Fundamentals of Electric Drives, PWS-Brooks/Cole Pub. Company, (2000).*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	25
2	EST	35
3	Sessional	40

UEI601 INDUSTRIAL INSTRUMENTATION

L	T	P	Cr
3	1	2	4.5

Course objectives: To provide the knowledge for the measurement of length, angle and area. To familiarize with motion and vibration measurement. To explain different methods for pressure and flow measurement. To introduce different methods of temperature, level and humidity measurement.

Metrology (Measurement of Length, Angle and Area): Dimensional measurement, Dial gauges, Gauge blocks, Comparators, Flatness measurement, Optical flats, Sine bar, Angle gauges, Planimeter.

Motion and Vibration Measurement: Translational and rotational displacement using potentiometers, Strain gauges, Differential transformer, Different types of tachometers, Accelerometers

Pressure Measurement: Moderate pressure measurement, Bourdon tube, Bellows and diaphragms, High pressure measurement: Piezoelectric, Electric resistance, Low pressure measurement: Mcleod gauge, Knudsen Gauge, Viscosity gauge, Thermal conductivity, Ionization gauge, Dead weight gauges.

Flow Measurement: Obstruction meter, Orifice, Nozzle, Venturi, Pitot tube, Rotameter, Turbine, Electromagnetic, Vortex, Positive displacement, Anemometers, Weirs and flumes, Laser Doppler anemometer, Ultrasonic flow meter, Mass flow meter.

Temperature Measurement: Bimetallic thermometers, Liquid-in-glass, Pressure thermometer, Semiconductor sensors, Digital thermometers, Pyrometers.

Level Measurement: Visual level indicators, Purge method, Buoyancy method, Resistance, Capacitance and inductive probes, Ultrasonic, Laser, Optical fiber, Thermal, Radar, Radiation.

Miscellaneous Measurements: Humidity, Dew point, Viscosity, nuclear radiation measurements.

Laboratory work: Experiments around Measurement of Length, Angle, Pressure, Temperature, Flow, Level, Humidity, Vibration using different techniques.

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. illustrate the different methods for the measurement of length and angle
2. elucidate construction & working of various industrial devices used to measure pressure, sound & flow
3. explicate the construction and working of various industrial devices used to measure temperature, level, vibration, viscosity and humidity
4. to analyze, formulate and select suitable sensor for the given industrial applications
5. summarize different methods for level measurement

Text Books:

1. *Doeblin, E.O., Measurement systems, Applications and Design, McGraw–Hill (1982).*
2. *Nakra, B. C. and Chaudhry, K. K., Instrumentation Measurement and Analysis, TMHl (2003).*

Reference Books:

1. *Murthy, D.V.S., Transducers and Instrumentation, Prentice–Hall of India Private Limited (2003).*
2. *Sawhney, A.K., A Course in Electrical and Electronic Measurements and Instrumentation, DhanpatRai and Co. (P) Ltd. (2007).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessional (May include Assignments//Quizes/Lab Evaluations/Project)	40

UEI605 PROCESS DYNAMICS AND CONTROL

L	T	P	Cr
3	0	2	4.0

Course objective: To make the students understand basic ideas, challenges, techniques, and applications of process control for controlling various processes. To familiarize with different actuators. To classify among different control modes.

Introduction: Historical perspective, Incentives of process control, Synthesis of control system. Classification and definition of process variables.

Mathematical Modeling: Need and application of mathematical modeling, Lumped and distributed parameters, Analogies, Thermal, Electrical and chemical systems, Modeling of CSTR, Modeling of heat exchanger, Interacting and non-interacting type of systems, Dead time elements

Control Modes: Definition, Characteristics and comparison of on-off, Proportional (P), Integral (I), Differential (D), PI, PD, PID, Dynamic behavior of feedback controlled processes for different control modes ,Control system quality, IAE, ISE, IATE criterion, Tuning of controllers Ziegler-Nichols, Cohen-Coon methods

Realization of Control Modes: Realization of different control modes like P, I, D, In Electric, Pneumatic, Hydraulic controllers.

Actuators: Hydraulic, Pneumatic actuators, Solenoid, E-P converters, Control valves, Types, Functions, Quick opening, Linear and equal percentage valve, Ball valves, Butterfly valves, Globe valves, Pinch valves, Valve application and selection

Advanced Controls: Introduction to advanced control schemes like Cascade, Feed forward, Ratio, Selective, Override, Split range and Auctioneering control

Laboratory Work: I to P, P to I, Valve characteristics, Simulation of different control modes, Experiments around Basic Process RIG.

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. demonstrate fundamental understanding of process control.
2. develop the mathematical model of various chemical processes.
3. explain different control modes and their application in controlling various processes.
4. explain the working of electric, hydraulic and pneumatic controllers.
5. demonstrate the working and application of different type of actuators and control valves

Text Books:

1. *Johnson, C.D., Process Control Instrumentation Technology, Prentice–Hall of India Private Limited (1992).*
2. *Stephanopoulos, G., Chemical Process Control, Prentice–Hall of India Private Limited (1983).*

Reference Books:

1. *Harriot, P., Process Control, Tata McGraw–Hill (1982).*
2. *Liptak, B.G., Instrument Engineers Handbook, Butterworth, Heinemann (2002).*
3. *Seborg, D.E. and Edgar, T., Process Dynamics and Control, John Wiley and Sons (1989).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
	MST	25
	EST	40
	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	35

UEI624 REHABILATIVE ENGINEERING

L	T	P	Cr
3	1	0	3.5

Course Objectives: To understand the concepts of Biomechanics and get the student able to apply biomechanics for rehabilitation

Introduction: Introduction to Biomechanics, Movements of the body, Skeletal System, Naming characteristics that describe muscle features, Muscular system, Regional anatomical kinesiology. Biomechanics in Orthopedics: Principles, Introduction to the structure and mechanics of the musculoskeletal system, Application of mechanics to bone, Tendon, Ligaments and other biological materials, Definition of biological tissue and orthopaedic device mechanics.

Engineering Concepts in Rehabilitation Engineering Anthropometry: Methods for Static and Dynamic Measurements: Area Measurements, Measurement of Characteristics and Movement, Measurement of Muscular Strength and Capabilities, Measurement Tools and Processes in Rehabilitation Engineering: Fundamental Principles, Structure, Function, Performance and Behaviour. Engineering Concepts in Sensory Rehabilitation Engineering: Sensory Augmentation and Substitution, Visual System, Visual Augmentation, Tactual Vision Substitution and Auditory Vision Substitution, Auditory System: Auditory Augmentation, Audiometer, Hearing Aids, Cochlear Implantation, Visual Auditory Substitution, Tactual Auditory Substitution, Tactual System.

Orthopedic Prosthetics and Orthotics in Rehabilitation: Engineering Concepts in Motor Rehabilitation, Applications. Intelligent Prosthetic Knee, A Hierarchically Controlled Prosthetic Hand, A Self-aligning Orthotic Knee Joint, Externally Powered and Controlled Orthotics and Prosthetics, FES Systems−Restoration of Hand Function, Restoration of Standing and Walking, Hybrid Assistive Systems (HAS).

Course learning outcome (CLO): After the completion of the course the students will be able to
1. Apply Orthopedics, Cardiology, Exercise Physiology, Surgery, Biomechanics in Orthopaedics
2. Engineer rehabilitation engineering anthropometry
3. Use sensory rehabilitation engineering concepts.
4. Rehabilitation using orthopedic prosthetics and orthotics in
5. Handle applications of active prostheses.

Recommended Books:

1. *Bronzino and Joseph, Handbook of Biomedical Engineering. CRC Press (2004).*
2. *Ghista, D.N., Orthopedic Mechanics, Academic Press (2008).*
3. *Horia-Nocholai, T. and Jain, L.C., Intelligent Systems and Technologies in Rehabilitation Engineering, CRC Press (2001).*
4. *Park, J.B., Bio-materials: Science and Engineering, Springer (1984).*
5. *Robinson C.J, Rehabilitation engineering, CRC Press (2006).*

Evaluation Scheme:

Evaluation Elements	Weightage (%)
MST	30
EST	45
Sessionals (May include Assignments/ Projects/ Tutorials/ Quizes/ Lab Evaluations)	25

UEI831 BIOSENSORS AND MEMS

L	T	P	Cr
3	**1**	**0**	**3.5**

Course Objectives: To introduce the concept of biosensors and MEMS, design and fabrication, types and their applications. To explain biosensors and bioelectronics devices. To introduce MEMS technology.

Overview of biosensors and their electrochemistry: Molecular reorganization: Enzymes, Antibodies and DNA, Modification of bio recognition molecules for Selectivity and sensitivity, Fundamentals of surfaces and interfaces

Bioinstrumentation and bioelectronics devices: Principles of potentiometry and potentiometric biosensors, Principles of amperometry and amperometric biosensors, Optical Biosensors based on Fiber optics, FETs and Bio-MEMS, Introduction to Chemometrics, Biosensor arrays; Electronic nose and electronic tongue

MEMS Technology: Introduction Nanotechnology and MEMS, MEMS design, and fabrication technology – Lithography, Etching, MEMS material, Bulk micromachining, Surface micromachining, Microactuator, electrostatic actuation, Micro-fluidics.

MEMS types and their applications : Mechanical MEMS – Strain and pressure sensors, Accelerometers etc., Electromagnetic MEMS – Micromotors, Wireless and GPS MEMS etc

Magnetic MEMS – all effect sensors, SQUID magnetometers, Optical MEMS – Micromachinedfiber optic component, Optical sensors, Thermal MEMS – thermo-mechanical and thermo-electrical actuators, Peltier heat pumps

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. explain the concept of molecular reorganization, fundamentals of surfaces and interfaces
2. elucidate the principles of different types of biosensors
3. explain the concept of MEMS design, and fabrication technology
4. explain bioinstrumentation and bioelectronics devices.
5. explain the different types of MEMS and its applications

Text books:

1. *Gardner, J.W., Microsensors, Principles and Applications, John Wiley and Sons (1994).*
2. *Kovacs, G.T.A., Micromachined Transducer Sourcebook, McGraw–Hill (2001).*
3. *Turner, A.P.F., Karube,I., and Wilson G.S., Biosensors–Fundamentals and Applications, Oxford University Press (2008).*

Reference Book:

1. *Trimmer, W., Micromechanics and MEMS, IEEE Press (1990)*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments/Projects/ Tutorials/ Quizes)	25

UEI833 OPTICAL INSTRUMENTATION

L	T	P	Cr
3	1	0	3.5

Course Objectives: To make the students able to understand different aspects of optical instrumentation. To introduce opto-electronic devices and optical components. To explain the concept of interferometry

Light Sourcing, Transmitting and Receiving: Concept of light, classification of different phenomenon based on theories of light, basic light sources and its characterization, polarization, coherent and incoherent sources, grating theory, application of diffraction grating, electro-optic effect, acousto-optic effect and magneto-optic effect.

Opto –Electronic devices and Optical Components: Photo diode, PIN, photo-conductors, solar cells, phototransistors, materials used to fabricate LEDs and lasers design of LED for optical communication, response times of LEDs, LED drive circuitry, lasers classification ruby lasers, neodymium lasers, CO_2 lasers, dye lasers, semiconductors lasers, lasers applications.

Interferometry: Interference effect, radiometry, types of interference phenomenon and its application, michelson's interferometer and its application refractometer, rayleigh's interferometers, spectrographs and monochromators, spectrophotometers, calorimeters, medical optical instruments

Optical Fiber Sensors: Active and passive optical fiber sensor, intensity modulated, displacement type sensors, multimode active optical fiber sensor (micro bend sensor) single mode fiber sensor-phase modulates and polarization sensors

Fiber optic fundamentals and Measurements: fundamental of fibers, fiber optic communication system, optical time domain reflectometer (OTDR), time domain dispersion measurement, frequency domain dispersion measurement.

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. explain the basic concepts of optical transmitting and receiving
2. describe different opto- electronic devices
3. elucidate different methods of interferometry
4. describe selection of the appropriate optical fiber sensors for industrial application
5. explain fibre optic fundamentals

Text books:

1. *J.Wilson&J F B Hawkes, Opto Electronics: An Introduction, Prentice Hall of India, (2011),3rd ed.*
2. *RajpalS.Sirohi , Wave Optics and its Application, (2001),1st ed.*
3. *A Yariv , Optical Electronics/C.B.S. Collage Publishing, New York, (1985)*
4. *Pollock ,Fundamentals of OPTOELECTRONICS,(1994)*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments//Quizes)	25

UEI847 ROBOTICS AND AUTOMATION

L	T	P	Cr
3	1	0	3.5

Course Objectives: To introduce the concepts of Robotic system, its components and instrumentation and control related to robotics.

Basic Concepts in Robotics: Automation and robotics, Robot anatomy, Basic structure of robots, Resolution, Accuracy and repeatability, and Classification and Structure of robots, Point to point and continuous path systems.

Robotic Systemand Control Systems: Components of robotic system,Hydraulic systems, d.c. servo motors, Basic control systems concepts and models, Control system analysis, Robot activation and feedback components. Positional and velocity sensors, actuators. Power transmission systems,

Robot arm Kinematics and Dynamics: Robot joints, The direct kinematics problem, The inverse kinematics solution, Lagrange-Euler formation ,GeneralizedD'Alembert equations of motion, DenavitHartenberg convention and its applications.

Sensors and Instrumentation in robotics: Tactile sensors, proximity and range sensors, Force and torque sensors, Uses of sensors in robotics. Vision equipment, Image processing, Concept of low level and high level vision.

Computer based Robotics: Method of robots programming, GUI based robotic arm control, Interfacing with computer, communication and data processing, Introduction to Artificial Intelligence.

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. explain the fundamentals of robotics and its components
2. illustrate the Kinematics and Dynamics of robotics
3. elucidate the need and implementation of related Instrumentation & control in robotics
4. illustrate the movement of robotic joints with computers/microcontrollers.
5. Explain sensors and instrumentation in robotics

Text Books:

1. *Nikku, S.B., Introduction to Robotics, Prentice –Hall of India Private Limited (2002).*
2. *Schilling. R. J., Fundamentals of Robotics: Analysis and Control, Prentice –Hall of India Private Limited (2006).*

Reference Books:

1. *Criag, J., Fundamentals of Robotics: Analysis and Control, Prentice –Hall of India Private Limited (2006).*
2. *Gonzalex, R. C. and Fu, K. S., Robotics Control Sensing, Vision and Intelligence, McGraw –Hill (2004). Koren,Y., Robotics for Engineers, McGraw –Hill (1985).*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	30
2	EST	45
3	Sessionals (May include assignments/quizzes)	25

UEI841 ADVANCED CONTROL SYSTEMS

L	T	P	Cr
3	1	0	3.5

Course objective: To provide knowledge of methods for analyzing the behavior of nonlinear control systems and the designing of control systems. To introduce z-plane analysis of discrete time control systems. To familiarize with the design of discrete time control systems.

Nonlinear Control Systems: Introduction to Nonlinear systems and their properties, Common Non-linearities, Describing functions, Phase plane method, Lyapounov's method for stability study, concept of Limit Cycle.

Optimal Control Theory: Introduction, Optimal control problems, Mathematical procedures for optimal control design: Calculus of variations, Pontryagin's optimum policy, Bang-Bang Control, Hamilton-Jacobi Principle

z-Plane Analysis of Discrete-Time Control Systems: Introduction, Impulse sampling and data hold, Reconstructing original signal from sampled signals, concept of pulse transfer function, Realization of digital controllers.

Design of Discrete-time Control Systems: Introduction, Stability analysis of closed-loop systems in the z-plane, Transient and steady state response analysis, Design based on the root-locus method, Design based on the frequency-response method.

State-Space Analysis: Introduction, State-space representations of discrete-time systems, Solving discrete-time state-space equations, Pulse transfer function matrix, Discretization of continuous time state space equations,Lyapunov stability analysis, Controllability and Observability, Design via pole placement, State observer design.

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. demonstrate non-linear system behaviour by phase plane and describing function methods and the
2. perform the stability analysis nonlinear systems by Lyapunovmethoddevelop design skills in optimal control problems
3. derive discrete-time mathematical models in both time domain (difference equations, state equations) and z-domain (transfer function using z-transform).
4. predict and analyze transient and steady-state responses and stability and sensitivity of both open-loop and closed-loop linear, time-invariant, discrete-time control systems.
5. acquire knowledge of state space and state feedback in modern control systems, pole placement, design of state observers and output feedback controllers

Text Books:

1. *Slotine& Li, Applied Non-Linear Control, Englewood Cliffs, NJ: Prentice-Hall, (1991).*
2. *Bandyopadhyay, M.N., Control Engineering: Theory and Practice, Prentice-Hall of India Private Limited (2003).*
3. *Ogata, K., Discrete-time Control Systems, Pearson Education (2005).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UEI625 ANALOG AND DIGITAL COMMUNICATION

L	T	P	Cr
3	1	0	3.5

Course objective: The main objectives of this course are to acquire knowledge about analog communication systems.

Unit I Introduction: Introduction to communication systems: Modulation, type and need for modulation. Introduction to Analog communication, Introduction to Digital communication

Unit II Amplitude and SSB modulation: Theory of amplitude modulation, AM transmission, , Basic principle of AM generation, Square law modulation, AM reception, Super heterodyne Receiver, Introduction and advantages of SSB Transmission, Generation of SSB, The Phase Shift Method, Vestigial Side-band Modulation, application of amplitude modulation.

Unit III Angle modulation: Theory of frequency modulation and demodulation Narrow band FM, Wide band FM, Phase modulation, Phase modulation obtained from frequency modulation, comparison of various analog communication system (AM-FM-PM)

Unit IV Analog Pulse Modulation: Introduction, Pulse amplitude modulation (PAM), Pulse Time Modulation (PTM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM)

UNIT V Digital Pulse Modulation Systems: Pulse code modulation (PCM), Noise in PCM systems, Differential pulse code modulation (DPCM), Adaptive pulse code modulation (ADPCM), Delta modulation (DM), Comparison of PCM, DPCM and DM, Adaptive delta modulation.

UNIT VI Digital Modulation Techniques: Amplitude shift keying, frequency shift keying, phase shift keying. Quadrature amplitude modulation, Bandwidth efficiency, comparison of various communication techniques (ASK, FSK, PSK,QAM)

Text Books: *Lathi.B.P., Modern Digital and Analog Communications Systems 3rd ed.*

Reference Books:

1. *Taub, H., Principles of Communication Systems, McGraw-Hill (2008) 3rd ed.*
2. *Haykin, S., Communication Systems, John Willey (2009) 4th ed.*
3. *Proakis, J. G. and Salehi, M., Fundamentals of Communication Systems, Dorling Kindersley (2008) 2nd ed.*
4. *Kennedy, G., Electronic Communication Systems, McGraw-Hill (2008) 4th ed.*
5. *Proakis John G., Digital Communication System, McGraw, (2000) 4th ed.*
6. *Simon Haylein, Digital Communication Systems, Wiley India edition, (2009) 2nd ed.*

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UEI401 ARTIFICIAL INTELLIGENT TECHNIQUES AND APPLICATIONS

L	T	P	Cr
3	1	2	4.5

Course Objectives: To introduce the concept of artificial intelligence, methods, techniques and applications

Overview of Artificial Intelligence: The concept and importance of AI, Human intelligence vs. Machine intelligence.

Artificial Neural Networks: Structure and function of a single neuron, Artificial neuron models, Types of activation functions, Neural network architectures, Neural learning,Evaluation of networks, Supervised learning, Back propagation algorithm, Unsupervised learning, winner–take all networks, Application of neural networks for Classification, Clustering, Pattern associations, Function approximation, Forecasting etc.

Fuzzy Logic: Fuzzy sets and systems, Operations on Fuzzy sets, Fuzzy relations, Membership functions, Fuzzy rule generation, De–Fuzzification, Fuzzy controllers,

Genetic Algorithms: Introduction and concept, Coding, Reproduction, Cross–over and mutation scaling, Fitness, Applications, Swarm intelligence, and their applications.

Laboratory work: Use of FIS, ANFIS, Simulink, Fuzzy logic, Neural Networks and GA applications in MATLAB.

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. explain the concept of artificial neural networks and its learning techniques.
2. apply back propagation algorithm for different applications
3. express fuzzy sets, membership functions and knowledge representation using fuzzy rules.
4. explain basics of expert systems.
5. use genetic algorithms for single and multiple objective optimization problems

Text Books:

1. *Petterson, D.W., Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India (2007).*
2. *Zurada, J.M., Introduction to Artificial Neural Network System, Jaico Publication (2006).*
3. *Hagan, M.T., Neural network design, Prentice Hall of India .*
4. *Ross, T.J., Fuzzy logic with engineering applications, TMH*

Reference Books:

1. *Yegnanarayana, B., Artificial Neural Networks, Prentice–Hall of India Private Limited (2008).*
2. *Winston, P.H., Artificial Intelligence, Addison Wesley (1994).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessional (May include Assignments//Quizes/Lab Evaluations)	40

UEI801 ADVANCED PROCESS CONTROL

L	T	P	Cr
3	1	2	4.5

Course Objectives: To make the students understand the basic concepts of advanced process control schemes, DCS, Artificial intelligence techniques used in Process Control, PLC and digital control system. To introduce artificial intelligence in process control. To explain programmable logic controller.

Introduction to advanced Control Schemes: Cascade, Feed-forward, Feed-forward plus Feedback, Ratio control, Inferential control, Dead time and Inverse response compensation, Adaptive control, Model reference adaptive control, Self tuning regulator Interactions and Decoupling of Control Loops: Design of cross controllers and selection of loops using Relative Gain Array

Distributed Control System (DCS): Evolution and advantages of computer control, Configuration of Supervisory, Direct digital control (DDC) and DCS.

Artificial Intelligence in Process Control: Expert systems, Neural networks, Fuzzy logic, Neuro Fuzzy , Genetic algorithm, Virtual instrumentation.

Programmable Logic Controllers: Comparison with hard wired relay and semiconductor logic, Hardware, Ladder diagram programming, Case studies, Introduction to **SPLD, CPLD, FPGA**

Digital Control: Sampling and reconstruction, Discrete systems analysis, Stability and controller design using z transform and difference equations, Smoothing filter realization using difference equations

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. explain the concept of advanced control schemes used in process control.
2. explain the working of distributed control system
3. elaborate the use of artificial intelligence techniques in process control.
4. explain the fundamental concepts of PLC.
5. explain the concept of digital control system.

Text Books:

1. *Stephanopoulos, G., Chemical Process Control, Prentice–Hall of India Private Limited (1983).*
2. *Liptak, B.G., Instrument Engineers Handbook , Chilton Book Company (1994).*

Reference Books:

1. *Deb, S.R., Robotics Technology and Flexible Automation, Tata McGraw–Hill (1994).*
2. *Johnson, C.D., Process Control Instrumentation Technology, Prentice–Hall of India Private Limited (2007).*
3. *Zaidi, A., SPC Concepts, Methodologies and Tools, Prentice–Hall of India Private Limited (1995).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessional (May include Assignments//Quizes/Lab Evaluations)	40

UEI701 DATA ACQUISITION AND SYSTEM DESIGN

L	T	P	Cr
3	0	2	4

Course Objectives: To understand concepts of acquiring the data from transducers/input devices, their interfacing and instrumentation system design. To familiarize with different data transfer techniques.

Data Acquisition Techniques: Analog and digital data acquisition, Sensor/Transducer interfacing, unipolar and bipolar transducers, Sample and hold circuits, Interference, Grounding and Shielding.

Data Acquisition with Op-Amps: Operational Amplifiers, CMRR, Slew Rate, Gain, Bandwidth. Zero crossing detector, Peak detector, Window detector. Difference Amplifier, Instrumentation Amplifier AD 620, Interfacing of IA with sensors and transducer, Basic Bridge amplifier and its use with strain gauge and temperature sensors, Filters in instrumentation circuits,

Data Transfer Techniques: Serial data transmission methods and standards RS 232-C: specifications connection and timing, 4-20 mA current loop, GPIB/IEEE-488, LAN, Universal serial bus, HART protocol, Foundation-Fieldbus, ModBus, Zigbee and Bluetooth.

Data Acquisition System (DAS): Single channel and multichannel, Graphical Interface (GUI) Software for DAS, RTUs, PC-Based data acquisition system.

Laboratory Work: Op-amp as a comparator and its application, Integrator and differentiator, Active filters, Simulation of the above applications using ORCAD, Instrumentation Amplifier/AD 620, Interfacing of sensors and transducers using DAQ cards.

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. elucidate the elements of data acquisition techniques.
2. design and simulate signal conditioning circuits.
3. explain various data transfer techniques
4. explain the components of data acquisition system
5. differentiate between single and multi-channel

Text Books:

1. *Coughlin, R.F., Operational Amplifiers and Linear Integrated Circuits, Pearson Education (2006).*
2. *Kalsi, H.S., Electronic Instrumentation, Tata McGraw Hill (2002).*
3. *Gayakwad, R.A., Op-Amp and Linear Integrated Circuits, Pearson Education (2002).*
4. *Mathivanan, N., Microprocessor PC Hardware and Interfacing, Prentice Hall of India Private Limited (2007).*

Reference Books:

1. *Ananad, M.M.S., Electronic Instruments and Instrumentation Technology, Prentice Hall of India Private Limited (2004).*
2. *Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India Private Limited (2006).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	40
3	Sessional	35

UEI718 VIRTUAL INSTRUMENTATION

L	T	P	Cr
2	**0**	**3**	**3.5**

Course Objective: The objective of this course is to introduce the concept of virtual instrumentation and to develop basic VI programs using loops, case structures etc. including its applications in image, signal processing and motion control.

Review of Virtual Instrumentation: Historical perspective, Block diagram and Architecture of Virtual Instruments

Data-flow Techniques: Graphical programming in data flow, Comparison with conventional programming.

VI Programming Techniques: VIs and sub-VIs, Loops and Charts, Arrays, Clusters and graphs, Case and sequence structures, Formula nodes, Local and global variables, Strings and file I/O.

Data Acquisition Basics: ADC, DAC, DIO, Counters and timers.

Common Instrumentation Interfaces: RS232C/ RS485, GPIB, PC Hardware structure, DMA software and hardware installation.

Use of Analysis Tools: Advanced analysis tools such as Fourier transforms, Power spectrum, Correlation methods, Windowing and filtering and their applications in signal and image processing, Motion Control.

Additional Topics: System buses, Interface buses: PCMCIA, VXI, SCXl, PXI, etc.

Laboratory Work : Components of Lab VIEW, Celsius to Fahrenheit conversion, Debugging, Sub-VI, Multiplot charts, Case structures, ASCII files, Function Generator, Property Node, Formula node, Shift registers, Array, Strings, Clusters, DC voltage measurement using DAQ

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. demonstrate the working of LabVIEW.
2. explain the various types of structures used in LabVIEW.
3. analyze and design different type of programs based on data acquisition.
4. demonstrate the use of LabVIEW for signal processing, image processing etc.
5. use different analysis tools

Text Books:

1. *Johnson, G., LabVIEW Graphical Programming, McGraw–Hill (2006).*
2. *Sokoloft, L., Basic Concepts of LabVIEW 4, Prentice Hall Inc. (2004).*
3. *Wells, L.K. and Travis, J., LabVIEW for Everyone, Prentice Hall Inc. (1996).*

Reference Book:

1. *Gupta, S. and Gupta, J.P., PC Interfacing for Data Acquisition and Process Control, Instrument Society of America (1988).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessional (May include Assignments//Quizes/Lab Evaluations)	40

UEI720 ANALYTICAL INSTRUMENTATION

L	T	P	Cr
3	1	2	4.5

Course objectives: To introduce the concept of analytical Instrumentation, methods, techniques and applications.

Introduction: Introduction to instrumental analysis-classification and its advantages, Sampling systems for gas analysis and liquid analysis.

Spectrometry: Introduction to atomic absorption spectrometer, emission spectrometer UV-visual spectrometer, infrared spectrometer, excitation sources: arc and spark, Nuclear magnetic resonance spectrometer, Mass spectrometry, biomedical applications of spectrometry.

Chromatography: Introduction to Chromatographic techniques, Liquid chromatography, Gas chromatography, Applications of chromatography. Introduction to optical Techniques and their Working, turbidimetry, Nephelometry, Polarimetry, Refractometry.

X-ray Analytical Methods: Introduction to X-ray spectral analysis, Fluorescence X-ray spectrometer Wavelength dispersive devices, Energy dispersive devices, Detectors, Scanning electron microscope, X-ray diffractometer, X ray absorption spectrometer Applications of X ray analytical methods in biomedical, industrial applications.

Potentiometry : Potential and standard potential, ion selective electrode, Glass electrode, Gas sensing electrode. Application of potentiometry.

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. explain the concept of spectrometry and optical techniques
2. elucidate the working of chromatography, elemental analyser
3. illustrate the working of X- ray diffractometer and scanning electron microscope
4. explain the concept of potentiometry and its applications
5. describe the working of different electrodes

Text Books:

1. *Braun, R.D., Introduction to Instrumental Analysis, Mc-Graw Hill (2008).*
2. *Khandpur, R.S., Handbook of Biomedical Instrumentation, Tata McGraw–Hill (2000)*
3. *Mathur, R.P., Water and Waste Water Testing Laboratory Manual, Nem Chand and Brothers (1982).*
4. *Patranabis D. Principles of Industrial & Instrumentation, Tata McGraw–Hill (1998)*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEI721 DIGITAL IMAGE PROCESSING

L	T	P	Cr
3	1	2	4.5

Course Objectives: To introduce the concepts of image processing and basic analytical methods to be used in image processing. To familiarize students with image enhancement and restoration techniques, To explain different image compression techniques. To introduce segmentation and morphological processing techniques.

Introduction: Fundamentals of Image formation, components of image processing system, image sampling and quantization.

Image enhancement in the spatial domain: Basic gray-level transformation, histogram processing, arithmetic and logic operators, basic spatial filtering, smoothing and sharpening spatial filters.

Image restoration: A model of the image degradation/restoration process, noise models, restoration in the presence of noise–only spatial filtering, Weiner filtering, constrained least squares filtering, geometric transforms; Introduction to the image enhance in frequency domain.

Image Compression: Need of image compression, image compression models, error-free compression, lossy predictive coding, image compression standards.

Morphological Image Processing: Preliminaries, dilation, erosion, open and closing, basic morphologic algorithms, The Hit-or-Miss Transformation

Image Segmentation: Detection of discontinuous, edge linking and boundary detection, thresholding, Hough Transform Line Detection and Linking, region–based segmentation.

Object Recognition: Patterns and patterns classes, matching, classifiers.

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. Explain the fundamentals of digital image and its processing
2. Perform image enhancement techniques in spatial and frequency domain.
3. Elucidate the mathematical modelling of image restoration and compression
4. Apply the concept of image segmentation.
5. Describe object detection and recognition techniques.

Text Books:

1. *Digital Image Processing, RafealC.Gonzalez, Richard E.Woods, Second Edition, Pearson Education/PHI.*

Reference Books

1. *Image Processing, Analysis, and Machine Vision, Milan Sonka, Vaclav Hlavac and Roger Boyle, Second Edition, Thomson Learning.*
2. *Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology*
3. *Computer Vision and Image Processing, Adrian Low, Second Edition, B.S.Publications*
4. *Digital Image Processing using Matlab, RafealC.Gonzalez, Richard E.Woods, Steven L. Eddins, Pearson Education.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessional (May include Assignments//Quizes/Lab Evaluations)	40

UEI723 EMBEDDED SYSTEMS DESIGN

L	T	P	Cr
3	1	2	4.5

Introduction: Introduction to Embedded Systems, Its Architecture and system Model, Microprocessors & Microcontrollers, Introduction to the ARM Processor architecture, Embedded Hardware Building Block.

Microprocessor Architecture: Core Architecture, Reset, Power architecture, Low power modes, Clock Functions, Memory organization and system, addressing modes, instruction set, Input & Output port, Data Conversion, RAM & ROM Allocation, Timer programming, Exception Processing–Watch dog, Soft Resets and Interrupts, Communications – SPI, RS232, I2C, CAN and ADC.

Embedded Programming: C language programming, Declarations and Expressions, Arrays, Qualifiers and Reading Numbers, Decision and Control Statements.

Development tools and Programming: Hardware and Software development tools, Project IDE, Compiler, Assembler and Debugger, JTAG and Hardware Debuggers, Interfacing with LCD, Real Time Clock and Temperature Sensors with I2C and SPI bus.

Real-time Operating Systems in Embedded system: Basic concepts of Real-time Operating Systems (RTOS) and its types, Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Concurrency, Reentrancy, Intertask communication, Implementation of RTOS with some case studies.

Laboratory Work:
Programming of microcontroller with Integrated development environment (IDE), Use of JTAG and Hardware Debuggers, Input Devices and Output Devices with their Programming, programming for Interrupts, Clock Functions, LCD interfacing, Interfacing Keypad and Switch Debouncing, ADC, DAC, Real Time Clock, Temperature Sensors with I2C and SPI bus. Interfacing to Motor, LCDs, Transducer, RS-232 Interface and their Examples.

Case Study: Embedded System Application using Microcontrollers
Product specification, Hardware design, Software design, System configuration, Integration of HW & SW, Product testing, Performance tools, Bench marking, Reports, User manual. – RTOS Micro Controller -issues in selection of processors.

Text Books:

1. *Barrett, S.F. and Pack, J.D., Embedded Systems, Pearson Education (2008).*
2. *Haung, H.W., The HCS12 / 9S12: An Introduction to Software and Hardware Interfacing, Delmar Learning (2007).*

Reference Books:

1. *Fredrick, M.C., Assembly and C programming for HCS12 Microcontrollers, Oxford University Press (2005).*
2. *Ray, A.K., Advance Microprocessors and Peripherals – Architecture, Programming and Interfacing, Tata McGraW Hill (2007)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UEI724 COMPUTER ARCHITECTURE AND OPERATING SYSTEMS

L	T	P	Cr
3	1	2	4.5

Course Objective: To learn about the basics of computer functioning and operating system.

History of computers, Boolean logic and number systems, Assembly language programming, ARM assembly language, Computer arithmetic, Design of a basic processor, Microprogramming, Pipelining, Memory system, Virtual memory, I/O protocols and devices, Multiprocessors.

Basic operating system concepts. Different types of the operating systems (OS) (Multiprogramming, Multiprocessing, Time-sharing, Distributed and real time operating systems). Overview of important features of computer architectures for operation of OS.

Process and memory management: Process creation, termination and scheduling, threads, concurrent processes, Semaphores, Barriers, Message Passing and process deadlocks. Memory; Address Translation; Interrupts and Exceptions, Paged Memory, Segmentation, and Virtual memory.

File management: File system semantics, design and implementation; File system Durability and Crash recovery. Protection and security: Security attacks, Security mechanisms and policies.

Text Books

1. *Mano, Morris M., Computer System Architecture, Prentice Hall (1992) 3rd ed.*
2. Hayes, J.P., Computer Architecture and Organization, McGraw Hill (1998) 3rded.
3. *Silberschatz, A., Galvin, P.B. and Gagne, G., Operating System Concepts, John Wiley (2004) 7th ed.*
4. *Stallings, Willam, Operating Systems Internals and Design Principles, Prentice Hall (2009) 6th ed.*

Reference Books

1. *Hennessy, J.L., Patterson, D.A, and Goldberg, D., Computer Architecture A Quantitative Approach, Pearson Education Asia (2006) 4th ed.*
2. *Leigh, W.E. and Ali, D.L., System Architecture: software and hardware concepts, South Wester Publishing Co. (2000).*
3. *Dhamdhere, D.M., Operating Systems: A Concept Based Approach, Mc Graw Hill (2008) 2nd ed.*
4. Flynn, I.M. and McHoes, A.M., Understanding Operating Systems, Thomson (2007).

Course Learning Outcomes (CLO): After the completion of the course student will be able to

1. explain about the basics of computer functioning
2. elucidate the concepts of operating system of the machines
3. get insight into the hardware and software interactions
4. Build their knowledge for low level programming

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UEI805 ENVIRONMENTAL INSTRUMENTATION

L	T	P	Cr
3	**0**	**0**	**3**

Course Objectives: To understand the concepts of pollution monitoring, to enable select, design and configure pollution monitoring instruments

Air Pollution: Impact of man of the environment: An overview, Air pollution sources and effects, Metrological aspect of air pollutant dispersion, Air pollution sampling and measurement, Air pollution control methods and equipment, Air sampling techniques, soil pollution and its effects, Gas analyzer, Gas chromatography, Control of specific gaseous pollutants, Measurement of automobile pollution, Smoke level meter, CO/HC analyzer.

Water pollution: Sources And classification of water pollution, Waste water sampling and analysis, , Waste water sampling techniques and analyzers: Gravimetric, Volumetric, Calometric, Potentiometric, Flame photometry, Atomic absorption spectroscopy, Ion chromatography, Instruments used in waste water treatment and control, Latest methods of waste water treatment plants.

Pollution Management: Management of radioactive pollutants, Noise level measurement techniques, Noise pollution and its effects, Solid waste management techniques, social and political involvement in the pollution management system

Course Learning Outcomes (CLO): After the completion of the course student will be able to :

1. explain sources and effects of air and water pollutants
2. explain air pollution sampling and measurement techniques
3. explain water sampling and analysis techniques
4. explain solid waste management and noise level measurement techniques
5. describe solid waste management techniques

Reference Books:

1. *Bhatia, H.S., A Text Book in Environmental Pollution and control, Galgotia Publication (1998).*
2. *Dhameja, S.K., Environmental Engineering and Management, S.K Kataria (2000).*
3. *Rao, M.N. and Rao, H.V., Air Pollution, Tata McGraw Hill (2004).*
4. *Rao. C.S., Environmental Pollution Control, New Age International (P) Limited, Publishers (2006) 2nd ed.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage(%)
1	MST	30
2	EST	50
3	Sessionals(may include assignments/quizzes)	20