COURSE SCHEME
&
SYLLABUS

FOR

B.E. ELECTRONICS

(INSTRUMENTATION

&

CONTROL) ENGINEERING

2014

COURSES SCHEME & SYLLABUS FOR B.E. ELECTRONICS (INSTRUMENTATION AND CONTROL) ENGINEERING

(2014)

SEMESTER-I

S. No.	Course No.	Course Name	L	T	P	Cr
1.	UMA001	MATHEMATICS–I	3	1	0	3.5
2.	UPH001	PHYSICS	3	1	2	4.5
3.	UES002	SOLID MECHANICS	3	1	2	4.5
4.	UHU002	BUSINESS & TECHNICAL COMMUNICATION	2	0	2	3.0
5.	UTA001	ENGINEERING GRAPHICS	2	0	4	4.0
6.	UTA003	COMPUTER PROGRAMMING	3	0	2	4.0
7.	UDP005	INTRODUCTION TO ELECTRONICS INSTRUMENTATION ENGINEERING	2	0	0	2.0
		TOTAL				**25.5**

SEMESTER-II

S. No.	Course No.	Course Name	L	T	P	Cr
1.	UCB008	APPLIED CHEMISTRY	3	1	2	4.5
2.	UMA002	MATHEMATICS–II	3	1	0	3.5
3.	UES008	ENGINEERING THERMODYNAMICS	3	1	0	3.5
4.	UES001	ELECTRICAL AND ELECTRONIC SCIENCE	3	1	2	4.5
5.	UTA002	MANUFACTURING PROCESS	2	0	3	3.5
7.		ELECTIVE*				3.5
		TOTAL				**23.0**

***** Biological Applications in Engineering,Introduction to Industrial Design, Mathematical Physics for Engineers, **Smart Materials (2 1 2), Semiconductor Devices**

SEMESTER – III

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCS401	COMPUTER SYSTEM ARCHITECTURE	3	1	0	3.5
2	UEI301	DIGITAL ELECTRONICS	3	1	2	4.5
3	UEI201	ANALOG ELECTRONIC DEVICES AND CIRCUITS	3	1	2	4.5
4	UHU034	HUMAN VALUES, HUMAN RIGHTS AND IPR	2	1	0	2.5
5	UMA032	NUMERICAL AND STATISTICAL METHODS	3	1	2	4.5
6	UEI302	SENSORS AND SIGNAL CONDITIONING	3	1	0	3.5
7	UEI303	TECHNIQUES ON SIGNALS AND SYSTEMS	3	1	0	3.5
TOTAL			**20**	**7**	**6**	**26.5**

SEMESTER – IV

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEI401	ARTIFICIAL INTELLIGENCE TECHNIQUES AND APPLICATIONS	3	1	2	4.5
2	UEI402	BIO-MEDICAL INSTRUMENTATION	3	1	2	4.5
3	UEI403	ELECTRICAL AND ELECTRONIC MEASUREMENTS	3	1	2	4.5
4	UEE503	NETWORK ANALYSIS AND SYNTHESIS	3	1	0	3.5
5	UMA031	OPTIMIZATION TECHNIQUES	3	1	0	3.5
6	UEE201	ELECTRICAL MACHINES	3	1	2	4.5
TOTAL			**18**	**6**	**8**	**25.0**

SEMESTER – V

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEI501	CONTROL SYSTEMS	3	1	2	4.5
2	UEI502	DATA ACQUISITION SYSTEMS	3	1	0	3.5
3	UEI503	DIGITAL SIGNAL PROCESSING AND APPLICATIONS	3	1	0	3.5
4	UEI504	MICROPROCESSORS AND APPLICATIONS	3	1	2	4.5
5		ELECTIVE–I	3	1	0	3.5
6	UTA012	INNOVATIONS AND ENTREPRENEURSHIP (5 Self effort hours)	1	0	2	4.5
7.	UEI591	SUMMER TRAINING				4.0
TOTAL			**16**	**5**	**6**	**28.0**

SEMESTER – VI

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEE504	POWER ELECTRONICS	3	1	2	4.5
2	UEIXXX	ENGINEERING DESIGN PROJECT	2	0	2	5.0
3	UEI602	MICROCONTROLLERS AND APPLICATIONS	3	1	2	4.5
4	UEI603	MICROELECTRONICS AND ICS	3	1	0	3.5
5	UEI604	PROCESS DYNAMICS AND CONTROL	3	1	2	4.5
6		ELECTIVE–II	3	1	0	3.5
TOTAL			**17**	**5**	**8**	**25.5**

SEMESTER – VII

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEI801	ADVANCED PROCESS CONTROL	3	1	2	4.5
2	UEI893	CAPSTONE PROJECT	0	0	2	8.0
3	UEN003	ENVIORMENTAL STUDIES	2	0	0	2.0
4	UEIXXX	MEASUREMENT SCIENCE	3	1	2	4.5
5	UES012	ENGINEERING MATERIALS	3	1	2	4.5
6		ELECTIVE-III	-	-	-	3.5
TOTAL			**11**	**3**	**8**	**27.0**

SEMESTER – VIII

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEI791	PROJECT SEMESTER	-	-	-	16.0
OR						
(ALTERNATE PROJECT SEMESTER)						
1	UEI792	DESIGN PROJECT	-	-	-	6.0
2	UEE712	ELECTRICAL ENGINEERING MATERIALS	3	1	0	3.5
3	UPH061	MODERN PHYSICS	3	1	0	3.5
4	UEE711	ALTERNATE SOURCES OF ENERGY	3	0	0	3.0
TOTAL			**9**	**2**	**0**	**16.0**

ELECTIVE

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UTA005	INTERNET AND JAVA PROGRAMMING	2	1	2	3.5
2	UTA006	WEB DESIGNING	3	0	1	3.5

ELECTIVE–I

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEE302	ELECTROMAGNETIC FIELD THEORY	3	1	0	3.5
2	UEI511	PRINCIPLES OF COMMUNICATION ENGINEERING	3	1	0	3.5
3	UEI512	ROBOTICS AND RELATED INSTRUMENTATION	3	1	0	3.5
4	UHU033	TOTAL QUALITY MANAGEMENT	3	1	0	3.5
5	UMA064	ADVANCED ENGINEERING MATHEMATICS	3	1	0	3.5
6	UEI841	ADVANCED CONTROL SYSTEMS	3	1	0	3.5
7	UEI842	BIO–MEDICAL DSP	3	1	0	3.5
8	UEI831	BIO–SENSOR AND MEMS	3	1	0	3.5
9	UEI832	DIGITAL IMAGE PROCESSING	3	1	0	3.5
10	UEI843	EMBEDDED CONTROL SYSTEM	2	1	2	3.5
11	UEI844	VLSI DESIGN FOR TESTABILITY	3	1	0	3.5
12	UEE522	ENERGY AUDITING AND MANAGEMENT	3	1	0	3.5

ELECTIVE –II

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEI621	ANALYTICAL INSTRUMENTATION	3	1	0	3.5
2	UEI622	DATA NETWORKS	3	1	0	3.5
3	UEI623	OBJECT ORIENTED PROGRAMMING AND APPLICATIONS	2	1	2	3.5
4	UCE611	FINITE ELEMENT METHODS IN ENGINEERING ANALYSIS	3	1	0	3.5
5	UMA062	GRAPH THEORY AND APPLICATIONS	3	1	0	3.5
6	UTA004	INFORMATION TECHNOLOGY	2	1	2	3.5
7	UPH062	NANOSCIENCE AND NANOMATERIALS	3	1	0	3.5

ELECTIVE -III

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEIXXX	INDUSTRIAL INSTRUMENTATION	3	1	0	3.5
2	UEIXXX	VIRTUAL INSTRUMENTATION	2	0	3	3.5

TOTAL CREDITS: 196.5

UDP005 INTRODUCTION TO ELECTRONICS INSTRUMENTATION ENGINEERING

L	T	P	Cr
2	0	0	2

Course Objectives: To introduce the Electronic Instrumentation & Control Engineering in general, Components of instrumentation and its applications in various domains and the latest trends.

Measurement: Concept of measurement, its significance and applications. Generalized scheme of measurements, Concepts of Sensors and transducers and associated signal conditioning. Electrical & Electronic measurements.

Electronic Instrumentation: Introduction to Analog Devices and Circuits, Digital Electronics, Microprocessors, Micro-controllers and Embedded Systems.

Industrial Instrumentation and Control: Concepts of Industrial instrumentation, Industrial Telemetry and Data Acquisition. Introduction to Control systems, Process Dynamics and Control.

Latest Trends: Introduction to Digital Signal Processing, Biomedical instrumentation, Virtual instrumentation, Image Processing, Biometrics, Bio-sensors and MEMS, Robotics.

Course learning Outcomes: After the successful completion of the course the student will be able to explain

- Basic concepts of Electronic Instrumentation & Control Engineering
- Components of Instrumentation like Measurement, Control and Automation
- The applications in the field of Process Industry, Embedded Systems, Signal Processing etc.
- the latest trends in their field for futuristic relevance.

Reference Books

1. *Sawhney, A.K. and Sawhney, puneet, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai (2008) 18th ed.*
2. *Ananad, M.M.S., Electronic Instruments and Instrumentation Technology, Prentice–Hall of India Private Limited (2004).*
3. *Johnson, C.D., Process Control Instrumentation Technology, Prentice Hall of India Private Limited (2002).*
4. *Liptak, B.G., Instrument Engineers Handbook, Butterworth, Heinemann (2002).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	40
2	EST	60
3	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UEI301DIGITAL ELECTRONICS

L	T	P	Cr
3	1	2	4.5

Introduction: Difference between analog and digital systems, Advantages and Disadvantages of digital system.

Number Systems: Introduction, Number systems: Decimal, Binary, Octal, Hexadecimal; Conversions; Representation of Signed Numbers, Sign magnitude, 1's complement, 2's complement, r's complement; Binary Arithmetic – addition, subtraction, multiplication and division, 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, Alphanumeric codes.

Minimization Techniques: Introduction, Boolean Algebra: Laws and Theorems, Demorgan's Theorem, Simplification of Boolean functions by Boolean algebra, K–map method and Quine–McClusky method in SOP and POS forms, Advantages and disadvantages of different minimization techniques.

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, Binary multiplier, Dividers, ALU, Code converters, Magnitude comparators, Parity Generators/checkers, Encoders, Priority encoder, Decoders, Multiplexers, Multiplexer as function generator, Demultiplexer.

Sequential Circuits: Introduction, Flip-flops: Types, Their conversions and applications, Registers: Serial/Parallel in/out, Bi–directional, Universal shift register, Counters: Synchronous, Asynchronous, Decade, Binary, Modulo-n, Shift register counters; Design of Synchronous sequential circuits.

Memories: Introduction and classification of ROM, ROM organization, Static and Dynamic RAM, DRAM Refreshing, Representative circuits for cells using BJT and FET's, Timing diagrams of memories, Memory expansion using IC's, Flash memory, CCD, Magnetic Memories.

Logic circuits: Introduction, Specification terminology: Fan out, Unit load, Current and voltage parameters; TTL, ECL, MOS, CMOS logic families and their comparison, Tristate Logic, Interfacing of TTL and CMOS logic families.

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.

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, Usage of IC tester, Computer simulation using EDA tools.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Understand number systems, codes and conversions
2. Apply minimization techniques
3. Design combinational and sequential circuits
4. Understand various types of memories
5. Understand the concept of logic circuits and converters

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	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UEI201 ANALOG ELECTRONICS DEVICES AND CIRCUITS

L	T	P	Cr
3	1	2	4.5

PN Junction: Depletion region, Junction capacitance, Diode equation (no derivation), Effect of temperature on reverse saturation current, Construction and Working, V–I characteristics and simple applications of Junction diode, Zener diode and Tunnel diode.

Bipolar Junction Transistor (BJT): PNP and NPN transistors–current components in BJT: BJT static characteristics (Input and Output), Early effect, CB, CC,CE configurations (cut–off, active, and saturation regions), CE configuration as two port network: h–parameters, h–parameter equivalent circuit. Biasing and load line analysis.

Field Effect Transistor (FET): Structure and working of JFET and MOSFET, output and transfer characteristics, Experimental arrangement for studying the characteristics and to determine FET parameters. Application of FET as voltage variable resistor and MOSFET as a switch, Advantages of FET over transistor.

Power Supplies: Rectifiers: Half–wave, Full–wave and bridge rectifiers, Efficiency, Ripple factor, Regulation, Harmonic components in rectified output, Types of filters: Choke input (inductor) filter, Shunt capacitor filters; Block diagram of regulated power supply, Series and shunt regulated power supplies, Three terminal regulators (78XX and 79XX), Principle and working of switch mode power supply (SMPS).

Amplifiers: Analysis and frequency response of single stage RC coupled CE amplifier. Feedback Amplifiers: Positive and negative feedback, Effect of feedback on gain, band width, noise, input and output impedances.

Oscillators: Condition for sustained oscillation, R-C phase shift, Hartley, Colpitts, Crystal and Wien Bridge Oscillators, Negative Resistance oscillator.

Wave shaping circuits: Switching characteristics of diodes and transistors including square wave response, High pass and low pass filters using R-C Circuits and operational amplifiers; R–L, R–L–C circuits, Attenuators, Clipping and clamping circuits, Clamping circuit theorem, Comparators.

Laboratory Work:
Familiarity with CRO and electronic components, Diodes and BJT characteristics, FET characteristics, Zener diode as voltage regulator, Series voltage regulator, RC coupled amplifier in CE mode, I/O characteristics of Transistor in CE mode, DC load line, Testing of diode and Transistor, Rectifiers. Use of Bistable, Astable and monostable multivibrator, Hartley and Colpitts Oscillator, Clipper and Clamper circuit, Computer simulation, Experiments in analysis, Design and characterization of electronics circuits.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Understand transistor amplifier circuits, their analysis and frequency response.
2. Use various types of differential and tuned amplifiers in any project.
3. Understand the working of feedback amplifiers, oscillator and multivibrators.
4. Understand rectifiers, its types and power supplies.
5. Design and implement circuit using various electronic devices for the benefit of society and mankind.

Text Books:

5. *Boylestad R. L., Electronic Devices and Circuit Theory, Pearson Education (2007).*
6. *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).*
2. *Sedra A. S. and Smith K. C., Microelectronic Circuits, Oxford University Press (2006).*

Evaluation Scheme:

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

UEI302 SENSORS AND SIGNAL CONDITIONING

L	T	P	Cr
3	1	0	3.5

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.

Generalized Static Stiffness and Input Impedance: Generalized impedance and stiffness concepts, Static stiffness and static compliance, Impedance matching and maximum power transfer.

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.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Understand the principles and applications of sensors and transducers
2. Analyze and design active filters
3. Understand the working of dc and ac bridges
4. Do signal conditioning of RTD and strain gauges

Text Books:

1. *Doebelin, E.O. & manic, D.N., Measurement Systems: Application & Design, McGraw Hill (2004)*
2. *Nakra, B.C. and Chaudhry, K.K., Instrumentation, Measurement and Analysis, TMH (2003).*

Reference Books:

1. *Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India (2003).*
2. *Sawhney, A.K. and Sawhney, puneet, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai (2008).*

Evaluation Scheme:

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

	Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	

UEI303 TECHNIQUES ON SIGNALS AND SYSTEMS

L	T	P	Cr
3	1	0	3.5

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 Series: Introduction, Dirichlet Conditions, Determination of Fourier Coefficients, Wave symmetry, Exponential form of Fourier Series.

Fourier Transform: Introduction, Condition for existence of Fourier Integral, Fourier Transform of Gate function, Impulse Function, Shifted impulse function, One–sided exponential function, Two–sided exponential function, $\sin(t)e^{-a(t)}$, Signum function, f(t) = 1 and unit step functions; Properties of Fourier Transform: Linearity, Time Scaling, Time Differentiation, Time Shifting Property, Translation in the frequency domain, Modulation theorem, Symmetry or duality property, Time convolution property, Frequency convolution, Frequency differentiation, Time integration, Fourier transform of f(–t) and Symmetry properties of Fourier Transform; Energy density and Power Spectral Density, Nyquist Theorem, System Analysis using Fourier Transform.

Laplace Transform: Introduction, Region of Convergence (ROC), Inverse Laplace Transform, Properties of Lapalce Transform, Laplace transform of a derivative $\frac{df(t)}{dt}$, Laplace transform of an integral $\int f(t)dt$, Laplace transform of unit step function, Impulse function, Ramp function, Parabolic function, $f(t) = e^{at}u(t)$, $f(t) = e^{-at}u(t)$, Sinusoidal function, Cosine function, Hyperbolic sine and cosine functions, Damped sine and cosine functions, Damped hyperbolic sine and cosine functions, t^n. Laplace transform of two sided functions and their ROCs. Initial value theorem and final value theorem. Partial fraction Expansions.

z–Transform: Introduction, Region of Convergence(ROC), Properties of z–transform: Linearity, Time shifting, Scaling in z–domain, Time reversal, Differentiation in z–domain, Convolution in z–domain, Correlation of two sequences, Multiplication of two sequences, Conjugate of complex sequence, Real part of a sequence, Imaginary part of a sequence. 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, Regularity and Ergodicity, Gaussian Process.

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).*

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Understand the basics of signals and systems.
2. Solve different type of problems related to Fourier series and Fourier transforms
3. Use Laplace and Fourier transforms for different applications.
4. Describe the concept of random signals.

Evaluation Scheme:

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

UEI401 ARTIFICIAL INTELLIGENT TECHNIQUES AND APPLICATIONS

L	T	P	Cr
3	1	2	4.5

Overview of Artificial Intelligence: The concept and importance of AI, Fields related to AI, Human intelligence vs. machine intelligence.

Knowledge and general Concepts: General concept of knowledge, Acquisition, Knowledge Representation and organization: Prepositional and Predicate Logic, Theorem Proving, Structured Knowledge representation using Semantic Networks, Frames, Scripts,, Conceptual Graphs, Conceptual Dependencies, Knowledge Manipulation: Search space control, Uninformed search, Depth first search, Breadth first search, Depth first search with iterative deepening, Heuristic Search :Minimax Search procedure.

Expert Systems: Expert systems: advantages, disadvantages, Expert system architecture, Functions of various parts, Mechanism and role of inference engine, Types of Expert system, Tuning of expert systems, Role of Expert systems in instrumentation and process control.

Artificial Neural Networks: History of neural networks, Structure and function of a single neuron, Biological neurons, Artificial neuron models, Types of activation functions, Neural network architectures: Fully connected, layered, Acyclic, Feed forward, Neural learning: Correlation, Competitive, Evaluation of networks; Supervised learning: Back propagation algorithm, Unsupervised learning, winner–take all networks, Adaptive resonance theory, Application areas of neural networks: Classification, Clustering, Pattern associations, Function approximation, Forecasting.

Fuzzy Logic: Fuzziness vs Probability, Crisp logic vs Fuzzy logic, Fuzzy sets and systems, Operations on sets, Fuzzy relations, Membership functions, Fuzzy rule generation, De–fuzzification, Applications of Fuzzy Logic in process Control and motion control.

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

Case Studies: Case studies related to AI in Instrumentation systems.

Laboratory Work:
MATLAB tools using Fuzzy logic, ANFIS, Neural Networks, GA.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Understand the knowledge and general concepts of artificial intelligence.
2. Understand the concept of Artificial Neural Networks, Learning and Pattern Classification
3. Understand fuzzy logic, genetic algorithms and its applications in control systems

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. *Zurada, J.M., C++ Neural Networks and Fuzzy Logic, BPS Publications (2009).*

Reference Books:

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

3. Evaluation Scheme:

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

UEI402 BIO-MEDICAL INSTRUMENTATION

L	T	P	Cr
3	1	2	4.5

Human Body Subsystems: Brief description of neuronal, Muscular, Cardiovascular and respiratory systems; Their electrical, Mechanical and Chemical activities.

Transducers and Electrodes: Principles and classification of transducers for bio−medical applications, Electrode theory, Different types of electrodes, Selection criteria for transducers and electrodes.

Cardiovascular System Measurements: Measurement of blood pressure, Blood flow, Cardiac output, Cardiac rate, Heart sounds; Electrocardiograph, Phonocardiograph, Plethysmograph, Echocardiograph.

Respiratory System Measurements: Measurement of gas volume, Flow rate, Carbon−dioxide and oxygen concentration in exhaled air.

Instrumentation for Clinical Laboratory: Measurement of pH value of blood, ESR measurement, Polarographic measurements.

Measurement of Electrical Activity in Neuromuscular System and Brain: Neuron potential, Muscle potential, Electromyograph, Brain potentials, Electroencephalograph.

Medical Imaging: Diagnostic X−rays, CAT, MRI, Thermography, Ultrasonography, Medical use of isotopes, Endoscopy.

Patient Care, Monitoring and Safety Measures: Elements of intensive care monitoring; Basic hospital systems and components; Physiological effect of electric currents, Shock hazards from electrical equipment, Safety measures; Standards, Codes and practices.

Computer Applications and Biotelemetry: Real time computer applications, Data acquisition and processing; Remote data recording and management.

Prosthetics and Orthotics: Introduction to artificial kidney, Artificial heart, Heart lung machine, Limb prosthetics and Orthotics elements of audio and visual aids.

Assisting and Therapeutic Devices: Introduction to cardiac pacemakers, Defibrillators, Ventilators, Muscle stimulators, Diathermy.

Lasers: Application of lasers to biomedical sciences.

Laboratory Work:
Study of various physiological parameters using multi−channel recorder, Study of pulse oximeter, Study of various parameters of spirometer associated with lungs capacity, Study of ECG signal for 12 lead system, EEG frequency analysis, Ultrasonic characterization study of biological samples, Auto analyzer study, Study around TMT and EMS analysis.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Explain the physiology of the heart, lung, blood circulation and circulation respiration.
2. Describe the biomedical applications of different transducers used and various sensing and measurement devices of electrical origin.
3. Elucidate electrical safety in medical equipments.
4. Describe different medical imaging techniques.

Text Books:

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

Reference Books:

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

UEI403 ELECTRICAL AND ELECTRONIC MEASUREMENTS

L	T	P	Cr
3	1	2	4.5

Units, Systems and Standards: Review of system of units, SI units, Classification of standards, Time and frequency standards, Electrical standards: Standards of emf and resistance, Frequency dependence of resistance, Inductance and Capacitance.

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.

Bridge Measurements: Wheatstone bridge and its sensitivity analysis, Kelvin double bridge, 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.

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

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

Electronic Instruments: Basic principle and advantages, D.C. voltmeter with direct coupled amplifier, Chopper stabilized amplifier, 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, Oscilloscopes: Block diagram, CRT, Electrostatic deflection, CRT circuits, Multi–beam and Multitrace oscilloscopes, 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, Kelvin double bridge, AC bridges, Measurement of iron losses with Llyod Fisher square, Storage type digital oscilloscopes.

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).*

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Compare various electromechanical indicating instruments
2. Measure power and energy
3. Design various ac bridges
4. Analyze various waveform with the help of storage oscilloscope

Evaluation Scheme:

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

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.

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):

1. Understanding the various laws and theorems related to electric networks.
2. Understanding the concept of two port networks.
3. Familiarisation with 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, Dhanpat Rai 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	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UEE201 ELECTRICAL MACHINES

L	T	P	Cr
3	1	2	4.5

Course Objective: To introduce the fundamentals of transformer, dc machines and ac machines.

Energy Conversion Principle: Magnetic field, Field energy, Mechanical forces and torques in singly-excited and doubly-excited systems, Electric field.

Rotating Machines: Concepts of reluctance and electromagnetic torques, Concept of transformer and speed e.m.f`s. and torque in round-rotor machines.

Transformers: Theory and operation, Phasor diagram, Equivalent circuit, Open circuit and short circuit tests, Regulation, Performance estimation, Auto-transformers, Parallel operation, Three phase transformer connections, Instrument transformers: Current Transformer (CT) and potential transformer (PT); Pulse transformers.

DC Machines: Methods of excitation, Magnetization and operating characteristics of generators, Starters, Speed-torque characteristics of DC motors. Speed control, Losses and efficiency. PM motors.

Induction Machine: Induction motor principle and applications as stepper and brushless motors, Induction motor equivalent circuit, Torque-slip characteristics, Methods of starting, Speed control of 3-phase induction motor.

Polyphase Synchronous Machines: MMF and EMF phasor, Concept of synchronous reactance, Regulation by EMF and MMF methods, Synchronous motor starting and V-curves.

Induction Machines: No load and Blocked rotor tests, Starters. Synchronous Machines: Regulation calculation by EMF method.

Laboratory Work:
DC machines: Constructional features, Characteristics of generators and motors, Speed control, Efficiency. Transformers: Open and short circuit tests, Parallel operation, Harmonics in no-load current.

Course Learning Outcome (CLO):
After the completion of the course the students will be able to:
1. Test the transformer and calculate its efficiency and performance in distribution system.
2. Scrutinize three-phase transformer connections and use special purpose transformer for measurement and protection.
3. Select appropriate DC motor for specific purpose and can compute their steady performance.
4. Thoughtfully select the speed control and starting method of DC motor.
5. Test the induction motor and compute its parameters.
6. Test the synchronous motor to compute voltage regulation.

Text Books:

1. *Bimbhra, P.S., Electrical Machinery, Khanna Publishers (2008).*
2. *Mukherjee, P.K. and Chakravorty, S., Electrical Machines, Dhanpat Rai and Co. (P) Ltd. (2004).*

3. *Nagrath, I.J and Kothari, D.P., Electric Machines, Tata McGraw Hill (2004).*

Reference Books:

1. *Bimbhra, P.S., Generalized Theory of Electrical Machines, Khanna Publishers (2007).*
2. *Toro, Vincert, Electromechanical Devices for Energy Conversion, Prentice Hall of India (2004).*
3. *Fitzgerald, A.E., Kingsley, C. Jr, and Umans, Stephen, Electric Machinery, McGraw Hill (2002).*

Evaluation Scheme:

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

UEI501 CONTROL SYSTEMS

L	T	P	Cr
3	1	2	4.5

Basic Concepts: Historical review, Definitions, Classification, Relative merits and demerits of open and closed loop systems

Mathematical Models of Physical Systems: Linear and non-linear systems, Transfer function, Mathematical modeling of electrical, Mechanical, Thermal, Hydraulic and pneumatic systems, Analogies, Block diagrams and signal flow graphs.

Components: AC and DC servomotors and tachogenerators, Potentiometers, Synchros, Stepper motors.

Analysis: Time and frequency domain analysis, Transient and frequency response of first and second order systems, Correlationship between time and frequency domain specifications, 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, M and N circles, Nichol's charts

MATLAB: Introduction, Applications in solution of control system problems.

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

Components: D.C. and A.C. Servomotors, D.C. and A.C. Tachogenerators, Potentiometers and optical encoders, Synchros and stepper motors, Introduction to PLCs, their hardware and ladder diagram programme.

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:

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:

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

Evaluation Scheme:

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

UEI502 DATA ACQUISITION SYSTEMS

L	T	P	Cr
3	1	0	3.5

Display Systems: Seven Segmental, Dot Matrix, Multiplexed, Code converter, LCD (construction, working and programming Hitachi controller), Plasma and Vapor displays.

Recorders: Galvanometric type, Null type, Potentiometric type, Strip chart and circular chart type, Magnetic tape recorder-principle and operation, Digital tape recorders.

General Telemetric Systems: Land line and RF telemetry, Voltage, Current and Position telemetry with feedback mechanism, RF telemetry, Amplitude modulation, Frequency modulation, Pulse modulation-Pulse amplitude modulation, Pulse code modulation, Wire line and radio channels, Microwave channels, Radio link, Transmitting and Receiving antenna, Telemetry with time and frequency division multiplexing, Telemetry hardware, Band width and Noise reduction (Interference, Grounding, Shielding, Guarding)

Data Transfer Techniques: DMA controller and data transfer in DMA mode, Serial data transmission methods and standards, 4-20 mA current loop, RS 232-C: specifications connection and timing, RS-422, RS-423, GPIB/IEEE-488 standard digital interface, Parallel communication, Centronix port, Communication protocols, Local area networks, Firewire, Universal serial bus, HART protocol, Foundation-Fieldbus, ModBus and other industrial protocols, TCP/IP- Transmission control protocol - Internet protocol, Data compression, Encryption, Error detection and correction techniques, Optical disk storage.

Data Acquisition System (DAS): Single channel and multichannel, Data conversion, Supervisory control and data acquisition system (SCADA), Data acquisition system around microprocessor, microcontroller and PC

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Understand the concept of various display systems and data acquisition systems.
2. Understand the working of various types of recorders.
3. Understand the modulation and multiplexing techniques used in general telemetric systems.
4. Use various protocols in given data transfer techniques.

Text Books:

1. *Kalsi, H.S., Electronic Instrumentation, Tata McGraw–Hill (2002).*
2. *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. *Hall, D.V., Microprocessor and Interfacing, Tata McGraw–Hill (2005).*
3. *Tanenbaum, A.S. , Computer Networks, Prentice–Hall of India Private Limited (2007).*

Evaluation Scheme:

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

UEI503 DIGITAL SIGNAL PROCESSING AND APPLICATIONS

L	T	P	Cr
3	1	0	3.5

Introduction: Representations of discrete signals and systems and basic operators, z−Transforms, Causality and Stability in terms of z−transform, Bilateral z−transform, Computation of z−transform.

Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT): Discrete Fourier Series,Discrete Fourier Transform and its Properties, Efficient Computation of DFT using FFT algorithms, Linear Filtering Approach to Computation of DFT.

Digital Filter Structure: Describing Equation, Structures for FIR Systems and Structure for IIR Systems. Representation of Structures using Signal Flow Graph.

Design of Digital Filters: Introduction, Difference between analog filters and digital filters, Implementation of digital filter, Types of filters, LTI systems as filters, Design of IIR filters from analog filters, IIR filter design using Butterworth Approximation, Frequency transformation, FIR filters design, Least square filter design, Designing digital filter from pole−zero placement, Butterworth filter design using Bilinear transformation, FIR filter design using windows, Design of filters using pole−zero combination.

Hardware Architecture of DSP Processor: Introduction, Desirable features of DSP processors, Types of architectures, Internal architecture of ADSP−21xx family, Features of ADSP−21xx family processors, System interface, Instruction set of ADSP−21xx, ADSP−21xx Development tools, ADSP−210x Processors, TMS DSP processor,.

Analysis of Finite Word−length Effects: Introduction, The quantization process and errors, Analysis of coefficient quantization effects in FIR filters, A/D conversion noise analysis, Analysis of arithmetic roundoff errors, Dynamic range scaling, Low sensitivity digital filters, Reduction of product roundoff errors, Limit cycles in IIR filters, Roundoff errors in FFT algorithms.

Applications: Dual−tone multi frequency signal detection, Spectral analysis using DFT, Short term DFT, Musical sound processing, oversampling A/D converter, Oversampling D/A converter, Protection.

COURSE LEARNING OUTCOME (CLO): The 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
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. *Helmut, U. and Willibald, W., Protection Techniques in Electrical Engg. Systems, Marcel Dekker Inc. (2001).*
2. *Proakis, J.G. and Manolakis, D.G., Digital Signal Processing, Prentice−Hall of India Private Limited (1996).*

3. *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	30
2	EST	45
3	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	25

UEI504 MICROPROCESSORS AND APPLICATIONS

L	T	P	Cr
3	1	2	4.5

History and Evolution: Background history of Microprocessors, Introduction to Basic features, General Architecture of Microprocessors, Recent trends and Applications,

INTEL 8085 Microprocessor: Pin Functions, Architecture, Addressing Modes, Instruction Set, Timing Diagrams, Interrupts, Programming Examples, Direct Memory Access, I/O Mapping.

Peripheral Controllers: USART (8251), RS-232C, Programmable Peripheral Interface (8255), Programmable Interrupt Controller (8259) and their applications.

INTEL 8086 Microprocessor: Pin Functions, Architecture, Characteristics and Basic Features of Family, Segmented Memory, Addressing Modes, Instruction Set, Data Transfer Instructions, Arithmetic, Logical, Shift and Rotate Instructions, String Instructions, Flag Control Instructions, Transfer of Control Instructions, Processor Control Instructions, Programming Examples, Interrupt Structures, Multitasking and Multiprogramming, MIN/MAX Modes of 8086,Co-processors 8087 and 8089.

Advanced Microprocessors: Main features, comparison of 80186, 80286, 80386, 80486 and Pentium processors. Case studies of Applications based on Microprocessors.

Laboratory work : Introduction to INTEL kit, Programming examples of 8085 and 8086. Interfacing using 8085, 8086 kits.. Interfacing of LED seven segment display, ADC, DAC, 8253, Printer, UP- PC Interface. Microprocessor based project .

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. emonstrate the concept of microprocessor and to be able to design a microprocessor based system to get desired results.
2. Use 8086 microprocessor in advanced applications, which will give them a good platform to work further.
3. Update with current trends through self study and show genuine need to learn on continuous basis.

Text Books:

1. *Gaonkar, R. S., The 8085 Microprocessor- Architecture, Programming and Interfacing, Penram International Publishing (India) Pvt. Ltd. (2004).*
2. *Hall, D.V., Microprocessor- Interfacing Programming and Hardware, Tata McGraw–Hill (1997).*

Reference Books:

1. *Brey, B.B., The INTEL Microprocessors, Prentice–Hall of India Private Limited (2002).*
2. *Liu, Y. C. and Gibson, G.A., Microcomputer Systems: The 8086/8088 Family–Architecture, Programming and Design, Prentice–Hall of India Private Limited (2007).*
3. *Uffenbeck, J., The 8086/ 8088 Family, Prentice–Hall of India Private Limited (1994).*

Evaluation Scheme:

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

UEI602 MICROCONTROLLERS AND APPLICATIONS

L	T	P	Cr
3	1	2	4.5

Microcontroller an overview : Introduction to 8 bit microcontrollers; Basic differences and similarities between Microprocessor and Microcontroller. Types of various architectures; Harvard and Von-Neumann, RSIC and CSIC. Concept of pipelining.

Introduction to 8051 Microcontroller : Intel8051 history, Pin diagram of 8051, 8051-architecture, Registers, Timers Counters, Flags, Special Function Registers, DPTR, PC, PSW, SP etc. Additional features in 8052.

8051 Assembly Programming - I: Addressing Modes, Data types and Directives, Jump, Loop and Call instructions Arithmetic instructions, and their simple programming applications.

8051 Assembly Programming – II : Logic Instructions Single –bit instructions, 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 Advanced microcontrollers: Overview of Microchip PIC 16Fxxx, Motorola 680XX, ARM etc. and their comparison with 8051.

Laboratory Work: Programming and Application development around 8051. Interfacing to LED, LCD, Keyboard, ADC , DAC , Stepper Motors and sensors etc.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Understand the concept of 8051microcontroller architectures
2. Understand the addressing modes, data types and instruction set
3. Understand and implement hardware interfacing
4. Understand the concept of advanced microcontrollers.

Text Books:

1. *Ayala, K.J., The 8051 Microcontroller Architecture, Programming and applications, Penram International Publishing (India) Pvt. Ltd. (2007).*
2. *Mazidi, M.A., The 8051 Microcontroller and Embedded System, Pearson Education (2008).*

Reference Book:

1. *Predko, M., Customizing The 8051 Microcontroller, Tata McGraw–Hill (2002).*

Evaluation Scheme:

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

UEI603 MICROELECTRONICS AND ICs

L	T	P	Cr
3	1	0	3.5

Integrated circuits: Introduction and advantages of IC technology, Effects of IC's on industry, Scales of integration.

Microelectronics circuits: Introduction to Analog Devices, Digital integrated circuit, Amplifier, Filter, Operational amplifier, Digital logic inverter.

Devices and basic circuits: Device structure, Physical operation and VI characteristics of diode, BJT, Zener diode, Schottkey diode, Varactor diode, Photo diode, LED, MOSFET.

Analog and digital integrated circuits: Circuit model and frequency response of Single stage integrated circuits amplifier, Differential and multistage amplifier, Feedback circuit.

Growth of single crystal of silicon: Growth from melt using Czochralski's method, Intrinsic and doped single crystals, Zone refining.

Wafer preparation: Slicing and polishing, Epitaxial layer growth, Defects in epitaxial layer and their removal, Types of epilaxy: VPE, MBE, MOCVD.

Diffusion: Impurity diffusion in a semiconductor crystal, Fick's law, Gaussian and complimentary error function distribution of impurities, Design of junction diode, Transistor, FET and MOSFETs.

Subsequent process: Oxidation, ion-implantation, photolithography etching and metallization, monolithic and hybrid IC's. IC Packaging.

Advanced digital circuits: Latches, RAM, Decoder circuit, Timer.

Text Books:

1. *Nagchoudhri, D., Principles of Microelectronics Technology, A.H.Wheeler (1998).*
2. *Sedra, A.S. and Smith, K.C., Microelectronic Circuitry , Oxford University Press (2006).*

Reference Books:

1. *Botkar, K.R., Integrated Circuits, Khanna Publishers (2007).*
2. *Sze, S.M., Semiconductor Devices, Physics and Technology, John Wiley and Sons (2002).*

Evaluation Scheme:

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

UEI604 PROCESS DYNAMICS AND CONTROL

L	T	P	Cr
3	1	2	4.5

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, Developing continuous time and discrete time models from process data.

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, Controller trouble shooting.

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, Cavitations and flashing, Dampers and variable speed Drives.

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

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

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Develop the mathematical modeling of various chemical processes.
2. Implement PID and IMC PID controllers for different processes.
3. Explain the working of various types of valves.
4. Implement advance control schemes such as ratio control, selective control on suitable processes.

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:

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

UEI801 ADVANCED PROCESS CONTROL

L	T	P	Cr
3	1	2	4.5

Introduction: Review of general concepts, Terminology, Applications of process control Simulation, Mathematical modeling

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.

Statistical Process Control: Quality control and assurance, Control charts, Total quality management (TQM), ISO

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

Robotics: Kinematics, Sensors, Actuators, End Effectors

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

Laboratory Work:
Level control and flow control using feedback mechanism, Programming with Robotic Arm, PLC programming with hardware and Simulation package.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Explain the concept of advanced control schemes used in process
2. Explain the working of distributed control system
3. Elaborate the use of artificial intelligence techniques in process
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:

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

4.

UEIXXXMEASUREMENT SCIENCE

L	T	P	Cr
3	1	2	4.5

Introduction: Definition: Application and types of measurements, measurement techniques for various physical parameters, Standards, Calibration, Selection of instruments.

Measurement science for physical parameters: Introduction to measurement of physical parameters, Rectilinear flow of heat, Thermal conductivity measurement, Seebeck effect, Peltier Effect, Johnson effect, Thermoelectric power, Thermoelectric diagram, application of thermodynamics for temperature measurement. Introduction to sound measurement, acoustic intensity, acoustic emission, sound level meter, microphones, microphone response characteristics. pressure response of a capacitor microphones, Basic methods of pressure measurement, manometers, various forms of manometers, manometer dynamics**,** measurement techniques for force and torque.

Analysis of Experimental data: Introduction, Causes and types of Experimental Errors, Error analysis on a common-sense basis, Uncertainty analysis, Evaluation of uncertainties for complicated data reduction.

Introduction to statistical analysis: Measures of central tendency and dispersion: mean, median, mode, range, mean deviation and standard deviation. Regression and correlation analysis. Probability and probability distributions; Binomial, Poisson, and Normal distribution.

Laboratory Work:
Experiments around Measurement of Pressure, Temperature, Flow, Force, Torque using different techniques.

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

1. Explain different terms used in measurement
2. Analyse experimental data.
3. Differentiate among various statistical techniques.
4. Explain the measurement of Sound, temperature and pressure.

Text Books:

3. *Doebelin, E.O. and manic, D.N., Measurement Systems: Applications and Design, McGraw–Hill (2004).*
4. *Holman,* J.P. *Experimental methods for engineers,* Tata McGraw Hill, *(2004).*

Reference Books:

3. *Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India (2003).*
4. *Sawhney, A.K. and Sawhney, puneet, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai (2008).*
5. *Nakra, B.C. and 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	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UEIXXX INDUSTRIAL INSTRUMENTATION

L	T	P	Cr
3	1	0	3.5

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

Motion and Vibration Measurement: Translational and rotational displacement using potentiometers, Strain gauges, Differential transformer, Synchros and induction potentiometer, Capacitance, Digital displacement transducers, Photo elastic, Moir- fringe, Holographic technique, Different types of tachometers, Accelerometers, Gyros. Force, Torque and Shaft Power Measurement: Elastic, Vibrating wire, Gyroscopic force transducers, Torque measurement in rotating shafts, Gyroscopic torque measurement, Shaft power measurement (Dynamometers).

Pressure and Sound 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, Sound level measurement using different types of microphones.

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

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

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

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

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Explain the basic concepts of metrology.
2. Describe the construction and working of different type of devices used to measure motion, vibration, pressure, sound, temperature, level and flow.
3. Elucidate different methods for the measurement of, humidity, viscosity and nuclear radiation etc.
4. Select the appropriate instrument/transducer for a given application/parameter.

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, Tata McGraw–Hill (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, Dhanpat Rai and Co. (P) Ltd. (2007).*

Evaluation Scheme:

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

UEI803 VIRTUAL INSTRUMENTATION

L	T	P	Cr
2	0	3	3.5

Review of Virtual Instrumentation: Historical perspective, Advantages etc., Block diagram and architecture of a virtual Instrument

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, String and file I/O.

Data Acquisition Basics: ADC, DAC, DIO, Counters and timers, PC Hardware' structure, Timing, Interrupts, DMA Software and hardware installation.

Common Instrumentation Interfaces: Current loop RS232C/ RS485, GPIB.

Use of Analysis Tools: Some tools from the advanced analysis tools relevant to the discipline may be included e.g, Fourier transforms, Power spectrum, Correlation methods, Windowing and filtering.

Applications of VI: VI Applications in various fields.

Additional Topics: System buses, Interface buses: USB, PCMCIA, VXI, SCXl, PXI, etc., Networking basics for office and industrial applications, VISA and IVI, Image acquisition and processing, Motion Control.

Laboratory Work:

Components of LabVIEW, 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 OUTCOME (CLO): The 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
4. Demonstrate the use of labview for signal processing image

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:

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

UEI511 PRINCIPLES OF COMMUNICATION ENGINEERING

L	T	P	Cr
3	1	0	3.5

Introduction to Electronic Communication: Evolution of Communication System, Elements of Communication systems, Types of electronic communications, Baseband signals and baseband transmission, Modulation techniques, Bandwidth requirements.

Amplitude Modulation: Introduction, Equation of AM signal, Modualtion index and percentage of modulation for sinusoidal AM, Frequency spectrum of the AM wave, Representation of AM wave, Average power for sinusoidal AM wave, Effective voltage and current for sinusoidal AM, Modulation, Low and high level modulation and their comparison, Low modulator, High level modulator: Basic requirements, modulator circuits: Collector modulator Class C Amplifier, Grid Modulated Class C Amplifier, Pulse Modulated Class C Amplifier. Amplitude modulated transmitters.

Single Sideband Modulation: Introduction, Suppression of carrier, Suppression of unwanted sideband, Extensions.

AM Receivers: Functions of receivers, Types of receivers, Characteristics of radio receiver, AM receivers, Double conversion receivers, Single and independent sideband receivers, Modified system(pilot carrier SSB system).

Frequency Modulation: Frequency modulation theory, Characteristic of frequency modulation, Mathematical representation of frequency modulated wave, Frequency modulators, Pre−emphasis, De−emphasis, Directly modulated FM transmitter, Phase modulation, Indirect method of FM modulation, Wide and narrow band FM transmission, Advantages and disadvantages of FM, Comparison of FM and AM system, Comparison of FM and PM system.

FM Receiver: FM receiver, Basic FM demodulators, Noise triangle in FM, Capture effect, FM stereo system.

Pulse Modulation: Introduction, Classification of pulse modulation, Continuous vs discrete time signals, Sampling process, Pulse amplitude modulation, Pulse time modulation, Pulse position modulation, Comparison of PAM and PPM systems, Pulse code modulation, Multiplex transmission, Crosstalk, Comparison of FDM and TDM, Differential pulse code modulation, Delta modulation, Adaptive delta modulation, Sigma−delta A/D conversion, Comparison between PCM,DM,ADM and DPCM.

Audio Communication: Microphones, Loudspeakers, Speakers enclosures and baffles, High Fidelity Systems, Streophony, Tone control circuits, Public address systems, Recent trends in sound recordings.

Telephony: Principles of telephony, Telephone transmitter and receiver, Side tone, Necessity for telephone exchange, Tones in telephony, Automatic exchange, Pulsed and DTMF dialing, Electronic telephone exchanges, E 10B Electronic exchange, Teleprinters.

Text Books:

1. *Blake, R., Electronic Communication Systems, Thomson Business Information (2008).*

2. *Lathi, B.P., Modern Analog and Digital Communication, Oxford University Press (2007).*

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Reference Books:

1. *Kennedy, G., Electronic Communication Systems, McGraw–Hill (2002).*
2. *Schweber, W., Electronic Communication Systems, Prentice–Hall of India Private Limited (2002).*

Evaluation Scheme:

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

UEI512 ROBOTICS AND RELATED INSTRUMENTATION

L	T	P	Cr
3	1	0	3.5

Basic Concepts in Robotics: Automation and robotics, Robot anatomy, Basic structure of robots, Resolution, Accuracy and repeatability

Classification and Structure of Robotic System: Point to point and continuous path systems. Control loops of robotic systems, The manipulators, The wrist motion and grippers.

Drives and Control Systems: Hydraulic systems, Dc servo motors, Basic control systems concepts And models, Control system analysis, Robot activation and feed back components. Positional and velocity sensors, actuators. Power transmission systems, Robot joint control design.

Robot arm Kinematics and Dynamics: The direct kinematics problem, The inverse kinematics solution , Lagrange-Euler formation ,Generalized D'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 Systems: Vision equipment, Image processing, Concept of low level and high level vision.

Robot Programming: Method of robots programming, Lead through programming methods, A robot programs as a path in space , Motion interpolation, WAIT, SIGNAL and DELAY commands, Branching capabilities and limitation of lead through methods.

Robot Language: The textual robot languages , Generations of robot programming languages , Robot language structure, Constants, Variables and other data objects. Motion commands, End effectors and sensor commands computations, Programme control and subroutines, communication and data processing , Monitor mode commands. Introduction to Artificial Intelligence.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Demonstrate the basic concepts of robotics, their classification and structure.
2. Explain the type of the drive and control systems used in robotics.
3. Describe the type of sensors and other instruments used in robotics.
4. Perform the robot language programming.

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/Projects/Tutorials/Quizzes/Lab Evaluations)	25

UEI841 ADVANCED CONTROL SYSTEMS

L	T	P	Cr
3	1	0	3.5

Nonlinear Control Systems: Introduction to Nonlinear systems, Liapounov's method for stability study, Phase plane method, Describing functions.

Optimal Control Theory: Introduction, Optimization by steepest decent method, Optimization with constraint gradient method, Minimization of functions by neumerical methods: Fletcher–Powell method, Newton–Raphson method; Optimal control problem: Characteristics of the plant, Requirements of the plant, Plant data supplied to the Controller; Mathematical procedures for optimal control design: Calculas of variations, Pontryagin's optimum policy, Bang–Bang Control, Hamilton–Jacobi Principle, Dynamic Programming; State regulator problem, Parameter optimization.

z–Plane Analysis of Discrete–Time Control Systems: Introduction, Impulse sampling and data hold, Obtaining the z–transform by the convolution integral method, Reconstructing original signal from sampled signals, The pulse transfer function, Realization of digital controllers and digital filters.

Design of Discrete–time Control Systems by Convolution Methods: 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, Analytical design 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, Liapunov stability analysis, Controllability, Useful transformations in state–space analysis and design, Design via pole placement, State observer, Servo systems.

Quadratic Optimal Control Systems: Introduction, Quadratic optimal control, Steady–state quadratic optimal control, Quadratic optimal control of a servo system.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Explain the basic concepts of nonlinear control systems.
2. Illustrate the concept and methods of optimal control.
3. Analyze and represent control systems in discrete domain.
4. Represent and analyze the control system in state space domain.

Text Books:

1. *Bandyopadhyay, M.N., Control Engineering: Theory and Practice, Prentice–Hall of India Private Limited (2003).*
2. *Ogata, K., Discrete–time Control Systems, Pearson Education (2005).*

Evaluation Scheme:

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

UEI842 BIO–MEDICAL DSP

L	T	P	Cr
3	1	0	3.5

Introduction: Characteristics of medical data, Software designof digital filters, Basic electrocardiography, ECG lead system, ECG signal characteristics, Sampling basics, Simple conversion system, Conversion requirements for biomedical signals.

Digital filters: Digital filters, The Z transform, Elements of digital filter, Types of digital filters, Transfer function of a difference equation, The Z plane pole zero plot, The rubber membrane concept, Characteristics of FIR filters, Smoothing filters, Notch filters, Window method of filter designing, Frequency sampling, Min max design, Generic equations of IIR filters, Simple one pole example, Integrators, Design methods of two pole filters, Basic design concept, Low pass integrator filter of low pass integer filter, High pass integer filters, Band pass integer filter and band reject filters, Effect of filter cascades.

Adaptive filters: Principle noise canceller model,, 50Hz adaptive canceling, Other applications of adaptive filtering, Basics of signal averaging, Signal averaging as digital filter, A typical average, Software for signal averaging , Limitations of signal averaging.

Data reduction techniques: Turning point algorithm, AZTECH algorithm, Fan algorithm, Huffman coding, SPIHT using wavelets and other techniques.

ECG Analysis: Power spectrum of ECG, Band pass filtering techniques, Differentiation techniques, Template matching techniques, A QRS detection algorithm, ECG interpretation, ST segment analyzer, Potable arrhythmia monitor.

Neurological signal processing: Brain and its potential, EEG signal and its characteristics, EEG analysis, Linear prediction theory, Auto regressive methods, Recursive parameter estimation, spectral error measure, Adaptive segmentation, Transient detection and elimination.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Explain the concepts of DSP in biomedical.
2. Distinguish among different digital filters.
3. Explain the concept of adaptive filtering.
4. Implement different type of data reduction techniques.
5. Analyse ECG and neurological signal using DSP.

***Text Books**:*

1. *Prokis, J.G., Digital signal processing, Prentice–Hall of India Private Limited (1997).*
2. *Tomkin, W. J., Biomedical DSP, Prentice–Hall of India Private Limited (2003).*

***Reference Books**:*

1. *Carr, J., Biomedical instrumentation, PHI Learning Pvt. Limited (2008).*

Evaluation Scheme:

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

UEI831 BIOSENSORS AND MEMS

L	T	P	Cr
3	1	0	3.5

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 – Micromachined fiber optic component, Optical sensors, Thermal MEMS – thermo-mechanical and thermo-electrical actuators, Peltier heat pumps

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Understand the concept molecular reorganization, fundamentals of surfaces and interfaces
2. Understand the Principles of different types of biosensors
3. Understand the concept of MEMS design, and fabrication technology 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 Books:

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

Evaluation Scheme:

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

UEI832 DIGITAL IMAGE PROCESSING

L	T	P	Cr
3	1	0	3.5

Intensity Transformations and spatial Filtering
Logarithmic and Contrast-Stretching Transformations, Histogram Processing and Function Plotting: Generating and Plotting Image Histograms, Histogram Equalization, Histogram Matching (Specification). Spatial Filtering: Linear Spatial Filtering, Nonlinear Spatial Filtering.

Frequency Domain Processing
2-D Discrete Fourier Transform, Computing and Visualizing the 2-D DFT in MATLAB. Filtering in the Frequency Domain: Fundamental Concepts, Basic Steps in DFT Filtering, An M-function for Filtering in the Frequency Domain. Obtaining Frequency domain Filters from Spatial Filters. Generating Filters Directly in the Frequency Domain: Creating Meshgrid Arrays for Use IN Implementing Filters in the Frequency Domain. Lowpass Frequency Domain Filters.

Image Restoration
Adding noise with Function imnoise, Generating Spatial Random Noise with a Specified Distribution, Periodic Noise, Estimating Noise Parameters
Restoration in the Presence of Noise Only-Spatial Filtering : Spatial Noise Filters, Adaptive Spatial Filters, Periodic Noise Reduction by Frequency Domain Filtering, Modeling the Degradation Function, Direct Inverse Filtering, Wiener Filtering, Constrained Lest Squares (Regularized) Filtering
Iterative Nonlinear Restoration using the Lucy-Richardson Algorithm, Blind Deconvolution. Geometric Transformations and Image Registration: Geometric Spatial Transformations, Applying Spatial Transformations to images, Image Registration

Image Compression
Coding Redundancy: Huffman Codes, Huffman Encoding, Huffman Decoding. Interpixel Redundancy. Psychovisual Redundancy. JPEG Compression: JPEG, JPEG 2000

Morphological Image Processing
Basic Concepts from Set Theory, Binary Images, Sets, and Logical Operators. Dilation and Erosion: Dilation, Structuring Element Decomposition, The strel Function, Erosion. Combining Dilation and Erosion: Opening and Closing, The Hit-or-Miss Transformation, Using Lookup Tables, Labeling Connected Components, Morphological Reconstruction: Opening by Reconstruction, Filling Holes, Cleaning Border Objects. Gray-Scale Morphology: Dilation and Erosion, Opening and Closing, Reconstruction

Image Segmentation
Point, Line, and Edge Detection: Point Detection, Line Detection, Edge Detection. Line Detection Using the Hough Transform: Hough Transform Peak Detection, Hough Transform Line Detection and Linking. Thresholding: Global Thresholding, Local Thresholding. Region-Based Segmentation: Basic Formulation, Region Growing, Region Splitting and Merging. Segmentation Using the Watershed Transform: Watershed Segmentation Using the Distance Transform, Watershed Segmentation Using Gradients, Marker-Controlled Watershed Segmentation.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Understand the concept of image processing
2. Understand the various methods for image enhancement, restoration, segmentation and compression
3. Understand the concept of colored images and object recognition techniques

Text Book:

1. *Gonzalez, R.C. and Woods, R. E., Digital Image Processing Using MATLAB, Pearson Education (2003).*

Reference Book:

1. *Jain, A.K., Digital Image Processing, PHI Learning Pvt. Limited (2008).*
2. *Gonzalez, R.C. and Woods, R. E., Digital Image Processing, 3rd Edition, Prentice Hall (2008)*

Evaluation Scheme:

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

UEI843 EMBEDDED CONTROL SYSTEMS

L	T	P	Cr
2	1	2	3.5

Introduction: Introduction to Embedded Systems, Its Architecture and system Model, Introduction to the HCS12/S12X series Microcontrollers, Embedded Hardware Building Block.

HCS12 System Description and Programming: The HCS12 Hardware System ,Modes of Operation, The B32 Memory System , The HCS12 DP256 Memory System, Exception Processing–Resets and Interrupts, Clock Functions, TIM, RTI, Serial Communications, SPI-Serial Peripheral Interface, I2C, HCS12 Analog-to-Digital Conversion System.

Basic Input /Output Interfacing Concepts: Input Devices, Output Devices and their Programming, Switch Debouncing, Interfacing to Motor, LCDs, Transducer, The RS-232 Interface and their Examples.

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

Real-time Operating Systems (RTOS): Basic concepts of RTOS and its types, Concurrency, Reentrancy, Intertask communication, Implementation of RTOS with some case studies.

Laboratory Work:
Programming of HCS12 with Code warrior for Interrupts, Clock Functions, TIM, RTI, SPI, LCD interfacing, Use of JTAG and Hardware Debuggers, Interfacing Keypad, ADC, DAC, LCD, Real Time Clock and Temperature Sensors with I2C and SPI bus.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Understand the concept of embedded Systems, architecture and system mode
2. Understand the programming, interfacing devices
3. Understand software and hardware tools and real-time operating systems

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	20
2	EST	40
3	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UEI844 VLSI DESIGN FOR TESTABILITY

L	T	P	Cr
3	1	0	3.5

Introduction to VLSI testing: Role of Testing, Digital and Analog VLSI Testing, VLSI Technology Trends Affecting Testing, Types of Testing, Automatic Test Equipment, Electrical Parametric Testing

Test economics and product quality: Defining Costs, Benefit-Cost Analysis, Economics of Testable Design, Yield, Defect Level as a Quality Measure, Test Data Analysis, Defect Level Estimation

Fault modeling: Defects, Errors, and Faults, Levels of Fault Models, Single Stuck-at Fault, Fault Equivalence, Fault Collapsing, Fault Dominance and Checkpoint Theorem

Logic and fault simulation: Simulation for Design Verification and Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-Value Simulation, Algorithms for Fault Simulation, Statistical Methods for Fault Simulation

Combinational circuit test generation: Algorithms and Representations, Redundancy Identification, Automatic Test-Pattern Generator (ATPG), Combinational ATPG Algorithms, Test Generation Systems, Test Compaction

Sequential circuit test generation: ATPG for Single-Clock Synchronous Circuits, ATPG for Single-Clock Synchronous Circuits, Approximate Methods, Cycle-Free Circuits, Cyclic Circuits

Text Books:

1. *Bushnell, M.L. and Agrawal, V. D., Essentials of electronic testing for digital memory and mixed signal VLSI circuits, Kluwer Academic Publishers (2002).*

Reference Books:

1. *Abramovici, M. and Friedman, A. D., Digital Systems Testing and Testable Design, Jaico Publishing House (2001).*

Evaluation Scheme:

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

UEE522:ENERGY AUDITING AND MANAGEMENT

L	T	P	Cr
3	1	0	3.5

Course Objective: To make the student understand about the energy scenario and its importance.

Energy Scenario: Energy scenario of growing economy, Energy pricing, Energy sector reforms, Energy and environment, Energy security, Energy conservation and its importance, Energy conservation Act-2001 and its features.

Energy Management and Audit: Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments

Material and Energy Balance: Methods for preparing process flow, Material and energy balance diagrams.

Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques- Risk and sensitivity analysis, Financing options, Energy performance contracts and role of ESCOs.

Electrical System: Electricity tariff, Load management and maximum demand control, T&D losses. Losses and efficiency in induction motors, Factors affecting motor performance and remedial solutions, energy efficient motors. Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues

Compressed Air System: Types of air compressors, Compressor efficiency, Efficient compressor operation, Compressed air system components, Capacity assessment.

HVAC and Refrigeration System: Vapor compression refrigeration cycle, Coefficient of performance, Capacity, performance and savings opportunities, Vapor absorption refrigeration system: Working principle, Saving potential, Fans, Blowers and pumps- Types, Performance evaluation, Flow control strategies and energy conservation opportunities.

Course Learning Outcomes (CLO):

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

1. Analyze about energy scenario nationwide and worldwide
2. Decide about energy management in more effective way.
3. Analyze about various energy related aspect of electrical system.
4. Carry out financial management.
5. Conduct studies related to operational aspects of compressed air system and refrigeration system.

Text Books:

1. *Abbi, Y.P. and Jain, S., Handbook on Energy Audit and Environment Management, Teri Bookstore (2006).*
2. *Diwan, P., Energy Conservation, Pentagon Press (2008).*

Reference Books:

1. *Younger, W., Handbook of Energy Audits, CRC Press (2008).*

Evaluation Scheme:

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

UEI621 ANALYTICAL INSTRUMENTATION

L	T	P	Cr
3	1	0	3.5

Introduction: Introduction to instrumental analysis-classification, advantages.

Spectrometry: Theory, Apparatus and Application of atomic absorption spectrometer, UV-visual spectrometer, Fourier transform infrared spectrometer, Nuclear magnetic resonance spectrometer, Mass spectrometry.

Optical Techniques: Working, Principle, Construction and application of turbidimetry, Nephelometry, Polarimetry, Refractometry.

Chromatography: Chromatographic techniques, High pressure liquid chromatography, Gas chromatography.

Elemental Analysis: Elemental analysis of C, H, N, S and O.

Potentiometry : Potential and standard potential, Theory of ion selective electrodes-Glass electrode, Gas sensing electrodes, Quantitative analysis.

X-ray Analytical Methods: Theory of X-ray spectral lines, Apparatus, Wavelength dispersive devices, Energy dispersive devices, Detectors, Scanning electron microscope, Chemical analysis by X-ray diffraction.

Air Pollution Measurement: Need of pollution monitoring unit, measurements and analysis of air pollutants like SO2, CO, Hydrocarbons, Petrochemical oxidants, Particulates.

Water Pollution Measurement: Measurement and analysis and control of water pollutant, Determination of inorganic, Organic substances, Waste water treatment, Odor measurement.

COURSE LEARNING OUTCOME (CLO): The student will be able to

1. Understand the concept of spectrometry and optical techniques
2. Understand the working of chromatography, elemental analyser and potentiometer
3. Understand the working of X- ray diffractometer and scanning electron microscope
4. Monitor selected parameters for air and water pollution

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).*

Evaluation Scheme:

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

UEI622 DATA NETWORKS

L	T	P	Cr
3	1	0	3.5

Introduction to Computer Networks: Uses of computer networks, Types of networks, Connection oriented and connectionless services.

Layered Network Architecture: The OSI Reference model, The TCP/IP reference model, Comparison of OSI and TCP reference models

Physical Layer: Overview of communication channels, Maximum Data Rate of a channel, Transmission media, Twisted pair, Coaxial, Fiber optics, Microwave, Satellite etc., Telephone system, Trunks and Multiplexing (PDH.SDH), Switching, Packet switching and circuit switching, N-ISDN, Broadband ISDN and ATM, Virtual circuits Vs Circuit switching, Transmission in ATM networks, Frame relay.

Data Link Layer: Error detection and correction, ARQ, Flow control and framing in data link layer, Sliding windows protocols, HDLC, Data link layer in Internet, Data layer in ATM.

Medium Access Sublayer: Queuing models, Little's theorem, M/M/1, M/M/m and M/G/1, Queuing systems. Static and dynamic allocation of channels in LANs, Multiple access protocols, Throughput, Delay and stability of ALOHA systems. CSMA and CSMA/CD Systems, IEEE 802 standards for Ethernet, Token bus and token ring, High speed LANS-FDDI.

Network Layer: Routing algorithms, Dijkstra algorithm, Bellman Ford algorithm, Optimality principle, Congestion control algorithms, Internetworking, The network layer in Internet, Network layer in ATM.

Transport Layer: Internet Transport Protocols (TCP and UDP), ATM adoption layer, performance of computer networks.

Text Books:

1. *Dimitri, P., Gallager, B., Data Networks, Prentice–Hall of India Private Limited (2004).*
2. *Tanenbaum, A.S., Computer Networks,Prentice–Hall of India Private Limited (2005).*

Reference Books:

1. *Dumas, M.B., Principles of Computer Networks and Communications, Prentice–Hall of India Private Limited (2003).*
2. *Steven, W.R., TCP/IP Illustrated (Vol. 2): The Implementation, Addison Wesley, (2002).*

Evaluation Scheme:

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

UEI623 OBJECT ORIENTED PROGRAMMING AND APPLICATIONS

L	T	P	Cr
2	1	2	3.5

Introduction: Need of Object Oriented Programming (OOP), Advantages of OOP, Characteristic of Object Oriented Languages, C++ and C.

C++ Programming: Data Types, Operators and Statements, Writing a Program in C++: Declaration of variables, Statements, Simple C++ programs, Features of iostream.h, Manipulator functions, Input and Output Stream Flags.

Control Statements: Conditional expressions, Switch statement, Loop Statements, Breaking control statements.

Functions AND Program Structures: Introduction, Defining a function, return statement, Types of functions, Actual and formal arguments, Local and global variables, Default arguments, Multifunction program, Storage class specifiers, recursive function, Preprocessors, Header files.

Arrays: Array notation, Array declaration, Array initialization, Processing with array, Arrays and functions, Multidimensional arrays, Character array.

Pointer: Pointer declaration, Pointer arithmetic, Pointers and functions, Pointers and arrays, Pointers and arrays, pointer and strings, Array of pointers, Pointers to Pointers.

Structures, Unions and Bit Fields: Declaration of structures, Initialization of a Structure, Functions and Structures, Arrays within a Structures, Nested Structure, Pointers and Structures, Unions, Bit Fields, Typedef, Enumerations.

Classes and Objects: Introduction, Structures and Classes, Declaration of Class, Member functions, Defining the Object of a Class, Accessing a member of class, Array of class objects, Unions and classes, Nested class.

More on Classes: Constructors, Destructors, Inline member functions, Static class members, Friend functions, Dynamic memory allocations, This pointer.

Inheritance: Introduction, Single inheritance, Types of base classes, Types of derivation, Ambiguity in single heritance, Array of class objects and single heritance, Multiple heritance, Container classes, Member access control.

Overloading: Function overloading, Operator overloading, Overloading of binary operators, Overloading of unary operators.

Polymorphism: Introduction, Early binding, Polymorphism with pointers, Virtual functions, Late binding, Pure virtual functions, Abstract base classes, Constructors under inheritance, Destructors under inheritance, Virtual Destructors, Virtual base classes,.

Templates and Exception Handling: Function Template, Class template, Exception handling.

Data File Operations: Opening and Closing of Files, Stream state member functions, Reading/Writing a character from a file, Binary file operations, Classes and file operations, Array of class objects and file operations, Nested classes and file operations, Random access file processing.

Application of OOP in Data Structure: Data Structures - Sparse matrices, Stacks, Queues, recursion, Applications of recursion, linked lists (singly linked, Doubly linked and circular linked lists). General graph features, Trees, Binary trees and their applications, Traversal algorithms for binary trees, Threaded binary tree, breadth first search, Depth first search and heuristic search algorithms, B trees and Game trees.

Laboratory Work:
Programing skills and applications based on various concepts of OOP.

Text Books:

1. *Aho, A.V., Hopcraft ,J.E. and Ullman, J.D., Data Structures and Algorithms, Addison Wesley (2004).*
2. *Langsam, Y., Augenstein, M. J. and Tenenbaum, A. M., Data Structures with C and C++, Prentice–Hall of India Private Limited (2000).*
3. *Tremblay,J.P. and Sorenson,P.G. Data StructuresOrganization and Architecture – Designing for Performance , Prentice–Hall of India Private Limited (2004).*

Reference Books:

1. *Pattric, N., The C++ Complete Reference, McGraw–Hill (1982).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	20
2	EST	40
3	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40