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MASTER OF TECHNOLOGY IN
APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
CURRICULUM & SYLLABUS

FIRST SEMESTER:

A. THEORY				
SL NO.	CODE	SUBJECT	NO. OF PAPERS	MARKS
1		Advanced Engg. Mathematics	1	100
2		Management	1	100
3	EIEM101	Advanced Electronics circuits	1	100
4	EIEM102	Signal and Systems	1	100
5	EIEM103	Elect I : a) Material science b) Measurement system and Design c) Mechatronics	1	100
TOTAL OF THEORY				500
B. PRACTICAL / SESSIONAL				
6	EIEM191	Laboratory I	1	100
7	EIEM192	Laboratory II	1	100
8	EIEM193	Seminar I	1	100
TOTAL OF PRACTICAL / SESSIONAL				300
TOTAL OF SEMESTER				800



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SECOND SEMESTER:

A. THEORY				
SL NO.	CODE	SUBJECT	NO. OF PAPERS	MARKS
1	EIEM201	Instrumental methods & analysis	1	100
2	EIEM202	Sensor science & technology	1	100
3	EIEM203	Process control systems design	1	100
4	EIEM204	Elect II : a) Non destructive Testing b) Medical Instrumentation c) Digital signal & image processing	1	100
5	EIEM205	Elect III : a) Instrumental studies of environment & its control b) Remote sensing and control c) Ultrasonic Instrumentation	1	100
TOTAL OF THEORY				500
B. PRACTICAL / SESSIONAL				
6	EIEM291	Laboratory III	1	100
7	EIEM292	Seminar II	1	100
TOTAL OF PRACTICAL / SESSIONAL				200
TOTAL OF SEMESTER				700



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THIRD SEMESTER:

A. THEORY				
SL NO.	CODE	SUBJECT	NO. OF PAPERS	MARKS
1	EIEM301	Soft computing theory & practice	1	100
2	EIEM302	Elect IV : a) Electro optics & Opto Electronics b)Units and standard	1	100
TOTAL OF THEORY				200

B. SESSIONAL				
3	EIEM391	Pre-submission Defense of Dissertation	1	100
4	EIEM392	Dissertation (part I)	1	100
TOTAL OF SESSIONAL				200
TOTAL OF SEMESTER				400

FOURTH SEMESTER:

SESSIONAL				
1	EIEM491	Post submission defense of dissertation	1	100
2	EIEM492	Dissertation (Completion)	1	300
3	EIEM293	Comprehensive Viva-Voce	1	100
TOTAL OF SESSIONAL				500
TOTAL OF SEMESTER				500

GRAND TOTAL MARKS: 2400



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Detailed Syllabus :

EIEM101 : ADVANCED ELECTRONICS CIRCUITS

CONTENTS	PERIODS
Introduction to Microelectronics: IC Production Process- Basic Steps involved in Production, Layout and Fabrication;	3
Basic Integrated Circuits building blocks.	7
Analog Integrated Circuits: Differential amps-BJT and CMOS (small signal operation, active load, cascode configuration) ; BiCMOS and GaAs amps, 741 Op-amp circuit-DC analysis, small signal analysis, Gain and Frequency response; Analysis of CMOS and BiCMOS Op-amps. Digital to Analog Converter Circuits, Analog to Digital Converter Circuits, Switched capacitor filter- Analog Signal processing Circuits- Oscillators and Phase-locked -loop	16
Digital Integrated Circuits- Design and performance analysis of CMOS inverter, CMOS logic Circuits, Pass-transistor Circuits, Dynamic Logic Circuits; Flip-flops and multivibrator circuits, Semiconductor-memories: PROM, Static and Dynamic RAM, Sense amplifier and Address Decoder. Advanced digital technology: BiCMOS and GaAs digital Circuits MSI and PLD Components;(Fussable) Programmable logic array: (Fussable) Logic gate array, Control implementation using Multiplexer and PLA	14
TOTAL	40

BOOKS: -

- 1) R.L.Geiger, P.E.Allen & N.R.Strader – Design techniques for Analog & Digital Circuits, McGraw Hill, Singapore, 1990
- 2) D.A.Hodges & H.G.Jackson – Analysis and Design of Digital Integrated Circuits, McGraw Hill, New York, 1983
- 3) W.I.Tletecher – An Engineering Approach to Digital Design, Prentice Hall, Englewoodcliffs, N. J., 1980.
- 4) N.H.E.Waste & K.Eshraghian – Principles of CMOS VLSI Design, Addison Wesley, Reading Mass, 1985
- 5) S.M.Sze – VLSI Technology, Second Edition, TMH, New selhi, 2004
- 6) D. Nagchoudhuri – Principles of Microelectronic Technology, Wheeler Publisher, Delhi, 1998

EIEM102 : SIGNALS AND SYSTEMS

CONTENTS	PERIODS
Signal Characterization: specification and models	3
State space analysis: State-variable model, LTI state equations, state equations for discrete times systems.	4
Spectrum analysis: Discrete Fourier transform and its limitations, Fast Fourier Transforms	4
Digital filters: FIR, IIR filters, Effect of finite word length, filter banks.	5
Principles of probabilistic modeling, stochastic model based finite dimensional distribution	4
Mathematical description of random signals, pseudorandom signals	4



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Analysis of non-stationary signals, random signals.	4
Response of linear systems to random input.	2
Kalman filters	2
Hardware consideration for various forms of algorithms.	4
Application systems: Speech processing, Biomedical signal processing.	4
TOTAL	40

BOOKS: -

- 1) T. Chonavel - Statistical Signal Processing, SpringerVerlag 2002
- 2) M.Schwarz, L.Shaw - Signal Processing: discrete Spectral analysis detection and estimation, McGraw Hill 1975
- 3) Oppenheim - Signals & Systems (2e), Pearson 2003

EIEM103(A) : MATERIAL SCIENCE

CONTENTS	PERIODS
Introductory Review: Science of metals and semiconductors and their behavioural patterns, Engineering metallurgy. Engineering materials	2
Structure of Atoms : Different modes, Bonding, Crystal structure, ionic and molecular crystals	4
Review of elastic and plastic behaviour of solids: Ductility, malleability, brittleness, fatigue, creep etc.	3
Electronic Properties: conductors, semiconductors, insulators, magnetism and its types, Dielectric behaviour, cohesive and repulsive forces in materials (metals), electronic energy, resistance and conductance. Electron Theory of metals.	6
Thermal properties of different materials: conductors, insulators, refractories, monomers and polymers	3
Chemical properties: Polymerization, Plastics. Corrosion-its control.	3
Metals: Iron carbon alloy, heat treatment	2
Nonferrous and ferrous alloys.	2
Organic materials, Composite materials and ceramics	3
Types, Analysis and specification of Semiconductors, Insulators, magnetic materials	6
Micromaterials and machining techniques	3
Nanomaterial and nanotechnology	3
TOTAL	40

BOOKS: -

- 1) Hummel - Electronic Properties of Materials, Springer Verlag, Berlin 2005
- 2) Hummel - Understanding Material Science (2e), Springer Verlag, Berlin 2005
- 3) Bhargava - Engineering materials: Polymers, Ceramics and Composites, Prentice Hall, 2003

EIEM103(B) : MEASUREMENT AND SYSTEM DESIGN

CONTENTS	PERIODS
Qualitative and Quantitative aspects of measurement.	4
Measurement system modeling via application of communication theory, information theory.	6
The probabilistic model.	4



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Design of measurement system using system theory, pattern recognition and parameter estimation.	6
Statistical analysis of measurement system output; band diagrams, Specification analysis, multi-parameter techniques, regression analysis.	8
Design with least interference and noise and optimum reliability. Analytical aspects of limitations of such designs	8
TOTAL	36

BOOKS: -

- 1) T.R. Padmanabhan - Industrial instrumentation-Principles of design, springer Instrumentational Edition 2000
- 2) M.Hordeski - Transducers for Atomation, Van Nostrand Reinhold, New York, 1987
- 3) DC Ramsay - Principles of Engineering Instrumentation, Wiley, New York, 1996
- 4) Triethy HL - Transducers in Electronic and Mechanical Design, Merceel Dekker 1986
- 5) E. O. Doebelin – Measurement Systems Application and Design (6ed) Mc Graw Hill, New York 2003
- 6) D. Patranabis – Principles of Industrial Instrumentation, Tata Mc Graw Hill (2 e) New Delhi, 1996

EIEM103 (C) : MECHATRONICS

CONTENTS	PERIODS
Introduction to Mechatronics, Mechanical systems, Functions of mechatronic system, Forms of Processes and Electronics, Ways of information Processing	2
Fundamentals of Theoretical Modeling of Technical Processes Theoretical and Experimental Modeling, Classification of Process Elements, Process Elements with Lumped Parameters, Process Elements with Distributed Parameters, Fundamental Equations of Process Elements with Energy and Matter Flows, Energy Balance Equations for Lumped Parameter Process, Connection of Process Elements Fundamental Equations of the Dynamics of Mechanical Systems with Mobile Masses Newton's Laws of Kinetics. Principles of Mechanics	4
Mechanical Elements Bars. Springs. Dampers. Bearings. One-mass Oscillator (Spring-mass-damper Systems). Multi-mass Oscillators. Mechanical Systems with Friction. Mechanical Systems with Backlash Electrical Drives Electromagnets. Direct Current Motors. Alternating Current Motors (AC). Single-phase Motors. Internally or Externally Commutated Electromotors	6
Machines and Drivetrains Coupling of Machine Components to Complete Machines. Characteristics and Stability of Machines. Static Behavior of Power –generating and Power consuming Machines. Dynamic Model of a Combustion Engine Test Stand. Dynamic Behavior of a Machine Tool Feed Drive. Dynamic Model of an AC Motor and Centrifugal Pump System. Advanced Control of Mechanical Systems Identification of Dynamic Systems Identification Methods. Test Signals. Closed-loop Identification. Parameter Estimation for Discrete Time Signals. Parameter Estimation for Continuous Time Signals. Time-varying Systems.	8
Models of Oscillations and their Identification Harmonic Oscillations. Identification of Harmonic Oscillations	2
Sensors Classification of sensors. Sensor Properties. Signal Types, Transducers, Measuring	8



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Amplifiers. Displacement Measurement. Velocity Measurement. Acceleration Measurement. Vibration and Oscillation Measurement. Force and Pressure Measurement. Electromagnetic Compatibility (EMC). Integrated and Intelligent Sensors Actuators Actuator Behavior and control. Requirements for Actuators and Servo-drives. Electromechanical actuator Drives. Hydraulic Actuators. Pneumatic Actuators. Unconventional Actuators. Shaped Memory Alloys. Electrochemical Actuators. Piezoelectric Actuators. Micro-Actuators. Fault-tolerant Components. Fault-tolerance for Components. Fault Detection for Sensors, Actuators and Mechatronic Servo-Systems. Fault-tolerant Sensors. Fault-tolerant Actuators	
Microcomputers Microcomputer Structure. Memory. Interfaces to the Process (Peripherals). Microcontrollers	6
Examples for the Design of Mechatronic Systems: Modeling, Control and Diagnosis Electromagnetic Actuator: Non-linear Control and Fault Detection. Electromechanical Disc Brake (EMB). Industrial Robot. Control Prototyping and Hardware-in-the-loop Simulation	4
TOTAL	40

BOOKS: -

- 1) Triethy HL - Transducers in Electronic and Mechanical Designs, Merce Dekker, 2003
- 2) Bolton - Mechatronics (2e), Pearson Education 2003
- 3) R.Isermann - Mechatronics, Springers (India) 2005
- 4) D.A.Bradley, D.Dawson, D. Berd and A.J. Loader - Mechatronics in Products and Processes, Chpran and Hall Lord, 1991

EIEM201 : INSTRUMENTALMETHODS AND ANALYSIS

CONTENTS	PERIODS
Absorption Spectroscopy: Quantitative aspects, photometer and spectrophotometer methods	2
Molecular UV and V absorption Spectroscopy, Absorbing Species, Application in qualitative and quantitative analysis, Photo acoustics spectroscopy.	3
Molecular fluorescense, photosphrescence and chemiluminescence spectroscopy.	2
Atomic spectroscopy, Atomic absorption types, Atomic fluorescense types	3
Emission spectroscopy with Plasma, Arc, Spark, Flame emission type.	2
IR absorption spectroscopy-qualitative and quantitative analysis, IR emission spectroscopy.	3
Raman spectroscopy-various types of the spectroscopy and their applications, NMR-application to Proton and other isotopes, environmental effects, ESR.	4
X-ray spectroscopy, fluorescense, absorption, diffraction. The electron microscope. Electron spectroscopy and its applications.	4
Mass spectroscopy-identification of pure compounds, Molecular secondary ion mass spectrometry.	3
Chromatography: Plate theory, qualitative and quantitative analysis, Computerized system; gas-liquid chromatography, Gas solid type, HPLC, Partition Chromatography, Absorption chromatography, Ion-exchange chromatography, Size exclusion chromatography, Superficial type.	6
Planer chromatography: Thin layer, paper and Electro chromatography.	2
Electron Microscopy-SEM with auxiliary equipment like AUGER.	3
Electrochemical cells, cell potentials, electrode potential, Reference electrodes, Metallic electrodes, Membrane electrodes, Potentiometric methods	4
TOTAL	41



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BOOKS: -

- 1) Skoog, D.A. - Principles of Instrumental Analysis, Savunders College Publishing, Philadelphia
- 2) Brawn R.D – Introduction of Instrumental Analysis, Mc Graw Hill, New York, 1987
- 3) Khandpur R. S. – Handbook of Analytical Instrument, Inter Mc Graw Hill, New Delhi, 1989
- 4) Patranabis D. – Principles of Industrial Instrumentation (2e), Tata Mc Graw Hill, new Delhi, 1996

EIEM202 : SENSORS-SCIENCE AND TECHNOLOGY

CONTENTS	PERIODS
Principle of physical and chemical transduction; sensors classification, characterization of mechanical, electrical, optical, thermal, magnetic, chemical and biological sensors; their calibration and determination of characteristics;	3
Sensor reliability, reliability models and testing, ageing tests, failure mechanisms and their evaluation, stability studies:	2
IC technology used in micro sensor system; Crystal growth and wafer making, oxidation lithography, masking, pattern generation and transfer, different types of etching, ion implantation and diffusion, and vacuum evaporation, assembling, packaging, micromachining, epitaxy, use of polysilicon materials, bonding of different types etc.	8
Sensor designing and packaging: Partitioning, Layout, Technology constraints, scaling, compatibility study. Examples of selected micro sensors	4
Thick Film process of sensor development, thin film techniques, Characterization and delineation, Langaur-Blodgett films, sensors developed using these techniques such as gas and ion sensors	4
Ceramics and oxides as sensor materials, materials like Zirconia, Alumina, semiconductors, oxides of Tin & Zinc, Piezoelectric, Pyroelectric, Ferro electric materials.	3
Sensors for different applications: Mechanical, Electrical, Thermal, Magnetic, Optical, radiation chemical and Biological types.	3
Sensor modeling, numerical medeling techniques, model equations: Different effects on modeling: Temperature, radiation, mechanical, chemical, magnetic, electrical like capacitive, resistive, piezo-resistive etc. Examples of modeling/micro-modeling of photodiodes, magnetic/mechanical sensor.	6
Smart sensors, methods of internal compensation, information coding, integrated sensor principles, present trends.	4
TOTAL	37

BOOKS: -

- 1) Triethy HL - Transducers in Electronic and Meachanical Design, Mercel Dekker 1986
- 2) D. Patranabis – Sensor and Transducers (2e) Prentice Hall, New Delhi, 2003

EIEM203 : PROCESS CONTROL SYSTEM DESIGN

CONTENTS	PERIODS
Process Modeling: The System equations approach, Analytical approximations, effect of parameter variation; Open loop step response method, frequency response ,method, the method of moments, the parameter estimation technique- linear regression, least square regression techniques.	3
Process dynamics-characteristics of processes of a few processes such as heat exchangers,	4



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boilers and condensers, distillation columns, packed mass transfer apparatus. Model analysis and control; System order reductions.	
Control via modes-ideal and manipulated variables case; applications in lumped systems and distributed systems.	4
Design process control systems following various approaches: Supervisory control, direct digital control, control via modes, Fuzzy logic control, Distributed Computer control, Adaptive and self-tuning control.	8
Supervisory control using procedural model and/or economic model, optimizing process, various aspects of direct digital control-hierarchical, multilevel etc. Comparison of design strategies and performances	6
Fuzzy logic process control – main advantages, the approach, the controller design and applications to systems	4
Control system design with distributed computer networks, local controller, conducting data links, Control information and display unit; redundancy, reliability, data transfer protocols, standard interfaces, real time languages.	4
Adaptive control – the system identification technique, the model reference technique, self adaptation, the predictive approach; Design of the self tuning control systems: Based on (i) Transient response, (ii) frequency response (iii) parametric models;	4
Variation of algorithm designs, comparisons. Cases studies of specific control schemes such as temperature of oven and/or flatness of rolled metal sheets-design details of the algorithm developed and the complete scheme.	4
TOTAL	41

BOOKS: -

- 1) B.Roffel and B.H.L. Betlem - Advanced Practical Process Control, Springer 2004
- 2) L.Smith - Digital Computer process Control, Intext Education Publishers, 1972
- 3) T.F.Edger, Himmelblau D.Y - Optimization of Chemical Process, Mc Graw Hill New York, 1988
- 4) B.Sohlberg - Supervision and control for industrial processes, Spring Verlag, Berlin1998
- 5) M.Morari and E.Zafirion - Robust Process control, Preince hall 1989
- 6) H. Nijmeijer and A.J.Vander Scaft - Nonlinear Dynamical Control, Springer-Verlag, Berlin (2 ed) 1991
- 7) Franklin - Digital Control of Dynamic Systems 3/e, Pearson 2003
- 8) Ogata - Discrete Time control System 2/e, Pearson 2003
- 9) Astram - Adaptive Control (2/e), Pearson, 2003
- 10) Bequette - Process Control-Modeling, Design and Simulation, Prentice Hall, 2003

EIEM204(A) : NON-DESTRUCTIVE TESTING

CONTENTS	PERIODS
Surface feature inspection and testing : General, Visual, Chemical, and Mechanical	4
Optical-laser probe, holography, and ultrasonic surface wave probing	5
Magnetic-magnetization, flux, and Electro potential, Electrical resistivity, Electromagnetic-eddy current techniques.	5
Penetrant, radiation backscatter, etc.	3
Sub-surface (Internal feature inspection and Testing: Thermal-temperature sensing)	1
Electrical resistivity	1
Ultrasonic-longitudinal and shear wave methods, acoustic emission methods	4
X-rays-refraction/diffraction and fluorescence, Gamma rays-radiography.	3
IQI (image quality indicator), Xerography, Image intensification methods.	2
Electron microscopic techniques. ISO specifications and certifications	4
TOTAL	32



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BOOKS: -

- 1) Krantkramer - Ultrasonic Testing of materials, Springer 2005
- 2) Handbook of Nondestructive Testing, Mc Graw Hill, 1998
- 3) U. Schnars, W. Jeuptner - Digital Holograpy, Springer, 2005
- 4) W. J. Price – Nuclear radiation Detection, Mc Graw Hill, New York, 1958

EIEM204(B) : MEDICAL INSTRUMENTATION

CONTENTS	PERIODS
General introduction of medical instrumentation, its problems and specialty.	2
Sensing devices for biomedical instruments: general requirements and special considerations	4
Equipment standards and patient safety.	3
Diagnostic equipment: vector cardiograph, echocardiograph, comparison of ECG, VCG and ECHO, monitoring and transmission of ECG.	6
IR imaging and its diagnostic criteria.	3
Measurement of blood flow-electromagnetic flow meters and its specialty, plethysmography-impedance plethysmography, discussion of other blood flow meters, their advantages and disadvantages over these methods,	6
Ultrasonography- principles, different scanning modes, its instrumentation.	4
Clinical instrumentation –body fluid content determination, bio-analytical sensors and its uses.	3
Assistive devices: hearing aid and its problems, contact lens and its problems, artificial heart and its viability	3
Therapeutic devices: chemotherapy.	2
TOTAL	38

BOOKS: -

- 1) Carr - Introduction to Biomedical equipment Technology 4/e, Pearson 2003
- 2) Cvomwell - Biomedical Instrumentation and Measurements 2/e, Pearson 2003
- 3) Domach - Introduction to biomedical engineering, Pearson 2003

EIEM204(C) : DIGITAL SIGNALS AND IMAGE PROCESSING

CONTENTS	PERIODS
Introduction Discrete time signals and systems Review of z-transforms	5
Discrete Fourier Transforms Efficient computation of DFT: FFT algorithm	5
Implementation of Discrete time system Design of digital filters	5
Digital Image Fundamentals Image enhancement Spatial and Frequency domains	7
Image restoration Color image processing	6
War and multi resolution processing	4



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Image compression	
Morphological image processing Image segmentation	4
Representation of Description Object recognition	4
TOTAL	40

EIEM205(A) : INSTRUMENTAL STUDIES OF ENVIRONMENT AND ITS CONTROL

CONTENTS	PERIODS
General introduction to Pollution, its classification & Measurement: Impact of man on environment, Types of Pollution, Pollution Control Aspects	2
Industrial Pollution Emissions & Indian Standards: Industrial Emissions – Liquids & Gases, Environment Legislation, Air (Prevention & Control of Pollution) Act-1981	3
Analysis of Pollutants: Industrial Waste Water Analysis, Industrial Gaseous Analysis, Particle Size Distribution	3
Air Pollution: Sources & Effects, Meteorological Aspects of Air Pollutant Dispersion, Sampling & Measurement, Controlling Equipments, Control of Gaseous Pollutants and their analysis: Sulphur Compounds, Nitrogen Compounds, Carbon Compounds and Hydrocarbons, Colour Dosimeter tubes and its limitations	6
Water Pollution: Sources and Classification of Water Pollutants, Water Pollution Laws & Standards, Waste Water Sampling & Analysis, types of treatment	6
Earth Pollution: Sources, Types, Effects, Measurements, Possible methods of Control	6
Sound Pollution: basics of Sound Pollution, its effect to environment	2
Acoustic noise measurement: microphone, sound level meter, integrating type, intensity measuring instrument, Acoustic noise control	2
Solid Waste Management: Sources and Classification, Public Health aspects, Methods of Collection and disposal	4
Pollution Monitoring Instruments: Opacity meter, Sulphur & Nitrogen Oxide Analyzer, Carbon Monoxide Analyzer	2
Pollution Control in Selected Process Industries: Fertilizer Industries, Petroleum Refineries and Petrochemical Units, Pulp and Paper Industries	4
TOTAL	40

BOOKS: -

1. C. S. Rao - Environmental Pollution Control Engineering, New Age
2. S. P. Mahajan - Pollution Control Process Industries, Tata McGraw Hill, New Delhi, 2000
3. M.N. Rao & H.U.N. Rao - Air Pollution, Tata McGraw Hill, New Delhi, 2001
4. Metcalf & Eddy - Waste Water Engineering, Tata McGraw Hill, New Delhi, 2003
5. Masters – Introduction to Environmental Engineering and Science, Pearson, 2003
6. Stiling - Ecology: Theories and Applications, 4e, Prentice Hall



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EIEM205(B) : REMOTE SENSING AND CONTROL

CONTENTS	PERIODS
Nature of electromagnetic radiation-special, spatial and temporal characteristics of objects	4
Atmospheric interaction sensors-photographic, thermal, multi-spectral, passive microwave and active microwave sensors.	8
Ground data acquisition-photo-interpretation-image processing techniques, remote sensing applications	8
Techniques of remote control; remote control in Industry including Oil pipelines, rocket motion and satellite movements.	12
TOTAL	32

BOOKS: -

- 1) Gupta - Remote Sensing Ecology (2e), Springer 2005
- 2) Jensen - Remote Sensing of the Environment, Pearson 2003

EIEM205(C) : ULTRASONIC INSTRUMENTATION

CONTENTS	PERIODS
Introduction Generation of Ultrasonic waves – magnetostriction and piezoelectric effects Power levels	5
Ultrasonic waves, principle of propagation Characterization of ultrasonic transmission – Intensity, Attenuation, coefficients. Advance parameters and their effects	7
Sensors units – types and characteristics	3
Ultrasonic Test methods: Echo, Transit time, Resonance, Direct contact and immersion types	5
Ultrasonic flow detectors	4
Ultrasonic methods of measuring thickness, depth, flow, level etc	5
Ultrasonic in medical diagnosis and therapy	5
Acoustic holography	3
Various parameters affecting ultrasonic testing and measurements, their remedy	5
TOTAL	42

EIEM301 : SOFT COMPUTING-THEORY AND PRACTICE

CONTENTS	PERIODS
Introduction to soft computing and its constituents	2
Introduction to fuzzy sets and its importance in real life. Definition, basic operators, T-norm, S-norm, other aggregation operators. Fuzzy relation, implications, cylindrical extension, projection and composition,	6
Approximate reasoning, compositional rule of inference, rule based system, term set, fuzzification, reasoning, defuzzification, different fuzzy models (MA/TS)- some applications of fuzzy rule based system.	8
Introduction to artificial neural networks, basic models like Hopfield networks, multilayer perceptron and learning vector quantization networks, self-organizing feature maps-their	10



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properties and applications	
Genetic Algorithms (GA) this features and applications.	6
Studies of Hybrid(neuro-fuzzy, fuzzy-neutral and fuzzy -GA) systems and applications	6
TOTAL	38

BOOKS: -

- 1) Goldberg - Genetic algorithm, Pearson 2003
- 2) Freeman - Neural Networks, Pearson 2003
- 3) Jang - Neuro-fuzzy and soft Computing, Pearson 2003

EIEM302(A) : ELCTRO-OPTICS AND OPTOELECTRONICS

CONTENTS	PERIODS
Polarization, polarizers, dichroism, birefringence, optical activity, induced optical effects- Kerr effect, Pockel effect.	4
Interface, interferometers-wave front splitting, amplitude splitting single and multilayer films	4
Diffraction – Fresnel, Fraunhofer, Rayleigh limit.	4
Spatial light modulators-mirrors, lenses, prisms, Kerr cells, Pockel cells, CCD: basic principle of operation, imaging devices	6
Optoelectronics: sources-LED, optical detectors, their characterization	5
Opto-isolators: their characteristics, advantages and limitations.	2
Laser-theory, types, characteristics.	3
Fiber Optics-basic characteristics, sensors-basic principle and operational details	4
Holography: principles, holographic recording and readout devices, its application.	4
Optical signal processing – Fourier optics, Optical applications.	4
TOTAL	40

BOOKS: -

- 1) BEA Salehi & MC Tech - Fundamentals of Photonics, Wiley, New York, 1991
- 2) U.Schnars, W. Jueptner - Digital Holography, Springer 2005
- 3) Mynabev - Fiber Optics Communication Technology, Pearson 2003
- 4) Bhattacharyya - Semiconductor Optoelectronic Devices (2 e), Prentice hall 2004
- 5) Boreman - Electro-Optics for Electrical Engineering, Prentice Hall, 2003
- 6) Wilson & Hawkes - Optoelectronics: An introduction, Prentice Hall, 2003
- 7) Setian – Applications in Electroptics, Prentice Hall of , New Delhi, 2003

EIEM302(B) : UNITS AND STANDARDS

CONTENTS	PERIODS
Fundamentals and derivative units.	2
Realization in standard in standard laboratories, maintenance and reproduction, test and review, Modern techniques, standards in different National Laboratories and Bureaus.	10
The fundamental constants and their classes, dimensionless and calculable fundamental constants and tests of quantum electrodynamics.	8
Some important null experiments for	6



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Experimental uncertainties and the evaluation of the “best values”.	4
Recent evaluation of the fundamental constants	4
Process Production Quality Standardization. Reliability studies and inspection, Product Standardization techniques	6
TOTAL	40

BOOKS: -

- 1) E. W. Golding and F.C. Widdis – Electrical Measurements and Measuring Instruments (5ed),
- 2) Dictionary of Applied Physics Vol II
- 3) ISA Monograph on Standards
- 4) Units and standards of Measurement employed at the Physical Laboratory Vol III (Dept Science & Industrial Remark) U. K. 1952

E: LABORATORY I

Students are required to choose three experiments from the following:

CONTENTS	PERIODS
E-1: Studies on process data telemetering and remote control using Electronic techniques. E-2: Studies on distributed process control system: Optimization of parameters. E-3: Testing and Calibration of Instruments through Automated Test Equipment facilities. E-4: Studies on flow meter testing (on Rig) including data acquisition and test-report preparation. E-5: Studies of the characteristics of various sensors using microprocessor-based data acquisition and control system. E-6: Studies on the process control communication systems and measurement of process parameters using special sensors E-7: Studies on Boiler Simulation Techniques. E-8: Process control using Soft-Computing Controllers	3periods/week each