SCHOOL OF ENGINEERING
SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES
Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology Department of Electronics and Instrumentation Engineering

Transducers and Sensors
EIA-801

EIA-801	Transducers and Sensors	3L:0T:0P	3 credits	3Hrs/Week

Course Preamble:

1. To make students familiar with the constructions and working principle of different types of sensors and transducers.
2.To make students aware about the measuring instruments and the methods of measurement and the use of different transducers.

Course Outcomes:

1. Use concepts in common methods for converting a physical parameter into an electrical quantity
2. Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light
3. Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc
4. Predict correctly the expected performance of various sensors
5. Locate different type of sensors used in real life applications and paraphrase their importance

UNIT 1 (10H)

Functional elements of an instrument; active &passive transducers ;analog & digital modes of operation; null & deflection methods; I/O configuration of measuring instruments &instrument system-methods of correction for interfering &modifying inputs. Generalized performance characteristics of Instruments: Static characteristics and static calibration-Meaning of static calibration, measured value versus true value, Some basic statistics least square calibration curves, calibration accuracy versus installed accuracy.

UNIT 2 (10H)

Motion and Dimensional measurement: Fundamental standards ,relative displacement stranslational and rotational, Calibration, Resistive potentiometers, differential transformers, variable inductance

&variable reluctance pickups, capacitance pickup, Digital displacement transducers, Mechanical fly ball angular velocity sensor, Mechanical revolution counters .

UNIT 3 (10H)

Force, Torque, Shaft power: Standards & calibration; basic methods of force measurement; characteristics of elastic force transducer -Bonded strain gauge, differential transformer, Piezoelectric transducer, variable reluctance/FM-oscillator, digital systems.

UNIT 4 (6H)

Flow measurement: Local flow velocity, magnitude and direction. Flow Visualization. Velocity magnitude from pilot static tube. Velocity direction from yaw tube, dynamic wind vector indicator. Hot-film shock-tube velocity sensor. Laser Doppler anemo-meter; gross volume flow rate: calibration and standards .Constant-area, variable-pressure-drop meters (obstruction meters).Averaging pilot tubes..

UNIT 5 (6H)

Temperature measurement: Standards & calibration; thermal expansion methods-bimetallic thermometers, liquid-in-glass thermometers, pressure thermometers; RTD, thermistor and thermocouple (comparative study); digital thermometers. Radiation Methods - radiation fundamentals, radiation detectors: thermal and photon, monochromatic brightness radiation thermometers, two color radiation thermometers, black body tipped fiber optic radiation thermometer, Fluor optic temperature measurement, infrared imaging systems.

Text Book:

1. E. O. Doebelin and D.N. Manik,"Measurement systems application and design‖, Tata McGraw Hill Publication.
2. Reference Book: 1. Arun K Ghosh, "Introduction to Transducers", PHI Publication. 2. Bela G. Liptak, "Process Measurement and Sensors

EIA-801	**Advance Programmable Logic Controller**	**0L:0T:2P**	**1 credits**	**2 Hrs/Week**

List of Experiments:

1. Characteristics of resistance transducer (i) Potentiometer (ii) Strain Gauge
2. Characteristics of LVDT.
3. Characteristics of capacitive transducer (i) Variable area (ii) Variable distance.

4. Characteristics of Thermistors
5. Characteristics of RTD.
6. Characteristics of Thermocouples
7. Characteristics of LDR, Photo Diode, and Phototransistor: (i) Variable Illumination. (ii) Linear Displacement.
8. Measurement of resistance by Wheatstone bridge and measurement of bridge sensitivity.
9. Measurement of Capacitance by De'Sautys and Schering Bridge.
10. Measure of low resistance by Kelvin's double bridge.

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Program Elective-V
EIA-802 (A)
Digital Control Systems

EIA-802(A)	Digital Control Systems	3L:0T:0P	3 credits	3Hrs/Week

Course Preamble:

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

Course Outcomes

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

UNIT-I (10H)

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

UNIT-II (10H)

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

UNIT-III (10H)

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

UNIT-IV (6H)

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

UNIT-V (6H)

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

Reference book

1. K. Ogata, Discrete Time Control Systems, Prentice Hall India, 2nd edition, 2005.
2. M. Gopal, Digital Control and state variable methods, Tata McGraw Hill, 3rd edition., 2008.

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Embedded systems
EIA-802 (B)

EIA-802(B)	**Embedded systems**	**3L:0T:0P**	**3 credits**	**3Hrs/Week**

Course Preamble:

1.Students have knowledge about the basic functions of embedded systems

Course Outcomes:

1. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

Unit I :(10H)

Introduction to Embedded System, Categories, Requirements, Applications, Challenges and Issues. Core of Embedded system, Memory, Sensors and Actuators, communication interface, Embedded firmware, system components.

Unit II: (10H)

Fundamental issues of hardware software co-design, computational models in embedded design data flow graph, control flow graph, state machine model, sequential programmed model, concurrent model, unified modeling language.

Unit III: (10H)

Architecture of 8085 microcontroller, memory organization, registers, interrupts, addressing modes, instruction sets.

Unit IV: (10H)

Embedded firmware design approaches- OS based, Super loop based. Embedded firmware development languages- Assembly language based, high level language based, mixed. Programming in embedded C.

Unit V: (10H)

Types of Operating system, Task, process and threads, Multi processing and multi task, Task scheduling, Task communication, Task synchronization.

References:-

1. Shibu K V, “Introduction to Embedded System”, TMH.
2. David E Simon, “An Embedded Software Primer”, Pearson education Asia, 2001.
3. Steven F. Barett, Daniel J. Pack, “Embedded Systems” Pearson education, First Impression 2008.
4. Vahid Frank, Tony Givargis, “Embedded System Design”, John Wiley and Sons, Inc.
5. Dream Tech Software Team, “Programming for Embedded Systems” Wiley Publishing house Inc.

Sriram V Iyer, Pankaj Gupta, “Embedded Realtime Systems Programming”, TMH

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Open Core Elective - IV
EIA-803(A)
CAD of Digital Systems

EIA-803(A)	**CAD of Digital Systems**	**3L:0T:0P**	**3 credits**	**3Hrs/Week**

Course Preamble:
1.Understand the fundamentals used to create and manipulate geometric models
2.Get acquainted with the basic CAD software designed for geometric modeling
3.Learn working principles of NC machines CNC control and part programming
4.Understand concept of Group Technology, FMS and CIM

Course Outcomes
1. Describe basic structure of CAD workstation, Memory types, input/output devices and display devices and computer graphics.
2. Acquire the knowledge of geometric modeling and Execute the steps required in CAD software for developing 2D and 3D models and perform transformations
3. Explain fundamental and advanced features of CNC machines
4. Illustrate Group Technology, CAQC and CIM concepts

Unit 1(10H)

Introduction: Information requirements of mfg organizations; business forecasting and aggregate production plan; MPS, MRP and shop floor/ Production Activity Control (PAC); Mfg as a system, productivity and wealth creation; production processes on volume-variety axes; importance of batch and job shop production; CIM definition and CIM wheel, evolution and benefits; CIM as a subset of Product Life Cycle (PLC) mgt; design for mfg (DFM) and concurrent engg; product design in conventional and CIM environment; terms like CAD, CAE,
CAM, CAP, CAPP, CATD and CAQ.

Unit 2(10H)

Graphics and standards: Raster scan, coordinate systems for model (M/ WCS) user and display; database for graphic modeling; PDM, PIM, EDM; define EDM, features of EDM; basic transformations of geometry- translation, scaling, rotation and mirror; introduction to modeling software; need for CAD data standardization; developments in drawing data exchange formats; GKS, PHIGS, CORE, IGES, DXF STEP DMIS AND VDI; ISO standard for exchange of Product Model data-STEP and major area application protocols.

Unit 3(10H)

Geometric Modeling: Its use in analysis and mfg; 2D and 3D line, surface and volume models; linear extrusion and rotational sweep; Constructive Solid Geometry (CSG); basics of boundary presentation- spline, Bezier, b-spline, and NURBS; sculpture surfaces, classification, basics of coons, Bezier, b-spline and ruled surfaces; tweaking, constraint based parametric modeling; wire frame modeling, definition of point, line and circle; polynomial curve fitting; introduction to rapid prototyping.

Unit 4(6H))

Numeric control and part programming: Principles of NC machines, CNC, DNC; NC modes of point to point, -line and 2D, 3D contouring; NC part programming; ISO standard for coding, preparatory functions(G)- motion, dwell, unit, preset, cutter compensation, coordinate and plane selection groups; miscellaneous (M) codes; CLDATA and tool path simulation; ISO codes for turning tools and holders; ATC, modular work holding and pallets; time and power estimation in milling, drilling and turning; adaptive control, sequence control and PLC; simple part programming examples.

Unit 5(6H)

Group Technology: Importance of batch and job shop production; merits of converting zigzag process layout flow to smooth flow in cellular layout, Production Flow Analysis (PFA) and clustering methods; concept of part families and coding; hierarchical, attribute and hybrid coding; OPITZ, MICLASS and DCLASS coding; FMS; material handling; robots, AGV and their programming; agile mfg; Computer Aided Process Planning (CAPP), variant/ retrieval and generative approach

References:

1. S.Kant Vajpay; Principles of CIM; PHI

2. Rao PN; CAD/CAM;TMH

3. Groover MP; Automation, Production Systems & CIM; P.H.I.

4. Rao PN, Tiwari NK, Kundra TK; Computer Aided Manufacturing; TMH

5. Alavudeen A, Venkteshwarn N; Computer Integrated Mfg; PHI

6. Radhakrishnan P, Subramanian S and Raju V; CAD/CAM/CIM;

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Engineering and Acoustics

EIA-803 (B)

EIA-803(B)	**Engineering and Acoustics**	**3L:0T:0P**	**3 credits**	**3Hrs/Week**

Course Preamble:
The fundamentals of sound wave description and propagation, noise control techniques, the hearing mechanism, acoustic instrumentation, noise criteria, psychoacoustics, sound source types and radiated sound fields, outdoor sound propagation, sound power measurement techniques, sound transmission loss, acoustic enclosures.

Course Outcomes
1. Be able to assess complex occupational and environmental noise problems using acceptable assessment criteria.
2. Understand the importance of protecting the community from excessive noise and how it damages the hearing mechanism.
3. Be able to use instrumentation for noise measurement and understand the type of measurements appropriate for various situations.

Unit-I (10H)

Audio and acoustics sub disciplines, survey Fundamental quantities, Fourier review, mass and vibration Damping, complex exponential solutions, forced oscillation.

Unit-II(10H)

Resonance, electrical circuit analogies Acoustic wave equation.

Unit-III (10H)

Armonic plane waves, intensity, impedance Spherical waves, sound level, dB examples Radiation from small sources.

Unit-IV (6H)

Baffled simple source, piston radiation Near field, far field Radiation impedance.

Unit-V (6H)

Recap and review Demos, speed of sound measurement.

Reference

1. Foundations of engineering acoustics Book by Frank Fahy

2. Engineering Acoustics: An Introduction to Noise Control Book by Michael Moser

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Project Stage-II

EIA-804

EIA- 804	**Projects –II (Major)**	**0L:0T:16P**	**8 credits**	**12Hrs/Week**

Preambles:

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone orjointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under EEP1;

2. Review and finalization of the Approach to the Problem relating to the assigned topic;

3. Preparing an Action Plan for conducting the investigation, including team work;

4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;

5. Final development of product/process, testing, results, conclusions and future directions;

6. Preparing a paper for Conference presentation/Publication in Journals, if possible;

7. Preparing a Dissertation in the standard format for being evaluated by the Department.

8. Final Seminar Presentation before a Departmental Committee