JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. EIE-II Sem

L	T/P/D	C
4	-/-/-	4

(A80219) INSTRUMENTATION PRACTICES IN INDUSTRIES

(Elective-III)

Course Objective: To provide the knowledge of basic and contemporary instrumentation and control practices in the Industries like Paper and Pulp, Petrochemical, Aerospace etc.,

Unit I:

Pulp and Paper Industries:

Manufacture of pulp: Raw Materials, Pulping Processes, Craft Pulping, Soda Pulping, Sulfite Pulping, Semi Chemical Pulping, Mechanical and Thermomechanical Pulping.

Manufacture of paper: Wet Processing, Fourdrinier Machine, Coated Papers, Speciality Papers.

Unit II:

Cement Industries: Portland Cements, Other Cements, Lime, Gypsum, Miscellaneous Calcium Components, Magnesium Components.

Nuclear Industries: Nuclear Reactions, Uranium and Thorium Fission, Uranium as an Energy Source, Nuclear Fuels, Nuclear Reactors, Fusion Reactions, Fusion, Processing Nuclear Materials, Isotopes and Isotope Separation, Protection from Radioactivity, Waste Disposal.

Unit III:

Petrochemical Industries: Unit Operations: Drying-Separation-Heat Transfer-Distillation-Thermal Cracking- Catalytic Cracking-Catalytic Reforming- Hydro Cracking – Hydre Treating -Chemical Oxidation-Chemical Reduction-Polymerisation- Alkylation- Isomerization-Production of Ethylene, Acetylene- And Propylene from Petroleum.

Measurements in refineries petrochemical industries – Differential Pressure Transmitter, Thermocouples Infrared Pyrometer, Mass Flow Meters, Potentiometric Level Transmitter, Vacuum Measurement.

Unit IV:

Flight Instrumentation-I

Primary Flight Instruments (Principle of operation): Pitot Static System For The Measurement Of Aircraft Speed, Aneroid Barometer And Altimeter, Gyroscope And Its Properties, Methods Of Operating Gyroscopic Flight Instruments, Gyro Horizon, Vacuum Driven Gyro Horizon, Electric Gyro Horizon.

Heading Indicating Instruments (Principle of operation): Direct Reading Magnetic Compass, Liquid Damping Direct Reading Compass and Liquid Expansion Compensating Direct Reading Compass, Remote Indicating Compass System.

Unit V:

Flight Instrumentation-II

Measurement of Engine Speed, Engine Temperature, Aircraft Pressure (Principle Of Operation): Mechanical Tachometers, Electrical Tachometers, Air Temperature Sensors To Measure RAT And SAT, Radiation Pyrometer System, Methods Of Measuring Pressure, U-Tube Manometer, Direct Reading Pressure Gauges, Remote Indicating Pressure Gauges.

Measurement of Fuel quantity and Fuel flow (Principle of Operation): Float Type Fuel Quantity Indicating System, Capacitance Type Fuel Gauge System, Fuel Flow Measurement, Independent and Integrated Flow Meter System.

TEXT BOOKS:

1. Austin G.T. Shreeves, Chemical Process Industries, Mcgraw-Hill International Student Edition, Singapore, 1985.
2. Pallet, E.H.J. Aircrafts Instruments and Integrated Systems. Longman Scientific & Technical, McGrawhill, 1992.

REFERENCES:

1. Principles of Industrial Instrumentation, D. Patranabis, Mc Graw Hill.
2. John R Lavigne, An Introduction To Paper Industry Instrumentation, Miller Freeman Publications, California, 1985 Series.
3. Liptak B.G. Instrumentation in Process Industries, Chilton Book Company, 1994.
4. Liptak B.G., Process Measurement and Analysis, Third Edition, Chilton Book Company, 1996.

Course Outcome:

Upon completion of this course the student shall be able to apply his instrumentation knowledge which he acquired during the course of study.

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(A82913) MEMS AND APPLICATIONS

(Elective-III)

Course Objective: To provide knowledge of fabrication process and applications.

Unit I:

Introduction to MEMS: MEMS, Use of MEMS. Fabrication process.

The Substrate and adding material to it: Introduction, The silicon substrate, Additive technique: Oxidation, Additive technique: Physical vapour deposition, other additive techniques.

Unit II:

MEMS Fabrication: Creating and transferring patterns-Photolithography: Introduction, Keeping it clean, Photoresist, Working with resist, masks, Resolution, Permanent resists.

Creating structures-Micromachining: Introduction, Bulk Micromachining processes, Surface Micromachining, Process Integration.

Unit III:

MEMS Transducers: I

Thinking about modelling: What is modeling? Units, The input-output concept, Physical variables and notation, preface to the modeling chapters.

MEMS Transducers-An overview of how they work: What is a transducer? Distinguishing between sensors and actuators, Response characteristics of transducers, MEMS Sensors: Principles of operation, MEMS Actuators: Principles of operation, Signal conditioning, RF applications and Optical applications.

Piezoresistive transducers: Introduction, Modeling Piezoresistive transducers, Piezoresistive pressure sensor.

Unit IV:

MEMS Transducers: II

Capacitive transducers: Introduction, Capacitor fundamentals, Modeling a capacitor sensor, Capacitive accelerometer.

Unit V:

MEMS Transducers: III

Piezoelectric transducers: Introduction, Modeling piezoelectric materials, Mechanical modelling of beams and plates, Cantilever piezoelectric actuator.

Thermal transducers: Introduction,Basic heat transfer, Hot-arm actuator.

TEXT BOOKS:

1. Introductory MEMS Fabrication and Applications.

REFERENCES:

1. **MEMS and microsystems: D**esign and manufacture, Tai-Ran Hsu, McGraw-Hill, 2002.
2. **MEMS:** Applications Mohamed Gad-el-Hak, CRC Press, 29-Nov-2005.

Course Outcome:

Upon completion of this course the student shall be able to apply his instrumentation knowledge and understand MEMS fabrication and its use in the industries.

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(A80242) SCADA & DCS

(Elective - III)

Course Objective: To make students learn about the theoretical concepts of HMI and distributed network.

UNIT I:

Introduction to SCADA: Definition of SCADA, applicable process,Elements of SCADA system,Limited two way system,Real time system, communication access and master slave, scan interval, Murphy's law and remote control, safety instrumented system, regulatory requirement.Communication:long distance,protocol,modem,synchronous and asynchronous.

UNIT II:

RTU,MTU and sensors and wiring: Communication interface,protocol details,Control:Discrete,Analog,Pulse and serial.Monitor of analog ,pulse count signal,serial signal,Non RTU functions.

Configration of any process. Applications ,data storage. Sensors,Actutators and wiring:standardinzation and maintenance.

UNIT III:

Distributed Control System Evolution – Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities.

UNIT IV:

Interfaces in DCS : Operator interfaces - Low level and high level operator interfaces – Operator displays - Engineering interfaces – Low level and high level engineering interfaces – General purpose computers in DCS.

UNIT V:

Hart and Field Bus Evolution of signal standards – HART communication protocol – Communication modes – HART networks – Control system interface – HART and OSI model – Filed bus introduction – General field bus architecture – Basic requirements of field bus standard – Field bus topology – Inter operability.

TEXT BOOKS

1. SCADA by Stuart .A.Boyer,3 rd Edition, ISA.
2. Michael P. Lukas, 'Distributed Control System', Van Nostrand Reinhold Co., Canada,1986.

REFERENCES:

1. A.S. Tanenbaum, 'Computer Networks', 3rd Edition, Pearson Education, 1996 / PHI.

Course Outcome:

Upon completion of this course the student shall be able to understand HMI and DCS architecture.

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(A80240) POWER PLANT INSTRUMENTATION

(Elective - IV)

Course Objective: Able to introduce various methods of power generation and specially provide the knowledge of instrumentation and control in thermal power plants.

UNIT - I:

Overview of Power Generation: Introduction, Various sources of Electrical energy, Non-conventional energy sources, Conventional energy sources, Importance of Instrumentation and control in power generation, piping and instrumentation diagram, Cogeneration of power, Control Rooms.

UNIT - II:

Instrumentation and Control in Water Circuit: Water circuit, Boiler Feed Water circulation, Measurements in Water circuit, Controls in water circuit, Impurities in Water and Steam.

UNIT - III:

Instrumentation and Control in Air- Fuel Circuit: Air- Fuel Circuit, Measurement in Air- Fuel Circuit, Controls in Air- Fuel Circuit, Analytical Measurement.

UNIT - IV:

Power Plant Management: Introduction, Master Control, Combustion Process, Boiler Efficiency, Maintenance of Measuring Instruments, Intrinsic and Electrical Safety, Interlocks for Boiler Operation, Computer based Control and Data Logging Systems, Distributed Control Systems.

UNIT - V:

Turbing – Monitoring and Control: Introduction, Turbine System Inlet System, turbine Measurements, Turbine Control Systems, Lubrication for Turbo-alternator, Turbo-alternator Cooling System.

TEXT BOOK:

1. **Power Plant Instrumentation by** K. Krishnaswamy, M. Ponni Bala, M. Ponni Bala PHI Learning Pvt. Ltd., 2011.

REFERENCES:

1. **Power-Plant Control and Instrumentation:** The Control of Boilers and Hrsg Systems, David Lindsey IET, 2000.

2. **Pow Plant Engg,** Nag, Tata McGraw-Hill Education, 07-Aug-2008.

Course Outcome: Upon completion of this course the student shall be able to apply his knowledge and understand how instrumentation system is designed for a power plant.

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(A80436) DIGITAL IMAGE PROCESSING
(Elective-IV)

Course Objectives:

The objectives of the course are to:

- Provide the student with the fundamentals of digital image processing.
- Give the students a taste of the applications of the theories taught in the subject. This will be achieved through the project and some selected lab sessions.
- Introduce the students to some advanced topics in digital image processing.
- Give the students a useful skill base that would allow them to carry out further study should they be interested and to work in the field.

UNIT -I:

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels.

Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

UNIT -II:

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement Through Point Operation, Types of Point Operation, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood Operation, Median Filter, Spatial Domain High-Pass Filtering.

Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Obtaining Frequency Domain Filters from Spatial Filters, Generating Filters Directly in the Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

UNIT -III:

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT -IV:

Image Segmentation: Detection of Discontinuities, Edge Linking And Boundary Detection, Thresholding, Region Oriented Segmentation.

Morphological Image Processing: Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, The Hit or Miss Transformation.

UNIT -V:

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

TEXT BOOKS:

1. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson, 2008.
2. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar - TMH, 2010.

REFERENCE BOOKS:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools - Scotte Umbaugh, 2nd Ed, CRC Press, 2011.
2. Digital Image Processing using MATLAB – Rafael C. Gonzalez, Richard E Woods and Steven L Eddings, 2nd Edition, TMH, 2010.
3. Fundamentals of Digital Image Processing – A.K.Jain , PHI, 1989.
4. Digital Image Processing and Computer Vision – Somka, Hlavac, Boyle- Cengage Learning (Indian edition) 2008.
5. Introductory Computer Vision Imaging Techniques and Solutions- Adrian low, 2008, 2nd Edition.
6. Introduction to Image Processing & Analysis – John C. Russ, J. Christian Russ, CRC Press, 2010.
7. Digital Image Processing with MATLAB & Labview – Vipula Singh, Elsevier.

Course Outcomes:

Upon successfully completing the course, the student should:

- Have an appreciation of the fundamentals of Digital image processing including the topics of filtering, transforms and morphology, and image analysis and compression.

- Be able to implement basic image processing algorithms in MATLAB.
- Have the skill base necessary to further explore advance d topics of Digital Image Processing.
- Be in a position to make a positive professional contribution in the field of Digital Image Processing.
- At the end of the course the student should have a clear impression of the breadth and practical scope of digital image processing and have arrived at a level of understanding that is the foundation for most of the work currently underway in this field.

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(A80238) NEURAL NETWORKS AND FUZZY LOGIC

(Elective-IV)

Objective:

This course introduces the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward Networks. Also deals with Associate Memories and introduces Fuzzy sets and Fuzzy Logic system components. The Neural Network and Fuzzy Network system application to Electrical Engineering is also presented. This subject is very important and useful for doing Project Work.

UNIT – I:

Introduction & Essentials to Neural Networks Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN. Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

UNIT–II:

Single & Multi Layer Feed Forward Neural Networks Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications. Credit Assignment Problem, Generalized Delta Rule, and Derivation of Back-propagation (BP) Training, Summary of Back-propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT-III:

Associative Memories-I: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory).

UNIT-IV:

Associative Memories-II: Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem. Architecture of Hopfield

Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network Summary and Discussion of Instance/Memory Based Learning Algorithms, Applications.

UNIT – V:

Fuzzy Logic Classical & Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

Fuzzy Logic System Components: Fuzzification, Membership value assignment, development of rule base and decision making system, De-fuzzification to crisp sets, De-fuzzification methods.

TEXT BOOKS:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications, Rajasekharan and Pai, PHI.
2. Neural Networks and Fuzzy Logic, C. Naga Bhaskar, G. Vijay Kumar, BS Publications.

REFERENCE BOOKS:

1. Artificial Neural Networks, B. Yegnanarayana, PHI.
2. Artificial Neural Networks, Zaruda, PHI.
3. Neural Networks and Fuzzy Logic System, Bart Kosko, PHI.
4. Fuzzy Logic and Neural Networks, M. Amirthavalli, Scitech Publications India Pvt. Ltd.
5. Neural Networks, James A Freeman and Davis Skapura, Pearson Education.
6. Neural networks by satish Kumar, TMH, 2004.
7. Neural Networks, Simon Hakins, Pearson Education.
8. Neural Engineering, C.Eliasmith and CH.Anderson, PHI.

Outcome:

After going through this course the student gets a thorough knowledge on, , biological neurons and artificial neurons, comparative analysis between human and computer, artificial neural network models, characteristics of ANN's, different types of activation functions, learning strategies, learning rules, perceptron models, single and multi layer feed-forward and feed-back neural networks, back-propagation algorithm, Kolmogorov Theorem, different types of associative memories and basics of fuzzy logic, concept of classical and fuzzy sets, fuzzy logic system components fuzzification and defuzzification, with which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

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(A80241) RELIABILITY ENGINEERING

Unit - I

Basic Concepts of Reliability: Introduction, Reliability and quality, Failures and failure modes, Causes of failures and reliability, Maintainability and availability, History of reliability, reliability literature.

Unit-II

Reliability Mathematics: Introduction, Random experiment , Probability , Random variables, Distribution functions, Discrete distribution ,Continuous distribution, Numerical characteristics of random variables , Laplace transform.

Component Reliability and Hazard Models: Introduction, Component reliability from test data, Mean time to failure, Time – dependent hazard models, Stress- Dependent hazard models , Derivation of reliability function using Markov, Treatment of field data.

Unit-III

System Reliability Models: Introduction - Systems with series components - Systems with parallel components - k-out – of- m systems - Non series parallel systems - Systems with - mixed – mode failures - Fault- tree technique

Unit-IV

Maintainability and Availability Concepts: Introduction - Maintainability function - Availability function - Frequency of failures - Two-unit parallel systems with repair - k-out-of-m systems - Preventive maintenance.

Reliability Improvement: Introduction - Improvement components - Redundancy - Element redundancy - Unit redundancy - Stand by redundancy - Optimization - Reliability – cost trade – off.

Unit-V

Economics of Reliability Engineering: Economic issues -Manufacture's cost- Customer's cost - Reliability achievement cost - models - Reliability utility cost models - Depreciation cost models - Availability – cost – model of parallel systems.

Reliability Management: Reliability programming - Management policies and decision - Reliability management by objectives - Reliability group - Reliability data : Acquisition and analysis - Managing people for reliability

TEXT BOOKS:

1. Reliability Evaluation of Engineering Systems. R. Billington, RN Allan, BS Publications 2007.
2. Reliability, Maintenance and safety Engineering - Dr. A.K. Gupta, Laxmi Publications

REFERENCE BOOKS:

1. Reliability Engineering- Patrick DTO-Wiley India.
2. Reliability Engineering and life testing –Naikan-PHI.
3. Engineering Maintenance a Modern Approach, B.S.Dhillon,2002 CRR Publications.
4. Maintenance Engineering and Management – RC Misra, PHI.
5. Reliability Engineering – Balaguruswamy- TMH.
6. Reliability Engineering- L.S.Srinath.

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(A80087) INDUSTRY ORIENTED MINI PROJECT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. EIE-II Sem	L	T/P/D	C
	-	-/6/-	2

(A80089) SEMINAR

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IV Year B.Tech. EIE-II Sem	L	T/P/D	C
	-	-/15/-	10

(A80088) PROJECT WORK

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	-	-/-/-	2

(A80090) COMPREHENSIVE VIVA