Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Instrumentation and Control Engineering (ICE)
(Applicable from the academic session 2018-2019)

Semester-VIII

PE-IC801	**Power Plant Instrumentation**	**3L:0T:0P**	**3 credits**

Course Outcomes:

- To provide an overview on power generation through various methods
- To understand the important power plant measurements and devices
- To educate on basic Boiler control techniques
- To understand on advanced Boiler control techniques
- To determine the turbine control techniques

Module 1: OVERVIEW OF POWER GENERATION (8 lectures)

Survey of methods of power generation :– hydro, thermal, nuclear, solar and wind power – Importance of instrumentation in power generation – Thermal power plant – Building blocks – Combined Cycle System – Combined Heat and Power System – sub critical and supercritical boilers.

Module 2: MEASUREMENTS IN POWER PLANTS (8 lectures)

Measurement of feed water flow, air flow, steam flow and coal flow – Drum level measurement – Steam pressure and temperature measurement – Turbine speed and vibration measurement – Flue gas analyzer – Fuel composition analyzer.

Module 3: BOILER CONTROL – I (8 lectures)

Combustion of fuel and excess air – Firing rate demand – Steam temperature control – Control of deaerator – Drum level control – Single, two and three element control – Furnace draft control – implosion – flue gas dew point control – Trimming of combustion air – Soot blowing.

Module 4: BOILER CONTROL – II (8 lectures)

Burners for liquid and solid fuels – Burner management – Furnace safety interlocks – Coal pulverizer control – Combustion control for liquid and solid fuel fired boilers – air/fuel ratio control – fluidized bed boiler – Cyclone furnace.

Module 5: CONTROL OF TURBINE (8 lectures)

Types of steam turbines – impulse and reaction turbines – compounding – Turbine governing system – Speed and Load control – Transient speed rise – Free governor mode operation – Automatic Load Frequency Control – Turbine oil system – Oil pressure drop relay – Oil cooling system – Turbine run up system.

TEXT BOOKS:

- Sam Dukelow, Control of Boilers, Instrument Society of America, 1991.
- Everett Woodruff , Herbert Lammers, Thomas Lammers, Steam Plant Operation,9th Edition McGraw Hill, 2012.
- Rajput R.K., A Text book of Power plant Engineering. 5th Edition, Lakshmi Publications, 2013.

REFERENCES:

- Liptak B.G., Instrumentation in Process Industries, Chilton Book Company, 2005.
- Jain R.K., Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999.
- P.K.Nag, Powerplant Engineering, Tata McGraw-Hill Education, 3rd edition, 2007.
- Tamilmani, Power plant instrumentation, Sams Publishers, 2011.
- Krishnaswamy.K and Ponnibala.M., Power Plant Instrumentation, PHI Learning Pvt.Ltd., New Delhi, 2011.

PE-IC802	**Nano Electronics**	**3L:0T:0P**	**3 credits**

Introduction to nanotechnology, meso structures,Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones.
Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.), Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Bandstructure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation.

Text/ Reference Books:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and theprocesses involved in making nano components and material.
4. Leverage advantages of the nano-materials and appropriate use in solving practical problems.

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OE-IC801	**Logic and Distributed control systems**	**3L:0T:0P**	**3 credits**

Course outcome:

1. Familiar with process automation technologies.
2. Able to design and develop a plc ladder programming for simple process applications.
3. Able to apply different security design approaches, engineering and operator interface issues for designing of distributed control system.
4. Familiar with latest communication technologies like hart and field bus protocol.

Module 1: Review of computers in process control: (8 **hours)**

Data loggers, Data Acquisition Systems (DAS), Direct Digital Control (DDC) .Supervisory Control And Data Acquisition Systems (SCADA), Sampling considerations. Functional block diagram of computer control systems. Alarms, interrupts. Characteristics of digital data, controller software, linearization. Digital controller modes: Error, proportional, derivative and composite controller modes.

Module 2: Programmable logic controller (PLC) basics (10 hours)

Overview of PLC systems, input/output modules, power supplies and isolators. General PLC programming procedures, programming on- off inputs/ outputs. Auxiliary commands and functions, PLC Basic Functions, register basics, timer functions, counter functions.

Module 3: PLC intermediate functions: (10 hours)

Arithmetic functions, number comparison functions, Skip and MCR functions, data move systems. PLC Advanced functions: Alternate programming languages, analog PLC operation, networking of PLC, PLC-PID functions, PLC installation, troubleshooting and maintenance. Design of interlocks and alarms using PLC, creating ladder diagrams from process control descriptions.

Module 4: Interface & bus standard:(6 hours)

Interface and backplane bus standards for instrumentation systems. Field bus: Introduction, concept. HART protocol: Method of operation, structure, operating conditions and applications. Smart transmitters, IEEE 1451 protocol, smart valves and smart actuators.

Module 5: Distributed Control Systems (DCS) (6 hours)

Definition, Local Control unit (LCU) architecture, LCU languages, LCU –Process interfacing issues, communication facilities, configuration of DCS, displays, redundancy concept -case studies in DCS.

Text Books:

1. Programmable Logic Controllers -Principles and Applications, F John. W .Webb Ronald A Reis, Fourth edition, Prentice Hall Inc., New Jersey, 1998.
2. Distributed Control Systems, Lukcas M.P Van Nostrand Reinhold Co., New York, 1986.
3. Programmable Logic Controllers, Frank D. Petruzella Second edition, McGraw Hill, Newyork,

Reference books:

1. Elements of Process Control Applications, P.B. Deshpande and R.H. Ash, ISA Press, New York, 1995.
2. Process Control Instrumentation Technology, Curtis D. Johnson Seventh edition, Prentice Hall, New Delhi, 2002
3. Computer-based Industrial Control, Krishna Kant, Prentice Hall, New Delhi, 1997.

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OE-IC802	**Smart and Wireless instrumentation**	**3L:0T:0P**	**3 credits**

Course Outcomes:

After complete this subject, students will be able to

1. Analyze Smart and Wireless Instrumentation and their classifications.
2. Design and develop various applications using WSN (Wireless sensor Network).
3. Understand of various Node architectures.
4. Understand the Fundamentals of wireless digital communication.
5. To design strategies as per needs and specifications.

Module 1: Introduction (10 Hours)

Smart Instrumentation: Materials, automation systems, sensing and Sensors, Sensor Classifications, Wireless Sensor Networks, Communication in a WSN, Important design constraints of a WSN like Energy, Self Management, Wireless Networking, Decentralized Management, Design Constraints, and Security etc.

Module 2: Node architecture (8 Hours)

The sensing subsystem, Analog to Digital converter, the processor subsystem, architectural overview, microcontroller, digital signal processor, application specific integrated circuit, field programmable gate

Array (FPGA), comparison, communication interfaces, serial peripheral interface, inter integrated circuit, the I Mote node architecture, The XYZ node architecture, the Hog throb node architecture.

Module 3: Fundamentals of Wireless Digital Communication (8 Hours)

Basic components, source encoding, the efficiency of a source encoder, pulse code modulation and delta modulation, channel encoding, types of channels, information transmission over a channel, error recognition and correction, modulation, modulation types, quadratic amplitude modulation, signal propagation.

Module 4: Frequency of Wireless Communication (4 Hours)

Development of Wireless Sensor Network based on Microcontroller and communication device-Zigbee Communication device.

Module 5: Applications (10 Hours)

Structural health monitoring-sensing seismic events, single damage detection using natural frequencies, multiple damage detection using natural frequencies, multiple damage detection using mode shapes, coherence, piezoelectric effect, traffic control, health care -available sensors, pipeline monitoring, precision agriculture, active volcano, underground mining.

Text Books:

1. Fundamentals of wireless sensor networks: theory and practice-Waltenegus Dargie, Christian Poellabauer, A John Wiley and Sons, Ltd., Publication.

2. Smart Sensors, Measurement and Instrumentation, Subhas Chandra Mukhopadhyay, Springer Heidelberg, New York, Dordrecht London, 2013.

3. Wireless Sensors and Instruments: Networks, Design and Applications, Halit Eren, CRC Press, Taylor and Francis Group, 2006.

4. Uvais Qidwai, Smart Instrumentation: A data flow approach to Interfacing“, Chapman & Hall; 1st Edn, December 2013.

5. Wireless Sensor Networks: Architectures and Protocols, Edgar H. Callaway Jr. and Edgar H. Callaway.

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HM-HU801	**Management Concept and Practice**	**3L:0T:0P**	**3 credits**

Course Outcomes:

After complete this subject, students will be able to

1. Understand the basic concept of management, diagnose the management issues in organizations, explain and analyze key principles of management planning, leading and controlling in business organizations, explain the ethical standards and external environmental aspects of the organizations, list and exercise social responsibility and sustainability in the practical context and maintaining good governance for organization.
2. Explain the basic concept, tools and environmental framework of marketing management, marketing research and its importance on the organization in order to develop the effective marketing communications strategy.
3. Explain the basic concept and functions of human resource management, human resource development and their applications in the organization, training and knowledge of human factors in engineering and various job designs.
4. Explain the concept of financial management and its impact on organization; understand the significance and source of capital participate in the preparation of a complete business plan.
5. Evaluate various kinds of skills in inter-personal communication, team work, leading people, and handling conflict in organizations.
6. Predict and control the quality of an end product, select and analyze an inventory control model based upon given data.

Module 1(10 Hours)

Basic concepts of management: Definition – Essence, Functions, Roles, Level.
Functions of Management: Planning – Concept, Nature, Types, Analysis, Management by objectives; Organization Structure –

Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organizational Effectiveness.

Module 2(10 Hours)

Management and Society – Concept, External Environment, CSR, Corporate Governance, Ethical Standards.
People Management – Overview, Job design, Recruitment & Selection, Training & Development, Stress Management. **Managerial Competencies** – Communication, Motivation, Team Effectiveness, Conflict Management, Creativity,Entrepreneurship.

Module 3(10Hours)

Leadership: Concept, Nature, Styles.
Decision making: Concept, Nature, Process, Tools & techniques.
Economic, Financial & Quantitative Analysis – Production, Markets, National Income Accounting, Financial Function & Goals,
Financial Statement & Ratio Analysis, Quantitative Methods – Statistical Interference, Forecasting, Regression Analysis,
Statistical Quality Control.

Module 4(10 Hours)

Customer Management – Market Planning & Research, Marketing Mix, Advertising & Brand Management.
Operations & Technology Management – Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.

Text Books:
1. Principles of Management, Premvir Kapoor, Khanna Publishing House
2. Management: Principles, Processes & Practices – Bhat, A & Kumar, A (OUP).
3. Essentials for Management – Koontz, Revised edition, Tata McGraw Hill
4. Management – Stoner, James A. F. (Pearson)
5. Management - Ghuman, Tata McGraw Hill(TMH)