AISSMS
INSTITUTE OF INFORMATION TECHNOLOGY
(IOIT)

ADDING VALUE TO ENGINEERING

An Autonomous Institute Affiliated to Savitribai Phule Pune University
Approved by AICTE, New Delhi and Recognised by Govt. of Maharashtra
Accredited by NAAC with "A+" Grade | NBA - 5 UG Programmes

Program in Instrumentation Engineering

MINOR COURSE

On

"SENSOR AND CONTROL TECHNOLOGY"

[Offered to the students of Computer Engineering, Information Technology, Artificial Intelligence and Data Science, Electronics & Telecommunication Engineering, and Electrical Engineering]

STRUCTURE AND DETAIL SYLLABUS

(Pattern 2025)

AISSMS INSTITUTE OF INFORMATION TECHNOLOGY
Kennedy Road, Near RTO,
Pune – 411 001, Maharashtra State, India
Email: principal@aissmsioit.org,
Website: https://www.aissmsioit.org

CHAIRMAN
BOS INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Institute Vision & Mission

Vision:

To be recognized amongst top 10 private engineering colleges in Maharashtra by the year 2026 by rendering value added education through academic excellence, research, entrepreneurial attitude, and global exposure.

Mission :

- To enable placement of 150 plus students in the 7 lacs plus category & ensure 100% placement of all final year students.
- To connect with 10 plus international universities, professional bodies, and organizations to provide global exposure students
- To create conducive environment for career growth, prosperity, and happiness of 100% staff.
- To be amongst top 5 private colleges in Pune in terms of admission cut off

Quality Policy

We commit ourselves to provide quality education & enhance our students quality through continuous improvement in our teaching and learning processes.

Department Vision & Mission

Vision:

To be recognized as one of the best instrumentation engineering programs by developing globally competent engineers, researchers and entrepreneurs to solve real life problems through skill-based education.

Mission:

M1:To promote learning for skill-based education and emerging technologies to make students globally competent.

M2:To create conducive environment for research, innovations and entrepreneurship.

Program Educational Objectives:

Graduates will

1. solve real life problems by applying the knowledge of instrumentation technology.
2. pursue higher education or be researcher or be entrepreneur.
3. contribute as a socially responsible citizen for the development of nation.
4. for the development of nation.

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

ProgramOutcomes(POs)

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. [Engineering knowledge]
2. Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. [Problem analysis]
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. [Design/development of solutions]
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. [Conduct investigations of complex problems]
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. [Modern tool usage]
6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. [The engineer and society]
7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. [Environment and sustainability]
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. [Ethics]
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. [Individual and team work]
10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. [Communication]
11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. [Project management and finance]
12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. [Life-long learning]

ProgramSpecificOutcomes(PSOs)

1. Graduates will be able to apply their knowledge of measurement and control to solve the problems related to environment, safety, health and agriculture sectors.

2. Graduates will be able to demonstrate their skills on Programmable logic controller, LabView, Distributed control system and Internet of thing.

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Instrumentation Engineering (Minor in Sensor and Control Technology)

Sr. No.	Code	Courses Name	Semester	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	INMNR301	Sensors and Transducers	III		---	---	03	--	75##	--	--	--	75
2	INMNR302	Sensors and Transducers Lab	III	---	---	02	01	--	--	25	--	--	25
3	INMNR401	Process Control Loop Components	IV	03	---	--	03	--	75##	--	--	--	75
4	INMNR402	Process Control Loop Components Lab	IV	---	---	02	01	--	--	25	--	--	25
5	INMNR501	Industrial Automation	V	03	--	--	03	--	75##	--	--	--	75
6	INMNR502	Industrial Automation Lab	V	---	---	02	01	--	--	25	--	--	25
7	INMNR601	Project Engineering And Management	VI	03	--	--	03	--	75##	--	--	--	75
8	INMNR602	Project Engineering And Management Lab	VI	---	---	02	01	--	--	25	--	--	25
	Total Credits for Minor Courses			**12**	**00**	**08**	**16**	--	**300**	**100**	--	--	**400**

##End Semester Examination (ESE) based on subjective/ MCQ questions

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Second Year Instrumentation Engineering Sensors and Transducers			
Course Code:	**INMNR301**	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	End-sem. Examination 75 Marks		

Pre-requisites: Basic knowledge of Electrical & Electronics Engineering

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	End Semester Examination	External	75

Course Objectives	
1	To make students familiar with Sensors & its applications.
2	To discuss constructions and working principle of different types of sensors and transducers.
3	To make students aware about the construction, operation various features of sensors and transducers.
4	To familiar with different measuring instruments and the methods of measurement
5	To impart skills to evaluate the performance of methods of measurement and the use of different transducers.

Course Outcomes: Students will be able to	
301.1	Understand correctly the expected performance of various sensors and its application
301.2	Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like level, pressure, flow, acceleration, etc
301.3	List and locate different type of sensors used in real life applications and paraphrase their importance
301.4	Outline and Use the concepts in common methods for converting a physical parameter into an electrical quantity.
301.5	Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light

CHAIRMAN
BOS INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Topics covered:

Unit I: DISPLACEMENT, FORCE AND SPEED MEASUREMENT (6 hrs.)

Need of sensors and transducers, transducers definition, classification, performance characteristics and selection criteria.

Displacement Measurement: resistive-potentiometers, inductive-LVDT and RVDT,capacitive, piezoelectric, ultrasonic and proximity sensors.

Force transducer: Basic methods of force measurement, Elastic force transducer, Load cell, LVDT

Speed Measurement: Tachometer, Magnetic pickups, Encoders, Photoelectric pickups,

Unit II: LEVEL MEASUREMENT (6hrs.)

Level Measurement: Dipstick displacer, float, Bubblers method, Diaphragm level detector, laser level sensor, time domain reflectometry, ultrasonic level detector.

Unit III: PRESSURE MEASUREMENT (6 hrs.)

Pressure scales and standards, Types of Pressure: Gauge pressure, Absolute pressure, Differential pressure, Vacuum pressure

Types of Pressure sensor: Dead weight tester, vacuum pressure sensor, Bourdon tube , Manometers

Elastic Pressure sensor: Bellows, bourdon tubes, diaphragm.

Unit IV: Temperature measurement (6 hrs.)

Temperature scales, classification,

Thermometer- types of thermometer, filled system thermometer,

RTD-Material used, types 2 wire,3 wire & 4 wire, application of RTD,

Thermistor –Material used, type (NTC , PTC) and it's application.

Thermocouples- Material used, Types(A,B,C,D,E,J,K,R,S,T), laws of thermocouples, cold junction compensation method.

Semiconductor temperature sensors- Diode & IC temperature sensor LM35.

Unit V: FLOW MEASUREMENT (6 hrs.)

Units, Classification of flow: Newtonian and non-Newtonian fluids, Reynolds's number, laminar and turbulent flows, velocity profile, Bernoulli's equation for incompressible flow, head type flow meters (orifice, venture meter and pitot tube), variable area type, turbine, electromagnetic , ultrasonic, vortex shedding, anemometers , mass flow meter: Coriolis flow meter.

Text Books:

1. Principle of Industrial Instrumentation by D. Patranabis, Tata McGraw Hill, 2nd Ed.
2. Instrumentation and Measurement Principles by . D.V.S. Murty, PHI, New Delhi, 2nd Ed.
3. Electrical and Electronics Measurement and Instrumentation by A.K. Sawhney, Dhanpat Rai & Co, 2nd Ed.
4. Process control instrumentation technology by Curtis D. Johnson, PHI learning Pvt. Ltd, 07th Ed.

References Books:

1. Measurement Systems by E.O. Doebelin, McGraw Hill, 06th Ed.
2. Process Measurement & Analysis by B.G. Liptak, CRC press, 04th Ed.
3. Instrumentation Devices and Systems by C. S. Rangan, G. R. Sharma and V. S. Mani, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 02nd Ed.
4. Mechanical and Industrial Measurements by R. K. Jain, Khanna

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Publishers, 02nd Ed.

Second Year Instrumentation Engineering Sensor and Transducers Lab			
Course Code:	**INMNR302**	**Credit**	**1**
Contact Hours:	2 Hrs/week (P)	**Type of Course:**	Practical
Examination Scheme	Term Work 25 Marks		

Pre-requisites:

- Basic knowledge of Electrical & Electronics Engineering

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Termwork	Internal	25

Course Objectives	
1	To explain different characteristics techniques of Transducers
2	To describe various performance of flow measurements.
3	To explain selection of methods for level measurement.
4	To make students aware about the simulation operation of various features of sensors
5	To familiar with different temperature measuring instruments and methods
6	To impart skills on the performance of arduino and labview methods of measurement

Course Outcomes: Students will be able to	
302.1	Test various characteristics operations of LVDT and Load cell.
302.2	Understand different applications of flow measurement.
302.3	Develop program code by selection of proper data structure using python language.
302.4	Solve through software simulation on various characteristics of sensor.
302.5	Identify the proper methods and instrument for temperature measurement
302.6	Understand the working on different open source and virtual instrument platform

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

List of Experiments:

Students are expected to perform any 8 experiments

1. Determine the characteristics of LVDT.
2. Study the characteristics of Load cell..
3. Compare performance of Orifice and Venture for flow measurement..
4. Evaluate performance characteristics of air purge method for level measurement.
5. Simulate the performance of a chemical sensor.
6. Characterization of RTD (PT100) for temperature measurement.
7. Characterize the temperature sensor (Thermocouple)
8. Calibration of pressure gauge using dead weight pressure tester.
9. Compare performance of encoder and tachometer for speed measurement.
10. Measurement of temperature and humidity using Arduino..
11. Water level measurement using Arduino..
12. Study on Temperature Measurement using Lab View.
13. Measurement of level in a tank using capacitive type level probe

Text Books:

1. Principle of Industrial Instrumentation by D. Patranabis, Tata McGraw Hill, 2nd Ed.
2. Instrumentation and Measurement Principles by . D.V.S. Murty, PHI, New Delhi, 2nd Ed.
3. Electrical and Electronics Measurement and Instrumentation by A.K. Sawhney, Dhanpat Rai & Co, 2nd Ed.
4. Process control instrumentation technology by Curtis D. Johnson, PHI learning Pvt. Ltd, 07th Ed.

References

1. Measurement Systems by E.O. Doebelin, McGraw Hill, 06th Ed.
2. Process Measurement & Analysis by B.G. Liptak, CRC press, 04th Ed.
3. Instrumentation Devices and Systems by C. S. Rangan, G. R. Sharma and V. S. Mani, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 02nd Ed.
4. Mechanical and Industrial Measurements by R. K. Jain, Khanna Publishers, 02nd Ed.

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Second Year B.Tech Instrumentation Engineering Process Control Loop Components			
Course Code:	**INMNR401**	**Credit**	**3**
Contact Hours:	3 Hrs/week (Th)	**Type of Course:**	Lecture
Examinatio nScheme		End-sem. Examination75 Marks	

Pre-requisites:

- Basic knowledge of sensors//transducers, control system, Linear Integrated Circuits.

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	End Semester Examination	External	75

Course Objectives	
1	To introduce basic fundamentals of automation.
2	To explain construction and working of transmitter, controller and control valve of process control loop.
3	To demonstrate the application of PID controller for pressure control loop and tuning methods.

Course Outcomes: Students will be able to	
401.1	draw temperature, pressure, flow and level process control loop using standard components symbols by studying process characteristics and list process variables associated with loop.
401.2	demonstrate the application of DPT for flow and level measurement.
401.3	apply suitable control law to regulate the controlled variable at its set point value
401.4	calculate PID parameters' tuning values by applying Z-N open loop and closed loop method to satisfy 1/4 th decay ratio tuning criteria
401.5	determine control valve coefficient and control valve size for different control valve characteristics.
401.6	explain causes of cavitation and flashing in different types of valves, its effects and remedies.

Topic Covered

UNIT I: FUNDAMENTALS OF PROCESS CONTROL (10 Hrs)

Components of process control loop, Examples of process loops like temperature, flow, level, pressure etc., concept of process variables, Signal line symbols, instrument symbols as per location, concept of field area and control room area, standard signals and its need, concept of live and dead zero. Process Characteristics: Process equation, capacity, self – regulation, control lag, process lag, distance/velocity lag (dead time).

UNIT II: TRANSMITTER (06 Hrs)

Need of transmitter, two and four wire transmitters, features of transmitter.

CHAIRMAN
308-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Electronic Capacitive Differential Pressure Transmitter: installation (impulse pipe and manifold), calibration setup, application of DPT for level and flow measurement, zero elevation and suppression. SMART: Comparison with conventional transmitter, block schematic, specifications.
UNIT III: CONTROLLER PRINCIPLES (08 Hrs) Control system parameters: Error, variable range, cycling, direct/reverse action. Discontinuous: two position, multi-position and floating control modes. Continuous: Proportional, integral, derivative, proportional-integral, proportional- derivative, proportional- integral-derivative (PID) control modes, reset windup, rate before reset, bump less transfer.
UNIT IV: TUNING OF PID CONTROLLER (05 Hrs) Tuning of controller: Different criteria like Quarter amplitude decay ratio, Integral time performance indices. Tuning Methods: Process reaction curve (open loop), Ziegler Nichols (closed loop)
UNIT V: CONTROL VALVES (08 Hrs) Converters: Current to pressure converter, pressure to current converter. Necessity of final control elements, Control valve parts, Actuators (Pneumatic, Electric, Hydraulic and handwheel), Control valve classification. Control valve terminology: Rangeability, turndown, viscosity index, valve capacity, AO, AC, fail-safe actions. Control valve characteristics: Inherent and installed. Control valve sizing coefficient CV, Linear valve: Globe, 3-way globe, Gate valve; Rotary valve: Butterfly and ball valve

Text Books:

1. C. D. Johnson, "Process control and Instrument technology" Tata McGraw Hill, Publications, 08th Ed.
2. N.A. Anderson, Boca Ratan, " Instrumentation for Process measurement and control, Radnor Pennsylvania, CRC Press, 03rd Ed.

Reference Books:

1. B. G. Liptak, "Process Control, Instrument Engineering Hand book CRC Press, 03rd Ed.
2. Tuning of industrial control systems, ISA.
3. Control valve Handbook, ISA

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Second Year Instrumentation Engineering Process Control Loop Components Lab			
Course Code:	**INMNR402**	**Credit**	**1**
Contact Hours:	2 Hrs/week (L)	**Type of Course:**	Practical
Examination Scheme	Termwork examination 25 Marks		

Pre-requisites:

- Basic knowledge of sensors//transducers, control system, Linear Integrated Circuits.

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Termwork	Internal	25

Course Objectives	
1	To explain the process control loop, component symbols and process variables.
2	To introduce workings and applications of the transmitter, controller, converter and final control element.

Course Outcomes: Students will be able to	
402.1	Demonstrate the application of DPT for Flow and level measurement.
402.2	Explain the procedure of calibration of DPT and converters and measurement with it
402.3	Implement the circuit for on-off controller.
402.4	Describe effects of control actions for pressure control loop.
402.5	Demonstrate the Z-N closed loop tuning method to tune PID parameters
402.6	Describe quick opening, linear and equal percentage control valve characteristics.

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

List of Experiments:

Students are required to perform minimum 08 experiments from the given list.

1. Measurement of flow rate with DPT.
2. Measurement of level using DPT.
3. Calibrate Differential pressure transmitter.
4. Calibrate I to P converter and plot its input-output response.
5. Calibrate P to I converter and plot its input-output response.
6. Implement the On-Off controller circuit.
7. Verify the effect of different proportional controller gain for pressure control loop.
8. Verify the effect of proportional- integral controller for pressure control loop.
9. Tune the controller for temperature/pressure control loop using Z-N closed loop method.
10. Tune the controller for level/flow control loop using Z-N closed loop method.
11. Study various parts of control valve and plot the quick opening, linear and equal percentage type installed characteristics.

Text Books:

1. Sawhney A. K, "Electrical and Electronics Measurements and Instruments" Dhanpat Rai & Co. 02nd Ed
2. W. D. Cooper & A. D. Helfrick, "Electronic Instrumentation and Measurement Techniques"
   i. PHI, 4th e/d, 1987
3. David A.Bell," Electronic Instrumentation and Measurements", PHI, 2e/d

Reference Books:

1. Anand M. M. S., "Electronic Instruments and Instrumentation Technology", PHI, 2004, 02nd Ed.
2. Kalsi H. S., " Electronic Instrumentation", TMH, 2nd or 3rd e/d, 2004/2010.
3. R. Subburaj, "Calibration the Foundation for ISO 9000 and TQM".
4. Bouwens A. J., "Digital Instrumentation", McGraw-Hill, second edition.

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Third Year B.Tech Instrumentation Engineering Industrial Automation			
Course Code:	**INMNR501**	**Credit**	**03**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	End-sem. Examination 75 Marks		

Pre-requisites: Analog and Digital Techniques

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External / Internal	Marks
1.	End Semester Examination	External	75

Course Objectives	
1	To introduce the basics of industrial automation, PLC, HMI, SCADA and DCS.
2	To explain ladder programming using basic and advanced PLC instructions.
3	To describe interfacing of analog and digital devices with PLC.
4	To introduce the architecture, components of SCADA and DCS.

Course Outcomes: Students will be able to	
501.1	Understand the fundamentals of Industrial Automation, PLC.
501.2	Develop Ladder Program using basic PLC instructions for industrial processes.
501.3	Develop Ladder Program using advanced PLC instructions for industrial processes.
501.4	Understand fundamentals of SCADA and its development.
501.5	Explain the DCS architecture, its functions.

CHAIRMAN
BOS–INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE–1.

Topics covered:
Unit I: Introduction to Automation and PLC Automation: Fundamentals of Industrial Automation Need & Role of Automation, Evolution of Automation. Introduction to PLC: Definition of PLC, Architecture, Types of PLC, Different Manufactures of PLCs and their revolution. DI-DO-AI-AO Modules.
Unit II: Basic PLC Programming (08) Programming Languages: Introduction to PLC Programming Languages as per IEC 61131-3: Ladder Programming (LD), Function Block Diagram (FBD), Instruction List (IL), Structured Text (ST) & Sequential Function Chart (SFC). Ladder programming for logic gates & Boolean algebra. Timers & Counters instruction, Applications of Timers & Counters.
Unit III: Advanced PLC Programming and interfacing (07) Comparison & Math operations: Equal, Not-equal to, Less than, Greater than, Less than or equal to, Greater than or equal to, Limit test, Mask Compare equal to, Compare expression, ADD, SUB, MUL, DIV, SQR, NEG, AND ,OR,NOR, EX-OR,NOT, CLEAR. Move, Jump & Label, Skip , Shift Register & Sequencer instructions. PLC Interfacing to actuators.
Unit IV: Introduction to Supervisory Control & Data Acquisition (SCADA) Supervisory Control & Data Acquisition (SCADA): General definition & SCADA Components. application & benefits, PLCs Vs RTUs, Types of SCADA System, Trending, Historical data storage & Reporting, Alarm management, Applications
Unit V: Introduction to Distributed Control System(DCS) (08) Distributed Control System (DCS): Introduction, Functions, Architecture, Features, Specification, Advantages, limitations, Applications. Comparison of DCS, PLC, and SCADA

Text Books:

1. Programmable Logic Controllers: Principles & Applications by John W. Webb, Ronald A. Reis, Prentice Hall of India, 5th ed.
2. Introduction to Programmable Logic Controllers by Gary Dunning, Delmar Thomson Learning, 3rd ed.
3. Krishna Kant, Computer-based Industrial Control, Prentice Hall, New Delhi, 1997.
4. Computer aided process control, S. K. Singh, PHI.
5. Krishna Kant, Computer-based Industrial Control, Prentice Hall, New Delhi, 1997.
6. Computer aided process control, S. K. Singh, PHI.

References Books:

1. Programmable Logic Controller by Frank D Petruzella, McGraw-Hill Education, 5th ed.
2. Programmable Logic Controllers by W. Bolton, Elsevier Newness publication, 4th ed.
3. Programmable Controller by T. A. Huges, ISA publication, 2nd ed.
4. SCADA by Stuart A. Boyer, ISA 1999.
5. Distributed computer control for industrial automation, Popovik, Bhatkar, Dekkar Pub.
6. Understanding Distributed Process Systems For Control, Samuel Herb, ISA.

AAS

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Third Year B.Tech Instrumentation Engineering Industrial Automation Lab			
Course Code:	**INMNR502**	**Credit**	**1**
Contact Hours:	2 Hrs/week (P)	**Type of Course:**	Practical
Examination Scheme	Term Work 25 Marks		

Pre-requisites: Analog and Digital Techniques

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25

Course Objectives	
1	To introduce the basics of industrial automation, PLC and SCADA.
2	To explain ladder programming using basic PLC instructions.
3	To describe interfacing of analog and digital devices with PLC.

Course Outcomes: Students will be able to	
502.1	Understand the fundamentals of Industrial Automation, PLC.
502.2	Develop Ladder Program using basic PLC instructions for industrial processes.
502.3	Develop Ladder Program using advanced PLC instructions for industrial processes.

List of Experiments:

Students are required to perform minimum 07 experiments from the given list:

Any 06 from 1 to 8

1. Introduction to Ladder Programming, develop and simulate Logic gates.
2. Develop and Simulate Ladder program for Boolean equations.
3. Develop and Simulate Ladder program for simple on-off applications.
4. Develop and Simulate Ladder program for timer operations.
5. Develop and Simulate Ladder program for timer applications.
6. Develop and Simulate Ladder program for counter operations.
7. Develop and Simulate Ladder program for counter applications.
8. Develop and Simulate Ladder program for comparison operations using PLC.

Any 01 from 9 to10

9. Implementation of DOL starter.
10. Implementation of PLC arithmetic instructions

Text Books:

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

1. Programmable Logic Controllers: Principles & Applications by John W. Webb, Ronald A. Reis, Prentice Hall of India, 5th ed.
2. Introduction to Programmable Logic Controllers by Gary Dunning, Delmar Thomson Learning, 3rd ed.
3. Krishna Kant, Computer-based Industrial Control, Prentice Hall, New Delhi, 1997.
4. Computer aided process control, S. K. Singh, PHI.

References Books:

1. Programmable Logic Controller by Frank D Petruzella, McGraw-Hill Education, 5th ed.
2. Programmable Logic Controllers by W. Bolton, Elsevier Newness publication, 4th ed.
3. Programmable Controller by T. A. Huges, ISA publication, 2nd ed.
4. SCADA by Stuart A. Boyer, ISA 1999.
5. Distributed computer control for industrial automation, Popovik, Bhatkar, Dekkar Pub.
6. Understanding Distributed Process Systems For Control, Samuel Herb, ISA.

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Third Year B. Tech Instrumentation Engineering Project Engineering and management			
Course Code:	**INMNR601**	**Credit**	**3**
Contact Hours:	3 Hrs/week (L)	**Type of Course:**	Lecture
Examination Scheme	End-sem. Examination 75 Marks		

Pre-requisites: Knowledge of Organization Structure, Types, Function.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	End Semester Examination	External	75

Course Objectives	
1	To relate and apply the basic concept of Project organization and management for instrumentation projects
2	To learn and understand the project Initiation and Finance Management.
3	To learn and understand the project Initiation and Finance Management.
4	To learn and know the use of various standards in instrumentation Projects
5	To get the Knowledge of front-end engineering design and testing Activity its documentation.

Course Outcomes: Students will be able to	
601.1	Evaluate the role and responsibilities in the project.
601.2	Identify the tools of project planning and budget.
601.3	Apply the design documents/ activities required in different phases of the project.
601.4	Classify the standards required for project development.
601.5	Interpret the design information from the documents and implement various construction and testing activities.

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

Topics covered:
Unit I: Project Management and Project Teams (08 hrs) A] Project Management: Introduction and objectives of Project Management, Types of projects and related information. Project manager, purpose of project management. Project Organization Techniques -Matrix project organization, Project-Oriented project organization B] Project Team: Teamwork, design teams, team management, key factors in team leadership
Unit II: Project Initiation and Finance Management (06hrs) Design & construction process, phases of a project, project strategy. Importance of early estimates, estimating work process, estimate checklist of documentation, project budgets, design budgets.
Unit III: Development stages of project (07hrs) Organizational structures, forming the project team, project execution plan, problems in developing project definition, techniques for planning and scheduling.
Unit IV: Instrumentation Preliminary and FEED Project Engineering Documents and Standards (07hrs) Introduction to ISA standards: ISA S-5.1, 5.2, 5.3, 5.4, 5.5 ,Front End Engineering and Design (FEED) documents: Plant and piping layouts, Instrument schedule, I/O schedule,
Unit V: Detail Engineering Design and Testing Activity (08hrs) Cable Engineering: Class of conductors, Types, Specification, Selection, Cable identification schemes, Cable trays. Earthing and Grounding for General and power Signals. System testing, Installation, documents required at this stage. Factory Acceptance Test (FAT), Customer Acceptance Test (CAT), Cold commissioning & hot commissioning.

Text Books:

1. Management systems by John Bacon (ISA).
2. Project Management A System Approach to Planning, Scheduling and Controlling by
Harold Kerzner (Van Nostrand Reinhold Publishing).
3. Applied instrumentation in process industries by Andrew & Williams (Gulf Publishing).

References Books:

1. Garold D. Oberlender, "Project Management for Engineering and Construction " Mc Grow Hill.
2. Instrument Installation Project Management (ISA).

CHAIRMAN
BOS–INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE–1.

Third Year B.Tech Instrumentation Engineering Project Engineering and Management Lab			
Course Code:	**INMNR602**	**Credit**	**1**
Contact Hours:	2 Hrs/week (P)	**Type of Course:**	Practical
Examination Scheme	Term Work 25 Marks		

Pre-requisites:

- .Basic knowledge of ISA Symbols, Phases Of Project.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Termwork	Internal	25

Course Objectives	
1	To Learn and understand the standards Symbol of ISA.
2	To know the work break down structure and Project schedule and cable scheduling
3	To prepare the Quotation, Comparative statements and Purchase orders.
4	To Prepare the Documentation, Bill of Material.

Course Outcomes: Students will be able to	
602.1	Understand the ISA Symbol and its use.
602.2	Identify the tools of project planning and budget and Project Scheduling .
602.3	Apply the design documents/ activities required in Comparative Statement, Purchase Orders
602.4	Classify the standards required for project development and cable Scheduling.
602.5	Interpret the design information from the documents and prepare the bill of material

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

List of Experiments:

Students are required to perform minimum 08 experiments from the given list.

1. Study of standards and symbols (ISA)
2. Design and develop the project development Schedule – WBS.
3. Preparation of Inquiry, Quotation, Comparative Statement, Purchase Orders.
4. Development of Process and Instruments diagram of Typical Process.
5. Prepare the sample cable Schedule.
6. Prepare the Specification Sheet.
7. Prepare a loop wiring diagram.
8. Prepare the Bill of material and its documentation.
9. Prepare a Hook up drawings for installation of transmitters and control valve.
10. Prepare documents required for FAT of a control Panel.
11. Develop instrument index sheet for P & ID developed in experiment 4.
12. Project Investment

Text Books:

1. Management systems by John Bacon (ISA).
2. Project Management A System Approach to Planning, Scheduling and Controlling by
Harold Kerzner (Van Nostrand Reinhold Publishing).
3. Applied instrumentation in process industries by Andrew & Williams (Gulf Publishing).

References Books:

1. Garold D. Oberlender, "Project Management for Engineering and Construction " Mc Grow Hill.
2. Instrument Installation Project Management (ISA).

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.

CHAIRMAN
BOS-INSTRUMENTATION ENGINEERING
AISSMS IOIT (AUTONOMOUS),
PUNE-1.