INSTRUMENTATION AND CONTROL
ENGINEERING

M. Tech. (Process Instrumentation)
Effective from A. Y. 2014-15

INDEX

<table>
<thead>
<tr>
<th>Item</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detailed Syllabus</td>
<td>3</td>
</tr>
<tr>
<td>Annexure-I: List of Open Elective/Professional Science courses offered by ALL departments</td>
<td>26</td>
</tr>
<tr>
<td>Annexure-II: List of Liberal Learning courses offered at Institute level</td>
<td>27</td>
</tr>
</tbody>
</table>

List of Abbreviations

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Abbreviation</th>
<th>Stands for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DEC</td>
<td>Departmental Elective Course</td>
</tr>
<tr>
<td>2</td>
<td>PCC</td>
<td>Program Core Course</td>
</tr>
<tr>
<td>3</td>
<td>LC</td>
<td>Laboratory Course</td>
</tr>
<tr>
<td>4</td>
<td>HSSC</td>
<td>Humanities and Social Science Course</td>
</tr>
<tr>
<td>5</td>
<td>MLC</td>
<td>Mandatory Learning Course</td>
</tr>
<tr>
<td>6</td>
<td>LLC</td>
<td>Liberal Learning Course</td>
</tr>
<tr>
<td>7</td>
<td>OEC</td>
<td>Open Elective Course</td>
</tr>
<tr>
<td>8</td>
<td>SEC</td>
<td>Science Elective Course</td>
</tr>
<tr>
<td>9</td>
<td>BSC</td>
<td>Basic Science Course</td>
</tr>
</tbody>
</table>
Program Education Objectives (PEOs):

PEO1: Practice the knowledge of Instrumentation and Control Engineering and allied and related fields.

PEO2: Demonstrate technical, communication skills and team spirit along with leadership qualities to pursue career in broad areas of instrumentation and Control Engineering.

PEO3: Engage in life-long learning through independent study and research.

PEO4: Undertake responsibilities for societal, environmental and ethical causes.

Program Outcomes (POs):

PO1: Acquire knowledge of Instrumentation and Control Engineering with ability to evaluate, analyze and synthesize knowledge related to Process Instrumentation.

PO2: Analyze complex problems related to Instrumentation and Control Engineering and synthesize the information for conducting research.

PO3: Think laterally to solve problems related to Instrumentation and Control Engineering and provide/suggest a range of solutions considering health, safety, societal, and environmental factors.

PO4: Extract knowledge through literature survey, experimentation and appropriate research methodology, techniques and tools.

PO5: Learn and use contemporary tools for solving problems related to Process Control, Automation, Measurement and Control etc.

PO6: Understand group dynamics and rational analysis in order to achieve common goals.

PO7: Ability to write clearly and to document own work for effective utilization.

PO8: Engage in life-long learning and learning through mistakes with / without external feedback.

PO9: Understand the impact of research and responsibility in order to contribute to the society.

PO10: Understand the role of a leader, leadership principles and attitude conducive to effective professional practice of Instrumentation and Control Engineering.
## CURRICULUM STRUCTURE OF M Tech (Instrumentation and Control)
### Specialization: Process Instrumentation
### Effective from Academic year 2014-15

### I-Semester

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Teaching Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OEC-I/IS-501-9</td>
<td>Advanced Mathematics</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Core-I/PI-511</td>
<td>Transducer Design</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Core-II/PI-513</td>
<td>Instrument Design Engineering</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Core-III/PI-515</td>
<td>Modern Control Theory</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>DE-I/PI-531</td>
<td>A. Process System Engineering</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>DE-I/PI-533</td>
<td>B. Industrial Automation</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>CS/PI-519</td>
<td>Course Seminar</td>
<td>L --</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>LLC/LL-503</td>
<td>Liberal Learning Course</td>
<td>L 1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>PGL/PI-521</td>
<td>PG Laboratory –I</td>
<td>L --</td>
<td>6</td>
</tr>
</tbody>
</table>

**Total**  

### II-Semester

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Teaching Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OEC-II</td>
<td>Open Elective / Science Elective</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>DE-II/PI-514</td>
<td>A. Advanced Control System</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>DE-II/PI-528</td>
<td>B. Robotics</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>DE-II/PI-530</td>
<td>C. Fiber Optics and LASER technology</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>DE-II/PI-518</td>
<td>D. Soft Computing</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Core –IV/PI-502</td>
<td>Embedded Systems</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>PSC-I/PI-516</td>
<td>A. Advanced Process Instrumentation</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PSC-I/PI-526</td>
<td>B. Process Dynamics and Identification</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PSC-I/PI-520</td>
<td>C. Building Automation</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>PSC-II/PI-512</td>
<td>A. Batch Process</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PSC-II/PI-522</td>
<td>B. Advanced Digital Signal Processing</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PSC-II/PI-524</td>
<td>C. Instrumentation for Strategic Application</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>MLC/ML-504</td>
<td>Intellectual Property Rights</td>
<td>L 1</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>PGL/PI-510</td>
<td>PG Laboratory -II</td>
<td>L 1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total**  

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Teaching Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OEC-I/IS-501-9</td>
<td>Advanced Mathematics</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Core-I/PI-511</td>
<td>Transducer Design</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Core-II/PI-513</td>
<td>Instrument Design Engineering</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Core-III/PI-515</td>
<td>Modern Control Theory</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>DE-I/PI-531</td>
<td>A. Process System Engineering</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>DE-I/PI-533</td>
<td>B. Industrial Automation</td>
<td>L 3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>CS/PI-519</td>
<td>Course Seminar</td>
<td>L --</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>LLC/LL-503</td>
<td>Liberal Learning Course</td>
<td>L 1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>PGL/PI-521</td>
<td>PG Laboratory –I</td>
<td>L --</td>
<td>6</td>
</tr>
</tbody>
</table>

**Total**  

- I-Semester: 16 L 0 T 6 P 20 Credits
- II-Semester: 16 L 0 T 6 P 20 Credits
### III-Semester

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Teaching Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
</tr>
<tr>
<td>1</td>
<td>MLC/ML-603</td>
<td>Environmental Studies</td>
<td>2</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>MLC/ML-601</td>
<td>Constitution of India</td>
<td>2</td>
<td>--</td>
</tr>
<tr>
<td>3</td>
<td>PS-I/PI-601</td>
<td>Project Work</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

OR

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Teaching Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
</tr>
<tr>
<td>1</td>
<td>OEC/ BSC</td>
<td>Humanities and Social Science Courses</td>
<td>3</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>LLC</td>
<td>Liberal Learning Course</td>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>3</td>
<td>PS-I/PI-601</td>
<td>Project (Dissertation) Stage I</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

### IV-Semester

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Course Code</th>
<th>Course Name</th>
<th>Teaching Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
</tr>
<tr>
<td>1</td>
<td>PS-II/PI-602</td>
<td>Project Work</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
IS-501-9  Advanced Mathematics

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks:Continuous evaluation-
Assignments/Quiz-40 Marks,
End-Sem Exam- 60 Marks

Course Content


Text books:
- Engineering Mathematics, Erwin Kreyszig, 9th Students edition, Wiley International
- Reliability and Maintainability Engineering, Charles Ebeling, Tata McGraw Hills Publication
- Engineering Optimization, S. S. Rao, New Age Publication

Reference books:
- Numerical Methods – S. S. Sastry
- Statistical methods- S. P. Gupta
- Higher Engineering Mathematics – B.V.Ramana
- Operations Research- S. D. Sharma
- Probability and Statistics in Engineering – W. W. Hines et al

Outcomes:
- Knowledge of optimization techniques and importance of reliability theory, numerical methods used in research [PEO1][PO-1]
- Ability to understand the use of statistical quality control in engineering research.[PEO1][PO-2]
PI-511 Transducer Design

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks

Course Contents:
Review of transducers for various parameters like temperature, pressure, flow, level, humidity, acceleration, vibration, density etc. Design considerations and selection criterion as per standards, Sensor fabrication techniques, process details, and latest trends in sensor fabrication, fiber optics sensors, electromechanical sensors, Solid state chemical sensors, Bio-sensors, Piezo-resistive sensors, characterization of sensors, effect of sensors on process identification, signal conditioning techniques.

Reference Books:

Outcomes:
- Knowledge of mathematical equations for the sensor design. [PEO1] [PO-1]
- Implementation of various sensors required for process plants. [PEO2] [PO-4]

PI-513 Instrument Design Engineering

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks
Course Contents:

Electromagnetic Compatibility: Noise, Interference, Noise Coupling, cabling, grounding, ground loops, balancing and filtering
Shielding: Near field, far field, absorption losses, and reflection losses
Contact Protections: Arc discharge, Glow discharge, intrinsic noise sources, active device noise, digital circuit grounding
EMC Applications: Digital circuit power distribution, Digital circuit radiations, Conducted emissions, RF and transient immunity, electrostatic discharge, PCB layout and design, EMC measurements. Automated Test equipment

Reference Books


Outcomes:

- An ability to analyze and justify the requirement of Instrument and systems. [PEO1][PO1]
- An ability to design various electronic circuits and measurement systems, noises identification and appropriate elimination methods related to instrument and system[PEO1][PO2]
- An ability to select, design appropriate enclosure, cables, PCB.[PEO1][PO5].
- An ability to estimate, analyze, improve the reliability of instrument and system[PEO3][PO2]

PI-515 Modern Control Theory

Teaching Scheme

Lectures: 3 hrs/week

Examination Scheme

100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks

Course Contents:

State space analysis, eigen values and eigen vectors, feedback control system using state space, Controller and observer design, Design using Ackermann formula, Frequency domain controller, Introduction to discrete time control, Controller design in discrete domain

Reference Books:

Outcomes:

- An ability to design continuous state feedback controller and observer in state space. [PEO1] [PO-I]
- An ability to design discrete state feedback controller and observer for continuous system. [PEO1] [PO-I]
- Ability to design compensators in continuous and discrete domain [PEO1][PO-I]

PI-531 Process System Engineering

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks

Course Contents:

Introduction to Unit operations, understanding and development of systematic procedures for the design and operation of process system, separation processes, computer based techniques for design, operation and management of process plants, case study of chemical process plants.

Reference Books:


Outcomes:

- Demonstrate various unit operations in process plants. [PEO2] [PO-4]
- Implementation of control schemes on existing platforms. [PEO1] [PO-2]

PI-533 Industrial Automation

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks
Course Contents:


Different standard for programming the control system. Different types of control system. Controlling advance applications with DCS, SCADA and PLCs. Discussion of available and suitable feature in hybrid control system.

HART, Foundation fieldbus, Profibus protocol introduction, frame structure, programming, implementation examples, Benefits, Advantages and Limitations. Comparison with other fieldbus standards including Device net, Profibus, Controlnet, CAN, Industrial Ethernet etc.

Distributed Control Systems Engineering and Design

DCS detail engineering, specifications, configuration and programming, functions including database management, reporting, Sequential event recording alarm management, communication, third party interface, control, display etc. Enhanced functions viz. Advance Process Control, Batch application, Historical Data Management, OPC support, Security and Access Control etc. Performance Criteria for DCS and other automation tools.

Reference Books:


Outcomes:

- Selection of DCS & network protocol based on applications. [PEO1][PO-3]
- Implementation of DCS for various process/plant. [PEO2][PO-5]

PI-519 Course Seminar

Course Contents:

The students are required to search / gather the material / information on a specific a topic comprehend it and present / discuss in the class.

Outcomes:

- Ability to understand of contemporary / emerging technology for various processes and systems. [PEO1][PO-4]
- An ability to share knowledge effectively in oral and written form and formulate documents [PEO2] [PO-6]
**PI-521  PG Laboratory I**

The students are expected to do the following:

- To get familiarize about the facilities available in the laboratory.
- To design, implement and verify the results of various experiments as per the suggestions of laboratory instructor.
- To devise, suggest and implement innovative experiments in the laboratory.
- To collaborate with other labs for implementing small projects.
- To suggest and provide solutions for upgrading the laboratory facilities.

**Outcomes:**

- Understanding the basics of state-of art software and hardware tools and its usability [PEO1][PO5]
- Capable of developing small projects proving the basic concepts  [PEO3][PO3]
- Able to teach, develop experiments and share his knowledge and competency with others [PEO2][PO7]
- Capable of pursuing research in domain of Instrumentation and Control Engineering [PEO3][PO8]

---

**PI-502  Embedded Systems**

**Teaching Scheme**
Lectures : 3 hrs/week

**Examination Scheme**
100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks
Course Contents:

Introduction to Reconfigurable Computing, FPGA Architectures
FPGA Design Cycle, Technology-independent optimization, Technology Mapping, Placement and Routing, FPGA Vs ASIC design, Algorithm Prototyping and benchmarking, area, speed and power analysis for FPGA design, Floating Point Design (Implementing math functions), Reconfigurable Computing Applications –Bioinformatics, Process Automation, Image processing, Computational Fluid Dynamics, Power Electronics;
FPGAs vs. Multicore architectures
Advanced FPGA Design, Dynamic Reconfiguration, Partial Reconfiguration;

Text Books:


Reference Books:


Outcomes:

- Understanding of the basic principles of Microcontroller based design and development. [PEO1][PO-1]
- Ability to design and build a functional prototype for real world applications.
- [PEO2][PO-3]
- To encourage the students to have a better understanding on state-of-art embedded technologies like system-on-chip design and reconfigurable embedded designs, their potential applications and their market views. [PEO2][PO-2]
- Ability to work in a group to design systems, solve problems and its applicability for the society. [PEO2 ][PO-6]
- To test whether students can apply their knowledge of fundamentals of Microcontrollers, programming and interfacing technology to solve and design simple engineering problems. [PEO3][PO-5]

PI-514        Advance Control System

Teaching Scheme    Examination Scheme
Lectures : 3 hrs/week 100 marks: Continuous evaluation
                                Assignments/Quiz-40 Marks
                                End-Sem Exam- 60 Marks
Course Contents:


Reference Books:


Outcomes:

- An ability to design continuous sliding mode controller and observer. [PEO1] [PO-l]
- An ability to design discrete using delta operator controller and observer for linear and nonlinear systems. [PEO1] [PO-l]
- Ability to design controller for uncertain and disturbed systems. [PEO1] [PO-l]

PI-528 Robotics

Teaching Scheme

Lectures : 3 hrs/week

Examination Scheme

100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks

Course Contents:

Introduction:- Basic Concepts such as Definition, three laws, DOF.....etc., Robotics and automation, Robot anatomy, Classification, structure of robots, point to point and continuous path robotic systems. Associated parameters i.e. resolution, accuracy, repeatability, dexterity, compliance, RCC device, etc..

Robot Grippers:- Types of Grippers, Design aspect for gripper, Force analysis for various basic gripper system

Sensors for Robots:- Characteristics of sensing devices, Selections of sensors, Classification and applications of sensors. Types of Sensors, Need for sensors and vision system in the working and control of a robot
Drives:- Types of Drives, Actuators and its selection while designing a robot system. Types of transmission systems

Control Systems :- Types of Controllers, Introduction to closed loop control, second order linear systems and their control, control law partitioning, trajectory-following control, modelling and control of a single joint, Present industrial robot control systems and introduction to force control

Kinematics :- Transformation matrices and their arithmetic, link and joint description, Denavit-Hartenberg parameters, frame assignment to links, direct kinematics, kinematics redundancy, kinematics calibration, inverse kinematics, solvability, algebraic and geometrical methods

Velocities and Static forces in manipulators: Motion of the manipulator links, Jacobians, singularities, static forces, Jacobian in force domain

Dynamics: - Introduction to Dynamics, Trajectory generations, Manipulator Mechanism Design


Robot Programming : Methods of robot programming, lead through programming, motion interpolation, branching capabilities, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages : Introduction to various types such as RAIL and VAL II ...etc,

Features of each type and development of languages for recent robot systems

Artificial Intelligence: - Introduction to Artificial Intelligence, AI techniques, Need and application of AI


Text Books:


Reference Books:


Outcomes:

- Ability to determine the various kinetics and dynamics of a robotic arm.[PEO-1][ PO-1]
- Ability to understand and implement the different control techniques for manipulators.[PEO2][PO-2]
PI-528       Fiber Optics and LASER technology

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignments/Quiz: 40 Marks
End-Sem Exam: 60 Marks

Course Contents:
Optical fiber: Light, waveguide, total internal reflection, NA, acceptance, critical angle
Optical fiber characteristics: attenuation, dispersion, refractive index profile, bending losses, polarization, optical amplifiers
Optical fiber sensors: different parameters such as light intensity, phase, etc to measure temperature, level, pressure, vibration
Optical sources: LED and LASERs, principle of LASERs, types of LASERs
LASERs application in biomedical: Endoscope, ophthalmic surgery, other surgical applications
LASER Applications: Holography, measurement of stain, stress, vibration, LASER gyroscope

Reference Books:
- J Wilson, "Optoelectronics", Prentice Hall India
- Silvano Donati, "Electro Optical Instrumentation", Pearson Education
- Jonh Dakin and Brian Culshaw, "Optical Fiber Sensors"

Outcomes:
- Ability to apply optical fiber for sensing various physical parameter [PEO1][PO-1]
- Analyzed the advantages of optical fiber sensor over conventional sensors [PEO2][PO-3]
- Application of LASER in various deceases [PEO2][PO-4]

PI-518       Soft Computing

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignments/Quiz: 40 Marks
End-Sem Exam: 60 Marks

Course Contents:
Knowledge based methods
Expert systems (ES)
Fuzzy expert system (FES)
Analytical Hierarchical methods (AHP)
Data mining methods: Neural Networks (NN), Genetic Algorithms (GA), Support Vector machine (SVM)
Reference Books:

- S N Shivanandam, “Introduction to Neural Networks Using MATLAB 6.0”, TMH
- Timothy Ross, “Fuzzy logic with application to engineering systems”, McGraw Hill

Outcomes:

- Understand and evaluate different soft computing techniques. [PEO1] [PO-1]
- Identification and implementation of the data mining techniques to solve complex problems. [PEO2] [PO-5]

**PI-516  Advance Process Instrumentation**

Teaching Scheme

Lectures : 3 hrs/week

Examination Scheme

100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks

Course Contents:


Reference Books:

- Design and Application of Process Control Systems, ISA

Outcomes:

- Utilization of various process identification techniques. [PEO1] [PO-1]
- Implementation of control schemes for different processes [PEO2] [PO-2]

**PI-526  Process Dynamics and Identification**

Teaching Scheme

Lectures : 3 hrs/week

Examination Scheme

100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks
Course Contents:
Introduction to process dynamics, development of dynamic models for typical unit operations from 1st principle, techniques for model identification using empirical information, introduction to process optimization, methods for parameter estimations and validation, process performance analysis and advanced process control.

Reference Books:

Outcomes:
- Correlation of the process dynamics and plant performance.[PEO1] [PO-1]
- Implementation of optimization tools for different processes. [PEO2] [PO-2]

PI-524 Instrumentation for Strategic Application

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks

Course Contents:
Introduction to process control, control objective and benefits, process dynamics, analysis for process control, dynamic behavior of typical process systems, PID algorithms, stability analysis and controller tuning, process control design: definition and design, managing the design procedure, continuous improvement.

Reference Books:
- Thomas E. Marlin, “Process control designing processes and control system for dynamic performance”, McGraw Hill,

PI-520   Building Automation

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks

Course Contents:

Reference Books:

Outcomes:
- Designing different systems for building automation and integrate those systems. [PEO2][PO-2]
- Identification of implementation issues associated with BMS [PEO1][PO-3]

PI-522   Advanced Digital Signal Processing

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks
Course Contents:

Advanced digital signal processing methods to include: statistical and deterministic least squares filter design, finite length register effects and their optimization in digital filters, Multirate Signal Processing, Wavelet Transform, Hadamard Transform, DCT, Nonlinear filters, Adaptive Filters, Advanced DSP Processors and associated tools, Case studies and applications

Reference Books:

- Proakis, Manolakis, “DSP Principles, algorithms and applications”, PHI
- Avtar singh, S. srinivasan , “DSP Implementation using DSP microprocessors with examples from TMS320C54XX” TMH

Outcomes:

- Acquire knowledge of advances in digital signal processing and its applications to Instrumentation and Control Engineering with ability to evaluate, analyse and synthesize knowledge related to Process Instrumentation, Instrumentation & Control Engineering, etc.[PEO1] [PO-1]
- Think laterally to solve problems related to Instrumentation and Control Engineering and provide / suggest a range of solution through literature survey, experimentation and appropriate research methodology, techniques and tools. [PEO2][PEO3] [PO-3] [PO-4]

PI-512 Batch Process

Teaching Scheme
Lectures : 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation
Assignments/Quiz-40 Marks
End-Sem Exam- 60 Marks

Course Contents:

Introduction to Batch Control System, Batch Control system terminology, Characteristics of Batch Processes, Hierarchical Batch Model, Control structure for batch systems. International Standards and Practices such as S 88, S 95, USA FDA regulation, 21CFR 11, etc. regulatory and discrete systems, Batch control design, system hardware and software, Batch control system specifications and implementation, Information/display requirements, cost justification and benefits, data management.
Case study of batch control system implementation for applications in food and beverages, pharmaceuticals, etc.
Reference Books:


Outcomes:

- Acquired knowledge of standards used for Batch process control [PEO-1][PO-3]
- Development of control schemes for different batch processes [PEO-2][PO-2]

PI-510 PG Laboratory II

Teaching Scheme

Examination Scheme

100 marks: Continuous evaluation
50 Marks, End- Sem Exam- 50 Marks

Course Contents:

The students are expected to do the following:

- To get familiarize about the facilities available in the laboratory.
- To design, implement and verify the results of various experiments as per the suggestions of laboratory instructor.
- To devise, suggest and implement innovative experiments in the laboratory.
- To collaborate with other labs for implementing small projects.
- To suggest and provide solutions for upgrading the laboratory facilities.

Outcomes:

- Understanding the basics of state-of-art software and hardware tools and its usability [PEO1][PO-5]
- Capable of developing small projects proving the basic concepts [PEO3][PO-3]
- Able to teach, develop experiments and share his knowledge and competency with others [PEO2][PO-7]
- Capable of pursuing research in domain of Instrumentation and Control Engineering [PEO3][PO-8]

PI-601 Dissertation Stage I

Teaching Scheme

Examination Scheme

100 marks: Continuous evaluation
50 Marks, End- Sem Exam- 50 Marks
Course Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study.

The dissertation should have the following
- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various domain

The student should complete the following:
- Literature survey
- Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

Outcomes:

- Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem [PEO1][PO-1]
- Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design [PEO3][PO-4]
- Ability to present the findings of their technical solution in a written report [PEO2][PO-7]

PI-602 Dissertation Stage II

Teaching Scheme

Examination Scheme

100 marks: Continuous evaluation - 50 Marks, End- Sem Exam - 50 Marks

Course Contents:

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them.

It may be based on:
- Entirely on study and analysis of typical Instrumentation and Control system, Process Instrumentation / devices / instruments / related topic
- Experimental verification / Proof of concept
- Design, fabrication, testing, and calibration of an instrumentation system
The viva-voce examination will be based on the above report and work.

Outcomes:

- Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem [PEO1][PO-1]
- Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design [PEO3][PO-4]
- Ability to present the findings of their technical solution in a written report[PEO2][PO-7]