Structure & Syllabus of

M.E. (Instrumentation and Control)

Pattern ‘A13’

Effective from Academic Year 2013-14

Prepared by: - Board of Studies in Instrumentation Engineering
Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune.

Signed by,

Chairman – BOS      Chairman – Academic Board
Vishwakarma Institute of Technology
Issue 04 : Rev No. 0 : Dt. 24/04/13

Title : Syllabus Format – PG Courses

FF No. : 658

M.E. (Instrumentation & Control-Process Instrumentation) Structure with effect from Academic Year 2013-14

Semester I

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Type</th>
<th>Teaching Scheme</th>
<th>Assessment Scheme</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC50101</td>
<td>Estimation Techniques</td>
<td>Theory</td>
<td>3 - 10 30 10 - 50</td>
<td>CT * MSE HA * CA ESE</td>
<td>3</td>
</tr>
<tr>
<td>IC50103</td>
<td>Measurement Systems</td>
<td>Theory</td>
<td>3 - 10 30 10 - 50</td>
<td>CT * MSE HA * CA ESE</td>
<td>3</td>
</tr>
<tr>
<td>IC50105</td>
<td>Process Control</td>
<td>Theory</td>
<td>3 - 10 30 10 - 50</td>
<td>CT * MSE HA * CA ESE</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Department Elective-I #</td>
<td></td>
<td>3 - 10 30 10 - 50</td>
<td>CT * MSE HA * CA ESE</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Department Elective-II †</td>
<td></td>
<td>3 - 10 30 10 - 50</td>
<td>CT * MSE HA * CA ESE</td>
<td>3</td>
</tr>
<tr>
<td>IC50301</td>
<td>PG Lab – I</td>
<td>Lab</td>
<td>- 4 - - - - 100</td>
<td>- - 4</td>
<td>3</td>
</tr>
<tr>
<td>IC50303</td>
<td>Communication &amp; Soft Skill</td>
<td>Lab</td>
<td>- 2 - - - - 100</td>
<td>- - 2</td>
<td>2</td>
</tr>
<tr>
<td>IC50401</td>
<td>CVV – I</td>
<td>Oral</td>
<td>- - - - - - 100</td>
<td>- - 2</td>
<td>2</td>
</tr>
<tr>
<td>IC57301</td>
<td>Semester Project – I</td>
<td>Project</td>
<td>6 - - - - 100</td>
<td>- - 2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15 12</td>
<td>25</td>
<td>&lt;</td>
</tr>
</tbody>
</table>
### Semester II

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Type</th>
<th>Teaching Scheme</th>
<th>Assessment Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>P</td>
<td>ISA</td>
</tr>
<tr>
<td>IC50102</td>
<td>Probability and Linear Algebra</td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IC50104</td>
<td>Instrumentation System Design</td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IC50106</td>
<td>Advanced Process Control</td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Department Elective–III #</td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Department Elective–IV †</td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IC50302</td>
<td>PG Lab – II</td>
<td>Lab</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>IC57302</td>
<td>Technical Seminar – I</td>
<td>Lab</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>IC50402</td>
<td>CVV – II</td>
<td>Lab</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>IC57304</td>
<td>Semester Project –II</td>
<td>Project</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

# Department Elective – III

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Type</th>
<th>Teaching Scheme</th>
<th>Assessment Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC52102</td>
<td>Modeling and Simulation</td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IC52104</td>
<td>Embedded Systems</td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† Department Elective - IV

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Type</th>
<th>Teaching Scheme</th>
<th>Assessment Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC52106</td>
<td>Digital Image Processing</td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IC52108</td>
<td>Mechatronics</td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Semester III

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Type</th>
<th>Teaching Scheme</th>
<th>Assessment Scheme</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC66102</td>
<td>Institute level Open Elective Theory</td>
<td>Theory</td>
<td>2</td>
<td>10 30 10</td>
<td>50</td>
</tr>
<tr>
<td>IC66104</td>
<td>Dept. level Open Elective: Project Engineering &amp; Management</td>
<td>Theory</td>
<td>2</td>
<td>10 30 10</td>
<td>50</td>
</tr>
<tr>
<td>IC67301</td>
<td>Dissertation Stage I Lab</td>
<td>4th</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>IC67303</td>
<td>Technical Seminar II Lab</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

# - Student is expected to work around 40 hours per week as Self Study

### Semester IV

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Type</th>
<th>Teaching Scheme</th>
<th>Assessment Scheme</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC67302</td>
<td>Dissertation Stage II Lab</td>
<td>8th</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
</tbody>
</table>

# - Student is expected to work around 40 hours per week as Self Study
## M.E. (Instrumentation & Control-Process Instrumentation)
### Syllabus with effect from Academic Year 2013-14

<table>
<thead>
<tr>
<th>Subject code</th>
<th>Subject</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC50101</td>
<td>Estimation Techniques (Theory Course)</td>
<td>07</td>
</tr>
<tr>
<td>IC50103</td>
<td>Measurement Systems (Theory Course)</td>
<td>09</td>
</tr>
<tr>
<td>IC50105</td>
<td>Process Control</td>
<td>12</td>
</tr>
<tr>
<td>IC52010</td>
<td>Department Elective I</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Modern Control Theory</td>
<td></td>
</tr>
<tr>
<td>IC52103</td>
<td>Communication Protocol</td>
<td>17</td>
</tr>
<tr>
<td>IC52105</td>
<td>Department Elective I</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Discrete Time Signal Processing</td>
<td></td>
</tr>
<tr>
<td>IC52107</td>
<td>Industrial Automation (Theory Course)</td>
<td>21</td>
</tr>
<tr>
<td>IC50301</td>
<td>LAB 1</td>
<td>24</td>
</tr>
<tr>
<td>IC50303</td>
<td>Communications And Soft Skill(Theory Course)</td>
<td></td>
</tr>
<tr>
<td>IC50401</td>
<td>CVV-I</td>
<td>25</td>
</tr>
<tr>
<td>IC57301</td>
<td>Semester Project I</td>
<td>25</td>
</tr>
</tbody>
</table>

|                |                                                            |          |
|                |                                                            |          |

### Semester II

<table>
<thead>
<tr>
<th>Subject code</th>
<th>Subject</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC50102</td>
<td>Probability and Linear Algebra(Theory Course)</td>
<td>26</td>
</tr>
<tr>
<td>IC50104</td>
<td>Instrumentation System Design (Theory Course)</td>
<td>29</td>
</tr>
<tr>
<td>IC50106</td>
<td>Advanced Process Control (Theory Course)</td>
<td>32</td>
</tr>
<tr>
<td>IC52102</td>
<td>Department Elective III</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Modeling And Simulation (Theory Course)</td>
<td></td>
</tr>
<tr>
<td>IC52104</td>
<td>Department Elective III</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Embedded Systems (Theory Course)</td>
<td></td>
</tr>
<tr>
<td>IC52106</td>
<td>Department Elective IV</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Digital Image Processing (Theory Course)</td>
<td></td>
</tr>
<tr>
<td>IC52108</td>
<td>Department Elective IV</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Mechatronics (Theory Course)</td>
<td></td>
</tr>
<tr>
<td>IC50302</td>
<td>LAB 2</td>
<td>45</td>
</tr>
<tr>
<td>IC57302</td>
<td>Technical Seminar 1</td>
<td>46</td>
</tr>
<tr>
<td>IC50402</td>
<td>CVV- II</td>
<td>47</td>
</tr>
<tr>
<td>IC57304</td>
<td>Semester Project II</td>
<td>47</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester III</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC66104</td>
<td>Project Engineering and Management (Theory Course)</td>
<td>48</td>
</tr>
<tr>
<td>IC67301</td>
<td>Dissertation Stage I</td>
<td>50</td>
</tr>
<tr>
<td>IC57302</td>
<td>Technical Seminar 2</td>
<td>51</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester IV</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC67302</td>
<td>Dissertation Stage II</td>
<td>52</td>
</tr>
</tbody>
</table>
SEMESTER I

IC50101 :: ESTIMATION TECHNIQUES

Credits: 03  Teaching Scheme: Theory 3 Hrs/Week

Unit I  (7 Hrs)
Random Variables and Distribution Functions
Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, uniform, binomial, geometric, Poisson, continuous uniform, exponential, gamma, Weibull, normal, lognormal, inverse Gaussian distributions

Unit II  (7 Hrs)
Non-parametric methods of identification
Time domain and frequency domain methods of system identification: Time response analysis and correlation analysis, frequency response analysis, Fourier analysis and spectral analysis, estimating the disturbance spectrum.

Unit III  (7 Hrs)
Parametric estimation method-I
Principles of parametric estimation methods, minimizing prediction errors, linear regressing and least squares method, Prediction error method, correlating prediction errors with past data.

Unit IV  (7 Hrs)
Parametric estimation method-II
Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions, problems.
Unit V

Integral Transforms

Generalized transforms, orthogonality, 1D and 2D transforms like Fourier, DCT, Wavelet and their properties

Unit VI

Case studies

Text Books:


Reference Books:

Objectives: Upon completion of this course, student should be able to:

i. To impart knowledge about the principles and analysis of sensors.
ii. Discussion of errors and error analysis.
iii. Emphasis on characteristics and response of transducers.

Course Outcomes:

i. Student can model the sensor and find out its response
ii. Students can carry out analysis of a sensor
iii. Student learn Real time interfacing of sensor

Unit I

Measurements and Measurement system

Measurement system Architecture: primary sensing element, variable conversion element, data presentation element, types of inputs, sensor dynamics, and static characteristics: static calibration, dynamic characteristics of sensor and system performance, errors in measurement and their statistical analysis, Units and standards.

Unit II

Mathematical model of Measurement system

Generalized mathematical model of Measurement system: Zero, I and II order electrical and non electrical system and its Response to impulse, step, ramp and sinusoidal input, Mechanical Translational and rotational system, Thermal system, Liquid level system, Pneumatic system
Unit III  
(7 Hrs)

Basic Measuring Sensor Dynamics

Mathematical model of variable resistive transducers: Potentiometer loading effect, Strain gauge analysis, Mathematical model of variable inductive transducers and its circuit analysis, methods of null reduction, Demodulation and filtering, Filter frequency response, Variable capacitive transducers: Capacitive pickups, its model, Feedback type capacitor pickups, Capacitive transducer signal processing, Piezoelectric transducers: Its equivalent circuit, its pulse response, methods to increase time constant magnetostrictive transducers, Displacement to pressure system (Flapper and nozzle system)

Unit IV  
(7 Hrs)

Process Measuring Sensor Dynamics I

Mathematical modeling and designing of flow measuring device: Hot wire and Hot Film anemometer: Energy balance equation, Dynamic compensation, Mathematical model building for Constant temperature anemometer and its calibration technique, Pitot tube, Magnetic Flow meter, Mathematical Modeling development of Mass and density flow meter. Coriolis type mass flow meter orifice and Rota meter

Temperature measuring devices: Mathematical model and analysis of Bimetallic Thermometer, Pulsed thermocouple technique, high speed thermocouples, venture pneumatic pyrometer,RTD-Pulse excitation techniques, average and differential temperature sensing, Thermistor linearization network, Junction semiconductor sensor application, Radiation detector- mathematical equation for radiation sensor, measurement problems with different materials, wavelength response of pyroelectric detector and electronics, frequency response of pyroelectric detector, Unchopped and chopped Broadband Radiation thermometers and detector system
Unit V

Process Measuring Sensor Dynamics II
Pressure Measurement: Manometer dynamics, Elastic pressure pickups- Diaphragm type strain gauge pressure pickups, diffused sensor transducers and auto reference techniques, model of force balance pressure sensor, dynamic response effects of volumes and connecting tubing, Liquid system heavily and moderately damped fast acting system, Dynamic testing of pressure measuring system,
Sound Measurement: Model of a Sound level meter, Microphone response characteristic, free field and pressure response of a capacitor and moving plate microphone and associated circuit analysis, Microphone frequency response,

Unit VI

Miscellaneous Sensor Dynamics
Clean room Technology, Fiber optics sensor, Manipulating, computing, compensating devices and their model building. Introduction, motivation, features, of Smart Sensor System Components, Sensor System Examples, Definition, Importance and Adoption of Smart Sensor, General Architecture of smart sensor, different smart sensors advantages and limitations of smart sensors, smart sensors’ capabilities.

Total Contact Hours: 42

Text Books:

Reference Books:
2. D. Patranabis “Principles of Industrial Instrumentation”
Title: Syllabus Format – PG Courses

Credits: 03

Teaching Scheme: Theory 3 Hrs/Week

Objectives: Upon completion of this course, student should be able to:

i. Understand various process model
ii. Understand process control
iii. Control system analysis and design

Course Outcomes:

i. Ability to develop mathematical and transfer function models
ii. Ability to empirically determine process dynamics for step response data and frequency response data
iii. Familiarity with different types of PID feedback controllers
iv. Ability to design feed forward control, cascade control
v. Ability to understand multivariable systems

Unit I  (7 Hrs)

Fundamentals of Process Control

Elements of process control loop, Process Characteristics and their significance. Process gain, Process reaction curve, process time constant, step analysis method, finding time constant, dead time.

Unit II

Feedback Controller Tuning

Types of Controllers, Tuning methods, Selection of controller for specific application, Controller settings- evaluation criteria – 1/4th decay ratio, IEA, ISE, ITAE - determination of optimum settings for mathematically described process using time response and frequency response.

Unit III

Stability Analysis and Performance of Feedback Control systems

Concept of stability, Stability analysis of linear and linearised systems, principles, Bode Method, Controller tuning based on stability
Control Performance via closed loop frequency Response, Control system factors influencing control Performance

Unit IV

Control strategies

Multi loop process control systems, Feedback-feed forward control, Cascade Control, Ratio Control, Selective Control, and Split-range Control with industrial applications

Unit V

Analysis of Multivariable Systems

Process Interaction, Effects of Interaction, Block representation and transfer function matrix interaction, relative gain array, resiliency, Morari resiliency index, Niederlinsky index

Unit VI

Multivariable Control

Singular Value Analysis, Selection of manipulated and Controlled Variables, Tuning of multiloop PID control systems, Decoupling and Multivariable control Strategies

Total Contact Hours : 42

Text Books:


Reference Books:

2. “Chemical Process Control”, Stephanopoulos George, PHI.
DEPARTMENT ELECTIVE I

IC 52010: MODERN CONTROL THEORY

| Credits: 03 | Teaching Scheme: Theory 3 Hrs/Week |

Objectives: Upon completion of this course, student should be able to know:

i. Give a deeper introduction to state-space representation of control systems, particularly for single input single output (SISO) linear systems.

ii. Help students to understand the importance of the system state.

iii. Familiarize students with the stability, controllability, and observability concept for linear systems.

iv. Design controllers using state space design methods.

v. Evaluate the performance of control systems under different conditions

Course Outcomes: At the end of the course student should be able to:

i. Demonstrate a satisfactory understanding of linear systems and the fundamental notions of controllability and observability.

ii. Demonstrate the ability to apply concepts and methods from modern control theory to design state and output feedback controllers for linear systems.

Unit I (8 Hrs)

Analysis of Control Systems in State Space

Introduction, basic materials in state space analysis, transfer matrix, State equations for dynamic systems, State equations using phase, physical and canonical variables, realization of transfer matrices, Minimal realization, Solution of state equation, concepts of controllability, reach ability, observability, Controllability and Observability tests: Kalman's test matrix, Gilbert's test.

Unit II (6 Hrs)

Design of control systems by state space methods
Introduction, Control system design via pole placement, design of state observer, design of servo systems, quadratic optimal control systems, model reference control systems.

Unit III  
(6 Hrs)  
**Discrete time control systems in state space**  
Sampling theorem, pulse transfer function, modified Z-transform, stability analysis.

Unit IV  
(8 Hrs)  
**State space analysis of discrete time multivariable systems**  
Discretization of State equations for dynamic systems, State equations using phase, physical and canonical variables, realization of transfer matrices, Minimal realization, Solution of state equation, stability.

Unit V  
(8 Hrs)  
**State Space and Matrix-Fraction Descriptions of Multivariable systems**  

Unit VI  
(6 Hrs)  
**Controller parameterization**  
Affine parameterization for stable systems, PID synthesis using affine parameterization, affine parameterization for systems with dead time. Affine parameterization of multivariable control systems.

**Total Contact Hours : 42**

**Text Books:**
Reference Books:

IC52103 :: COMMUNICATION PROTOCOL

Credits: 03  
Teaching Scheme: Theory 3 Hrs/Week

Objectives: Upon completion of this course, student should be able to:

i. To understand electronic communication systems

ii. To understand digital communication systems

iii. To understand different industrial communication protocol

Course Outcomes:

i. Know electronic communication systems

ii. Interfacing of UART for digital communication

iii. Know embedded (wire and wireless) communication protocol

iv. Know HART, Fieldbus and Profibus Communication Protocol

Unit I                                                                                                               (7 Hrs)

Basic Communication systems

Basic Communication systems: Introduction, data communication principles, Modulation: Amplitude, Frequency and Phase Modulation, PAM, PWM, PPM, ASK, FSK, PSK Modulation

Multiplexing: FDM, TDM

Transmission Media: Guided and Unguided Media, Performance

Unit II                                                                                                               (7 Hrs)

Digital Data communications

communication modes, asynchronous and synchronous communication, UART


Introduction to TCP/IP, SMTP, HTTP, UTP, and OPC.

Unit III (7 Hrs)

**Wireless Communication protocol**

Study of different OSI layers, packet formation, Error correction, Interfacing and applications of IrDA, Bluetooth, ZigBee, IEEE802.11, IEEE802.16, Study of GSM and GPRS network

Unit IV (7 Hrs)

**Serial Communication protocol I**

Study of different OSI layers, packet formation, Error correction, Interfacing and applications of MODBUS, SPI, I2C

Unit V (7 Hrs)

**Serial Communication protocol II**

Study of different OSI layers, packet formation, Error correction, Interfacing and applications of CAN, Ethernet IP, HART

Unit VI (7 Hrs)

**Foundation Field bus and Profibus**

Study of different OSI layers, packet formation, Error correction, Interfacing and applications of Foundation Field bus Protocol and Profibus communication protocol.

**Total Contact Hours : 42**

**Text Books:**

2. "Practical Data Communications for Instrumentation and Control" John Park, Steve Mackay, Edwin Wright, Elsevier Publications.

**Reference Books:**


DEPARTMENT ELECTIVE II

52105 :: DISCRETE TIME SIGNAL PROCESSING

Objectives: Upon completion of this course, student should be able to:

i. Provide a thorough understanding of design, implementation, analysis and comparison of digital filters and applications of signal processing.

ii. Understand transforms and its significance in signal analysis.

iii. Provide insight to multirate signal processing.

Course Outcomes:

i. Design digital filters required for a typical application.

ii. Effectively apply transforms for analysis of signals.

iii. Apply concepts of multirate signal processing for system design.

Unit I
Discrete Time signals
(7 Hrs)
Sequences, representation of signals on orthogonal basis. Sampling and Reconstruction of signals, Correlation of discrete time signals and applications.

Unit II
Discrete systems
(7 Hrs)
Attributes, Z transforms, analysis of LSI systems, Frequency analysis, Inverse systems,
Discrete Fourier Transform, Fast Fourier transform algorithm, Implementation of Discrete time systems.

Unit III
Design of FIR digital Filters (7 Hrs)
Asymmetric and Symmetric FIR filters, Linear phase filters, Least Square method, Park McClellan's method. Effect of finite register length in FIR filter design.

Unit IV

Design of IIR digital Filters (7 Hrs)
Butterworth, Chebyshev and Elliptic Approximations; Low pass, Band pass, Band stop and High pass filters

Unit V

Multirate Digital Signal Processing (7 Hrs)
Introduction to multirate signal processing, Decimation factor, Interpolation factor, Filter design and implementation for sampling rate conversion, Multistage implementation, applications of multirate signal processing.

Unit VI

Application of DTSP (7 Hrs)
Application of DSP to Speech processing, meteorological measurements, active noise cancellation, vibration etc

Text Books:

Reference Books:
Title: Syllabus Format – PG Courses

IC52107 :: INDUSTRIAL AUTOMATION

Credits: 03
Teaching Scheme: Theory 3 Hrs/Week

Objectives: Upon completion of this course, student should be able to:

i. Know the architecture and operation of various automation tools.

ii. Design automation strategy for industrial applications.

iii. Prepare various documents required for any automation projects.

Course Outcomes:

i. Ability to select suitable component for given applications, built suitable control strategy for application.

ii. Ability to understand the elements of building automation and application in Social, Environmental, and Industrial areas.

iii. Information/Knowledge gained by the students towards the confidence of engineering of various aspects of projects during the course of their professional activities.

Unit I

Introduction to Industrial Automation and control devices


Industrial control devices: Construction, working and applications of different types of switches, relay and contactors, fundamentals of electrical wiring diagrams. Development of wiring diagram for given application using above components.

Unit II

Programmable Logic Controller

Unit III
PLC Programming
(7 Hrs)
Development of Relay Logic Ladder Diagram, Introduction to PLC Programming, Programming devices and languages as per IEC 61131-3 like IL, ST, FBD, CFC, SFC, PLC Timers and Counters. Advanced PLC instructions like, Program control, comparison, mathematical, logical, communication, shift registers, sequencers, data handling, advanced mathematical, PID Control using PLC, PID instruction, PID for temperature control loop.

Unit IV
Distributed control system
(7 Hrs)
DCS Introduction, Location of DCS in Plant, functions, advantages and limitations, Comparison of DCS with PLC, DCS components/ block diagram, Architecture, Functional requirements at each level, Database management.
Layout of DCS, Controller Details, Redundancy, I/O Card Details, Junction Box and Marshalling Cabinets, Operator Interface, Workstation Layout, different types of control panels, types of Operating Station, Programming as per IEC 61131-3, Advantages, Overview of Programming Languages, Device Signal Tags, Configuration, Programming for Live Process, Selection of DCS, DCS plant layout.

Unit V
Introduction to SCADA and HMI
(7 Hrs)
SCADA Concept of SCADA systems, Programming techniques for : Creation of pages, Sequencing of pages, Creating graphics & animation, Dynamos programming with variables, Trending, Historical data storage & Reporting, Alarm management, reporting
of events and parameters. HMI types, Interfacing with PLC.

Unit VI

(7 Hrs)

Introduction of building automation


Total Contact Hours : 42

Text Books:


Reference Books:

<table>
<thead>
<tr>
<th>Title : Syllabus Format – PG Courses</th>
<th>FF No. : 658</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC:50301 LAB 1</td>
<td></td>
</tr>
<tr>
<td>Credits: 01</td>
<td>Teaching Scheme: Laboratory 04 Hrs/Week</td>
</tr>
</tbody>
</table>

Objectives:

i. Formulate Hypothesis  
ii. To have direct hands-on experience on state of the art software and the hardware design tools.  
iii. To study, formulation and implementation of prerequisite problems of main project  
iv. To develop and design simple experiments/experimental set ups of undergraduate courses

Course Outcomes:

i. Understanding the basics of state-of-art software and hardware tools and its usability.  
ii. Capable of developing small projects proving the basic concepts  
iii. Able to teach, develop experiments and share his knowledge and competency with others  
iv. Capable of pursuing research in domain of Instrumentation and Control engineering

List Of Experiments:

i. Getting familiarize about the facilities available in the laboratory.  
ii. Design, implement and verify the results of various experiments as per the suggestions of laboratory instructor.  
iii. Devise, suggest and implement innovative experiments in the laboratory.  
iv. Suggest and provide solutions for upgrading the laboratory facilities.

| Total Contact Hours | 56 |
A comprehensive viva-voce will ordinarily be held immediately after the end of first semester examination. The oral examination will carry 2 (two) credits and cover the entire course of study during the first semester. The viva voce will be conducted by a committee of examiners (internal and external).

IC: 57301 SEMESTER PROJECT - I

| Credits: 01 |
|-------------|----------------|

Teaching Scheme: Laboratory 02 Hrs/Week

The objectives behind the Mini Project are:
1. Scope for creativity
2. Hands on experience
3. Academic occupancy

Mini Project will be based on all subjects of that Semester.

1. The Semester Mini Project will be for a group of 3 to 5 students. Head of Department to appoint Mini Project Guides, 2 credits will be awarded to the candidate after the viva voce and project demonstration at the End of Semester.
2. Group formation, discussion with faculty advisor, formation of the Semester Mini Project statement, resource requirement, if any should be carried out in the earlier part of the Semester. The students are expected to utilize the laboratory resources before or after their contact hours as per the prescribed module.

The Assessment Scheme will be:
(a) Continuous Assessment 50 marks
(b) End Semester 50 marks

Total Contact Hours: 28
SEMESTER II

IC 50102 ::  Probability and Linear Algebra

Credits: 03  Teaching Scheme: Theory 3 Hrs/Week

Objectives: This module is about the understanding and application of fundamental techniques involved in the analysis of engineering systems. This aims to equip the students with mathematics needed to analyze and solve a range of engineering problems with focus on conceptual understanding.

Course Outcomes: By the end of the module students will be expected to

i. Solve systems of linear equations.

ii. Be acquainted with the notions of vector spaces and transforms.

iii. Be comfortable with the basic concepts and methods of probability and statistics.

Unit1:                           (7 Hrs)

Matrices and Gaussian Elimination

System of Linear Equations, the geometry of linear equations, Matrix notation of linear system, Gaussian elimination, Matrix inversion, Orthogonal, Hermitian, Unitary matrices.

Unit2:                           (7 Hrs)

Vector Spaces and Transformation

Vector Spaces and subspaces. Function spaces. Linear independence, Basis and Dimension. Inner product spaces, projection, least square, orthogonal basis, Gram Schmidt Orthogonalization process.
Unit3: (7 Hrs)

Eigen Values and EigenVectors

Eigen values and Eigenvectors, Eigenbases, Diagonalization. Quadratic Forms, positive definite matrix and its applications, spectral theorem.

Unit-4 (7 Hrs)

Discrete and continuous random variables


Unit-5: (7 Hrs)

Moments and Expectation for multiple Random Variables

Discrete and continuous bivariate random variables, joint and marginal probability distributions. Moments and Expectation based on multiple Random Variables, Moment Generating Functions. Transform Methods, Moments and Transforms of discrete and continuous distributions.

Unit-6: (7 Hrs)

Sampling theory and Statistical Hypothesis testing

Sampling Theory, Population and sample, sampling distribution of Sample mean (σ known and unknown), central limit theorem, Chi-square, t-distribution and F-distribution, Biased and unbiased estimation, point and interval estimates, statistical hypothesis, tests of hypothesis, one tailed and two tailed tests, type I and type II errors, level of significance, P value approach. Chi square test for goodness of fit.

| Total Contact Hours: 42 |

Text Books:

1. Strang G., "Linear Algebra And Its Applications". Thomson Brooks,
Australia, 1998.


Reference Books:


IC50104 :: INSTRUMENTATION SYSTEM DESIGN

Credits: 03

Teaching Scheme: Theory 3 Hrs/Week

Objectives: Upon completion of this course, student should be able to know:

i. Instruments specification and selection criteria
ii. Designing of signal conditioning circuits.
iii. Various types of instrument testing methods.
iv. Reliability engineering.

Course Outcomes:

i. Ability to select suitable instruments for given applications.
ii. Ability to Design signal conditioning circuit for given application.
iii. Knowledge of measurement system design.
iv. Designing of instruments for higher reliability.

Unit I (8 Hrs)

Instruments specification and selection criteria:

Review of various static and dynamic characteristics of instruments. Specifications of various process instruments such as flow meters, Level meters, PH meters, temperature indicators, such as speed, position, weight etc. Selection criteria for the above instruments.

Unit II (8 Hrs)

Design of signal conditioning circuits:

Requirements of signal conditioning. Design of signal amplifiers such as preamplifiers, instrumentation amplifiers bridge amplifiers, isolation amplifiers etc. Signal conditioning of thermocouples, RTDs, thermistors, strain gauge bridge, piezo sensors, PH probes, LVDT, photo diode, linear hall effect sensors, humidity sensors and biomedical signals.
Unit III  

ICs for instrumentation Applications:
Study and designing of signal conditioning circuits using precision operational amplifier ICs such as AD620, AD524 and others. Sample and hold ICs. Thermocouple signal conditioning using AD594 series ICs. Voltage to current converter ICs. XTR110, Isolation amplifier IC HCNR200 and applications. Analog to digital converters ICs, specifications and selection.

Unit IV  

Enclosures design and selection:
Functions of enclosures, materials for enclosure design, various types Enclosure types such as MEMA, DIN types of enclosures. IPxx types of enclosures. Enclosure selection criteria.

Unit V  

Testing of measuring instruments:
Various types of testing for measuring instruments. Environmental tests such as temperature, dust, humidity and others. Mechanical testing such as shock, vibration, jurk, impact etc. EMI and EMC testing such as ESD, noise susceptibility, transients etc.

Unit VI  

Reliability Engineering:
Definition, quality and reliability, causes of failures and unreliability, Types of failures, bath tub curve, Maintainability and availability. MTTF, MTBF etc. Designing for higher reliability and redundancy techniques.

Total Contact Hours: 42

Text Books:
1. “Instrumentation Devices and Systems”, Rangan, Sharma, Mani. Tata
3. "Design with Operational Amplifiers and Integrated Circuits.", Sergio
   Franco, Tata McGraw Hill
4. "Electronic Instruments and Instrumentation Technology.", M M S Anand,
   Prentice Hall of India.

Reference Books / :

1. "Instrument engineers Hand Book (Process measurement)", Bela Liptak
   CRC Press.
2. Related applications notes form: Texas Instruments, Analog Devices
   Intersil Corporation, Fairchild semiconductor etc.
IC50106 :: ADVANCED PROCESS CONTROL

Credits: 03  
Teaching Scheme: Theory 3 Hrs/Week

Objectives: Upon completion of this course, student should be able to:

i. Understand various advanced control strategies

ii. Select appropriate control technologies for various applications

Course Outcomes:

i. Ability to select suitable component for given applications, built suitable control strategy for application.

ii. Ability to understand the elements of process and application in Social, Environmental, and Industrial areas.

iii. Information/Knowledge gained by the students towards the confidence of engineering of various aspects of projects during the course of their professional activities.

Unit I (7 Hrs)
Review of some common loops
Development of control loops, Design aspects and selection criterion for field instruments, instrumentation scheme for Boiler, Heat Exchanger, Evaporator, Dryer

Unit II (7 Hrs)
System Identification
Models for linear time varying systems and time varying and non linear systems, examples of models.

Unit III (7 Hrs)
Model Predictive Control
Differences from Other Controllers, Types Basic concept of MPC, Dynamic Matrix Control, Quadratic DMC, Limitations of MPC, Advantages of MPC, Industrial MPC applications
Unit IV  
**Adaptive control system**  
Introduction, Standard approaches, Self adaptive systems, Predictive approach, adaptive control by parameter estimation

Unit V  
**Fuzzy Logic and Neural Networks in Control applications**  
Introduction, Definitions, Considerations for design of controller based on fuzzy logic and neural networks, Design of PI controller using fuzzy logic for Process Control application, Case studies

Unit VI  
**Statistical Process Control**  
Introduction, Statistical distribution, Control charts, data collection and recording, Control chart analysis, Case studies in Chemical and Pulp and Paper industry

---

**Total Contact Hours : 42**

**Text Books:**

3. “Tuning of Industrial Control Systems”, A. B. Corripio, ISA
5. “Statistical Process Control”, C. L. Mamzic, ISA

**Reference Books:**

2. “Chemical Process Control”, Stephanopoulos George, PHI.
Title: Syllabus Format – PG Courses

DEPARTMENT ELECTIVE III
IC 52102:: MODELING AND SIMULATION

Credits: 03  Teaching Scheme: Theory 3 Hrs/Week

Objectives: Upon completion of this course, student should be able to know:

i. Explain the benefits of modeling and simulation in a important application area such as process control.

ii. Demonstrate the ability to apply the techniques of modeling and simulation to a range of chemical and physical systems.

iii. To provide basic mathematical tools needed for modeling, simulation of chemical and physical systems.

iv. Computational process analysis using simulation is emphasized.

v. The course also provides an increased understanding and proficiency in process control.

Course Outcomes: At the end of the course student should be able to:

i. Ability to find mathematical models of chemical and physical systems.

ii. Ability to simulate chemical and physical systems using numerical methods for analysis purpose.

iii. Understand the concepts of modeling and simulation of dynamic systems

Unit I (8 Hrs)

Mathematical models of Chemical systems


Unit II (8 Hrs)

Mathematical models of Physical systems

Modeling of first, second and higher order electrical, mechanical systems in differential equation, transfer function and state space representation. Modeling of armature controlled and field controlled D. C. motor. Modeling of level control system, gravity flow tank, pneumatic systems

Unit III
Computational methods for differential equations
Solution of differential equations: Euler method modified Euler method, Runge Kutta

Unit IV
Computational methods for solving algebraic equations and curve fitting:
Solution of algebraic equations: Interval halving method, Newton Raphson method
Curve fitting: Lagrange interpolation method and least square method.

Unit V
Computer simulation of physical systems
Simulation of First and second order electrical/mechanical systems, field controlled and armature controlled D. C. motors, liquid level control system.

Unit VI
Computer simulation of chemical systems
Simulation of gravity flow tank, three isothermal CSTRs in series, non-isothermal CSTR, batch reactor, ideal binary distillation column.

Total Contact Hours: 42

Text Books:

Reference Books:


IC52104 :: EMBEDDED SYSTEMS

Credits: 03  
Teaching Scheme: Theory 3 Hrs/Week

Objectives: Upon completion of this course, student should be able to:

i. Know the architecture and operation of 8/16/32 bit microcontrollers.
ii. Design embedded system for industrial applications.
iii. Prepare algorithm for embedded system for industrial applications.

Course Outcomes:

i. Ability to select suitable microcontroller for a given application.

ii. Ability to select suitable embedded system components like memory, ADC DAC, communication port etc for a given application.

iii. Ability to design an algorithm for a given application

Unit I  
(7 Hrs)

Embedded Systems Introduction

History, design challenges, optimizing design metrics, time to market, NRE and unit cost design metrics, applications of embedded system and recent trends in embedded systems.

System and Processor Architecture: Hardware and software architecture, processor selection for embedded system, memory and I/O devices, 8 bit microcontroller – 8051 and I/O interfacing, Comparison between 8/16/32 bit microcontrollers

Unit II  
(7 Hrs)

ARM Architecture

Design Approaches (i) CISC (ii) RISC, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, ARM architecture - ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline Exceptions,

Interrupts and the Vector table Introduction to ARM 7/ ARM 9 and ARM extensions, Architecture of ARM7TDMI processor, Introduction to ARM Instruction Set, Assembly language programming, JTAG, Introduction to Thumb Instruction Set: Introduction to ARM Thumb, Thumb Programmers model, ARM Thumb inter working.

Unit III (7 Hrs)

ARM Processor
LPC 2148 – 32 bit ARM Microcontroller, architecture, peripherals – GPIO, Timer, I2C, USART, USB, RTC, ADC, DAC etc

Unit IV (7 Hrs)

Operating System
Operating system concept – Process management, Memory management, Interprocess communication and synchronization of process, Scheduling, device drivers for embedded systems.

Unit V (7 Hrs)

Real Time Operating System
RTOS - Architecture of kernel, Overview of Commercial RTOS like VXWorks, RTLinux, MUCOS, Software development cycle, Introduction to mobile computing.

Unit VI (7 Hrs)

Case study of embedded systems
Case study of embedded systems like digital camera, smart card and RFID. Detail study of Hardware architecture, Software architecture for above embedded systems. Introduction to DSP processor TMS320C67xx.

Text Books:
2."Embedded System Design: A Unified Hardware/Software Introduction", by Frank Vahid/ Tony Givargis, Wiley India Pvt.Ltd.
3."ARM Architecture Reference Manual"

Reference Books

Title: Syllabus Format – PG Courses

DEPARTMENT ELECTIVE IV

IC52106 : Digital Image Processing

Credits: 3  Theory: 3hrs/week

Objective: To learn and understands the fundamentals of gray scale image processing and its significance in solving the real world problems.

Unit 1: Visual preliminaries and image transformation (6 Hrs)
Introduction, brightness adaptation and contrast, activity and contour, texture and pattern discrimination.
Geometric model of an image, basic transformations, perspective projection, photometric model: intensity, transformation of energy, noise process.

Unit 2: Image Transforms (6 Hrs)
2-D Fourier transform, Discrete cosine transform, Short time Fourier transform, Gabor transform, Radon transform.

Unit 3: Image Enhancement (6 Hrs)
Contrast intensification: linear stretching, non-linear stretching, histogram specification, low contrast stretching.
Smoothing: Image averaging, mean filter, order statistics filter, edge preserving smoothing.
Sharpening: High pass filtering, homomorphic filtering.

Unit 4: Image Restoration (6 Hrs)
Minimum mean-square error restoration, least-square error restoration, constrained least-square error restoration, restoration by singular value decomposition, restoration by homomorphic filtering.

Unit 5: Image Analysis: Segmentation (6 Hrs)
Region extraction, pixel based approach: feature thresholding, optimum threshold, threshold selection methods, multilevel thresholding, and region based approach

**Unit 6: Image Analysis: Edge detection**  
(6 Hrs)

Edge detection, derivative operators: Sobel, Prewitt, Canny, second order derivative, line detection: overview of earlier work.

**Total Contact Hours : 42**

**Text/References:**

IC52108 : MECHATRONICS

Credits: 03  Teaching Scheme: Theory 3 Hrs/Week

Objectives: Upon completion of this course, student should be able to:

i. Know the architecture and operation of mechatronics.
ii. Design control strategy for mechatronics applications.
iii. Apply advanced control strategies to mechatronics applications.

Course Outcomes:

i. Ability to develop control logic for given process strategy
ii. Ability to understand instrumentation systems used in robotics applications

Unit I (7 Hrs)
Overview of Mechatronics
Introduction to mechatronics and design approach, block diagram, multidisciplinary scenario, system Interfacing, instrumentation and control systems, open loop and closed loop systems, microprocessor-based controllers and microelectronics, introduction to automation, micro- and nanotechnology

Mechanical components: springs (compression, extension, torsion, flat, leaf and motor spring), gears (spur, bevel, gear trains), mechanisms, bearings, gears, rack and pinion, ratchets, pawl, crank, sliders, cranks, cams, followers, chain and sprocket.
Mechanical components like couplings, belt, chain, pulleys, Geneva wheels, four-bar linkages.

Unit II (7 Hrs)
Hydraulic Components

Hydraulics: principle, block diagram, advantages, disadvantages, applications, hydraulic fluid properties and its selection.
Hydraulic components: hydraulic power pack, hydraulic pumps, actuator (cylinders and motors), hydraulic valves, filters, piping, heat exchangers and motors.

Hydraulic circuits: development of hydraulic circuits using standard symbols. Hydraulic circuits like meter in, meter out, reciprocating, speed control, sequencing of cylinders, direction control, deceleration, regenerative circuit, etc. troubleshooting in hydraulic circuits. Introduction to circuit design.

Unit III

Pneumatic Components

Pneumatics: principle, block diagram, advantages, disadvantages, applications.

Pneumatic components: pneumatic power Supply, types of pneumatic relay, FRL unit, pneumatic actuator (cylinders and air motors), pneumatic valves,

Pneumatic circuits: development of pneumatic circuits using standard symbols, sequence diagram (step-displacement) for implementing pneumatic circuits, different pneumatic circuits like reciprocating, sequencing, anti-cycle repetition, block transfer, speed regulation, job sorting, electro-pneumatic circuits, etc.

Fluidic elements and its applications, development of pneumatic circuits, troubleshooting in pneumatic circuits.

Unit IV

Robot Fundamental, Sensors and Actuators

Robot definition and classification, brief history of robotics, types of robots, advantages and disadvantages of robots, robot components, Robot terminologies like position, orientation, degree of freedom, configuration, workspace (reach), kinematics, dynamics, accuracy, repeatability, path, trajectory, robot joints, robot coordinates, robot reference frames, robot applications and social issues.

Robot sensors: sensor characteristics, position sensors, velocity sensors, acceleration sensors, force and pressure sensors, proximity sensors, light and infrared sensors, torque sensors, microswitches.

Robot actuators: characteristics of actuating systems, comparison of actuating systems, electric motors, microprocessor control of electric motors, magneto-strictive actuators, shape-memory type metals, speed reduction techniques.

Unit VI (7 Hrs)
Trajectory Planning
Path vs. trajectory, joint-space vs. Cartesian-space descriptions, basics of trajectory planning, joint-space trajectory planning. Cartesian-space trajectories, continuous trajectory recording. Higher order trajectories. Robot differential motions and velocities.

Total Contact Hours : 42

Text Books
2. “Pneumatic Systems: Principles and Maintenance”, Majumdar,

Reference Books
1. “Industrial Hydraulic Technology”, Parker Motion & Control, Training Department.
Title : Syllabus Format – PG Courses  

IC:  LAB 2  

Credits: 01  
Teaching Scheme: Laboratory 04 Hrs/Week

Objectives:

i. Formulate Hypothesis
ii. To have direct hands-on experience on state of the art software and the hardware design tools.
iii. To study, formulation and implementation of prerequisite problems of main project
iv. To develop and design simple experiments/ experimental set ups of undergraduate courses

Course Outcomes:

i. Understanding the basics of state-of art software and hardware tools and its usability.
ii. Capable of developing small projects proving the basic concepts
iii. Able to teach, develop experiments and share his knowledge and competency with others
iv. Capable of pursuing research in domain of Instrumentation and Control engineering

Experiments based on:

i. Getting familiarize about the facilities available in the laboratory.
ii. Design, implement and verify the results of various experiments as per the suggestions of laboratory instructor.
iii. Devise, suggest and implement innovative experiments in the laboratory.
iv. Suggest and provide solutions for upgrading the laboratory facilities.

Total Contact Hours : 56
### ICS7302: Technical Seminar 1

<table>
<thead>
<tr>
<th>Credits: 04</th>
<th>Teaching Scheme: Lab 02 Hrs/Week</th>
</tr>
</thead>
</table>

#### Objectives:

1. Understand his/her topic of interest.
2. Develop his/her oral communication and presentation skills.

The seminar should be on any topic having relevance with Instrumentation and control engineering and probably from Research Articles from reputed Journals/Conferences. The same should be decided by the student and concerned teacher (Guide).

The candidate will deliver a talk on the topic for half an hour and assessment will be made by two internal examiners, out of which one will be Guide.

1. **Review – I**: during Mid Semester Examination (Compulsory) as per the Academic Calendar.
2. **Review – II**: Before End Semester Examination (Optional)
3. For poor performing students identified by the examination panel, a second review to be taken. Review II optional for other students. For Review II, deduction of 10 marks will take place.
4. Seminar is an individual activity with separate topic and presentation.
5. Duration of presentation – 20 minutes
   Question and answer session – 10 minutes

#### Seminar Evaluation Scheme:

1. Relevance of Seminar topic – 10 marks
2. Literature review – 10 marks
3. Technical contents – 10 marks
4. Presentation – 10 marks
5. Question & answer Session – 10 marks

**Total Contact Hours**: 28
A comprehensive viva-voce will ordinarily be held immediately after the end of second semester examination. The oral examination will carry 2 (two) credits and cover the entire course of study during the second semester. The viva voce will be conducted by a committee of examiners (internal and external).

**IC: 57304 SEMESTER PROJECT II**

The objectives behind the Mini Project are:
1. Scope for creativity
2. Hands on experience
3. Academic occupancy

Mini Project will be based on all subjects of that Semester.

1. The Semester Mini Project will be for a group of 3 to 5 students. Head of Department to appoint Mini Project Guides. 2 credits will be awarded to the candidate after the viva voce and project demonstration at the End of Semester.

2. Group formation, discussion with faculty advisor, formation of the Semester Mini Project statement, resource requirement, if any should be carried out in the earlier part of the Semester. The students are expected to utilize the laboratory resources before or after their contact hours as per the prescribed module.

The Assessment Scheme will be:
(a) Continuous Assessment 50 marks
(b) End Semester 50 marks

<table>
<thead>
<tr>
<th>Total Contact Hours</th>
<th>28</th>
</tr>
</thead>
</table>
SEMESTER III

IC66104 :: PROJECT ENGINEERING AND MANAGEMENT

Credits: 02  Teaching Scheme: Theory 2 Hrs/Week

Objectives:
To impart and train the perspective engineers who would like to join the EPC contracting or designing or project enterprises organizations in respect of instrumentation engineering.

Course Outcomes:

i. Ability to know Role of Management in Instrumentation projects.

ii. Ability to prepare various engineering drawings required for any Instrumentation projects

Unit I
Concept study and definition of Project Engineering & Management
Type of Standards and its studies as applicable to instrumentation and control engineering, Basics of Project Management, Degree of Automation, Organization Structure, Interdepartmental, Inter-organizational and Multi agency interaction involved in Project and their co ordination Project statement. Methods of tagging and nomenclature scheme based on ANSI / ISA std. (S-5.1), P & ID symbols for process loops like temperature, flow, level, pressure, etc.

Unit II
Project Management
Project Management, Planning and Scheduling Life cycle phases, Statement of work (SOW), Project Specification, milestone scheduling, Work breakdown structure.
Cost and estimation: Types of estimates, pricing process, salary overheads, labor hours, materials and support costs. Program evaluation and review techniques (PERT) and Critical path method (CPM), S-curve concept and crash time concepts, software’s used in project management; software features, classification, evaluation and implementation.
Unit III

Project engineering documents, drawing and software’s

Statement of Project (SOP), Process Flow Diagram, Material Balance Diagram, Pressure and Temperature Diagram, P & I diagram, Process Data sheet, Instrument Index, Specification sheet (S-20 Format) for Local and Primary Instruments, Transmitting and Secondary instruments and Final control devices for process and analytical parameters., Plant layouts and General arrangement drawing (Plans and Elevation), Isometric of instrument piping, Cable schedules Loop wiring diagrams, Cable engineering, Cable trays, Field installation sketches, BOM and MBOM, Study of project engineering documents and software like INTools, MS-Project, Primavera

Unit IV

Procurement activities

Vendor registration, Tendering and bidding process, Bid evaluation, Pre-Qualification Evaluation of Vendor, Purchase orders, Kick-off meeting, Vendor documents, drawing and reports as necessary at above activities.

Construction activities: Site conditions and planning, Front availability, Installation and commissioning activities and documents require at this stage, Installation sketches, Contracting, Cold Commissioning and Hot commissioning, Performance trials, As-built Drawings and Documentations and final hand over. Factory Acceptance Test (FAT), Customer Acceptance Test (CAT) and Site Acceptance Test (SAT).

Total Contact Hours: 28

Text Books

2. “Management systems”, John Bacon, ISA Publications

Reference Books


The dissertation work should be chosen on the following basis:

i. Relevant to social needs of society  
ii. Relevant to value addition to existing facilities in the institute  
iii. Relevant to industry need  
iv. Problems of national importance  
v. Research and development in various domains

The student should complete the following:

i. Motivation for study and Objectives  
i. Literature survey  
iii. Problem Definition  
iv. Feasibility study  
v. Preliminary design

In the beginning of the second year semester III, student should submit synopsis of their dissertation which will include the following:

1) Area of dissertation work / Title  
2) Objectives  
3) Methodology  
4) Outcomes expected  
5) Time chart / Action plan  
6) References

Synopsis has to be signed by the respective guide and the student and is to be submitted to the PG coordinator.

A dissertation stage I report based on above work is to be submitted at the end of the semester. Evaluation of the dissertation work will be based on the presentation of the dissertation stage I work.

# - Student is expected to work around 40 hours per week as Self Study
Title: Syllabus Format – PG Courses

IC57302: Technical Seminar 2

<table>
<thead>
<tr>
<th>Credits: 04</th>
<th>Teaching Scheme: Lab 02 Hrs/Week</th>
</tr>
</thead>
</table>

**Objectives:**

1. Identify his/her research area for carrying out dissertation.
2. Complete preliminary literature survey in his/her research area.
3. Develop his/her oral communication and presentation skills.

The seminar should be on literature survey and problem identification based on dissertation topic. The same should be decided by the student and concerned Guide. The candidate will deliver a talk on the topic for half an hour and assessment will be made by two internal examiners, out of which one will be Guide.

1. **Review – I:** during Mid Semester Examination (Compulsory) as per the Academic Calendar.
2. **Review – II:** Before End Semester Examination (Optional)
3. For poor performing students identified by the examination panel, a second review to be taken. Review II optional for other students. For Review II, deduction of 10 marks will take place.
4. Seminar is an individual activity with separate topic and presentation.
5. Duration of presentation – 20 minutes
   Question and answer session – 10 minutes

**Seminar Evaluation Scheme:**

1. Relevance of Seminar topic – 10 marks
2. Literature review – 10 marks
3. Technical contents – 10 marks
4. Presentation – 10 marks
5. Question & answer Session – 10 marks

**Total Contact Hours:** 28
SEMESTER IV

IC: 67302 DISSERTATION STAGE II

Credits: 15  Teaching Scheme: Lab 08  Hrs/Week

The dissertation stage II is will be the continuation of the dissertation work started in Dissertation stage I.

The student should complete the following:
   i. Proof of concept proposed in dissertation stage I
   ii. Implementation / Experimentation / Design, fabrication, testing, and calibration of an instrumentation system
   iii. verification / Results

A dissertation report based on above work done in stage I and II is to be submitted at the end of the semester.

Pre-Dissertation Submission Guidelines

- It is expected that students shall publish at least one paper on his/her research work in National/International conference /IEEE conference or National / International Journal.
- There will be Mid Semester review of the dissertation work which will carry marks to be included in dissertation stage I and II.
- When the PG student satisfies the condition of publication of the research paper he/she is eligible to submit his/her dissertation work.
- The final decision of submission of the dissertation work solely depends on the PG committee’s satisfactory report given at the time of Pre-dissertation seminar.

# - Student is expected to work around 40 hours per week as Self Study