### DEPARTMENT ELECTIVES

<table>
<thead>
<tr>
<th>15MH316E</th>
<th>Industrial Instrumentation and Control</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
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**Co-requisite:** Nil  
**Prerequisite:** Nil  
**Data Book / Codes/Standards:** Nil  
**Course Category:** Professional Elective  
**Course designed by:** Department of Mechatronics Engineering  
**Approval:** 32nd Academic Council Meeting held on 23.07.2016.

**Purpose:** To impart the knowledge of applying the instruments in industry environment.

**Instructional Objectives**

<table>
<thead>
<tr>
<th>Instructional Objectives</th>
<th>Student Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>At the end of the course, student will be able to</td>
<td></td>
</tr>
<tr>
<td>1. Apply concepts of measurements knowledge to industrial problems.</td>
<td>a c</td>
</tr>
<tr>
<td>2. Implement process control approach in industries.</td>
<td>a e</td>
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<tr>
<td>3. Improve their ability in controlling the actuator parameters.</td>
<td>a e</td>
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<tr>
<td>4. Apply controllers concepts in real time applications.</td>
<td>a e</td>
</tr>
<tr>
<td>5. Formulate the concept of distributed control systems in industries.</td>
<td>a e</td>
</tr>
</tbody>
</table>

### Session Description of Topics

<table>
<thead>
<tr>
<th>Session</th>
<th>Description of Topics</th>
<th>Contact hours</th>
<th>C-D-I-O</th>
<th>IOs</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit I: Industrial Automation</strong></td>
<td></td>
<td>9</td>
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<tr>
<td>1. Evolution of instrumentation and control.</td>
<td>1</td>
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<tr>
<td>2. Role of automation in industry.</td>
<td>1</td>
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<td>3. Architecture of industrial automation systems.</td>
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<td>4. Need for sensors and measurement systems.</td>
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<td>5. Pressure and force measurements.</td>
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<td>6. Temperature measurement: Thermocouple and Thermistor.</td>
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<td>7. Displacement and speed measurement.</td>
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<tr>
<td>8. Measurement of level, humidity, pH.</td>
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<td>9. Need for Signal Conditioning and processing.</td>
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<td><strong>Unit II: Process Control</strong></td>
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<td>10. Process control: Introduction</td>
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<td>11. PID control: Implementation of PID controllers.</td>
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<td>12. Need for controller tuning.</td>
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<td>13. Significance of digital controllers.</td>
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<td>14. Principles of predictive control.</td>
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<td>15. Control of systems with inverse response.</td>
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<td>16. Special control structures: Concepts of cascade control.</td>
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<tr>
<td>17. Introduction of automation tools: PLC, DCS, SCADA, Hybrid DCS/PLC.</td>
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<tr>
<td><strong>Unit III: Controlling of Actuators</strong></td>
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<td>18. Control of Machine tools: Introduction, CNC Machines.</td>
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<td>19. Analysis of a control loop.</td>
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<td>20. Adjustable field drives: DC motor drive.</td>
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<td>21. Variable frequency control of induction motor drive.</td>
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<td>22. Closed loop synchronous motor drive.</td>
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<td>23. Need of proportional valve in fluid power systems.</td>
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<td>24. Need of servo valve in fluid power systems.</td>
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<td>25. PID based pneumatic controllers for positioning.</td>
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<td><strong>Unit IV: Programmable Logic Controllers</strong></td>
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<td>26. Sequence Control: Introduction.</td>
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<td>27. Need of Programmable Logic Controllers (PLC).</td>
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<td>28. Concepts of Relay Ladder Logic (RLL).</td>
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<td>29. Sequence control: Scan cycle, RLL Syntax.</td>
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<td>30. Analog control using PLC.</td>
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<td>31. Advanced RLL programming.</td>
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<td>32. PLC interfacing to SCADA/DCS using communications</td>
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Mechatronics Engineering 2015 - 16
<table>
<thead>
<tr>
<th>Session</th>
<th>Description of Topics</th>
<th>Contact hours</th>
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<th>IOs</th>
<th>Reference</th>
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<tbody>
<tr>
<td>33.</td>
<td>Need for industrial Ethernet.</td>
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<td>Advanced applications of PLC.</td>
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<td>Introduction to Distributed Control Systems (DCS).</td>
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<td>36.</td>
<td>DCS functions, advantages and limitations.</td>
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<td>DCS as an automation tool to support Enterprise Resource Planning (ERP).</td>
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<td>DCS component schematic block diagram.</td>
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<td>39.</td>
<td>Specifications involved in DCS.</td>
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<td>40.</td>
<td>Latest trends and developments.</td>
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<td>SCADA specifications for different real time applications.</td>
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<td>42.</td>
<td>Cycle test – I</td>
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<td>43.</td>
<td>Cycle test – II</td>
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<td>Surprise test / Assignment and Quiz</td>
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**Total contact hours 45**

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### Learning Resources

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<th>Sl. No.</th>
<th>Text Books</th>
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### Course nature

<table>
<thead>
<tr>
<th>Assessment Method (Weightage 100%)</th>
<th>Theory</th>
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<tbody>
<tr>
<td><strong>In-semester</strong></td>
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<tr>
<td>Assessment tool Weightage</td>
<td>Cycle test I</td>
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<td>Weightage</td>
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End semester examination Weightage: 50%