

| Course code   | Course Name   | L-T-P -Credits | Year of Introduction |
|---|---|----------------|----------------------|
| EE492   | Instrumentation Systems   | 3-0-0-3        | 2016                 |
| <b>Prerequisite: Nil</b>  |   |                |                      |
| <b>Course Objectives</b>  |   |                |                      |
| <ul style="list-style-type: none"> <li>To introduce the measurement techniques for measurement of mechanical quantities</li> <li>To introduce different types of electronic circuits for measurements and their applications.</li> </ul>  |   |                |                      |
| <b>Syllabus</b>   |   |                |                      |
| General Concepts ,Generalised Configurations and Functional Description of Measuring Instruments, Measuring Devices, Force and Torque Measurements, Shaft Power Measurements, Pressure and Sound Measurements, Dynamic Testing of Pressure-Measuring Systems, Flow Measurement, Temperature Measurement, Bridge Circuits ,Amplifiers ,Filters, Integration and Differentiation, Voltage-Indicating and Recording Devices, Electromechanical Servo type XT and XY Recorders. |   |                |                      |
| <b>Expected outcome.</b>  |   |                |                      |
| The students will have the  |   |                |                      |
| <ol style="list-style-type: none"> <li>Ability to understand and analyze Instrumentation systems.</li> <li>Ability to select proper measurement system for various applications.</li> </ol>   |   |                |                      |
| <b>Text Book:</b>   |   |                |                      |
| <ul style="list-style-type: none"> <li>Ernest O Doebelin and Dhanesh N Manik, Measurement Systems, Mc Graw Hill, 6e.</li> </ul>   |   |                |                      |
| <b>References:</b>  |   |                |                      |
| <ol style="list-style-type: none"> <li>Neubert, Instrument Transducers, Oxford University Press.</li> <li>Turner and Hill, Instrumentation for Engineers and Scientists, Oxford University Press</li> </ol>   |   |                |                      |
| <b>Course Plan</b>  |   |                |                      |
| Module  | Contents  | Hours          | Sem. Exam Marks      |
| I   | General Concepts : Need for Measurement Systems, Classification of Types of Measurements Applications<br>Generalised Configurations and Functional Description of Measuring Instruments : Functional Elements of an Instrument , Active and Passive Transducers , Analog and Digital Modes of Operation ,Null and Deflection Methods, Input-Output Configurations of Instruments and Measurement Systems  | 7              | 15%                  |
| II  | Measuring Devices :<br>Motion Measurements : Fundamental Standards, Relative Displacements : Translational and Rotational , Relative Velocity : Translational and Rotational, Relative-Acceleration Measurements<br>Force and Torque Measurements : Standards and calibration , Basic Methods of Force Measurements , Characteristics of Elastic Force Transducers ,Torque Measurement on Rotating Shafts | 7              | 15%                  |
| <b>FIRST INTERNAL EXAMINATION</b>   |   |                |                      |
| III   | Shaft Power Measurements : Shaft Power Measurements (Dynamometers ), Vibrating-Wire Force Transducers<br>Pressure and Sound Measurements: Standards and Calibration , Basic Methods of Pressure Measurements, Deadweight Gages and Manometers , Elastic Transducers, Vibrating-Cylinder and   | 7              | 15%                  |

|                                    |   |   |     |
|------------------------------------|---|---|-----|
|                                    | Other Resonant Transducers  |   |     |
| <b>IV</b>                          | Dynamic Testing of Pressure-Measuring Systems, High Pressure Measurement, Low Pressure(Vacuum) Measurement, Sound Measurements<br>Flow Measurement : Local Flow Velocity , Magnitude and Direction , Gross Volume Flow Rate   | 7 | 15% |
| <b>SECOND INTERNAL EXAMINATION</b> |   |   |     |
| <b>V</b>                           | Temperature Measurement : Standards and Calibration , Thermal-Expansion Methods ,Thermoelectric Sensors (Thermocouples ), Electric-Resistance Sensors, Junction Semiconductor Sensors ,Digital Thermometers ,Radiation Methods  | 7 | 20% |
| <b>VI</b>                          | Bridge Circuits ,Amplifiers ,Filters, Integration and Differentiation<br>Voltage-Indicating and Recording Devices : Standards and Calibration , Analog Voltmeters and Potentiometers<br>Electrical Instruments : RMS Voltmeter , Ohm Meter , Phase Meter , Q Meter<br>Digital Voltmeters and Multimeters , Signal Generation, Square Wave Generation , Electromechanical Servo type XT and XY Recorders | 7 | 20% |
| <b>END SEMESTER EXAM</b>           |   |   |     |

### QUESTION PAPER PATTERN:

Maximum Marks: 100

Exam Duration: 3Hours.

**Part A:** 8 compulsory questions.

One question from each module of Modules I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x 5)=40

**Part B:** 3 questions uniformly covering Modules I & II. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

**Part C:** 3 questions uniformly covering Modules III & IV. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

**Part D:** 3 questions uniformly covering Modules V & VI. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.