# Ch. Ranbir Singh State Institute of Engineering & Technology, Jhajjar

**DEPARTMENT OF MECHANICAL ENGINEERING**

II Yr. IV Semester (Mechanical Engineering)

### LESSON PLAN

Program : **B. Tech**

Year & Sem. :  **II / IV**

Course No : **PCC-ME-210G**

Course Title : **Instrumentation and Control**

Max Marks **: 75**

No. of Total Lecture **: 49**

Schedule : **3L+0T=3**

Lecturer : **Dr. Parveen Kumar**

**Recommended Books:**

1. Mechanical Measurements by D. S. Kumar, Kataria & Sons.
2. Instrumentation, Measurement and Analysis – B.C. Nakra and K.K. Chaudhary, TMH

**Lesson Plan:**

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| Lect. No(s) | Ref. No. | Topics to be covered |
| 1 |  | Unit I: **Measurement systems and performance** |
| 2 | 1.1 | Accuracy, Range, Resolution |
| 3 | 1.2 | Error Sources |
| 4-5 | 1.3 | Instrumentation system elements – sensors for common engineering measurements |
| 6 | 1.4 | Signal processing and conditioning |
| 7-8 | 1.5 | Typical Applications of Instrument Systems |
| 9 | 1.6 | Functional Elements of a Measurement System |
| 10 | 1.7 | Classification of Instruments |
| 11 | 1.8 | Standards and Calibration.. |
| 12 | 1.9 | Problems |
|  |  | Unit II: Transducer Elements |
| 13 | 2.1 | Introduction, Analog and Digital Transducers |
| 14 | 2.2 | Electromechanical; Potentiometric |
| 15 | 2.3 | Inductive Self Generating and Non-Self Generating Types |
| 16 | 2.4 | Electromagnetic, Electrodynamic, Eddy Current, Magnetostrictive |
| 17 | 2.5 | Variable Inductance, Linearly Variable Differential Transformer, Variable Capacitance |
| 18 | 2.6 | PiezoElectric Transducer and Associated Circuits |
| 19 | 2.7 | Unbonded and Bonded Resistance Strain Gages. Strain Gage Bridge circuits |
| 20 | 2.8 | Single Double and Four Active Arm Bridge Arrangements, Temperature Compensation, Balancing and Calibration |
| 21 | 2.9 | Ionisation Transducers, Mechano Electronic Transducers, Opto-Electrical Transducers, Photo Conductive Transducers |
| 22 | 2.10 | Photo Volatic Transducers, Digital Transducers, Frequency Domain Trans. |
| 23 | 2.11 | Vibrating String Transducer, Binary codes, Digital Encoders |
| 24 | 2.12 | Problems |
|  |  | Unit III: **Motion, Force and Torque Measurement** |
| 25 | 3.1 | Introduction, Relative motion Measuring Devices |
| 26 | 3.2 | Electromechanical, Optical, Photo Electric, Moire-Fringe, Pneumatic |
| 27 | 3.3 | Absolute Motion Devices, Seismic Devices, Spring Mass & Force Balance Type |
| 28 | 3.4 | Calibration, Hydraulic Load Cell, Pneumatic Load Cell |
| 29 | 3.5 | Elastic Force Devices, Separation of Force Components |
| 30-31 | 3.6 | Electro Mechanical Methods, Strain Gage, Torque Transducer, Toque Meter |
| 32 | 3.7 | Amplifiers, Mechanical, Hydraulic |
| 33 | 3.8 | Pneumatic, Optical, Electrical Amplifying elements |
| 34 | 3.9 | Compensators |
| 35 | 3.10 | Differentiating and Integrating Elements, |
| 36 | 3.11 | Problems |
|  |  | Unit IV: **Pressure and Flow Measurement** |
| 37-38 | 4.1 | Moderate Pressure Measurement, Monometers, Elastic Transducer |
| 39 | 4.2 | Dynamic Effects of Connecting Tubing, High Pressure Transducer |  |
| 40 | 4.3 | Low Pressure Measurement, Calibration and Testing |
| 41 | 4.4 | Quantity Meters, Positive Displacement Meters |
| 42 | 4.5 | Flow Rate Meters, Variable Head Meters, Variable Area Meters |
| 43 | 4.6 | Rotameters, Pitot-Static Tube Meter, Drag Force Flow Meter |
| 44 | 4.7 | Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter |
| 45 | 4.8 | Solid Rod Thermometer, Bimetallic Thermometer |
| 46 | 4.9 | Liquid-in-Glass thermometer, Pressure Thermometer, |
| 47 | 4.10 | Semiconductor Resistance Sensors (Thermistors), Thermo–Electric Sensors, Thermocouple Materials, Electrical Resistance Thermometers |
| 48 | 4.11 | Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer |
| 49 | 4.12 | Problems |

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| Week | Exp. No. | Practical Topics to be covered |
| 1st | 1 | To study various types of measurement Error |
| 2nd | 2 | Vibration measurement |
| 3rd | 3 | To Study various Temperature Measuring Instruments  (a). Mercury – in glass thermometer  (b). Thermocouple |
| 4th | 4 | To study the working of Bourdon Pressure Gauge and to check the calibration of the gauge in a dead-weight pressure gauge calibration set up. |
| 5th | 5 | To study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure a small displacement. |
| 6th | 6 | To measure torque of a rotating shaft using torsion meter/strain gauge torque transducer |
| 7th | 7 | To measure the speed of a motor shaft with the help of non-contact type pick-ups (magnetic or photoelectric) |
| 8th | 8 | To measure the stress & strain using strain gauges mounted on simply supported beam/cantilever beam |
| 9th | 9 | To measure static/dynamic pressure of fluid in pipe/tube using pressure transducer/pressure cell |
| 10th | 10 | To test experimental data for Normal Distribution using Chi Square test |

**(Dr. Parveen Kumar)**

Department of ME

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