## Information :

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| **Course Code :** | MPR 321 | **Level** | : | Undergraduate | **Course Hours :** 2.00- Hours |

| **Department :** | Department of Mechanical Engineering |
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### Instructor Information :

| Title | Name | Office hours |
|---|---|---|
| Professor | Abdelaziz Morgan Abdelaziz Ahmed | 5 |
| Teaching Assistant | Eman Mohamed Hammad Ahmed | 2 |

### Area Of Study :

This course aims to:
˝Enrich the student's basic theoretical knowledge about the measurement systems.
˝Explain the difference between static and dynamic performance of a measuring instrument.
˝Train students to build and test measuring sensors.

### Course outcomes :

**a.Knowledge and Understanding: :**

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| 1 - | Explain the static and dynamic performance of a measuring instrument. |
| 2 - | Describe various measuring instruments of displacement, pressure, temperature and flow rate. |
| 3 - | Explain different techniques employed by different instruments. |

**b.Intellectual Skills: :**

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| 1 - | Evaluate uncertainty in a measured value for a set of data points. |
| 2 - | Derive the governing equations measuring instruments. |
| 3 - | Analyze the various operations of measurement instruments. |

**c.Professional and Practical Skills: :**

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| 1 - | Construct the circuits of various sensors. |
| 2 - | Calibrate different sensors. |

**d.General and Transferable Skills: :**

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| 1 - | Work coherently and successfully as a part of a team in experiments. |
| 2 - | Write reports in accordance with the standard scientific guidelines. |

## Course Topic And Contents :

| Topic | No. of hours | Lecture | Tutorial / Practical |
|---|---|---|---|
| Basic concepts of measuring instruments: -static performance; accuracy, precision, sensitivity, resolution, threshold, hysteresis. -Generalized measurement system. -Impedance matching. | 3 | 2 | 1 |
| Dynamic performance: Zero order, first order, second order systems. | 3 | 2 | 1 |
| Analysis of experimental data: Type of errors, error analysis, standard deviation, Chauvenet's criterion for rejecting a reading, method of least squares fitting. | 7 | 6 | 1 |
| Displacement transducers: LVDT, capacitive transducers, digital transducers. | 4 | 3 | 1 |
| Pressure measurements: inclined manometers, Burdon tube gauges, dead weight tester, variable reluctance diaphragm, LVDT diaphragm | 4 | 3 | 1 |
| Flow measurements: -Positive displacement methods; rotary, lobed impeller, Turbine. -Rotameter, magnetic, Pitot tube, hot wire.- Obstruction methods: Nozzle, venturi, orifice. | 6 | 4 | 2 |
| Temperature measurements: -Mechanical sensors; liquid in glass thermometer. -Electrical sensors; thermocouples, resistance, optical sensors | 5 | 4 | 1 |
| Force sensors: Load cell, strain gauges | 9 | 6 | 2 |
| Lab: Dynamic performance of first order system using RC circuit -Level measurement using capacitance transducer . Speed measurement using infrared encoder | 5 | | 5 |

## Teaching And Learning Methodologies :

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| Interactive Lecturing |
| Problem based learning |
| Discussion |
| Experimental learning |
| Project based learning |
| Research |

## Course Assessment :

| Methods of assessment | Relative weight % | Week No | Assess What |
|---|---|---|---|
| Assignment | 5.00 | 11 | |
| Final Exam | 40.00 | 16 | Written |
| Lab Exper. | 10.00 | 9 | Lab. Report |
| Mid- Exam 1I | 15.00 | 11 | Written Exam |
| Mid- Exam I | 15.00 | 6 | Written Exam |
| Participation | 5.00 | 15 | |
| Project B.L. | 5.00 | 12 | Written |
| Quizzes | 5.00 | 7 | Progress marks for Tutorial |

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**Recommended books :**

Doebelin, Erest O. ," Measurements Systems Application and Design", McGraw Hill, 1990.