

# Engineering Measurements

## Undergraduate 2 credit course in Polymer Engineering curriculum

### Amirkabir University of Technology

**Chapter 1: Principles of measurement** (description of measurement and instrumentation, measurement system applications, Instrument types and performance characteristics, choosing an appropriate instrument, measuring units, developed measuring systems).

**Chapter 2: Data analysis and interpretation** (important terms (uncertainty, calibration, precision, accuracy, sensitivity and...), statistical characteristics calculation, error analysis, histogram and normal distribution, curve fitting and graphical analysis, correlation factor).

**Chapter 3: Pressure measurement** (definitions and units, manometers, load balancing pressure gauges (diaphragms, bellows, Burdon), dead weight gauge, electrical pressure gauges (pirani, Knudsen, thermocouples, strain gages), ionization gauges, and the other types).

**Chapter 4: Flow meters** (positive displacement methods, open channels, head and area flow meters, pitot tube, non-mechanical flow meters (magnetic, hot wire, strain gauge, turbine, dupler and.. ), mass flow meters (conveyor, coriolis, thermal).

**Chapter 5: Level meters** (direct methods (gage glass, float, displacement method, thermal method...), indirect methods, electrical methods, sound wave, radioactive based and etc.

**Chapter 6: Viscosity measurement** (definitions and units, viscometers for Newtonian materials (Ostwald, Ubbelohde, Saybolt, capillary, rotameter), viscometers for non-Newtonian viscose materials (falling body, Brookfield, Stormer and ... ), viscometers for the melt state of polymers (Money, ODR, MDR, RMS, RPA, MFI, Capillary and ..)

**Chapter 7: Temperature measurement** (principle and units, standard points, errors, thermal expansion methods (liquid in glass, vapor and gas pressure, and bimetal), electrical methods (resistance thermometers, thermoelectric effects, thermocouples), other methods (optical pyrometer, radiation pyrometers, and..).

#### References:

1. S. Morris, "Principles of measurement and instrumentation" Butterworth-Heinemann, Oxford, 2001.
2. J. Holman, "Experimental methods for engineers", 8<sup>th</sup> ed, McGraw-Hill, 2011.
3. W. Boyes, "Instrumentation reference book". 4<sup>th</sup> ed, Elsevier, 2010.
4. T.A. Polak C. Pande, "Engineering Measurements: Methods and Intrinsic Errors" Wiley, 1999.
5. P. F Dunn, M. P. Davis, "Measurement and Data Analysis for Engineering and Science", 4<sup>th</sup> ed, CRC Press, 2017.