

GUJARAT TECHNOLOGICAL UNIVERSITY

Diploma in Instrumentation & Control Engineering

Semester: V

Subject Name: **Analytical Instrumentation**

Sr. No.	Course Content
1.	<p>Analysis Using Different Properties :</p> <p>1.1 Analysis Using Mechanical Properties</p> <p>1.1.1 Viscosity</p> <ul style="list-style-type: none"> • Definitions • Viscometers : Efflux Cup Type ,Say bolt, Ford cup, Zahn Cup, Automatic Efflux Cup, Diff. Pressure Type, Magnetically Coupled Type. <p>1.1.2 Density and specific gravity</p> <ul style="list-style-type: none"> • Definitions • Displacement type density meter, • Buoyancy effect densitometer, Radio active densitometer. • Vibrating U Tube type, Oscillating Coriolis Type, Liquid Densitometer, • Straight Tube Pneumatic Densitometer, • Thermal conductivity type Densitometer <p>1.2 Analysis Using Thermal Properties</p> <ul style="list-style-type: none"> • Thermal conductivity analysis • Construction of hotwire thermal conductivity cell <p>1.3 Analysis Using Electrical Properties :</p> <p>1.3.1 pH analysers</p> <ul style="list-style-type: none"> • Introduction of pH • Principles of pH measurement • Electrodes of pH measurement • Construction and Working of pH meters <p>1.3.2 Conductivity analyser</p> <ul style="list-style-type: none"> • Introduction and applications • Methods of Measurement of Conductance : Null method and Direct reading method • Conductivity cell • Temperature compensation in Conductivity Measurement <p>1.4 Analysis Using Radiant Energy Property :</p> <ul style="list-style-type: none"> • X-Ray techniques of analysis by diffraction method. • Geiger Muller (G.M.) counter and its measuring circuit.
2.	<p>O2 Analyzer</p> <ul style="list-style-type: none"> • Heat of reaction method, oxygen analyser. • Paramagnetic O2 analyzer
3.	<p>Polarography</p> <ul style="list-style-type: none"> • Types & Theory of polarography
4.	<p>Flourescence Spectrography:</p> <ul style="list-style-type: none"> • Absorption spectrography, Scheme of X-Ray absorption spectrography.

5.	Ionization Radiation: <ul style="list-style-type: none"> • Properties of Cesium-134 and Cobalt-60
6.	Spectrometer: <ul style="list-style-type: none"> • Nuclear Magnetic Resonance Spectrometer (NMR) • Principles and Constructional details of NMR • Electron Spin Resonance Spectrometer (ESR) • Principles and Constructional details of ESR
7.	Gas Chromatographs: <ul style="list-style-type: none"> • Chromatography • Basic Parts of a Gas Chromatograph • Carrier gas supply • Sample Injection System • Chromatographic Column • Thermal compartment • The detection system (Thermal Conductivity Detector, Flame Ionisation Detector) • Recorders
8.	Ultrasonics : <ul style="list-style-type: none"> • Properties • Applications of ultrasonic transducer • Ultrasonic flaw detector • Pulse echo method
9.	Refractometers: <ul style="list-style-type: none"> • Theory of operation • Single pass & double pass method • Critical angle type • Applications
10.	Application Guidelines for Analytical Systems: Online Analysers <ul style="list-style-type: none"> • Sample conditioning (Inlet/Exhaust) • Housing of online analyzer • Sample injection methods

Reference Books:

1. Handbook of Analytical Instruments by R S Khandpur (Tata McGraw-Hill Company Limited).
2. Process Instruments and Controls Handbook by Douglas M Considine (McGraw Hill Book Company).
3. Analytical Instrumentation by B G Liptak.
4. Instrumental methods of Analysis by Willard.

Note:

An industrial visit is essential for this subject.