



DIRECTORATE OF TECHNICAL EDUCATION  
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME  
2015 -2016 onwards

III YEAR  
VI SEMESTER

ELECTIVE THEORY - II  
**32081 – MECHANICAL INSTRUMENTATION**

CURRICULUM DEVELOPMENT CENTRE

## M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

**Course Name** : DIPLOMA IN MECHANICAL ENGINEERING  
**Course Code** : 1020  
**Subject Code** : 32081  
**Semester** : VI  
**Subject Title** : MECHANICAL INSTRUMENTATION

### TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Mechanical Instrumentation	5	75	<b>Internal Assessment</b>	<b>Board Examination</b>	<b>Total</b>	3 Hrs
			25	75	100	

### Topics and Allocation of Hours:

Unit	Topics	Hours
I	TYPES OF MEASUREMENT, MEASUREMENT OF <i>ERROR</i>	15
II	DISPLACEMENT MEASUREMENT- PRESSURE MEASUREMENT	15
III	TEMPERATURE MEASUREMENT- FLOW MEASUREMENTS	15
IV	MISCELLANEOUS MEASUREMENT	15
V	CONTROL SYSTEMS	15
	REVISION AND TEST	7
	<b>TOTAL</b>	<b>75</b>

### RATIONALE:

Measurements are more important for the quality of the product. In this subject various methods of measurements are discussed.

## OBJECTIVES

- Study about the different instruments, errors.
- Impart knowledge on displacement measurements
- Understand about temperature measurement
- Study about miscellaneous measurement
- Understand the application of measurement system

## MECHANICAL INSTRUMENTATION

### DETAILED SYLLABUS

#### Contents: Theory

Unit	Name of the Topic	Hours
I	<p>Types of measurement, classification of instruments - Static terms and characteristics - Range and Span, Accuracy and Precision, Reliability, Calibration, Hysteresis and Dead zone, Drift, Sensitivity, Threshold and Resolution, Repeatability and Reproducibility, Linearity.</p> <p>Dynamic characteristics - Speed of response, Fidelity and Dynamic errors, overshoot.</p> <p>Measurement of <i>error</i> - Classification of errors, environmental errors, signal transmission errors, observation errors, operational errors</p> <p>Transducers : Classification of transducers, active and passive, resistive, inductive, capacitive, piezo-resistive, thermo resistive.</p>	14
II	<p><b>Displacement Measurement:</b> Capacitive transducer, Potentiometer, LVDT, RVDT, Specification, Selection &amp; application of displacement transducer. Optical measurement scale and encoders</p> <p><b>Pressure Measurement:</b> Low pressure gauges- McLeod Gauge, Thermal conductivity gauge, Ionization gauge, Thermocouple vacuum gauge, Pirani gauge.</p> <p>High Pressure gauge-Diaphragm, Bellows, Bourdon tube, Electrical resistance type, Photoelectric pressure transducers, piezoelectric type, Variable capacitor type</p>	14
III	<p><b>Temperature Measurement:</b> Non-electrical methods - Bimetal, Liquid in glass thermometer and Pressure thermometer.</p> <p>Electrical methods - RTD, Platinum resistance thermometer, Thermistor, Thermoelectric methods - elements of thermocouple, Seebeck series, law of Intermediate metals, thermo emf measurement.</p>	14

**Flow Measurements:** Variable area meter - Rota meter, Variable velocity meter – Anemometer, Special flow meter - Hot wire anemometer, Electromagnetic flow meter, Ultrasonic flow meter ,Turbine meter ,Vortex shedding flow meter

#### **IV Miscellaneous Measurement:**

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Introduction to sound measurement and study of Electro dynamic microphone and Carbon microphone.

Humidity measurement –Hair hygrometer, Sling psychrometer, Liquid level measurement – direct and indirect methods.

Force & Shaft power measurement - Tool Dynamometer (Mechanical Type), Eddy Current Dynamometer, Strain Gauge Transmission Dynamometer. Speed measurement -Eddy current generation type tachometer, incremental and absolute type, Mechanical Tachometers, Revolution counter & timer, Slipping Clutch Tachometer, Electrical Tachometers, Contact less Electrical tachometer, Inductive Pick Up, Capacitive Pick Up, Stroboscope, Strain Measurement - Stress-strain relation, types of strain gauges, strain gauge materials, resistance strain gauge- bonded and unbounded, types (foil, semiconductor, wire wound gauges), selection and installation of strain gauges load cells, rosettes.

#### **V Control Systems :**

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Block diagram of automatic control system, closed loop system, open loop system, feedback control system, feed forward control system, servomotor mechanism.

Comparison of hydraulic, pneumatic, electronic control systems, Control action: Proportional, Integral, derivative, PI, PD, PID. Applications of measurements and control for setup for boilers, airconditioners, motor speed control.

#### **Text Books:**

- 1) Mechanical Measurements &Control-D.S.Kumar-Metropolitan Publications, New Delhi.
- 2) Mechanical & Industrial Measurements-R.K.Jain-Khanna Publications, NewDelhi,