

**Instrument Mechanics Works - National Technical
Certificate (NTC) and Advanced National Technical
Certificate (ANTC)**

Electrical/Electronic Instruments II

PROGRAMME: National Technical Certificate in Instrument Mechanics Works.

MODULE: CIM 13 - Electrical/Electronic Instruments II

DURATION: 252 Hours

GOAL: This module is designed to equip the trainee with the knowledge and skill to install, service and maintain other electrical/electronic instruments such as power and energy, frequency, level and speed devices, including electronic amplifiers/trained users as well.

GENERAL OBJECTIVES:

On completion of this module the trainee should be able to:

1. Understand the working principles of power and energy measuring instruments.
2. Know frequency meaning/indicating instruments
3. Understand the concept of electrical/electronic level measuring devices.
4. Understand the concept of speed measuring devices.
5. Know the working principles of electronic amplifiers
6. Know the working principles of electrical/electronics transducers
7. Know the working principles of electromagnetic solenoid.

Programme: NTC INSTRUMENT MECHANICS WORKS			
Module: ELECTRICAL/ELECTRONIC INSTRUMENTS II		Module Code: CIM 13	Contact Hours: 20 Hrs/Wk
Module Specification:			
General Objective 1.0: Understand the working principles of power and energy measuring instruments.			
Week	Specific Learning Objective:	Teacher Activities:	Learning Resources:
1-7	<p>1.1 Identify the instruments used for the measurement of power and energy e.g.</p> <p style="padding-left: 20px;">a. Wattmeter</p> <p style="padding-left: 20px;">b. Watt hour demand meter.</p> <p>1.2 Explain the working principles of the A.C. and D.C. wattmeters in terms of the following:</p> <p style="padding-left: 20px;">a. kilo watt hour</p> <p style="padding-left: 20px;">b. demand meters.</p> <p>1.3. Distinguish between the A.C and D.C. wattmeters in terms of the following</p> <p style="padding-left: 20px;">a. working principles</p> <p style="padding-left: 20px;">b. construction.</p> <p>1.4 Read and record powers and energy from appropriate meters.</p> <p>NOTE: Power and energy meters should be protected from atmosphere effects.</p>	<ul style="list-style-type: none"> • Discuss the difference in operation in AC and DC. • Display the meters for the learners. 	<ul style="list-style-type: none"> • Watt meter • Kilo watt • Energy meter
General Objective 2.0: Know Frequency Measuring/Indicating Instruments.			
Week	Specific Learning Objective:	Teacher Activities:	Learning Resources:
8-13	<p>2.1 Explain the function of a signal generator.</p> <p>2.2 Explain the working principles of a signal generator.</p> <p>2.3 Use signal generator to produce wave-forms and display the wave-forms on the oscilloscope.</p>	<ul style="list-style-type: none"> • Use question techniques to describe working principle of signal generator. • Set up the oscilloscope with the signal generator for operation. 	<ul style="list-style-type: none"> • Signal generator • Oscilloscope

Programme: NTC INSTRUMENT MECHANICS WORKS			
Module: ELECTRICAL/ELECTRONIC INSTRUMENTS II		Module Code: CIM 13	Contact Hours: 20 Hrs/Wk
Module Specification:			
General Objective 2.0: Know Frequency Measuring/Indicating Instruments.			
Week	Specific Learning Objective:	Teacher Activities:	Learning Resources:
1-7	<p>2.4 Define the following terms:</p> <ul style="list-style-type: none"> a. Frequency b. wavelength c. pitch d. period e. amplitude f. resonance g. bandwidth <p>2.5 Perform simple calculations involving frequency, wavelength, amplitude, resonance, etc.</p> <p>2.6 Identify instruments used for measurement of frequency e.g. oscilloscope, frequency meter.</p> <p>2.7 Explain the working principles of the cathode ray tube with the aid of sketches.</p> <p>2.8 Explain the working principles of the oscilloscope with the aid of labeled sketches.</p>		<ul style="list-style-type: none"> • Oscilloscope.
8-13	<p>2.9 Use the oscilloscope for the display of wave-forms NOTE: Oscilloscope carries very high voltages and therefore should be handled with necessary precaution.</p> <p>2.10 Apply the oscilloscope for the measurement of the following:</p> <ul style="list-style-type: none"> a. frequency b. amplitude etc. <p>2.11 Calculate the following from the results obtained in the wave-form measurement in (2.10) above.</p> <ul style="list-style-type: none"> a. rms voltage b. average value c. period. <p>2.12 Use frequency meter to measure frequency of waveform and compare with the result obtained from the oscilloscope.</p>	<ul style="list-style-type: none"> • Stress the necessary safety precaution in handling oscilloscope. • Illustrate 2.11 on the chalkboard. 	<ul style="list-style-type: none"> • Oscilloscope frequency meter.

Programme: NTC INSTRUMENT MECHANICS WORKS			
Module: ELECTRICAL/ELECTRONIC INSTRUMENTS II		Module Code: CIM 13	Contact Hours: 20 Hrs/Wk
Module Specification:			
General Objective 3.0: Understand The Concept Of Electrical/Electronic Level Measuring Devices.			
Week	Specific Learning Objective:	Teacher Activities:	Learning Resources:
1-8	<p>3.1 Identify electrical/electronic instruments used for level measurement e.g.</p> <ul style="list-style-type: none"> a. capacitance probe b. resistive probe c. electronic D.P. cell d. load cells. <p>3.2 Describe the working principles of the level measuring instrument by:</p> <ul style="list-style-type: none"> a. disassembling and cleaning the parts b. reassembling and calibrating the instruments. 	<ul style="list-style-type: none"> • Discuss the working principle, dismantle and assemble level measuring devices. 	<ul style="list-style-type: none"> • Capacitor probe level meter DP. Cel.
General Objective 4.0: Understand The Concept Of Speed Measuring Devices.			
Week	Specific Learning Objective:	Teacher Activities:	Learning Resources:
9-10	<p>4.1 Identify electrical/electronic instrument used for speed measurement i.e voltage responsive tachometer.</p> <p>4.2 Explain the working principle of the voltage responsive tachometer.</p> <p>4.3 Use voltage responsive tachometer to measure speed.</p>	<ul style="list-style-type: none"> • Provide the real object for demonstration. 	<ul style="list-style-type: none"> • Tachometer

Programme: NTC INSTRUMENT MECHANICS WORKS			
Module: ELECTRICAL/ELECTRONIC INSTRUMENTS II		Module Code: CIM 13	Contact Hours: 20 Hrs/Wk
Module Specification:			
General Objective 5.0: Know The Working Principles Of Electronics Amplifiers.			
Week	Specific Learning Objective:	Teacher Activities:	Learning Resources:
11-13	<p>5.1 Draw labeled schematic diagrams of simple amplifier circuit using:</p> <ol style="list-style-type: none"> Transistor Configuration, common base, common emitter, common collector. transistors (PNP, NPN). <p>5.2 Explain the functions of the component parts of the amplifiers in (5.1) above.</p> <p>5.3 Explain the principle in (5.1) above.</p> <p>5.4 Construct simple amplifiers given the circuit diagrams.</p> <p>5.5 Feed in signal into an amplifier with a signal generator and monitor the output with an oscilloscope.</p>	<ul style="list-style-type: none"> Show well labeled diagram for amplifier circuit. Carry out practical demonstration. Transistor configuration CC, CB, CE. Arrange different components of the amplifier and guide the learners. 	<ul style="list-style-type: none"> Electronic amplifier. Multimeter Amplifier circuit.
1-4	<p>5.6 Compare the input signal in (5.5) with the output signal and determine the gain of the amplifier.</p> $\text{Gain} = \frac{\text{Output Voltage}}{\text{Input Voltage}}$ <p>NOTE:</p> <p>5.7 Measure voltages at various points of a given amplifier and record the readings.</p> <p>5.7 Test the amplifier given in (5.7) above for proper operation by feeding a signal into it and observing the output voltage.</p> <p>5.8 Enumerate and describe the characteristics of the following types of amplifiers and state their uses e.g.</p> <ol style="list-style-type: none"> audio amplifiers. power amplifiers. Operational amplifiers. 	<ul style="list-style-type: none"> Set the signal to show different characteristics of the amplifier bring out the difference in amplifier listed in 5.9. 	<ul style="list-style-type: none"> Audio power and Operation amplifier.

Programme: NTC INSTRUMENT MECHANICS WORKS			
Module: ELECTRICAL/ELECTRONIC INSTRUMENTS II		Module Code: CIM 13	Contact Hours: 20 Hrs/Wk
Module Specification:			
General Objective 6.0: Know The Working Principle Of Electrical/Electronics Transducers.			
Week	Specific Learning Objective:	Teacher Activities:	Learning Resources:
5-8	6.1 Explain the function of electrical/electronic transducers. 6.2 Name and identify the following types of transducers and state their application: a. voltage to pressure (E/P) b. Pressure to current (P/I), Voltage to current (E/I)	<ul style="list-style-type: none"> Carry out demonstration to name and identify the various transducers mentioned. 	<ul style="list-style-type: none"> Transducers.
9	6.3 State the standard range of variables in the transducers named in (6.2) above. a. E/Pv - 10v/0.2kg/cm ² -1kg/cm ² b. I/P 4mA-20mA/0.2kg/cm ² -cm ² -1kgcm ² c. E/I 0-10v-/4mA-20mA. 6.4 Explain the principle of operation of each of the transducers in 6.2	<ul style="list-style-type: none"> Discuss the operating principle and units of measurement and students should be engaged in the practical examples. 	<ul style="list-style-type: none"> Transducers.
General Objective 7.0: Know The Working Principles Of Electromagnetic Solenoid.			
Week	Specific Learning Objective:	Teacher Activities:	Learning Resources:
10-12	7.1 Explain the principle of operation of electro-magnetic solenoid with the aid of sketches. 7.2 Give examples of the use of solenoid in instrumentation e.g. a. opening and closing of solenoid valves. b. Control valves. c. Control of power cylinders etc.	<ul style="list-style-type: none"> Set up practical demonstration of electro-magnetic solenoid effect. 	<ul style="list-style-type: none"> Electro-magnetic solenoid
13	7.3 State the importance of electro-magnetic principle in Electrical/Electronic Instruments.	<ul style="list-style-type: none"> Use questions and answers techniques to explain its importance. 	

EXPERIMENT

NTC INSTRUMENTS MECHANICS WORK (CIM 13)

Week	Experiment (Electrical/Electronics Instruments li Cim 13)	Teachers/Students Activities	Resources
Term 1	Read and record powers and energy from appropriate meters		
Term 2	Demonstrate signal generators to produce wave forms and display the wave form on the oscilloscope.		
Term 3	Demonstrate how to use frequency meter to measure frequency of wave forms and compare with the result obtained from the oscilloscope.		
Term 4	Demonstrate how to use voltage responsive tachometer to measure speed.		
Term 5	Construct simple amplifiers given the circuit diagram. Feed signal into an amplifier with signal generator and monitor the impact on oscilloscope. Compare output/input signal and hence measure the gains.		