HEM ELECTRONIQUES,C-46, M.I.D.C, MIRAJ –416410

INSTRUMENTATION TUTORS :IT

With expanding technology, role of electronic Instrumentation and control engineering has become very prominent. Instrumentation is now becoming an interdisciplinary subject, which is very important for all branches of engg. The modules designed as Instrumentation tutors, are simple to use, elegantly designed and try to develop complete insight into the subject.
Digital Instrumentation Tutor part I, II & III is available in three parts. All the transducers provided with the set up are suitably mounted. The set up includes necessary accessories, cables and connectors. Digital Instrumentation Tutor is self-contained with one DPM (to be shared) and power supplies. Other technical specifications are as per individual modules.

DIGITAL INSTRUMENTATION TUTOR PART-I
Covers speed with (Photo electric pickup & magnetic Pick-up), Thermocouples, RTD, & Thermistor with accessories, ¼ HP. motor with speed controller, heater, cables water bath etc. D.P.M.199.9mv.
Panel size: 590*290*300mm.

DIGITAL INSTRUMENTATION TUTOR PART-II
This covers LVDT and Strain gage. LVDT range is +/- 20mm and strain gage set up comes with 4kg weights and cantilever beam mounted with 4 strain gages. D.P.M.1999mv. Box Size: 570*290*260mm.

DIGITAL INSTRUMENTATION TUTOR PART-III
This includes inductive pick-up, capacitive pick-up (for angular displacement measurement), piezo electric pick-up and LDR. All transducers with cables are supplied. D.P.M.1999mv.Size: 590*290*300mm

OR

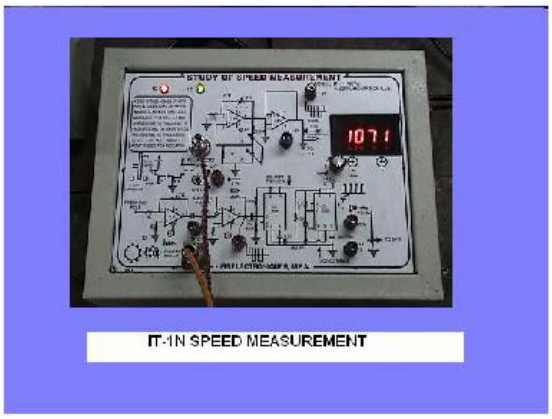
DIGITAL INSTRUMENTATION TUTOR IN SEPRATE MODULES.
The following units are housed in individual MS power coated elegant boxes with anodized front plates marking all the controls. Every unit has its own power supply along with signal conditioning circuitry and digital display. The relevant sensor and detailed instruction manual with be supplied along the set up.

Following are the general specifications of the transducer trainers.
1.SPEED MEASUREMENT MODULE. (IT-1)
Panel: BOX TYPE PANEL DIMENSIONS:192*96*300MM.
DPM 1 NO, 200MV, + OR 1999 COUNTS
Test points for observing various waveforms on the CRO. Selector switch for selection of the transducer is provided & the speed of d.c. motor can be measured with the help of photo electric and magnetic pick up.
This sensor is mounted on a rigid base supporting ¼ HP variable speed D.C. Motor for the measurement of speed. The variable reluctance pick up and the

photo electric pick up will be mounted on either side of the motor and the indicated speed can be checked with the help hand held tachometer generally available in the laboratory. The range of speed variation will be 150 to 1500 RPM and a speed controller for the d.c. motor is also provided. Necessary cable connections are also supplied. Photoelectric pick up consists of a transistor alongwith light source.Range: 150 RPM to 1500 RPM. Built in calibration source of 500 Hz provided.Accuracy +/- 1% of full scale.

IT-1(P)Speed measurement with proximity switch with 12V motor and rpm indicator
With digital indicator and maximum speed 2000 RPM.With cables and variable power supply suitable for 12 volt motor for speed variation.

2.THERMOCOUPLE MODULE. (IT-2)
Panel provisions: DPM 200mv.Box size: 192*96*160mm.
Thermocouple (Chromel-Alumel) suitable for the range 0 to 100 degree centigrade will be supplied along with the set up.In order to perform the temperature measurement (ie thermocouple, RTD and thermistor) a water container along with 1 kW heater, cable will be supplied as a common accessory for all these experiments. A standard laboratory thermometer will also be supplied.
Accuracy: +/- 1.5%



IT-2 Study of thermocouple for Temp measurement

3.THERMISTOR MODULE. (IT-3)
Panel provision: DPM 2 volts, Box size: 192*196*160 mm.
An NTC thermistor with a nominal value of resistance, at 25 degree centigrade, of 1 kohm will be supplied. The resistance Vs Temp. characteristics in the range 0 to 100 degree centigrade can be plotted. To protect the thermistor from water, this bead type element will be enclosed properly. This is a non-linear element with maximum allowable temperature of 150 degrees centigrade.
Accuracy: non-linear response.

4.RESISTANCE TEMPERATURE DETECTOR (RTD) MODULE. (IT-4)

Panel provisions: 200mv DPM, Box size: 192*96*300 mm.

A standard PT-100 element enclosed in a stainless steel cover along with teflon wire will be supplied. This is a very good linear transducer giving a reliable performance over a wide range of temperature.

The transducer exhibits a resistance of 100 ohms at 0 degree centigrade and 139 ohms at 100 degree centigrade. We can study and plot the characteristics of transducers in terms of temperature versus indicated temperature and also temp. versus resistance characteristics .Maximum temp. is 200 degree centigrade and accuracy +/- 1%.

5.LINEAR VARIABLE DIFFERENTIAL TRANSFORMER (LVDT) MODULE. (IT-5a & IT- 5b)

Panel provision: DPM 2 volts Box size: 192*96*300mm.

a) This transducer enables measurement of mechanical displacement in the range of +/- 20 mm using an ordinary scale. Provision is made for 30-cm long fibreglass housing and magnetic core alongwith primary and secondary windings. An over all accuracy of +/- 2% of full scales is possible. Appropriate test points are also provided for observation of waveforms. Primary excitation at around 4 kilohertz and 1 volt RMS is used.

b) LVDT using Dial Gage: in this module input displacement can be measured very accurately by using a dial gage in the range 0 to 10 mm. Over all accuracy of +/- 1% can be expected from this module. Other specifications remains as in part (a) above.

6.STRAIN GAUGE MODULE. (IT-6a & IT-6b)

Panel provisions: DPM 2volts, Box size: 192*96*300 mm.

a) Four no. of strain gages with nominal value of 350 ohms are mounted on a cantilever beam which can be loaded with the help of weights in a pan. The system is designed for a maximum of 5-kg load and can be used as a load cell also. Detailed calculations regarding stress and strain in the beam can be performed. Provision is made for two- arm and four-arm operation. Bridge balance controls in terms of coarse control and fine control are provided. An

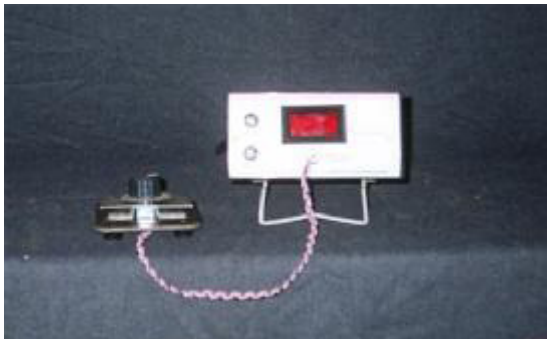
amplifier with variable gain in the range of 0 to 1000 is used for signal processing.
Accuracy: +/- 1%

b) An industrial type of load cell with 10-kg capacity will be providing at an extra cost.

7.STUDY OF INDUCTIVE PICK UP. (IT-7)

Panel provisions: DPM 2 volts. Box size: 192*96*300mm.

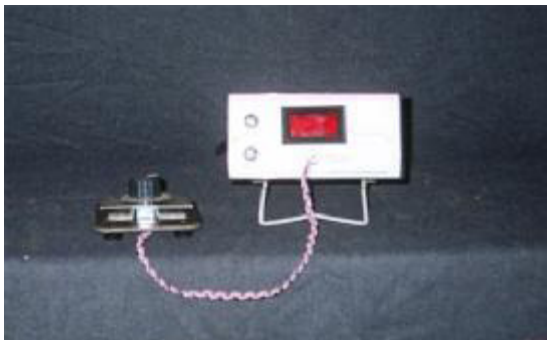
Inductive pick up is mounted on a rigid base holding 25 to 50 mm-precision micrometer with least count of 10 microns. The displacement of the magnetic core in the micrometer can be measured with an accuracy, which is better than +/- 2% in the range 0 to 5.0 mm. Appropriate test points are provided on the rear of the panel.



8.STUDY OF CAPACITIVE PICK UP. (IT-8)

Panel provisions: DPM 2 volts. Box size: 192*96*300mm

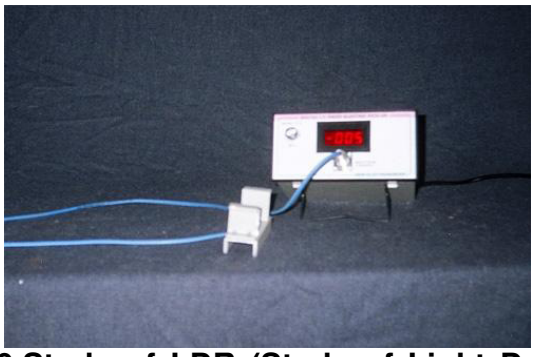
Variable gang condenser on a suitable base forms part of a Wein bridge oscillator and the system can be used to demonstrate measurement of angular displacement in the range of 0 to 170 degrees. However the response of the transducer is non-linear. Appropriate test points are provided.



9.STUDY OF PIEZO ELECTRIC TRANSDUCER (PIEZO ELECTRIC MODULE). (IT-9)

Panel provisions: 2 volt DPM Box size: 192*92*160 mm.

Mounted on rigid base provided with UHF cable connection & high input impedance signal conditioning circuit provided for transducer isolation from measurement device. This system demonstrates how dynamic force can be converted into a voltage. No quantitative measurement can be carried out on the set up.This is only a demo. Set up.



10.Study of LDR (Study of Light Dependant resistance or study of photo conductive cell) (IT-10)

Panel provisions:BOX SIZE:192*96*160MM.2 volt DPM

Even though the response is linear over a limited range, measurement of displacement over range of 15 cm with LDR and light source is possible in this set up. This system also facilitates characteristics of LDR (Photoconductive cell) in terms of resistance versus distance when calibration pot is fully clockwise. The input /output response is non-linear for this transducer.

11.STUDY OF HALL EFFECT SENSOR. (IT-11)

Panel provisions:BOX size: 192*96*300MM.

Two digital panel meters, one for flux density measurement and other for current measurement.

A linear Hall effect sensor IC is used as a sensing element in this set up, which facilitates measurement of flux density B in millitesla(up to 40-m tesla). Calibration is done with a suitable solenoid excited by a known controllable current source. A digital panel meter is provided for current measurement.

Accuracy of the order of +/- 2% can be expected. Magnetic field of permanent magnet also can be investigated.

12 . WATER LEVEL MEASUREMENT USING STATIC PRESSURE SENSOR. (Model IT-12 (a))

Panel provisions:DPM 1No (0 to 2V). BOX size: 192*96*160MM.

Water level measurement and indication is done with the help of static pressure sensor, which is a two wire transmitter operating in the range 4ma to 20 ma (for 0 to 1 bar pressure range.). The static pressure, experienced by sensor because of water height changes, is linearly related with water height. The current changes for the sensor are converted into voltage changes by appropriate I to V convertor,zero balance and calibration (Max.) controls. The current output may be measured by an external DMM (not covered in scope of supply).A small tank with 1 Meter height and mechanical gauge indicator is provided. Range: 5cm. To 60cm.

Accuracy: +/-2%

13a.PRESSURE MEASUREMENT. (IT-13 (a))

Panel provisions:DPM 1No (0 to 2V).BOX size: 192*96*160MM.

A very good quality piezo resistive sensor, which is compact and reliable, is used to sense the air pressure in the range 0 to 50 p.s.i. This piezo resistive sensor forms a part of a wheatstone bridge and with the help of signal conditioning provided in the panel measures air pressure with an accuracy of +/- 2%. A foot pump and input pressure gage alongwith an arrangement to reduce the pressure is supplied along with the set up as a standard accessory.Output from sensor in mv resulting from pressure changes can also be measured by the DPM.

13b.PRESSURE MEASUREMENT. (IT-13 (b))

Panel provisions:

DPM 1No (0 to 2V).BOX size: 192*96*160MM.

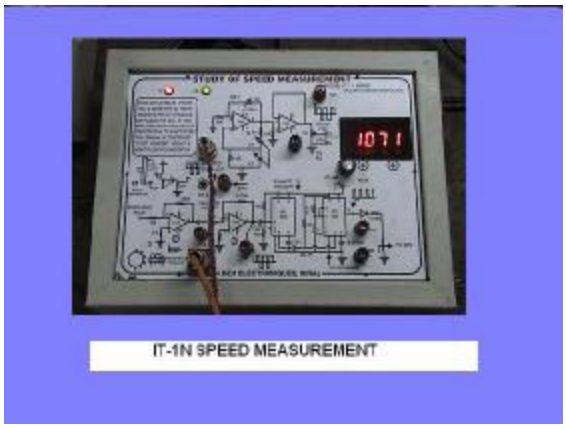
A very good quality piezo resistive sensor with built in 4 ma to 20 ma converter is used to sense the air pressure in the range 0 to 50 p.s.i. The current changes for the sensor are converted into voltage changes by appropriate I to V converter, zero balance and calibration (Max.) controls. The current output is also measured with the help of DPM. It measures air pressure with an accuracy of +/- 2%. A foot pump and input pressure gage alongwith an arrangement to reduce the pressure is supplied along with the set up as a standard accessory.

NEW INSTRUMENTATION KITS:-

We are pleased to inform you that we have introduced new design for some of the instrumentation kits.All these new models are typically board models with neatly labeled circuit diagrams on the front panel. Necessary test points are provided wherever required. So these kits are easy to understand and students can get the idea of the system by studying the diagrams printed on the panel.
Models are provided in elegant powder coated M.S. boxes.All other general specifications are as per IT-1 to IT-13 above.

IT-1 N :- Speed measurement unit .
All other General specs will be same as per IT-1

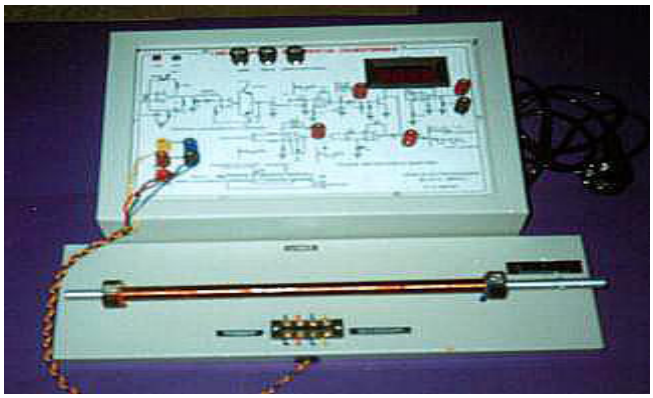
STUDY OF THERMOCOUPLE CHARCTERISTICS. (IT-2 N)
Thermocouple characteristics set up with 4 and half digit DPM. This is a completely new set up.
This set up is a combined set, which facilitates study of thermocouple as direct temperature indicator (digital) in the range 0 to 200 degree centigrade and enables the user to study temperature versus milivolt output for the thermocouple. The unit comes with chormel –Alumel and iron constantan thermocouples along with heater, water bath and thermometer.
All other specifications will be same as per our Item No. IT- 2.
Following are List of the items for which these board models are available: -



IT-4 N :- RTD module .
All other General specs will be same as per IT-4 IT-5(a) N :- LVDT module unit . (Ordinary scale)
All other General specs will be same as per IT-5 (a)

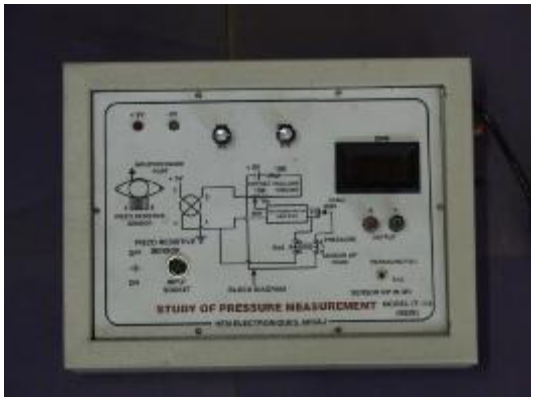
IT-5(b) N :- LVDT module unit . (With dial gauge) All other General specs will be same as per IT-5(b)

IT-5(a)



IT-6(a) N :- strain gauge module unit. All other General specs will be same as per IT-6 (a)
IT-6(b) N :- Industrial type load cell unit. All other General specs will be same as per IT-6 (b)
IT-7 N :- Study of Inductive pick up :All other specs will be same as per IT-7.
IT-8 N :- Study of capacitive pick up . All other General specs will be same as per IT-8

IT-13 N :- Pressure measurement module All other General specs will be same as per IT-13



14.Digital Torque Measurement. (IT-14)

Panel Provision:-192*192*300 mm DPM :-2 V

This Digital Torque Indicator is based on the principle of standard spring balance type of torque measuring system where the difference in the spring balance reading for a loaded brake drum gives the torque in kg-cm denomination.

This is an indirect method of torque measurement. In order to get direct digital indication of the torque on the meter, the spring balances along with instrumentation and reliable electronic load cell electronic (strain gauge type) are suppliedScope Of Supply:

1Load Cells 50Kg capacity 2No.s

2.0.5 h.p. D.C.motor with pre-loaded pulley.

3.Loading arrangement on the motor.

4.Motor speed controller with an ammeter 0 to 2 amp.

5.Signal conditioning unit Digital indicator.(3 & ½ digit)

6.Course and fine balance for both sensor channels.

Unit comes with powder coated M.S.Box. Appropriate test points are provided.

15.STUDY OF TEMPERATURE SENSOR. (IT-15)

This set up is designed to enable the student to study the following sensors.

1) Thermocouple: Range 0 to200 degree C. Accuracy: +/- 1.5% of the range.
2) Thermistor: Only characteristics with two ranges (0 to 2000 ohm & 0 to 20 Kohm) selectable by switch.
3) RTD: using PT 100 with provision for study of temp. versus resistance and temp. (I/P) with indicated temp. Characteristics of this widely used sensor. range 0 to 200 degree C. with an accuracy of +/- 1% of the range.
4) IC Sensor: IC Sensor AD 590 is used to study its application as temp. sensor in the Range 0 to 200 degree C, along with its characteristics. The system comes with water container, heater with cable & thermometer. It is housed in an elegant powder coated MS box with neatly labeled anodized plate with suitable connecting terminals.
   Box size: 290*145*300 mm approx. Common DPM of 199.9 milli volt to be shared .

16.STUDY OF LINEAR POTENTIOMETER FOR DISPLACEMENT MEASUREMENT. (IT-16)

The system facilitates measurement of linear displacement in the range 0 to 50 mm with digital indicator, power supply and cable. Typical accuracy of +/- 2% of the range is claimed. The unit is housed in a sturdy powder coated box with neatly anodized front panel of the size 192*96*160 mm.

17.STUDY OF I TO V & V TO I CONVERTER. (IT-17)

The V to I converter converts 0 to 2 volts in 4 mA to 20 mA current range and 4 to 20 mA is again converted back to 0 to 2 volts by I to V converter. The units have built in power sources, 3 and half digit DPM each. These two units are separate and housed in powder coated MS boxes with dimensions 192*96*150 mm.

18.STUDY OF INSTRUMENTATION AMPLIFIER (IT-18)

This set up facilities complete understanding of a typical Instrumentation Amplifier with linear gain adjustment in the range 0 to 1000, it has built in power supplies and millivolt source, A.C. source etc. it can demonstrate the measurement of differential gain, common mode gain and CMMR, alongwith DPM.199.9 milli volt.

The powder coated MS box has the dimensions of 192*192*300 mm.

19.DIGITAL STRAIN INDICATOR. (IT-19)

This a single channel strain indicator with built in power supply and 3 and half digit DPM has the following features

1) Strain range: 0 to 2000 micro strain.
2) Gage factor adjustment: 2 to 4.
3) Calibration facility for 1000 micro strain.
4) Bridge configuration: Selectable in the range 1 arm, 2arm and 4 arm.
5) Nominal value of strain gage resistance: 120Ω, 350Ω and 600Ω selectable from rotary switch.
6) Recorder output provided.
7) Coarse and fine balance control provided. The system comes with a cantilever beam with four strain gages, 5 kg load. It has neatly labeled anodized plate with all controls properly indicated.
   Dimensions: 290*145*300 mm.

20. DATA ACQUISITION SYSTEM(IT-20)

The instrumentation trainer interfaced with IBM compatible PC is based on a modular construction. A complete set up for detailed study of instrumentation system is offered which includes various peripherals, accessories and the required hardware for PC. The necessary software shall be provided alongwith the set up.

The total system consists of the following modules.
Module I: Computer will not be supplied.(To be made available by the user)
Module II:INTERFACE UNIT FOR IBM COMPATIBLE PC.
ModuleIII:Separate units with power supply, digital display and signal conditioning for every transducer.
Module IV: - Transducers.

MODULE II: Interface unit for IBM PC.

The interface unit for this trainer system consists of high performance analog interface card, which is compatible with IBM PC and compatible computers. It uses hardware based on successive approximation method, providing 25 thousand samples per second acquisition rate. The true 12 bit conversion gives an over all accuracy of 0.15% reading plus or minus one bit. The output channel provides fast settling time with high accuracy.
Interface will be RS-232 serial interface.
Interface unit will include controller for serial interface (RS-232) .Which will be having 8 channel ADC interface and 1 DAC output (all Voltage input 0-5 V D.C. range) on the front panel. Serial to USB converter will also be supplied

MODULE III: Signal Conditioning for Instrumentation

The instrumentation signal conditioner module consists of the electronic circuitry for the sensing and measurement of signals from the transducers. The transducers as mentioned in the specifications for module IV, will be supplied alongwith the system.
The signal conditioner is required for amplification of weak signals and for the elimination of noise from the transducers. **Output from each of these signal conditioning unit will be in Voltage (range 0-2 V).**

MODULE III: TRANSDUCERS

The transducers covered with this set up for which the instrumentation trainer is designed are as follows. The parameter to be measured by the transducer is also indicated.
General specifications will be identical to those offered with individual modules.

TRANSDUCERS		PARAMETER
1. A) Variable reluctance pick up B) Photo electric pick up.	**IT-1**	Speed Speed
2. Thermocouple	**IT-2**	Temperature
3. Thermistor	**IT-3**	Temperature
4. Resistance temp. detector (RTD)	**IT-4**	Temperature
5. Linear Variable Diff. Transformer (LVDT) **IT -5(b)**		Displacement
6. Strain Gauge	**IT-6(a)**	Stress, strain
7. Level Sensor	**IT-12**	Water Level
8. Pressure pick up	**IT-13**	Air Pressure
9. Inductive pick up	**IT-7**	Displacement.

Please refer Individual IT (Instrumentation No.s) in the leaflet provided for specs of each sensor.

IV:- SOFTWARE

The system application software from HEM Electroniques consists of suitable data handling procedures to have complete study set up for each of the transducers separately. Software for getting graphical representation of the characteristics of the transducers shall be included as a part of the experiment in a menu driven environment. Theoretical study software for some of the transducers shall be provided. Help levels for running the software are also included. A detailed instruction manual along with block diagrams, detailed circuit diagrams, suggestions for the maintenance etc. will be supplied along with the set up.

Salient Features:

Software: Very powerful user friendly software will be supplied which enables acquisition of the data from the transducers and analysis of the data.

Graphical representation of various characteristics.

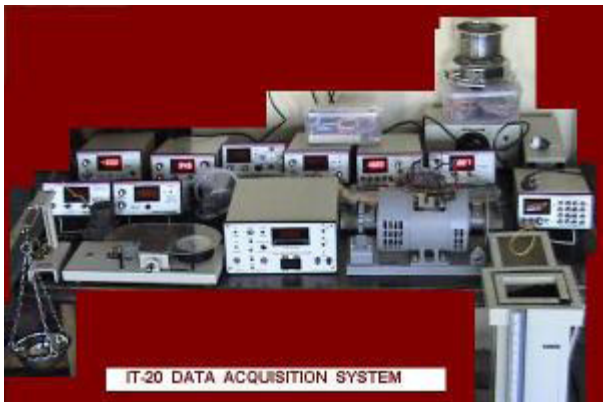
Software also enables to study the ADC /DAC process through serial interface. As well as Study of serial interface.

All the units are standalone. Each transducer module is independent and can be used independently for experimentation without connecting to PC.

Scope of supply does not include computer.

(TO BE MADE AVAILABLE BY THE USER)

P3 or P4 with COM1 or COM2 9 pin D SOCKET, Preferably win98 or XP.



IT-21.STUDY OF ERROR ANALYSIS: (IT-21)

This set up is designed to demonstrate the basic concepts of accuracy, precision, tolerance, stability, sensitivity, dependent and independent linearity and Also methods are given in the manual.

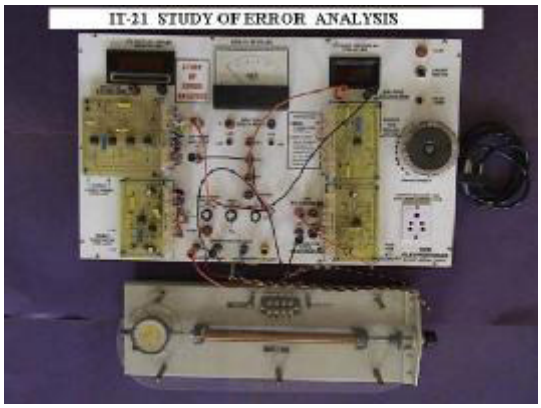
The set up comes with built in digital measurements and analog instruments to demonstrate the various ideas of the error analysis.

1 No. of 3 &1/2 digit DPM,1 no. of 4 &1/2 digit DPM and 1 No. of 0-1 ma ANALOG METER.

1 No. OF MICROMETER DIAL GAUGE BASED LVDT SENSOR. Its signal card, Signal conditioning card, with zero adjustment and gain adjustment facility.

With also facility to vary excitation given to LVDT Primary.

To see the effect of temperature on accuracy of the instrumentation 1 No. of BULB with necessary socket is provided on board. Also for temperature measurement 1 No. of mercury thermometer is provided.
The setup is typically a board model with all PCBs are mounted on neatly labeled Front panel. It is 230 V, 50Hz operated unit with all necessary power supplies and Patch cords.



22.STUDY OF NOISE (IT-22)

The set up is very important to develop clear understanding of the concept of noise, its cause and ways to carry out measurements almost free of noise.23 :- STUDY OF CHOPPER STABILIZED AMPLIFIER (IT-23)
The set up is typically a board model with facilities to study
D.C.amplifiers with and with out Chopper stabilization.
Setup is provided with 4 and ½ digit D.P.M. and thermometer and
60 W heater Bulb for temp variation to study temp. effects.
The set up is designed to bring to the notice of the students the problems of low level signal amplification, drift with changes in ambient temperature for
1.General purpose op amp
2.Higher performance op amp
3.Chopper stabilized amplifier

24 HUMIDITY MEASUREMENT KIT): - (IT-24

Capacitance sensor based direct measurement (RH). with necessary signal conditioning and display are provided. This will show ambient Relative humidity.
Also for indirect measurement by dry and wet bulb method, two
RTD PT-100 and appropriate containers are provided.
A separate display is provided for indirect method.
A overall accuracy of +/- 6% is achieved with this setup. Setup comes with a very attractive printed panel and powder coated box.
On the panel a table for indirect method is provided.

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IT-25 STUDY OF VELOCITY RATIO USING BELT DRIVE ASSEMBLY:- (IT-25)

This equipment consists of a d.c. motor ¼ H.P. 1500RPM, 220V, 50Hz with speed indicator and controller .A 3-slot pulley of diameters 3", 4", 5" is mounted on the driver side shaft. Driven side Pulley of same type is mounted with two bearings. An M.S.shafting is provided for driven side.

V belt of B34 is provided as main belt. The two pulleys are mounted in such a fashion so that diameters ratios will be such as D1/D2 = 3/5, 4/4, 5/3 .So we will get 3 different sets of ratios.

A Speed measuring facility is provided on both the sides. A Photo electric circuitry along with disk with holes is provided on both the shafts. Phototransistor 2N577 is used as sensor. Light source is also provided.

Necessary signal conditioning for the above signals with 1 No. 3 and ½ digit digital display is provided. Necessary inbuilt power supplies and test points are provided.

This signal conditioning unit is housed in Powder coated M.S.Box.

Comprehensive Technical manual is provided along with the equipment.

This Kit is specifically designed for First year Basic mechanical engg. Lab.

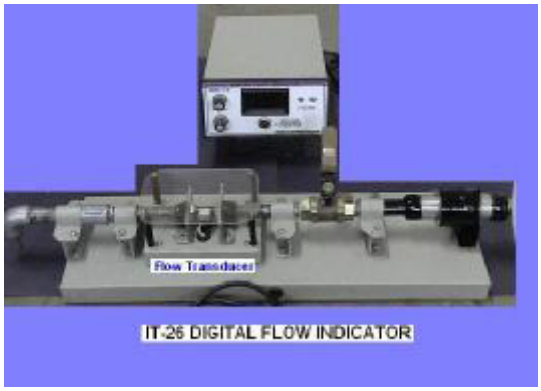
IT-26 Digital Flow Indicator:- (IT-26)

Panel Provision: -192*92*160 mm DPM: -2 V System consist of two parts:

(1)Transducer assembly, generating signal whose frequency is proportional to flow.

(2)Signal Conditioning With Digital Indicator

(1) It uses a very high quality turbine type flow sensor.It gives square wave output
Proportional to flow. A simple filter assembly is installed and also a ball valve is used to vary the amount of flow. User has to be provide a water source to perform the experiment. Sensor range is(1 to 15 lit/min).1/2" piping is used. Measurement accuracy +/- 2%
(2)Necessary standalone Signal Conditioning Unit with its own power supplies is provided.3&1/2 DPM is provided. Necessary Test points are provided to study the output waveforms. Unit comes with power coated M.S.Box.
1 liter water container and stopwatch is also provided along with the system to measure the incoming flow.
This unit enables students to study the basic principles of Digital Flow Measurement.



27 TWO WIRE TEMPERATURE TRANSMITTER USING RTD (4MA TO 20MA) (IT-27)

Panel Provision:-192*92*160 mm ,Powder coated M.S.box, DPM :-2 V
This system is designed to be operated with 24-volt supply. The temperature variations are converted by RTD into proportional voltage, which in turn is converted to 4 -20mA current range for a temperature of 0 to 200ºC. The current signal can be monitored by a meter in series (Or DMM in current mode) with the supply or by means of a voltage drop across R_L. The key advantage to this system is that circuit performance is not affected by long transmission lines and this feature can also be demonstrated here.. The system supplied here is divided into two parts.
1. Main instrument which houses 24 volt supply and DPM with associated circuitry to convert 4mA -20mA current range to display temperature of RTD in the range of 0 to 200ºC. Necessary calibration pots are provided on the front panel of this set up. Pot P1 is for MAX setting and where as pot P2 is for minimum setting. For zero temp of RTD, simulated by 100-ohm precision resistance, pot P2 is adjusted to give 000.0 degree C & for RTD at 100 DEG C the pot P1 is adjusted at 100.0 on DPM with a precision resistance of 139 ohms.

2. This part houses digital multimeter operating in current range of 20mA with 9V battery and its switch. The switch enables the battery to be switched ON or OFF, when DMM is used to measure the current signal in the range of 4mA to 20mA. For 0 to 200^{OC,} the current range is 4mA to 20mA.

Scope Of Supply:

1) 2 wire RTD sensor (PT-100, 0 to 200^{OC})
2) Signal Conditioning unit with DPM.
1) Digital Multimeter.
2) Pan, Heater And Thermometer.

IT-28 :STUDY OF VIBRATION MEASUREMENT

The present Set-up is designed to introduce the student with both the type of the system i.e. vibration pick-up & accelerometer. Scope of supply includes:

1.Vibration Pick-up:

2.The accelerometer is of industrial version.

Vibration pick up consists of a displacement transducer associated with spring mass system along with signal conditioning to observe waveforms on CRO ,thus enabling the student to measure peak to peak amplitude of vibration . Student can also calculate the undamped natural frequency of the seismic system provided. Vibration exciter is not provided but in case our speed measurement system is purchased ,the sensor can be mounted on the d.c. motor provided with the system

Vibration measurement using accelerometer (piezo electric sensor with built in signal conditioning) can be used to measure peak to peak displacement of 2000 microns. The system is battery operated with LCD display .The vibration measurement can be carried out over a frequency range of 10HZ to 1KHZ.

29.Study of Roundness measurement (Eccentricity measurement)

This item is a demonstration set up useful for metrology LAB of mechanical engg dept. An inductive pick up is used as a sensing element for displacement measurement. The total range of displacement is 3.00mm with a least count of 0.01 mm & an overall accuracy of 3%. A study set up in terms of a reference circle & 2 samples of eccentric circles (where eccentricity introduced purposely for study purpose) are mounted on a hand rotated shaft provided with dial &

pointer for angular position measurement which enables the user to plot the polar graph. The system comes with inductive pick up sensor (which is spring loaded) along with signal conditioning and digital indicator & instruction manual.

30. Optical rotary encoder trainer(IT-30)

This unit houses optical encoder and D.C. motor For direction control a switch is provided for changing the polarity of armature voltage..

The unit houses also the wave shaping circuitry for getting speed (RPM) & pulse rate indication, DPM and power supplies. This unit also houses a speed controller which provides a variable d.c. voltage to the armature of the D.C. motor & a fixed field excitation voltage. The output test points for channel A, channel B and marking pulses Z are provided on the front panel.A 250 PPR or 360PPR optical encode is also provided.

31-Optical encoder for angle measurement –(IT-31)

A 360 pulses per revolution (PPR) optical encoder is mechanically coupled through a special coupling to 20 RPM d.c. motor (with gear train) excited y 12 volt d.c. supply. The push button is used to rotate the motor and in turn optical encoder shaft slowly. The optical encoder is mounted on a base with angular scale fitted on it. Starting from zero angle position, when the push button is pressed ,motor starts rotating and hence the shaft angle goes on increasing. The pulses from optical encoder are supplied to input of an up counter (which is initially reset to zero) and we get indication on the counter in terms of lapsed angle. As the optical encoder is 360 PPR type , for 1 degree of rotation ,1 pulse is generated and these pulses are counted to provide angle indication. Motor can be rotated in one direction only and only increasing angle measurement is possible.

32- Characteristics of photo transistor and LDR –(IT-32)

We offer our set up for study of optical sensors for LDR, Photo diode, photo transistor and photo cell with digital lux meter and DPM (variable voltage source for lamp intensity variation to plot the device characteristics.
We also supply infrared based proximity switch to demonstrate application of photo transistor.

33- Digital Static Torque Measurement Trainer- (IT-33)

This unit comes with rosset strain gauge based static torque measurement system With sturdy M.S. torque arm.Torque arm loading system by using Pan , weight set.
Torque Arm Length:- 50cm
(with facility to select torque arm as 25cm,37.5 cm, 50 cm)

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Weight set :- upto 2 Kg (500 gm*4)
Torque measurement range (experimental):- 100 Kg-cm (i.e. 1kg-m)
Torque Indicator capacity (max) :- 2000kg-cm
Indicator :- 3 and ½ digit display
Resolution :- 1 kg cm

Self contained unit with neatly labeled front panel and inbuilt power supplies.
With comprehensive technical manual.
