Department of

Electronic & Telecommunication Engineering

LAB MANUAL

ELECTRONIC MEASUREMENT & INSTRUMENTATION LAB

B.Tech– IV Semester

KCT College OF ENGG AND TECH.

VILLAGE FATEHGARH

DISTT.SANGRUR

INDEX

EXPERIMENT NO. 1

AIM: MEASUREMENT OF RESISTANCE USING WHEATSTONE BRIDGE

To measure the given medium resistance using Wheatstone Bridge.

OBJECTIVE:
1. To study the working of bridge under balanced and unbalanced condition.
2. To study the sensitivity of bridge.

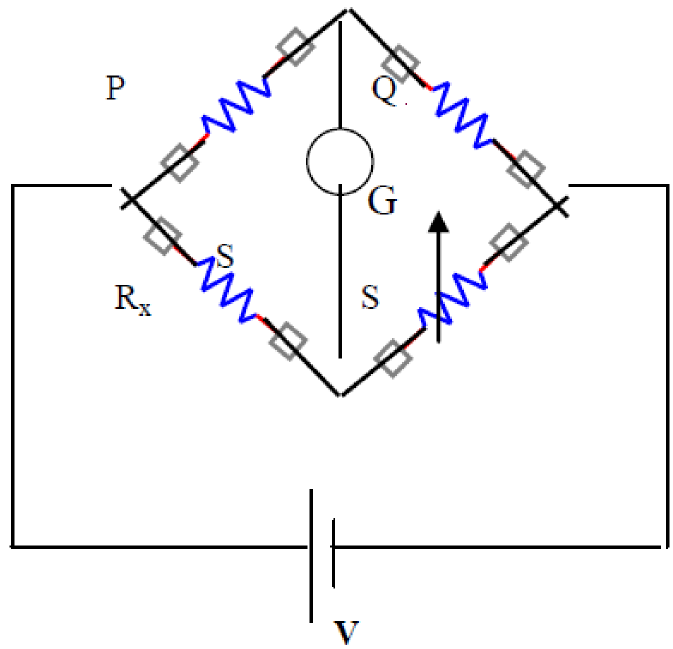
EQUIPMENT:
1. Wheat stone Bridge kit – 1 No
2. Unknown resistance – 1 No
3. Multimeter – 1 No
4. Connecting Wires.

EXERCISE:
1. Design a bridge for the given parameters.
2. Find the unknown resistance.
3. Find the sensitivity of Bridge.

PROCEDURE:
1. The resistance to be measured is connected between XX points in the bridge kit.
2. The P/Q ratio (multiplier) is initially kept at position '1' and the deflection of the galvanometer is observed by
Pressing both the battery and the galvanometer keys.
3. The S arm (X 1000□) is adjusted and two positions are identified for which the deflection of the galvanometer is on
Either side of the null point or kept at the lowest value of S. Then the x100□, x10□, x1□knobs of S are adjusted to
Get null deflection. If necessary the sensitivity knob may be controlled to get appreciable deflection. [If not possible
P/Q ratio is kept at suitable value i.e., any one of ratios provided.]
4. The value of unknown resistance is read. (S value)
5. Steps 3 and 4 are repeated for some other P/Q ratio. The mean value is taken.
6. The experiment is repeated with other samples provided.

The above experiment may be used for measuring resistance of the samples less than 1□to greater than
10000□with lesser sensitivity.

CIRCUIT DIAGRAM :



CALCULATION:

Unknown Resistance, Rx = P/Q * S (□)
Where P, Q = Ratio Arms.
S = Variable resistance,
Rx = Unknown resistance.

TABULAR COLUMN:

TABULAR COLUMN:

S.NO	SAMPLE	P/Q RATIO (MULTIPLIER)	S VALUE (Ω)	UNKNOWN RESISTANCE RX (Ω)

EXPERIMENT NO. 2

MEASUREMENT OF RESISTANCE USING KELVIN'S DOUBLE BRIDGE.

AIM: To measure the given low resistance using Kelvin's double bridge method**.**

OBJECTIVE

1. To study the working of bridge under balanced and unbalance condition.
2. To study the sensitivity of bridge.

EQUIPMENT

1. Kelvin Double bridge kit – 1 No
2. Unknown resistance – 1 No
3. Multimeter – 1 No
4. Connecting wires.

FORMULA USED:

Rx = P/Q * S ohms

Where

P,Q First set of ratio arms.

P,q Second set of ratio arms.

S Standard resistance,

Rx unknown resistance.

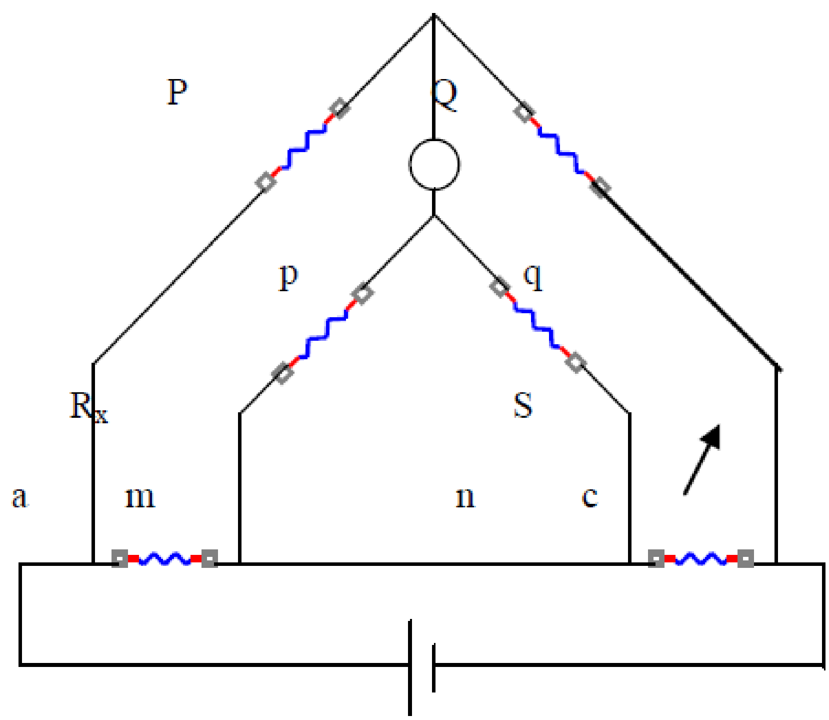
EXERCISE

1. Design a bridge for the given parameters.
2. Find the unknown low resistance.
3. Find the sensitivity of bridge

PROCEDURE:

1. The resistance to be measured is connected such that the leads from +C and + P are connected to one end and those From –C and –P are connected to the other end in the kit.
2. The P/Q ratio (multiplier) is initially kept at position '1' and the deflection of the galvanometer is observed by Pressing the galvanometer key.
3. The 'S' arm (main dial) is adjusted and two positions are identified for which the deflection of the galvanometer is On either side of the null point. [If not some other P/Q ratio is to be tried].
4. The lower of the two positions indicates the coarse value of the unknown resistance and the null point is obtained by Adjusting the Vernier scale, with the galvanometer sensitivity knob at the maximum position.
5. The value of unknown resistance is read. ['S' Value]
6. Steps 3,4,5 are repeated for some other P/Q ratio for the unknown resistance. The mean value is taken.
7. The above procedure is repeated with another sample.

CIRCUIT DIAGRAM



TABULAR COLUMN:

S.NO	SAMPLE	P/Q RATIO (Multiplier)	S VALUE		UNKNOWN RESISTANC RX (Ω)
			COARSE (Ω)	FINE (Ω	

RESULT:

The value of unknown resistance is found experimentally

EXPERIMENT NO. 3

MEASUREMENT OF CAPACITANCE USING SCHERING BRIDGE.

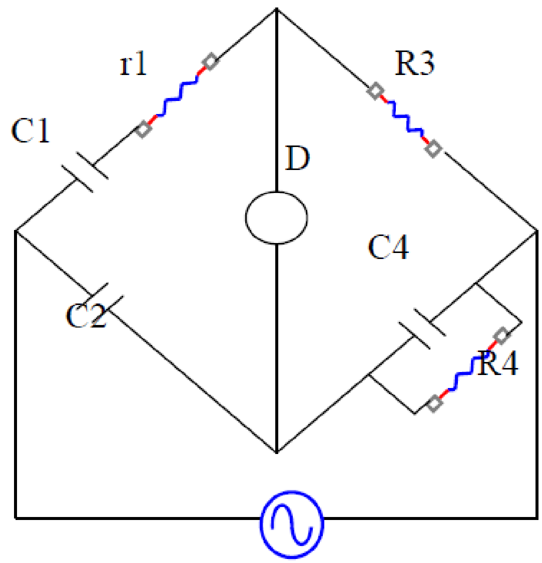
AIM: To measure the unknown capacitance using Schering bridge.

OBJECTIVE:
1. To measure the unknown capacitance.
2. To study about dissipation factor.

EQUIPMENT:
1. Schering Bridge kit – 1 No
2. Multimeter – 1 No
3. Unknown capacitance – 1 No
4. Connecting wires

PROCEDURE:
1. Connections are given as shown in the circuit diagram.
2. The value of R2 is selected arbitrarily (say1K) and R1 is varied.
3. If the selection of R2 is correct the balance point (NULL POINT) can be observed on the oscilloscope by varying
R1.If not another value of R2 is chosen. [At balance the vertical line in the oscilloscope comes to a point for an
Particular value of R1 in the same direction.]
4. The capacitor C1 can be varied for fine balance adjustment.
5. When the balance condition is reached, the trainer kit is switched OFF and the value R1 is measured using a
multimeter.
6. The value of unknown capacitance is calculated.
7. The experiment is repeated for various samples provided.

CIRCUIT DIAGRAM :



EXERCISE

1. Design a bridge circuit for the given parameters.
2. Find the dissipation factor.
3. Fluid the unknown capacitance.
4. R2 = Non-Inductive Variable Resistor

CALCULATION:

Unknown capacitance, Cx = R1/R2 * C3,
Where C3 = Known Capacitance, Microfarads

TABULAR COLUMN:

S.NO	SAMPLE	R2 (Ω)	R1 (Ω)	UNKNOWN CAPACITANC (Farads)

RESULT:

The value of unknown capacitance is found experimentally by using the Schering Bridge.
Unknown Capacitance, Cx =

EXPERIMENT NO. 4

STUDY OF DISPLACEMENT TRANSDUCER – LVDT

AIM: To study the operation of LVDT

OBJECTIVES

1. To study the basic principle of LVDT.
2. Study of signal conditioning circuit.
3. Study of LVDT as transducer.

EXERCISE

1. Draw the characteristic curve for a given LVDT.
2. Find the residual voltage.
3. Fluid the non-electrical quantity displacement in terms of voltage.

EQUIPMENT

1. LVDT kit – 1 No
2. Multimeter – 1 No

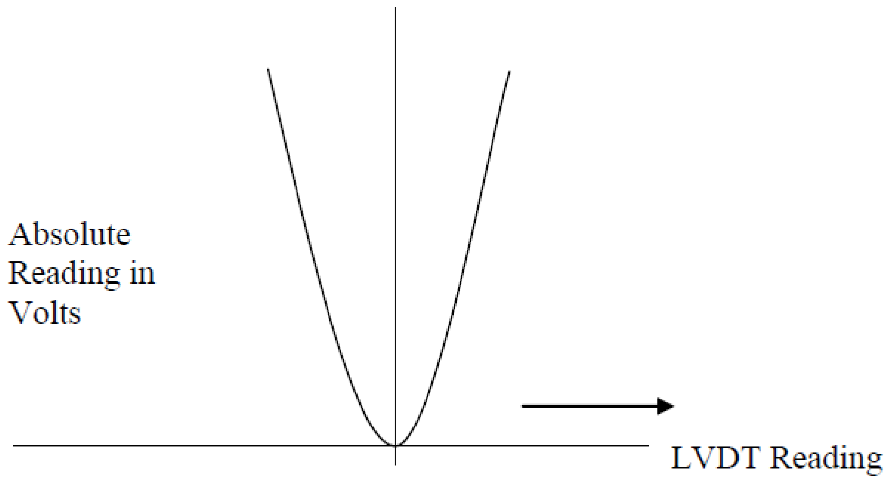
PROCEDURE:

1. Adjust the micrometer to read 200m of micrometer figure. This position is called as end of transducer
Position.
2. Adjust the span adjustment pot to read 10mm.
3. Now adjust the micrometer jig. This position is called negative end of transducer position.
4. No need to adjust any further for this as the displacement automatically reads -10.
5. Repeat steps 3 and 4 repeatedly till we get the absolute value.

TABULAR COLUMN:

S.NO	DISPLACEMENT ON MICRO-METER (mm)	DISPLACEMENT INDICATOR READING (mm)	MULTIMETER READING (Volts)

MODEL GRAPH:



RESULT:

Thus the displacement is found using LVDT and hence the output is verified using different graphs.

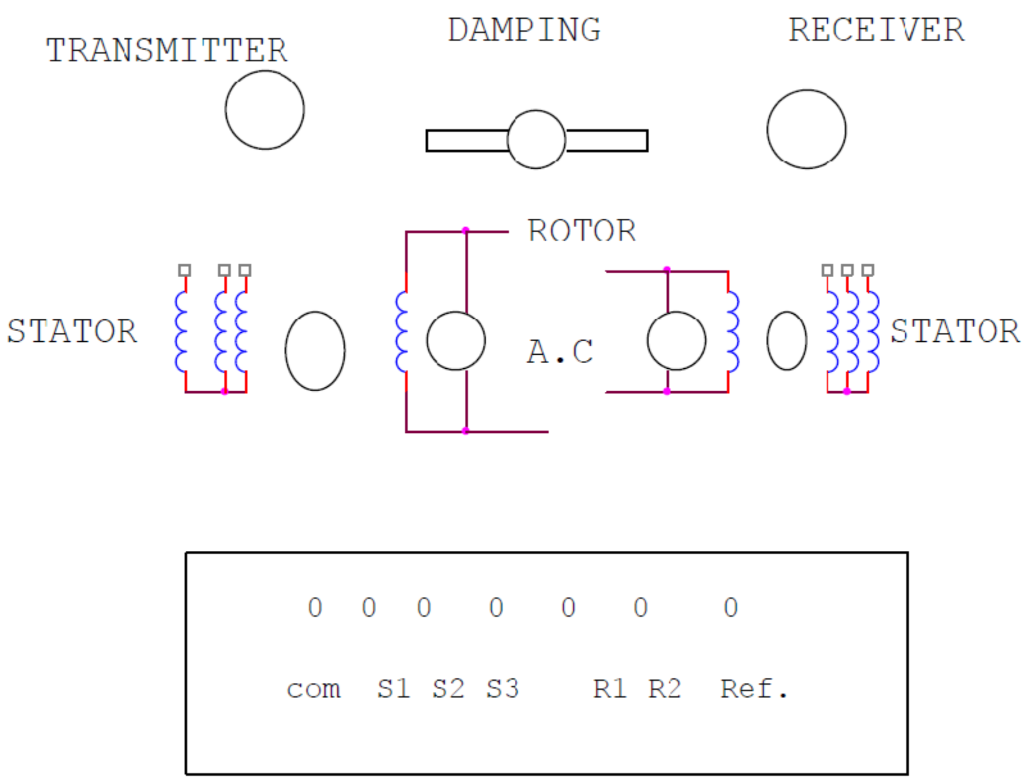
EXPERIMENT NO. 5

AIM: - To study of synchros (transmitter/ Receiver) system.

APPARATUS REQUIRED: - Synchrony Tx & Rx set, A dual trace CRO and connecting leads.

BRIEF THEORY: - The synchrony Transmitter/ Receiver demonstrator unit is designed to study of remote transmission of position in AC servomechanism. These are also called as torque Tx and Rx. The unit has one pair of Tx –Rx synchrony motors powered by 60 V AC inbuilt supply. The synchrony Tx has dumb ball shaped magnetic structure having primary winding upon rotor which is connected with the line through set of slip rings and brushes. The secondary windings are wound in slotted stator and distributed around its periphery.

CIRCUIT DIAGRAM:-



PROCEDURE:-

The experiment is completed is in three parts

1. To study of synchrony Tx in terms of position V/s phase and voltage magnitude w.r.t. rotor voltage magnitude/ phase. Connect the circuit as shown in fig. Note the o/p Vpp and its phase angle either same as reference o/p or out of phase for each stator winding. Rotate Tx dial in 30 steps and note voltage magnitude and phase w.r. t. input as reference. Prepare an observation table.
2. To study synchro Tx/Rx as an Error detector. Connect the circuit as shown in fig. Start from 60 or 90 and note the Rx R2 o/p voltage and phase.
3. To study of remote position indication system using synchro-Tx and Rx. Connect the circuit as shown in fig. Keep Tx dial at 0 and watch Rx dial if there is any

error removes it. Increase Tx from 30 to 330 in steps of 30 and note the Rx position record the observation in a table and find the difference between Tx and Rx dial position.

OBSERVATION TABLE:-1

S.No.	Angular Position in Deg. Tx	Magnitude Phase S1	Magnitude Phase S2	Magnitude Phase S3

OBSERVATION TABLE: - 2

S.No.	Angular Position in deg. Tx	Angular Position in deg. Rx

OBSERVATION TABLE:-3

S.No.	Angular Position in deg. Tx	Angular Position in deg. Rx	Difference in Degree Tx-Rx.

PRECAUTIONS: -

1. Move the transmitter and receiver dials slowly to avoid errors in reading.
2. Take the reading carefully in steady condition.
3. Switch of the setup when not in use.

EXPERIMENT NO:6

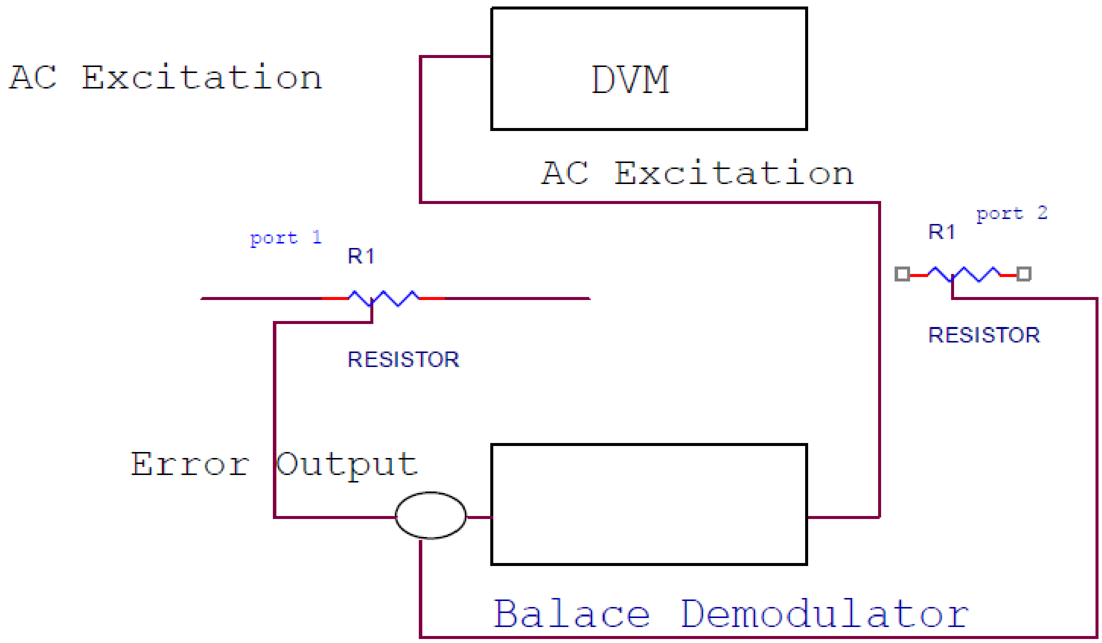
AIM : To study characteristics of positional error detector by angular displacement of two servo potentiometers.

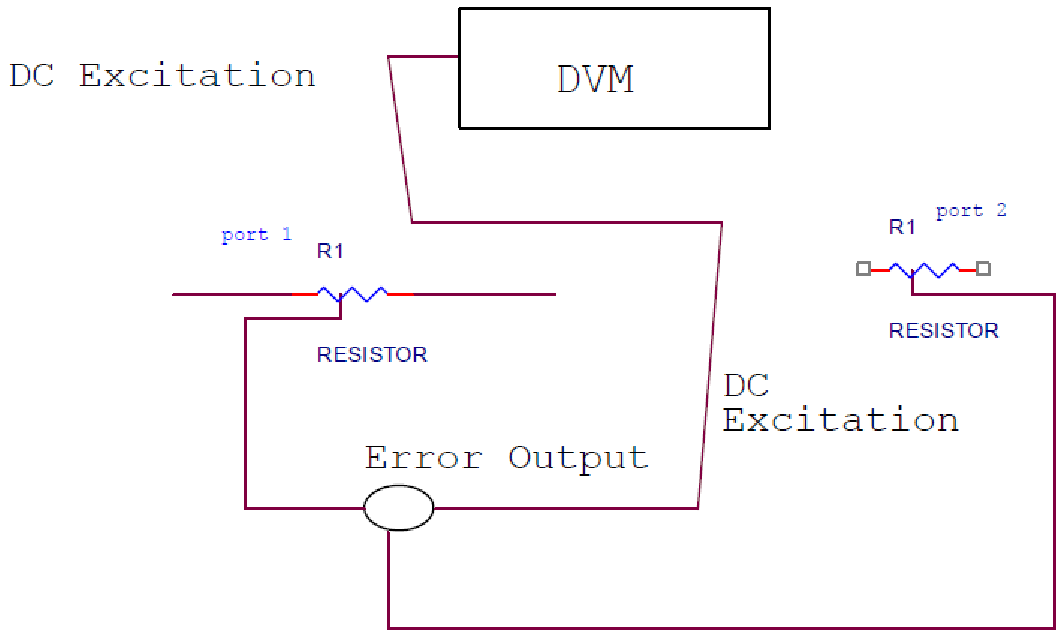
APPARATUS: Potentiometer kit,Dual trace CRO and connecting leads

THEORY:

Potentiometric transducers are used in control applications. The set-up has built –in source of +5V dc and about 2Vpp 400Hz AC output. A DVM is provided to read dc voltage and AC can be read on CRO. The potentiometers are electrtomechanical devices which contain resistance and a wiper arrangement for variation in resistance due to displacement. The potentiometers have three terminals. The reference DC or AC voltage is given at the fixed terminals and variable is taken from wiper terminals.

CIRCUIT DIAGRAM :





PROCEDURE :

1. Connect the power and select the excitation switch to DC. Keep Pot.1 to center =180°. Connect DVM to error output. Turn Pot.2 from 20° to 340° in regular steps. Note displacement in 0°=θ2 and output voltage E as V0. Plot graph between V0 and θe= θ1- θ2.
2. Switch ON the power and select excitation switch to AC. Connect one of CRO input with carrier output socket and ground. Connect other input of CRO with error output socket. Keep pot.1 fixed at 180° and move pot.2 from 20° to 340°. Note displacement in θ° and Demodulator voltage VDM. Plot graph between displacement and demodulator voltage.

OBSERVATION TABLE :

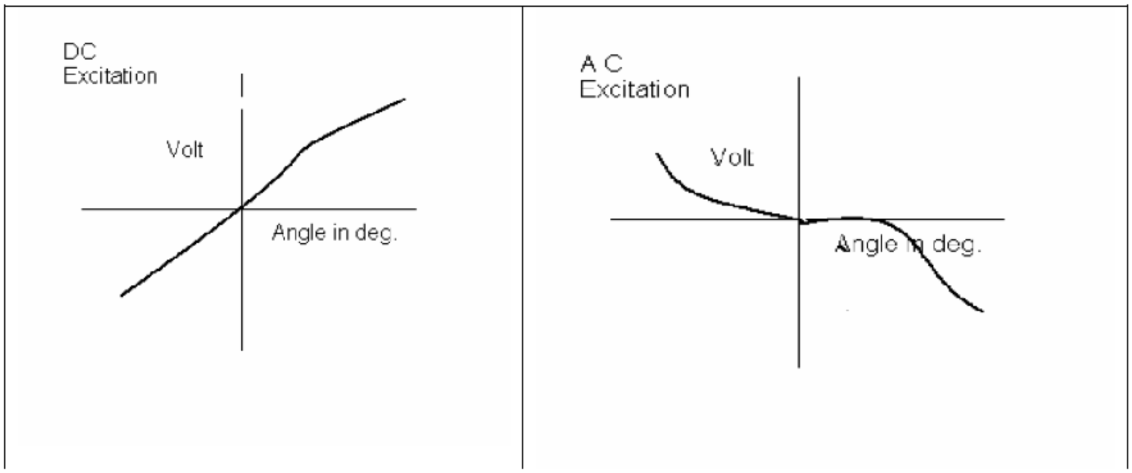
Sl.No.	Pot.2 position in θ°	θe= θ1- θ2	Output Voltage = V_0

Sl.No.	Pot.2 position in θ°	θe= θ1- θ2	Output Voltage = V_0

PRECAUTIONS :1.Select the excitation switch as required, AC or DC. Wrong

selection may cause error in experiment or damage the setup.
2.Take the reading carefully.
3.Switch OFF the setup when not in use.

GRAPH:-



DISCUSSION:-

The graph is plotted between displacement angle and output voltage. For DC Excitation the output voltage increases linearly with positive displacement angle and decreases with negative displacement angle. But for AC excitation it is reverse. The output voltage increases with negative displacement and decreases with positive displacement angle.

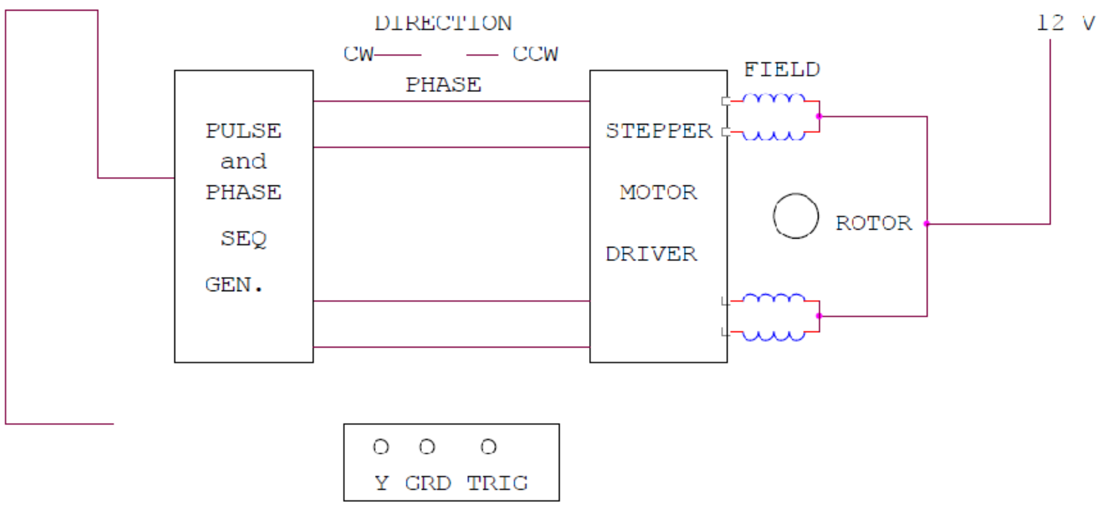
EXPERIMENT No.7

AIM:- To study the stepper motor and to execute microprocessor computer based control of the same by changing number of steps, the direction of rotation and speed.

APPARATUS USED:- Stepper Motor Kit,µP Kit, Interface Cord and Connecting Leads.

THEORY:- The stepper motor is a special type of motor which is designed to rotate through a specific angle called step for each electrical pulse received from its control unit. It is used in digitally controlled position control system in open loop mode. The input command is in form of a train of pulses to turn the shaft through a specified angle. the main unit is designed to interface with µP 8085 kit. The stepper motor controller card remains active while the pulse sequence generator disabled as given plug is connected with µp interface socket . following programmed enables the stepper motor to run with µp 8085 kit. For two phases four winding stepper motor only four LSB signals are required.

CIRCUIT DIAGRAM:-



PROCEDURE:- Connect the stepper motor with µp 8085 kit as shown in fig. press EXMEM key to enter the address as given then press NEXT to enter data

.

ADDRESS DATA

2000 3E 80 MVI A,80 Initialize port A as output port.
2002 D3 03 OUT 03 OB
2004 3E F9 Start MVI AFA
2006 D3 00 OUT 00 Output code for step o.
2008 CD 3020 call delay delay between two steps.
200B 3E F5 MVI A, F6 Location reserve for current
Delay.
200d D3 OO OUT OO Output code for step 1.
200F CD 3020 Call delay delay between two steps.
2012 3E F6 MVI A, F5
2014 D3 OO OUT OO Output code for step 2.
2016 CD 3020 calls delay between two steps.

2019 3E FA MVI A, F9.
201B D3 OO OUT OO Output code for step 3.
201D CD 3020 call delay delay between two steps.
2020 C3 04 20 JMP START Start.
Press FILL key to store data in memory area. This will complete the pulse sequence generation. To delay programmed route, first press EXMEM to start, a dot sign will appear in address field then enter the start address. Press NEXT to enter data.

ADDRESS DATA

2030 11 00 00 LXI D 00 00 Generates a delay.
2033 CD BC 03 CALL DELAY
2036 11 00 00 LXI D 00 00 Generates a delay.
2039 CD BC 03 CALL DELAY
203C C9 RET
Press FILL to save data.to execute the programmed press the key GO .The above programmed is to rotate the motor at a particular as defined by the given address. Changing the following contents will change the motor speed.

ADDRESS DATA

2030 11 00 20 AND 2036 TO SIMILAR 11 00 20
CHANGE 11 00 10 TO 11 00 10
CHANGE 11 00 05 TO 11 00 05
CHANGE 11 00 03 TO 11 00 03.
The motor direction depends upon codes FA, F6 ,F5 AND F9.Change in following codes will change the motor direction.

ADDRESS DATA
2005 3E F9 TO 3E FA
200C 3E F5 TO 3E F6
2012 3E F6 TO 3E F5
2019 3E FA TO 3E F9.

OBSERVATION TABLE:-

Sr No.	**No. of Pulses**	Displacement	Step Angle

RESULT:- The stepper motor runs as per fed programme.

PRECAUTION:-

1. Make the connection of motor with µp kit properly.
2. Feed the programmed carefully and correctly.
3. Do not change the motor direction at high speed.

EXPERIMENT No. 8

OBJECT:

Plot the characteristic curve of Phototransistor at variation of illumination.

EQUIPMENT REQUIRED:

Module Holder
Light Transducer and Control Module G13/EV
Light Transducer Interface Unit TY13/EV
PS1-PSU- Power supply unit
Measurement unit IU9/EV.
Connecting wires
DIN Cable

THEORY:

Phototransistor

The phototransistor is a device with a structure similar to the one of a standard transistor, but with a photo sensible base. It is generally NPN kind, it is powered with a positive voltage between collector and emitter while the base can be left open or connected to the emitter with a resistor.

In the second case, the sensitivity of the phototransistor can be adjusted by varying the value of the resistor used. In dark conditions, the current of the collector Ic is minimum and increases with illumination. Figure shows the symbol with the typical diagram of the connection of the phototransistor; furthermore it shows the characteristic curve with the relation between the variations of Ic and the variations of the illumination.

The main parameters of a phototransistor, in addition to the characteristic curve, are:

- The maximum dark current.
- The wavelength of maximum sensitivity.
- The switching speed (rise and fall times).
- The maximum admitted values of current, voltage and power.

The phototransistor used in the equipment has the following main characteristics:

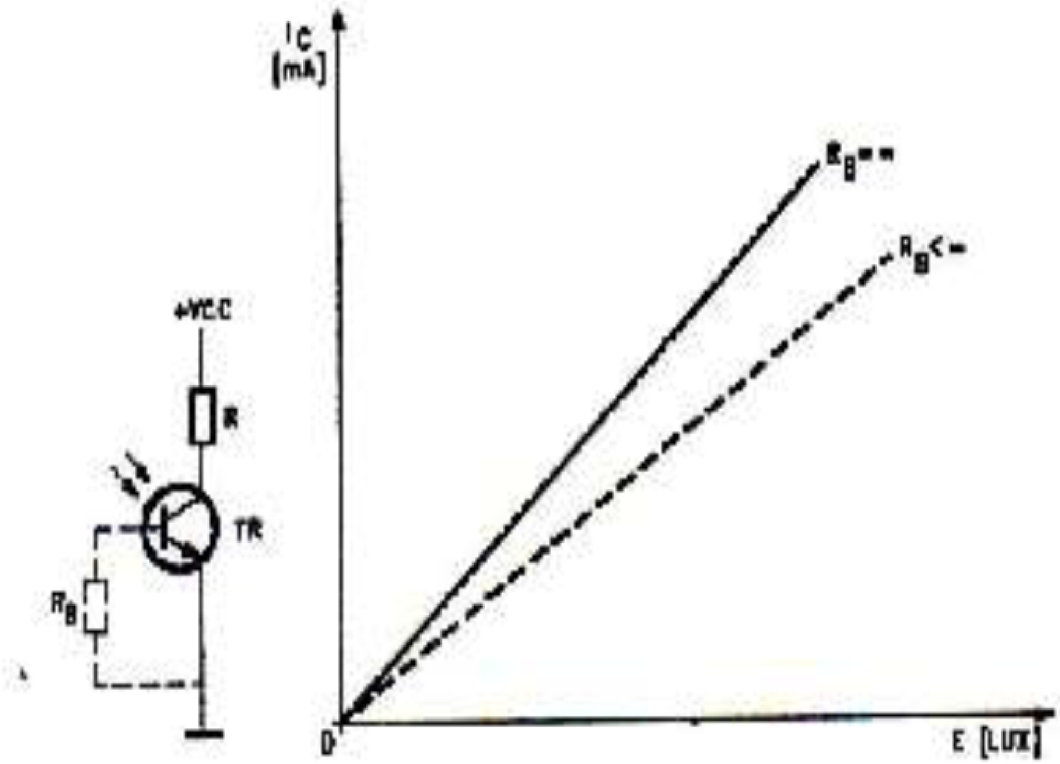
- Dark current: 20 μA
- Rise time: 8 μs
- Fall time: 6 μs
- Vce max: 30 V DC

PROCEDURE:

- Carry out the circuit of figure and connect module G-13 to units TY13/EV as in figure
- Set the switch of the PHOTODIODE CONDITIONER block to the position A, set the multimeter for D.C. current measurement and connect it between terminals 23 and ground.
- Connect module G13 to all the necessary supplies.
- Set the lamp to the maximum distance with the slide.
- Set the potentiometer of the SET-POINT block to the maximum value (300 Lux).
- Move the lamp near the light transducers with the slide, and in correspondence to the divisions shown on the panel of unit TY13/EV, read the

current values indicated by the multimeter and report them in table

- Plot a graph with illumination on the x-axis and current on the y-axis and draw the points detected.
- The characteristic curve of the transducer is obtained by joining these points.
- Set the switch to B and insert the multimeter, selected as voltmeter for D.C. voltage, between terminal 28 and ground.
- Repeat all the last measurements: in this case measure the response of the transducer together with the one of the signal conditioner.
- Plot a graph with illumination on the x-axis and voltage on the y-axis and draw the points detected.
- The characteristic curve of the transducer together with its signal conditioner is obtained by joining these points.
- Confront the quality of the two graphs.



OBSERVATION:

S no	Lux	Ampere	Volt
1	57		
2	68		
3	83		
4	104		
5	133		
6	177		
7	248		
8	370		
9	612		
10	1200		
11	3330		

RESULT:

The characteristic curve of Phototransistor is drawn and studied.

EXPERIMENT No. 9

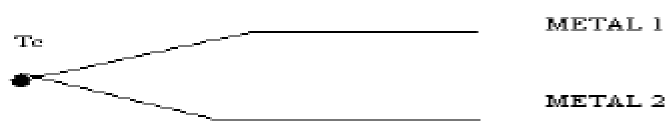
OBJECT:
Plot the characteristic curve of J type thermocouple and to determine thermo conditioner Couple linearity.

EQUIPMENT REQUIRED:
1. Module Holder
2. Module for transducer control G34/ EV
3. PS1-PSU- Power supply unit
4. Transducer attachment TY 34/EV
5. Measurement unit IU9/EV.
6. Connecting wires
7. Thermo Couple DIN cable.

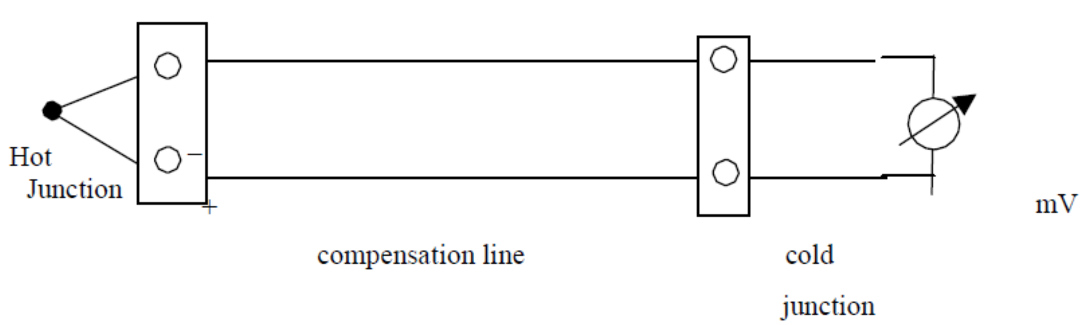
THEORY:

Thermocouple:

Thermocouples consist of two different metallic conductors, which are joined at one end by a galvanic contact (i.e. soldered) as shown in fig



The thermocouple (or hot junction) is introduced into the surrounding where the temperature is to be measured (e.g. inside an oven) and the conductors are brought to the point of measurement (cold junction), which is at a different temperature (see fig.). This circuit generates a thermoelectric E.M.F. (Electromotive force), which varies according to the difference between TC and TF (See beck effect)



By measuring this electromotive force, and as the temperature TF is a known quantity, it is possible to calculate the value to Tc. Since it is necessary to know the value of TF in order to calculate Tc, it is necessary to extend the wires of the thermocouple with compensating wires to a point at which the temperature is constant and known.

The most important of the thermocouples available in the market are as follows:

- **Fe-Constantan (type J)**
- **Ni-NiCr (type K)**
- **Cu-Constantan (type T)**

The E.M.F. of the Fe-Constantan thermocouple (J type) is much greater than that of the other types; its linearity is good, and it is inexpensive. One disadvantage is that the maximum temperature is limited by the iron element (700-800 °C).

The thermocouple examined in this case is of the Fe-Constantan type (type J), and has the following main characteristics:

- Transduction constant: 53 µV/°C
- Error: ±2.2°C in the 0 - 270°C range

±0.75% in the 270 - 760°C range

- Protected against atmospheric agents by metallic sheath

PROCEDURE:

- Set up the apparatus as described in the previous experiment replacing the signal conditioner for the (STT) with the signal conditioner for the thermocouple.
- Starting from ambient temperature, adjust the Set-Point knob in order to increase the temperature of the oven in 10°C step (i.e. bring the voltage on jack 2 to a value which corresponds to ambient temperature, then increase this voltage by a quantity which corresponds to a 10°C temperature increase). Measure the output voltage of the signal conditioner as soon as the temperature is stabilized.

If the temperature exceeds 150°C, remove the semiconductor transducer in order to avoid the possibility of damages.

- The reference temperature is given by a precision mercury thermometer (Centigrade scale)
- Compile a Voltage/Temperature table and then plot the characteristic curve on a graph
- Calculate the linearity of the thermocouple as described in the previous experiment.

OBSERVATION

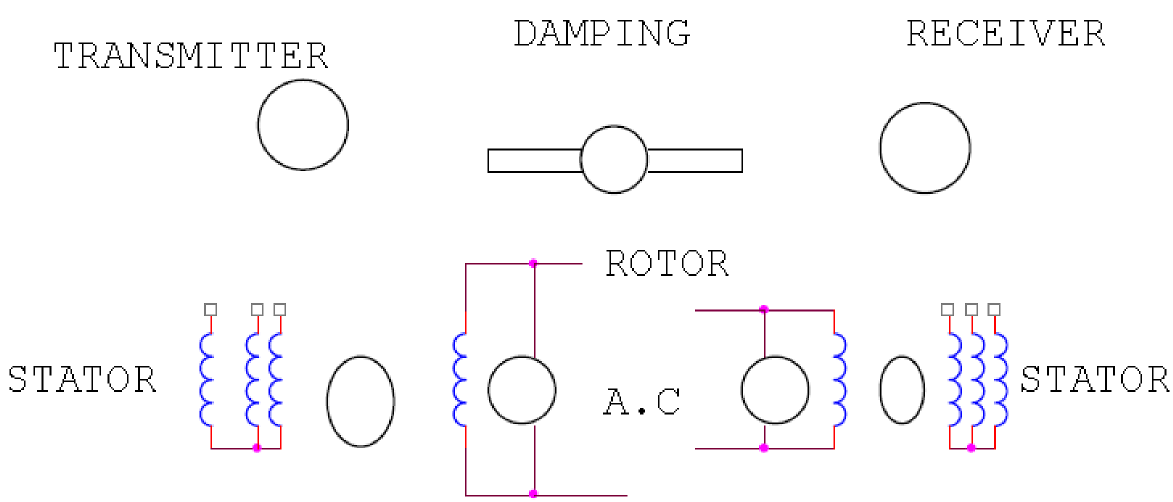
S. No.	T (°C)	Output Voltage of STT Sensor (V)
1	30 °C	
2	40 °C	
3	50 °C	
4	60 °C	
5	70 °C	
6	80 °C	
7	90 °C	
8	100 °C	
9	110 °C	
10	120 °C	
11	130 °C	

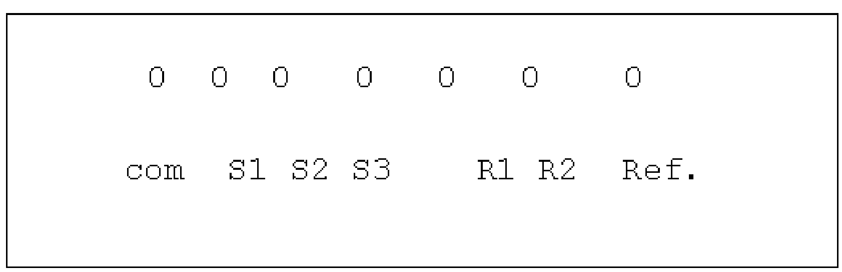
RESULT:

1. The characteristic curve of thermocouple is determined and studied.
2. The linearity of thermocouple is found to be %.

EXPERIMENT NO. 10

AIM: - To study of synchros (transmitter/ Receiver) system.
APPARATUS REQUIRED: - Synchro Tx & Rx set, A dual trace CRO and connecting leads.
BRIEF THEORY: - The synchro Transmitter/ Receiver demonstrator unit is designed to study of remote transmission of position in AC servomechanism. These are also called as torque Tx and Rx. The unit has one pair of Tx –Rx synchro motors powered by 60 V AC inbuilt supply. The synchro Tx has dumb ball shaped magnetic structure having primary winding upon rotor which is connected with the line through set of slip rings and brushes. The secondary windings are wound in slotted stator and distributed around its periphery.
CIRCUIT DIAGRAM:-





PROCEDURE:-
The experiment is completed is in three parts
1. To study of synchro Tx in terms of position V/s phase and voltage magnitude w.r.t. rotor voltage magnitude/ phase. Connect the circuit as shown in fig. Note the o/p Vpp and its phase angle either same as reference o/p or out of phase for each stator winding. Rotate Tx dial in 30 steps and note voltage magnitude and phase w.r. t. input as reference. Prepare an observation table.
2. To study synchro Tx/Rx as an Error detector. Connect the circuit as shown in fig. Start from 60 or 90 and note the Rx R2 o/p voltage and phase.

3. To study of remote position indication system using synchro-Tx and Rx. Connect the circuit as shown in fig. Keep Tx dial at 0 and watch Rx dial if there is any error removes it. Increase Tx from 30 to 330 in steps of 30 and note the Rx position record the observation in a table and find the difference between Tx and Rx dial position.

OBSERVATION TABLE:-1

S.No.	Angular Position in deg. Tx	Angular Position in deg. Rx	Difference in Degree Tx-Rx.

PRECAUTIONS: -

1. Move the transmitter and receiver dials slowly to avoid errors in reading.
2. Take the reading carefully in steady condition.
3. Switch of the setup when not in use.