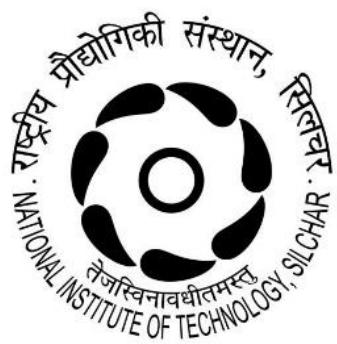


**Assignment No. 4    END SEM**

- 1) Write short notes on
  - a) Photochemical smog
  - b) Acid rain
  - c) Global warming
  - d) Salination of soil
  - e) Radioactive pollution
  - f) Composting
  - g) Maximum carrying capacity
  - h) Control method of air pollution
  - i) Disposal of solid waste, Land filling and composting
  - j) Disaster management
  - k) Watershed management
  - l) Role of engineers in sustainable development
  - m) Reasons of loss of biodiversity
- 2) Classify pollutant and explain with examples.
- 3) Explain various effects of water pollution.
- 4) What are the sources of soil pollution?
- 5) Explain the effects of various air pollutants on human being.
- 6) Explain the various control methods of air pollutants
- 7) Explain the various sources of ground water pollution.
- 8) Explain the measures adopted for control of noise pollution. State the zone-wise permissible ambient noise level recommended by Central Pollution Control Board.
- 9) Explain the factors affecting population growth rate.
- 10) What are the role of information technology in environment and human health?
- 11) What are the roles of CFCs in global environmental change?
- 12) What are the methods to control soil pollution?
- 13) What are the methods to control noise?
- 14) Enumerate the types of primary and secondary air pollutants?
- 15) Explain the effects of various nuclear radiation hazards.
- 16) Explain the Disposal of solid waste, Land filling and composting
- 17) What are the methods to control marine pollution?
- 18) Explain the Disposal of solid waste, Land filling and composting
- 19) What are the methods to control population growth?
- 20) SEE THE PREVIOUS QUESTION PAPER (2018 onwards) ALSO

**NATIONAL INSTITUTE OF TECHNOLOGY, SILCHAR**  
**(SUBMISSION OF ASSIGNMENT)**



NAME: RUDRANKA DAS  
SCHOLAR ID: 2113005  
DEPT. ELECTRICAL ENGINEERING  
SECTION: F  
SEMESTER: 1<sup>ST</sup>  
SUBJECT: CE 102  
DATE OF : 26/01/2022  
SUBMISSION

## **Q1. Define environment. Describe the components of environment.**

**Ans:** The environment refers to those surroundings that surrounds living beings from all sides and affect their lives in daily life. The place which surrounds us by various components such as water, air, land etc is known as environment.

The four major components of environment include lithosphere, hydrosphere, atmosphere and biosphere, corresponding to rocks, water, air and life respectively.

a-Lithosphere - The lithosphere refers to the solid, rocky crust that covers the entire planet.

b-Hydrosphere- The hydrosphere refers to the most important resource. The hydrosphere includes all forms of water in the Earth's environment. The forms of water include things such as the ocean, lakes, rivers, snow and glaciers, water underneath the earth's surface and even the water vapour that is found in the atmosphere.

c-Atmosphere- The atmosphere refers to the air that surrounds the earth. The atmosphere is always in motion and constantly changing. It's believed that there are about 14 different gases that make up the atmosphere.

d-Biosphere- The biosphere is composed of all living organisms, including; plants and animals. It is believed that all life exists in the biosphere.

## **Q2. Types of Environment. Objective of Environmental education.**

**Ans.** Well there are basically 2 types of accepted environments, which are:

**a. Natural or geographical:** The natural environment or natural world encompasses all living and non-living things,

meaning in this case not artificial. This environment encompasses the interaction of all living species, climate, weather and natural resources that affect human survival and economic activity.

Eg. Rivers, lakes, mountains, Trees etc

**b. Manmade:** Man-made environment is the environment created by humans. It includes permanent human settlements like villages, towns, cities, and transport and communication facilities, besides various other communities.

Eg. city, metro, malls etc.

The objectives of environmental studies are:

(a) Creating the awareness about environmental problems among people.

(b) Imparting basic knowledge about the environment and its allied problems.

(c) Developing an attitude of concern for the environment

### **Q3. How are Environmental studies multidisciplinary in nature?**

**Ans:** EVS is a multidisciplinary academic field that is involved with the exploration, research, and expansion of an understanding of the living and physical environment. It also helps in a better understanding of the natural, political, technological, economic, social, and cultural aspects of environments. It can also be said that Environmental Studies or EVS is the science of physical phenomena in the environment.

#### **Q4. What are major causes of environmental crisis?**

Ans. There are various causes for environmental crisis such as tremendous increasing rate of population, personal greed, becoming rich fast etc. some reasons may also include Pollution of air, land and water through excessive deforestation, industrialization and overfilling landfills which emits CO<sub>2</sub> and adds to greenhouse gas emissions are all topmost causes of these environmental issues and also some reason includes poverty, extreme urbanisation, and food insecurities.

The outcomes of environmental crisis can be:

- a) Climate change
- b) Depletion of Ozone layer
- c) Depletion or lowering levels of ground water.
- d) Land contamination
- e) Soil erosion etc

#### **Q5. What is the importance of environmental studies?**

Ans: Importance of environmental studies:

Environmental Education helps students understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future generation yet to come. Also, it's important to conserve our environment as it's not completely ours it also belongs to other creatures on this planet earth so that even they can feel the environment.

Also environmental Studies assists in understanding the current environmental problems by providing knowledge of physical, chemical, social, and biological processes. It is not a

hidden fact that development resulting in Urbanization; Industrial growth has a negative impact on the environment.

**Q6. Enumerate the major types of natural resources?**

**Ans.** The major types natural resources are renewable, living, non-renewable.

**Q7. Briefly explain the types of natural resources?**

**Ans.**

**a. Renewable:** A renewable resource, also known as a flow resource, is a natural resource which will replenish to replace the portion depleted by usage and consumption, either through natural reproduction or other recurring processes in a finite amount of time.

eg. Biomass, water, air, soil etc.

**b. Non-renewable:** A non-renewable resource is a natural resource that cannot be readily replaced by natural means at a pace quick enough to keep up with consumption.  
eg. Fossil fuels, petroleum, coal, heavy metals.

**c. Living:** These are those resources who are living creatures who perform some activities such as moving, grazing, eating etc.

eg. Hens, cattle, plants etc.

**Q8. Why forest is considered as natural resources?**

**Ans.** Forest are considered to be natural resources because natural resources mean ' from nature ' and forest is full of natural resources like wood, leaves, fruits, timber etc.

Also, Timber is used for making furniture, constructing houses, manufacturing paper, plywood and other products. A forest is a complex ecosystem which is predominantly composed of trees, shrubs and is usually a closed canopy. Forests are storehouses of a large variety of life forms such as plants, mammals, birds, insects and reptiles etc. Hence forests are also considered as natural resources.

**Q9. What do you mean by deforestation? How does it affect the ecosystem?**

**Ans.** Deforestation is a term used for cutting of forests precisely the trees for human purposes such as building roads, railways, connectivity, or human fun like places. It's generally done as mass cutting of trees inside a forest.

Sometimes deforestation is done by nearby people for wood collection, hunting purposes etc.

Sometimes even for some construction purposes complete forests are laid down to make the place spacious.

It affects our ecosystem in following manner:

- a. It degrades the soil leading to soil erosion.
- b. Due to this the rainfall is much less than previous.
- c. Groundwater levels become low because forests hold the groundwater through their roots.
- d. It takes away homes of animals.

**Q10.What are the measures that can be adopted for the conservation of forest?**

**Ans:** The following steps can be adopted for conservation of forest:

- a. Regulated planned cutting of trees
- b. Control over forest fire

- c. Reforestation and Afforestation
- d. Protection of forest
- e. Proper utilization of forest products and forest

### **Q11. Why is water regarded as natural resource?**

**Ans.** Water is a natural resource because it is a part of nature. It is present on earth before life started. It is natural because it is derived from nature by rain or other natural sources such as lake, river etc.

And the best way to conserve the water is by rainwater harvesting as it gives out the purest form of water.

### **Q12. What are problems faced with water resources?**

**Ans.** The problems faced by water resources are as follows:

1. The chemicals released by factories.
2. People bring their animals such as cattle, buffaloes, etc for cleaning them.
3. People wash their clothes and release their detergents and soaps in the water body only.
4. Acid rains affect the water bodies a lot by decreasing their pH by a considerable amount.
5. Maritime fishing is also a great cause in water pollution now a days.

### **Q13. What are major environmental issues of water pollution?**

**Ans:** The major issues of water pollution are :-

1. Water pollution depletes aquatic ecosystems.
2. Fishing in polluted waters and the use of waste water for livestock farming and agriculture can毒害 the food which are harmful to our health when eaten.

3. Lack or bad quality of drinking water.
4. Decreases the basicity/alkanity of water by making it acidic killing tremendous aquatic life.

#### **Q14. What are main approaches to conserve water?**

Ans. First of all we all should by our own try to conserve water by using it precisely or in a less amount. For example, we should install water saving toilet or flush which will save a good amount of water.

Also Digging ponds, lakes, canals, expanding the water reservoir, and installing rain water catching ducts and filtration systems on homes are different methods of harvesting rain water.

Also, in some countries people keep their water storing tank clean to boil and drink this water.

#### **Q15. Explain values of minerals as natural resources?**

Ans. Minerals are natural resources which are limited and non-renewable in nature.

Also, Minerals provide the material used to make most of the things of industrial-based society; roads, cars, computers, fertilizers, etc.

Demand for minerals is increasing worldwide as the population increases and the consumption demands of individual people increase.

The mining of earth's natural resources is, therefore accelerating, and it has accompanying environmental consequences.

Minerals are generally found deep inside earth in form of ores or sometimes pure.

## **Q16. What are the effects of Mining and its remedial measures?**

**Ans.** Mining is the extraction of minerals and other geological materials of economic value from deposits on the Earth.

**Effects:** Mining adversely affects the environment by inducing loss of biodiversity, soil erosion, and contamination of surface water, groundwater, and soil. Mining can also trigger the formation of sinkholes.

**Remedial measures** are as follows:

- a. By instead using new, alternative low-impact mining techniques.
- b. Companies can use waste rocks in simple on-site construction, like backfilling voids and reconstructing mined terrain in a way that prevents soil erosion.
- c. By planting more and more trees.

## **Q17. What are world food problems?**

**Ans.** Two of the major food problems to the world is because of poor soil quality due to lack of nutrients, acidic nature of soil etc.

And secondly the tremendous increasing population of globe due to which the food is either not reached to people or if it reached then the quality becomes adverse.

The total number of people suffering from a lack of food is over one billion people worldwide. The fact is that population growth outpaces agricultural production and the development of agricultural technologies.

## **Q18. What are impacts of overgrazing and impacts of traditional methods of agriculture?**

**Ans.** The major impacts of overgrazing are:

1. The topmost layer soil of soil which is most fertile gets depleted.
  2. Reduces productivity of soil.
  3. Reduces the number of good bacteria and micro- organisms in soil as they get eaten by animals.
- The major impacts of traditional methods of agriculture
1. Wastage of tremendous amount of water.
  2. Usage of much more labour and manpower.
  3. Wastage of time and money as traditional methods require lots of equipments and time.

## **Q19. What are impacts of modern agriculture in crop production?**

**Ans.** There are both positive and negative impacts of modern methods which are as listed below: -

### **POSITIVE-**

1. Usage of much less amount of water.
2. Saves time and money.
3. Reduces labour work and other members can do other work.

### **NEGATIVE-**

1. Usage of lots of fertilizers as people do it in greed of fast production of crops.
2. Kills the important bacteria present in the soil.
3. Installation of the hardware required is not that easy.

**Q20. State the basic principle of soil conversion and brief various methods of conserving it.**

**Ans.** The basic principle of soil conversion is to maintain its fertility and its texture so that the soil remains fit for work for quite a long period of time.

Some of the methods are:-

- a. **Crop rotation:** It includes changing the production of crops over a season but not repeating the same crop for all seasons as the same crop year after year depletes the soil mineral
- b. Using of natural manure made of cow dung and natural items in place of chemical fertilizers and urea.
- c. Not flooding the crops but using amount of water only needed because flooding the crops washes away the fertile part of soil.
- d. **Dry farming:** This practice is useful for croplands grown in low and moderate rainfall areas where ordinary farming is at risk. Crop production, animal husbandry and growing grazing fields are the possibilities of checking erosion.

**Q21. How can we control land degradation?**

**Ans:-** We can control land degradation in following ways:-

- a. Afforestation.
- b. Proper management of grazing to control over grazing.
- c. Planting of shelter belts of plants.
- d. Stabilization of sand dunes by growing thorny bushes.
- e. Control of mining activities.
- f. Proper discharge and disposal of industrial effluents and wastes after treatment.

## **Q22. Enumerate various sources of energy for mankind?**

**Ans.** The various forms of energy are as follows:-

- a. Solar energy
- b. Wind energy
- c. Hydro/hydro electric energy
- d. Fossil fuels, coal and petroleum
- e. Natural gas and gobar gas.
- f. Geothermal energy.

## **Q23. Describe in brief various natural resources of energy?**

**Ans.** Renewable energy term coins for the energy or source of energy which is easily replenished in less amount of time either naturally or by artificial methods and we can rely on them for lifelong as our sources of energy.

The various renewable sources of energy are as follows: -

**a. Solar energy** is simply the light and heat that come from the sun. People can harness the sun's energy in a few different ways: Photovoltaic cells, which convert sunlight into electricity.

Its best and most reliable source of energy as sun is never going to end in our lifetime.

**b. Wind energy** describes the process by which the wind is used to generate electricity. Wind turbines convert the kinetic energy in the wind into mechanical power or electricity.

**c. Geothermal energy** is a type of renewable energy taken from the Earth's core. It comes from heat generated during the original formation of the planet and the radioactive decay of materials. This thermal energy is stored in rocks and fluids in the centre of the earth.

**d. Biomass energy** is basically produced from the biomass such as cow dung and other animal wastes. It's also renewable source of energy as it takes approximate 5-6 months to

replenish and the best part of this form of energy is it does not cause any pollution by any means.

**Q24. Describe the advantages and disadvantages of**

- A. Solar energy      B. Tidal energy      C. Wind energy**
- D. Hydropower energy      E. Biomass energy.**

**Ans.**

**a) Solar energy** is the most reliable source of energy as its directly derived from sun itself and its completely free source of energy.

The negative impact of solar energy is the solar cells are way too costly because of use of high-quality silver and silicon inside it. Also, this energy can't be harnessed on cloudy days.

**b) Tidal energy** is a highly predictable energy source. High energy density. Operational and maintenance costs are low. An inexhaustible source of energy. But it can't directly depend on it as its very much depends on prediction and it is not efficient way of energy harnessing.

**c) Wind energy** is a renewable and clean source of energy does not cause any pollution but the building cost and maintenance of windmill is high also its very noise producing source of energy

**d) Hydro plants** is also a renewable source of energy and its safe and reliable source of energy. But it's very expensive to build and it has environmental consequence.

**e) Biomass energy** is also a renewable source of energy and it maintains amount of CO<sub>2</sub> in nature as preparation requires CO<sub>2</sub>. But it requires a lot of space which can lead to deforestation and it's not that clean.

**Measurement Laboratory**

**B. Tech (Electrical Engg.) - Third Semester (Core)**

**List of Experiments**

1. To calibrate a three phase Energy Meter by comparing with a Sub-standard meter.
2. Measurement of Power and Power Factor of a three-phase circuit.
3. To calibrate Single-phase Energy meter by comparing with a Sub-standard meter.
4. To measure medium resistance with the help of Wheatstone bridge.
5. To measure medium resistance with the help of Substitution method.
6. To measure capacitance of a given capacitor by using A.C. bridge.
7. Measurement of Peak and RMS Voltages and Frequency of AC by using Cathode Ray Oscilloscope (CRO).

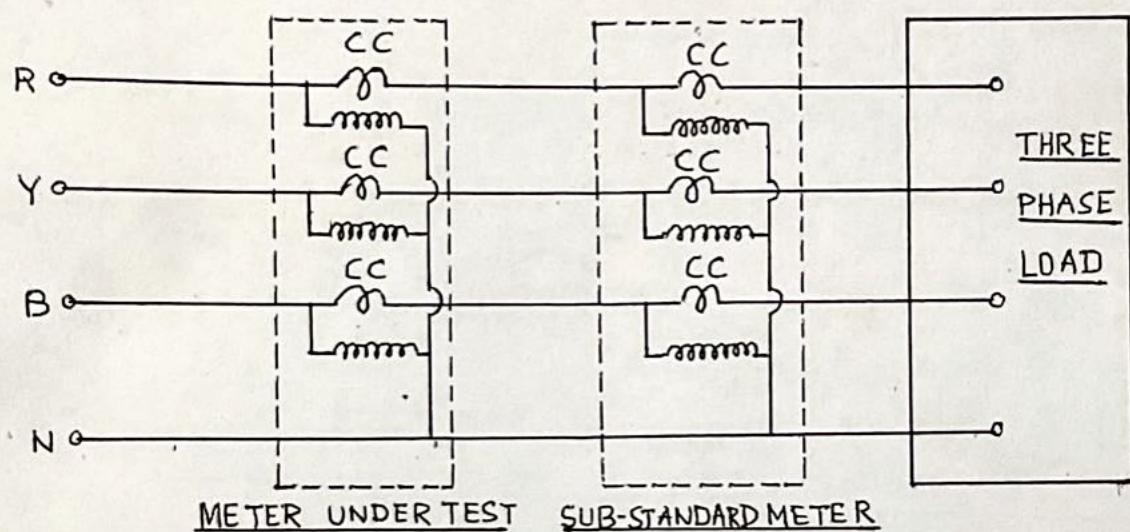
## Experiment No.1

Name of the Experiment:- To calibrate a three phase Energy Meter by comparing with a Sub-standard meter.

Objectives:- To measure the Energy in a Three phase load using a Three phase Energy meter.

Brief Theory:- An Energy meter has two elements , current coil & Potential coils.Three phase Energy meters may have two elements or three elements.All the elements drive the same disc mounted on a spindle .In addition to compensating drives,attached to each element,an adjustable magnetic shunt is provided on one or both elements to balance the torque that produced .The Pressure coils are connected in parallel and the current coils are connected in series with three phase system having 3 phase load .

Circuit diagram:-



Instrument & Accessories:-

SL. No.	Name of the Equipment /Instrument	Range /Rating	Maker
1	Energy meter 3-φ induction type		
2	Energy meter 3-φ induction type		
3	3-φ variable load		
4	Any other		

Procedure :- The two 3- $\phi$  energy meters and variable load are connected according to ckt. diagram .Before switching "ON" the position and Reading of both the Energy meter's Disc & Registers are noted down .Power is now switched "ON "and a particular Load is thrown in the ckt.The Load is supplied with 3- $\phi$  power for an hour .Source is then switched off .Readings of the No. of revolutions made by Disc's of both Energy meter are noted down along with indicated value of registers Percentage Error is calculated.

Let,  $N_1$  = No of Revolution of Sub-Standard meter  
 $N_2$  = No of Revolution of meter under test.

$$\text{Percentage error} = 100 * (N_2 - N_1) / N_1$$

Observations and Results :-

Sl No	Revolution of Substandard Meter ( $N_1$ )	Revolution of meter under test ( $N_2$ )	Error ( $N_2 - N_1$ )	%ge Error = $100 * (N_2 - N_1) / N_1$

Comments and discussion on the result :-

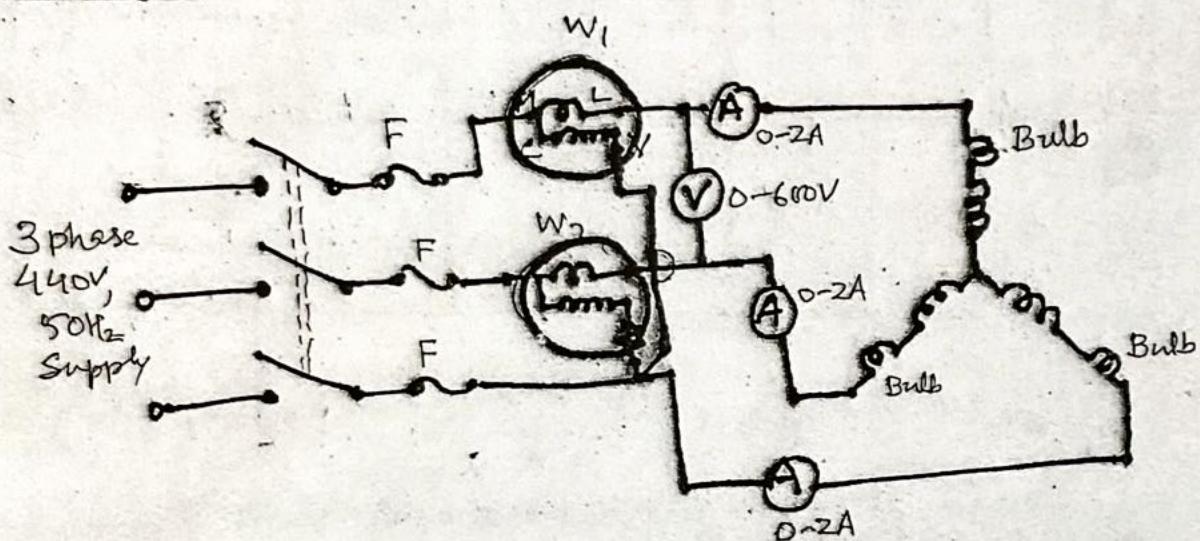
Discuss on the methods of testing of energy meters (any two method)

Experiment No.2

Title: Measurement of Power and Power Factor of a three phase circuit.

Aim: To measure the power in three phase AC circuit by two wattmeter method and to calculate the p.f of the load.

Circuit diagram:



Theory: In the two wattmeter method of power measurement in a three phase circuit.

The two wattmeter readings are

$$W_1 = VI \cos(30^\circ - \phi) \text{ and } W_2 = VI \cos(30^\circ + \phi)$$

$$W_1 + W_2 = \sqrt{3} VI \cos \phi ; \text{ where } V = \text{line voltage}$$

I = line current

$$W_1 - W_2 = VI \sin \phi$$

$$\text{therefore, } \phi = \arctan(\sqrt{3}(W_1 - W_2)/(W_1 + W_2))$$

$$\text{therefore, p.f.} = \cos \phi$$

Procedure:

Experimental Observation

M.F of wattmeter - C.C rating \* P.C rating  
No of divisons

S l n o	Wattmeter readings		V	I		W = W1 + W2	$\cos \phi =$	Inference
	W1	W2						
1			22					
2								
3								

Important:

Draw the phasor diagram and verify your calculated result with this graphical method and compare the phase angle.

Answer the following questions.

- 1) Draw the phasor diagram of the 3-phase circuit in the experiment.
- 2) What is lagging p.f load? How it is made?
- 3) Whether the p.f obtained here is lagging or leading?

## Experiment No. 3

Name of the Experiment :- To calibrate a Single-phase Energy meter by comparing with a Substandard meter and also by calculation.

Objectives :- (1) To measure Energy by using a Kwh-meter.

(2) To compare the Readings of a given Energy meter with that of a Sub standard-meter.

Brief Theory :- The manufacturer generally prints the meter constant on each Energy-meter. A meter constant of say 600 means that for 600 revolution of meter disc, the meter will record 1Kwh. To check correctness of this, the meter is connected in series with a sub standard meter with a known Load. The true value of Energy consume for a fixed period of time recorded by a stop watch, is calculated from the readings of ammeter and Volt-meter, and a Power-factor meter.

The Energy recorded by the Energy-meter is calculated from its meter constant as follows :

For 600 revolutions the meter reads 1Kwh.

Therefore, for X revolutions the meter reads  $\frac{1 \times X}{600}$  Kwh.

Energy calculated by the Load is also calculated from the readings of the Voltmeter ammeter and Stop watch and Power-factor meter.

$$\text{Energy consumed Kwh} = \frac{\text{V I}}{1000} * \text{time in hour} \rightarrow E_C$$

Let Energy recorded by the Substandard meter  $= E_S$

Energy recorded by the meter under test  $= E_T$

Energy Calculated  $= E_C$

$$E_P = \frac{E_S - E_T}{E_S} * 100 \quad \text{by comparing with a sub-standard meter.}$$

$$E_P = \frac{E_C - E_T}{E_C} * 100 \quad \text{by comparing with calculated Value}$$

Errors thus found may be compared.

Procedure :- (1) Make connection as per the circuit diagram.

(2) Switch 'ON' a fixed Load.

(3) Switch 'ON' main Power Supply.

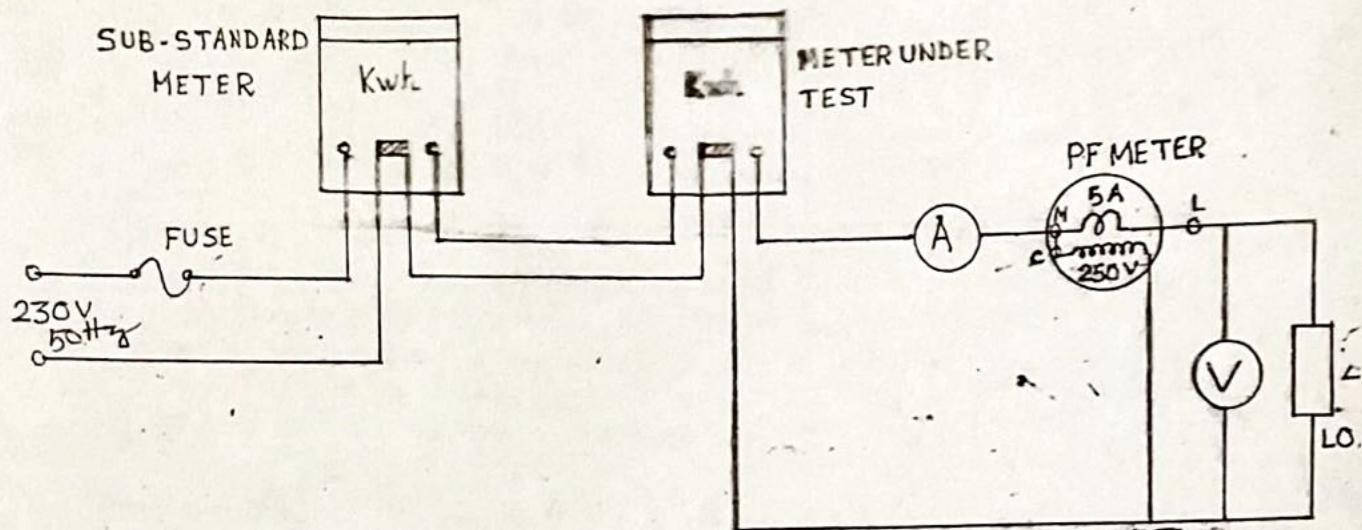
(4) And at the same time run the Stop watch.

(5) Record the Energy meter readings over a fixed period of time (say 30 minutes).

(6) Record the readings of Volt-meter, Ammeter and Power-factor meter.

(7) Count the revolutions of Disc of Energy meter.

Circuit Diagram :-



Instruments /Accessories required :-

Sl. No.	Name of the Equipment/Instrument	No.	Range / Rating	Maker's Name
1.	Energy meter , 1-φ			
2.	Sub standard Energy meter Single-Phase .			
3.	Stop watch .			
4.	Ammeter			
5.	Voltmeter			
6.	Single phase Load			
7.	Connection Lead			

Observations & Results :-

Sl. No.	No.of revolution of the meter under test	No.of revolution of the Sub - standard test	Voltmeter reading	Ammeter reading	Gas Watt meter reading	% Error with Substandard meter E <sub>1</sub>	% Error with calculate-dEnergy E <sub>2</sub>	Remarks on observations if any
1.								
2.								

1. Comments / Discussion on the Results :-

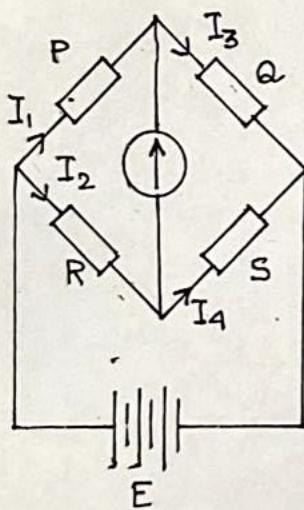
2. Explain creeping and phantom loading.

## Experiment No. 4

Name of the experiment : To measure medium resistance with the help of Wheatstone Bridge.

Objective : To measure medium resistance and to verify the result with that of standard value.

Brief Theory : Wheatstone Bridge is a very simple circuit used most commonly for measuring medium resistances. It has four resistive arms, together with a source of emf (a battery) and a galvanometer/detector. A simple circuit of the Wheatstone Bridge is shown below:



At null point no current flows through the galvanometer. At balance ( or at null point).

$$I_1 P = I_2 R \quad \dots \dots \dots (1)$$

$$I_1 = I_3$$

$$\text{And, } I_2 = I_4$$

$$I_1 = I_3 = E/(P+Q) \quad \dots \dots \dots (2)$$

$$I_2 = I_4 = E/(R+S) \quad \dots \dots \dots (3)$$

Substituting I<sub>1</sub> and I<sub>2</sub> in equation (1) gives,

$$E.P/(P+Q) = E.R/(R+S)$$

$$\text{or, } PR + PS = PR + QR$$

$$\text{or, } PS = QR$$

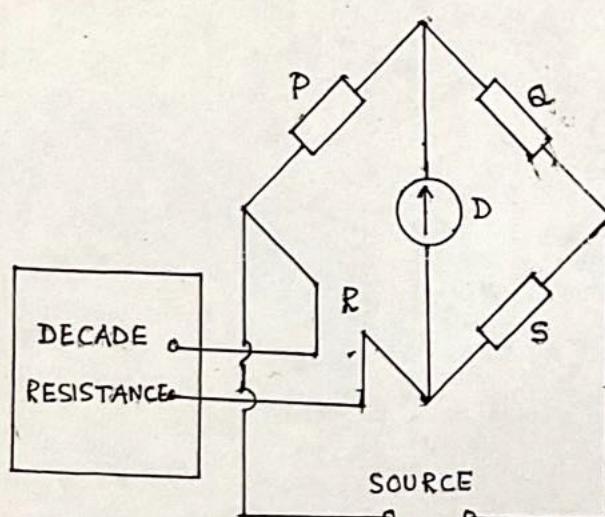
$$\text{or, } P/Q = R/S$$

$$\text{or, } R = S.P/Q$$

where S is called standard arm and P and Q are called ratio arm of the bridge.

#### Procedure :

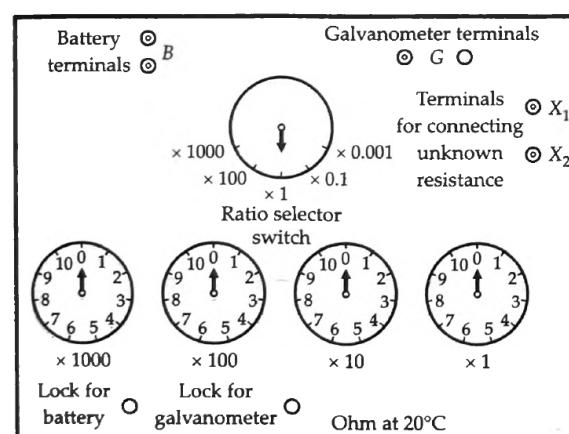
Make connection as shown below. Fix a Standard Resistance in the arm 'R' of Bridge, put on the supply. Now adjust resistance 'S' of standard resistance of Wheatstone bridge till a null point as indicated by the detector of the bridge is obtained. Increase the sensitivity of the detector and check the null point to confirm the balance of the bridge. Read the value of the standard resistance of the bridge as indicated by the knob. The value of this resistance is the value of the unknown resistance. Since unknown resistance is connected to the decade resistance box, the value of the unknown resistance as indicated by the decade resistance box is known. Compare the test value with standard value and find error.



#### Instruments and Accessories :

Sl.No.	Name of instrument	Range, Rating

In the industrial and laboratory form of the bridge, the resistors which make up P, Q and S are mounted together in a box, the appropriate values being selected by dial switches. Battery and galvanometer switches are also included together with a galvanometer and a dry battery in the portable sets. P and Q normally consist of four resistors each, the values being 10, 100, 1000 and 10,000  $\Omega$  respectively S consists of a 4 dial or 5 dial decade arrangement of resistors. Figure 14.4 shows the commercial form of Wheatstone bridge.



#### Observation and Result :

Sl.No.	Calculated value	Standard value	Difference	Error	% Error

#### Discussion/ Comments :

Explain the localization of faults in cables by i) Murray loop test  
ii) Verley loop test

# Experiment No. 5

- Name of the Experiment :- To measure the Medium resistance using Substitution Method .

objectives :-(1) To get familiar with substitution Method for measuring Medium resistance.

(2) To get familiar with change over switch .

Brief Theory :- Resistance from the pt. of view of measurement may be classified as follows :

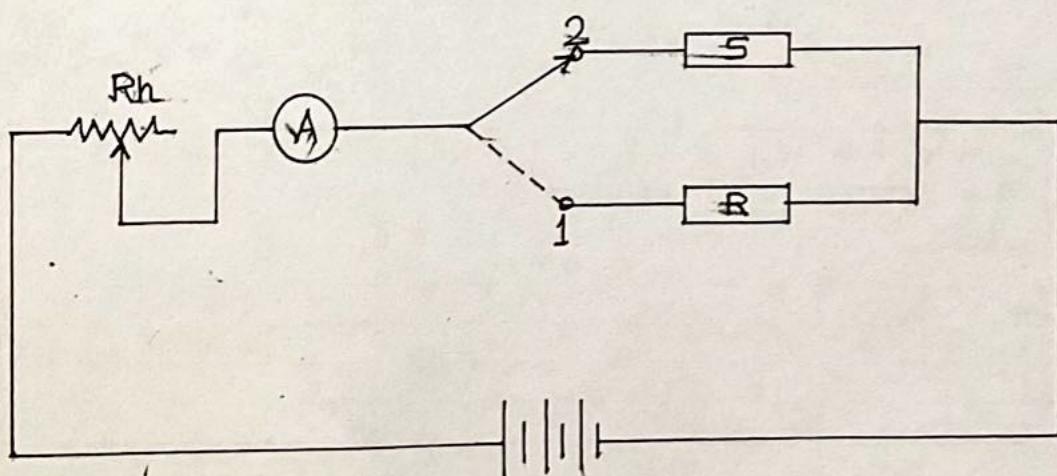
- (1) *Low resistance*: All the resistances of the order of 1 ohm or less are classified as Low resistance .
- (2) *Medium resistance* : All resistances from 1 ohm to 100k-ohm are put under this class .
- (3) *High resistance* : All resistances from 100k-ohm and above are classified as High resistance .

The different methods for measurement of medium resistances are :

- (a)Ammeter-Voltmeter method .
- (b)Wheatstone-bridge method .
- (c) Substitution-method .
- (d) Ohm-meter-method .

## Circuit Diagram :

The ckt. diagram used for measurement of Medium resistance by Substitution method is given below :



E 12V

S =Standard variable resistance

R=Unknown resistance.

R<sub>h</sub>= Rheostat

*W.S. 100*  
The switch is first placed at the position 1 and a suitable current  $I$  is obtained in the ckt. by varying  $R_h$ . Switch is now placed at the position second standard resistance  $S$  varied till the same current  $I$  is obtained. The value of  $R$  is thus equal to dial reading of the variable resistance  $S$ .

This method is more accurate than Ammeter Voltmeter method. However, the source emf should be strictly const. during the measurement.

Instruments required :

Sl.No.	Name of the instrument	Range/Rating	Maker's name
1.	Ammeter (A)		
2.	Resistance(S)		
3.	Un-known resistance (R)		
4.	Rheostat ( $R_h$ )		
5.	Throw switch		

- Procedure :
- (1) Connect all the components as shown in the ckt. diagram .
  - (2) Put the change over switch at the position 1 and vary  $R_h$  until a suitable a current  $I$  can be read from the ammeter .
  - (3) Now place the switch at the position 2 .
  - (4) Leave  $R_h$  unturned .
  - (5) Vary the standard resistance  $S$  until the same  $I$  is seen in the ammeter .
  - (6) This value of  $S$  is the value of your unknown resistance .

Observations & Results :-

Sl.No.	Reading of the Ammeter with switch at position 1(A)	Value of S Switch at position 2(ohm)	Value of Unknown resistance(R)
1.			
2.			
3.			
4.			
5.			

Discussion :-

Describe a method to measure resistance of stones (chips).

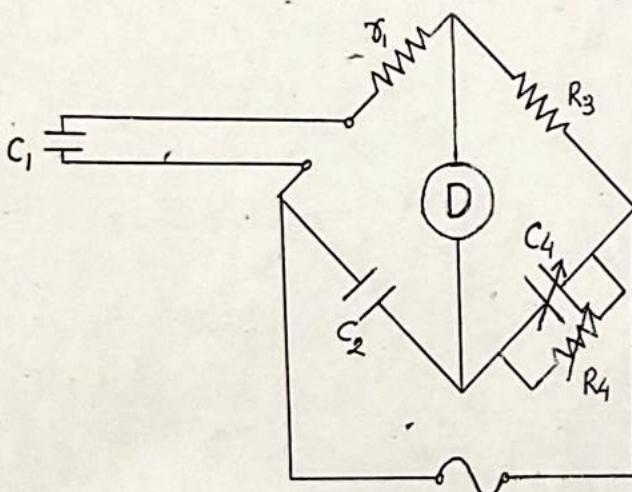
# Experiment No. 6

Name of the experiment : To measure capacitance of a given capacitor.

Objective : To measure capacitance of a given capacitor using Schering Bridge and to calculate dissipation factor.

**Brief Theory :** Schering Bridge is an A.C Bridge which can be used to measure value of unknown capacitance of a capacitor. The figure below shows different components of arms of the bridge. By varying the capacitor  $C_4$  and resistance  $R_4$ , a null point is obtained by using a ear phone as a detector. At balance condition.

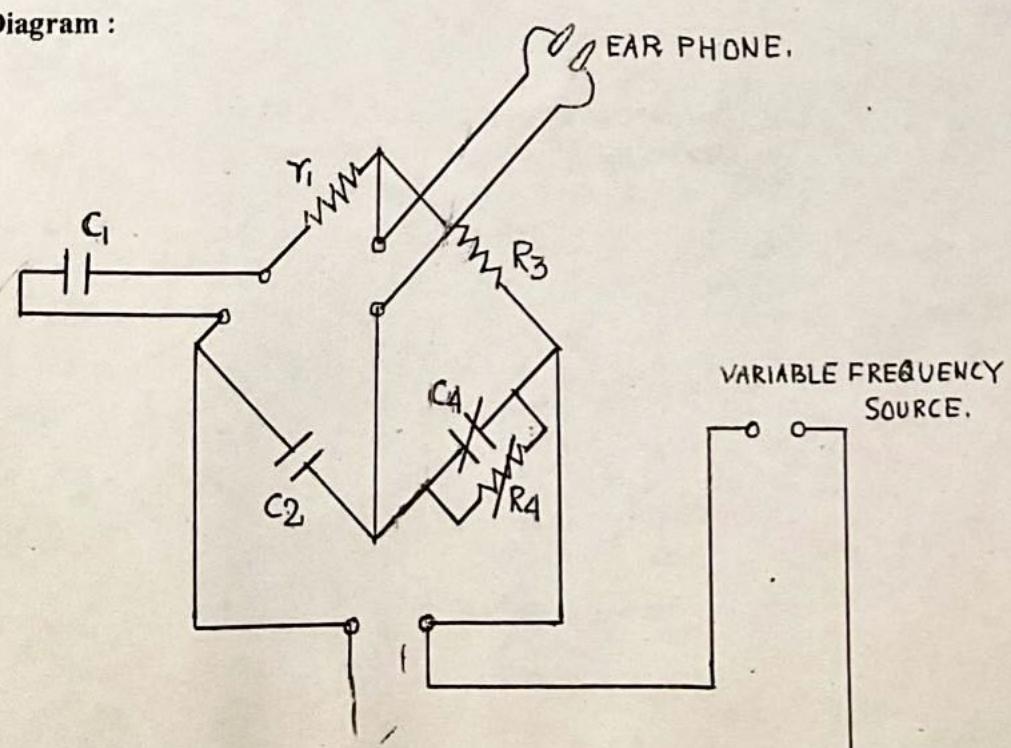
$$C_1 = (C_2, R_4)/R_3$$



$$\text{Dissipation factor } D_1 = \tan \delta = \omega C_1 R_1 = \omega C_4 R_4$$

Therefore for finding dissipation factor 'D1', the frequency of the source must be known.

**Circuit Diagram :**



**Procedure :**

The connection is made as per circuit diagram as shown in other page. A variable frequency source is connected as shown. By varying  $C_4$  and  $R_4$  a balance condition is obtained with the help of a ear phone which acts as detector. The value of unknown capacitance and dissipation factor is calculated by using formulae mentioned in the theory.

**Instruments and Accessories :**

Sl.No.	Name of instrument	Range, Rating	Maker's name

**Observation and Result :**

Sl. No	Frequency Of the source G.S	Value Of $C_4$ in Farad	Value Of $C_2$ in Farad	Value Of $r_1$ in ohm	Value Of $R_3$ in ohm	Value Of $R_4$ in ohm	Calculated value of	
							Dissipa- tion factor	$C_1$ in Farad

**Discussion/ Comments :****Questions :**

1. Draw the phasor diagram of the Bridge.
2. Discuss the advantages and disadvantages of the bridge.
3. Comment on selection of source frequency.
4. How the effect of stray capacitances can be eliminated.

# Experiment No. 7

Measurement of Peak and RMS Voltages and Frequency of AC by using Cathode Ray Oscilloscope (CRO)

**Aim:-** To study the different waveforms, to measure peak and RMS voltages and the frequency of A.C.

**Apparatus:-** A C.R.O and a signal generator.

**Theory:-** Cathode ray oscilloscope is one of the most useful electronic equipment, which gives a visual representation of electrical quantities, such as voltage and current waveforms in an electrical circuit. It utilizes the properties of cathode rays of being deflected by an electric and magnetic fields and of producing scintillations on a fluorescent screen. Since the inertia of cathode rays is very small, they are able to follow the alterations of very high frequency fields and thus electron beam serves as a practically inertia less pointer. When a varying potential difference is established across two plates between which the beam is passing, it is deflected and moves in accordance with the variation of potential difference. When this electron beam impinges upon a fluorescent screen, a bright luminous spot is produced there which shows and follows faithfully the variation of potential difference.

When an AC voltage is applied to Y-plates, the spot of light moves on the screen vertically up and down in straight line. This line does not reveal the nature of applied voltage waveform. Thus to obtain the actual waveform, a time-base circuit is necessary. A time-base circuit is a circuit which generates a saw-tooth waveform. It causes the spot to move in the horizontal and vertical direction linearly with time. When the vertical motion of the spot produced by the Y-plates due to alternating voltage, is superimposed over the horizontal sweep produced by X-plates, the actual waveform is traced on the screen.

**Procedure:-**

**Study of Waveforms:** To study the waveforms of an A.C voltage, it is led to the y-plates and the time base voltage is given to the X-plates. The size of the figure displayed on the screen, can be adjusted suitably by adjusting the gain controls. The time base frequency can be changed, so as to

accommodate one, two or more cycles of the signal. There is a provision in C.R.O to obtain a sine wave or a square wave or a triangular wave.

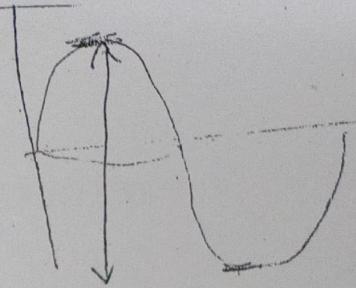
**Measurement of D.C. Voltage:** - Deflection on a CRO screen is directly proportional to the voltage applied to the deflecting plates. Therefore, if the screen is first calibrated in terms of known voltage i.e. the deflection sensitivity is determined, the direct voltage can be measured by applying it between a pair of deflecting plates. The amount of deflection so produced multiplied by the deflection sensitivity, gives the value of direct voltage.

**Measurement of A.C Voltage:** - To measure the alternating voltage of sinusoidal waveform, The A.C. signal, from the signal generator, is applied across the y-plates. The voltage (deflection) sensitivity band switch (Y-plates) and time base band switch (X-plates) are adjusted such that a steady picture of the waveform is obtained on the screen. The vertical height ( $l$ ) i.e. peak-to-peak height is measured. When this peak-to-peak height ( $l$ ) is multiplied by the voltage (deflection) sensitivity ( $n$ ) i.e. volt/div, we get the peak-to-peak voltage ( $2V_o$ ). From this we get the peak voltage ( $V_o$ ). The rms voltage  $V_{rms}$  is equal to  $V_o / \sqrt{2}$ . This rms voltage  $V_{rms}$  is verified with rms voltage value, measured by the multi-meter.

**Measurement of Frequency:** - An unknown frequency source (signal generator) is connected to y-plates of C.R.O. Time base signal is connected to x-plates (internally connected). We get a sinusoidal wave on the screen, after the adjustment of voltage sensitivity band switch (Y-plates) and time base band switch (X-plates). The horizontal length ( $l$ ) between two successive peaks is noted. When this horizontal length ( $l$ ) is multiplied by the time base ( $m$ ) i.e. sec/div, we get the time-period ( $T$ ). The reciprocal of the time-period ( $1/T$ ) gives the frequency ( $f$ ). This can be verified with the frequency, measured by the multi-meter.

Result:

Table: 1  
Voltage Measurement



Sl No.	Peak to peak (vertical) length. (Division) (l)	Voltage Sensitivity. (Volt/Div). (n)	Peak to peak voltage ( $V_{PK} - V_{PK}$ )=n xl (volts)	$V_{max} = \frac{V_{PK} - V_{PK}}{2}$ (volts)	RMS Voltage $V_{rms} = \frac{V_{max}}{\sqrt{2}}$ (volts)	Measured voltage with multimeter (volts)
1.	12	5V	73.9	= 35	24.74	04.96
2.	13.9	2				
3.						
4.						7
5.						

Table: 2  
Frequency measurement

Sl. No.	Horizontal length for a complete cycle. (Division) (l)	Time-base Sec/Div (m)	Time period $T=mxl$	Measured frequency $F=1/T$	Applied Frequency Hz	Measured frequency with multimeter (Hz)
1.						
2.						
3.						
4.						
5.						0.686

Precaution: 1) The continuity of connecting wires should be tested first.

2) The frequency of the signal should be varies such that steady wave form is formed.