Summer – 2017 Examinations

Model Answers **Subject Code: 17322 (EEM)**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.

2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.

3) The language errors such as grammatical, spelling errors should not be given more importance (Not applicable for subject English and Communication Skills).

4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.

5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.

6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.

7) For programming language papers, credit may be given to any other program based on equivalent concept.

1 **Attempt any TEN of the following:** 20

1 a) State the meaning of absolute instrument and secondary instrument.

Ans:

Absolute instrument: These are instruments which read quantity under measurement indirectly i.e. in terms of deflection, degrees and meter constant e.g. tangent galvanometer 1 mark each

Secondary instrument: These instruments read the quantity under measurement directly at the time of measurement e.g. ammeter, voltmeter.

1 b) Write any two difference between indicating and integrating instruments.

Ans:

Difference between indicating and integrating instruments:

Indicating Instruments	Integrating Instruments
1. These instruments give RMS or average value of quantity under measurement.	1. These instruments give summation of quantity under measurement over a certain period of time.
2.Reading is given with the help of pointer and calibrated scale.	2. Reading is given with help of registering and counting mechanism.
3.Example:Ammeter,voltmeter	3. Example: Energy Meter, ampere-hour Meter.

Any two differences 1 mark each

1 c) State the use of shunt and series resistance used in extension of meter.

Ans:

Use of shunt and series resistance: 1 mark each

i) Use of shunt: To extend the range of Ammeter.

ii) Use of series resistance: To extend the range of Voltmeter.

1 d) Define :- (i) Accuracy (ii) Resolution

Ans:

i) Accuracy: It is the closeness of an instrument reading with the true value of the quantity under measurement. 1 mark each

OR

It is defined as the ability of an instrument to respond to a true value of a measured variable under reference conditions.

ii) Resolution: The smallest incremement input which can be detected with certainty by an intrument.

OR

Resolution is the smallest measurable input change.

1 e) Name the material used for :-
(i) Moving coil
(ii) Permanent magnet in PMMC instrument.

Ans:
(i) Material used for Moving coil: Copper, Aluminum(some times)
(ii) Permanent magnets are made of special alloys such as :

1 mark each

- Aluminum-Nickel-Cobalt (Alnicos)
- Strontium-Iron
- Neodymium-Iron-Boron
- Samarium-Cobalt.

1 f) Define balanced and unbalanced load in three phase circuit.

Ans:

Balanced Load: 1 mark each

When all the imedances of 3 phases are equal in magnitude and of same nature then load is said to be balanced.

Unbalanced Load:

When all the imedances of 3 phases are not equal in magnitude and of different nature then load is said to be unbalanced.

OR equivalent definitions.

1 g) List any two methods of reactive power measurement in 3ϕ circuit.

Ans:

Methods of reactive power measurement in 3ϕ circuit:

(i) Two single phase wattmeter method 1 mark
(ii) One single phase wattmeter method 1 mark

1 h) State the meaning of creeping error in 1 ϕ energy meter.

Ans:

Creeping error:

It is defined as the slow and continuous rotation of the disc of the energy-meter when only pressure coil is energized with no current in the current coil (load current = 0). 2 marks

1 i) A wattmeter has a voltage range of 300 V and current range of 10A. If the FSD of meter is 1500 watt, then calculate the multiplying factor of meter.

Ans:

$$\text{multiplying factor} = \frac{Voltage\ Range \times Current\ Range \times PF}{FSD}$$ 1 mark

Assuming power factor of unity,

$$\text{multiplying factor} = \frac{300 \times 10 \times 1}{1500} = 2$$ 1 mark

1 j) Write any two factors on which earth resistance depends.

Ans:

Factors on which earth resistance depends:
(1) The shape and material used for the electrode
(2) Depth of the electrode in the ground.
(3) The specific resistance of the soil around the electrode
(4) Moisture content in the soil.
(5) Nature of soil

Any two 1 mark each.

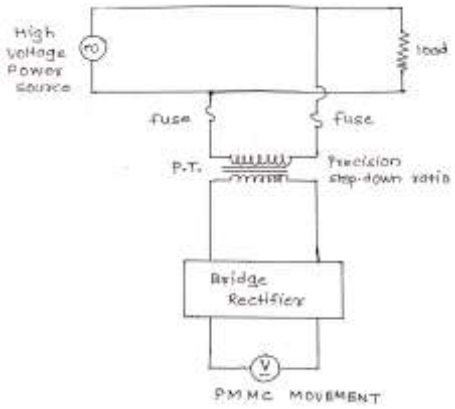
1 k) State the use of:-
(i) Clip-on-ammeter
(ii) Phase sequence indicator

Ans:
(i) **Clip-on-ammeter:** used for measurement of current in cables/lines in live conditions without disconnecting them.
(iii) **Phase sequence indicator:** To determine /find the phase sequence of 3 phase supply.

1 mark each

1 l) Draw circuit for A.C. voltmeter using PMMC movement and potential transformer construction.

Ans:
Circuit for A.C. voltmeter using PMMC movement and potential transformer:



2 marks

2 **Attempt any FOUR of the following**: 16

2 a) List out any four effects of electric current used in measuring instruments & write name of meter working on it.

Ans:
Effects of Electric Current used in measuring instruments:
1. Magnetic Effect: PMMC and Moving Iron type Ammeters, voltmeter and Dynamometer type wattmeters etc.
2. Electromagnetic induction effect: Induction type Ammeters, voltmeters, wattmeters, energy meters etc.
3. Heating effect: Hot wire instruments - Ammeters, voltmeter
4. Electrostatic effect: Voltmeters.
5. Hall Effect: Flux meter, Poynting vector wattmeter.

1 mark for Each of any four effects with at least one instrument of each

2 b) Give the classification of the errors used in measuring instrument & state the reason for their occurrence.

Ans:

Types of errors in measuring instruments:

A) Gross error: These are due to mistakes on the part of person using the instrument.

B) Systematic Error:

i) Instrumental Error: These errors are caused due to the mechanical structure of measuring instrument. — 2 marks for list,

a) Inherent shortcomings of instruments: Instrument may read too low or too high.

b) Improper use of instruments: Improper handling e.g. overloading, overheating, failure to adjust zero, use of high resistance leads. — 2 marks for Reasons

c) Loading effect: cause distortion in original signal.

ii) Environmental Error: These are because of surrounding conditions such as temperature, pressure, humidity, dust, vibrations, or external magnetic fields or electrostatic fields.

iii) **Observational Error:** Parallax errors, incorrect multiplying factor.

C) Random error: These persist even after gross and systematic errors are removed.

2 c) Name the different torque and their function in measuring instrument.

Ans:

List of torques in analog instruments:

1. Deflecting torque — 1 mark for list
2. Controlling / restraining torque.
3. Damping torque.

1. Deflecting torque:
   - To create deflection of pointer proportional to the quantity to be measured; this is normally electric current. — 1 mark

2. Controlling / restraining torque:
   - To restrict the motion of pointer/spindle and stop the pointer at the relevant position to get correct reading. — 1 mark
   - To bring back pointer to zero position when the quantity under measurement is removed.

3. Damping torque:
   - To stop pointer/spindle at the final deflected position. — 1 mark
   - Bring the pointer to standstill quickly.
   - To minimize oscillations about final position.

2 d) A moving coil instrument has a FSD of 10 mA when potential difference across it is 100mV. Calculate the shunt resistance required to extend the range of meter to100A.

Ans:

Given for full scale deflection current I_G = 10 mA,

Potectial difference across MC (moving coil) is = 100 mV.

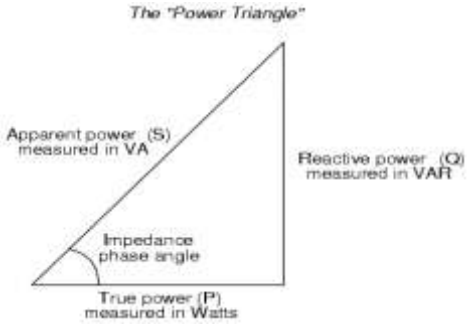
Resistance of MC, R_G = PD/current = (100 mV/10 mA) = 10 ohms. — 1 Mark

Shunt resistance R_{sh} for full scale deflection when the arrangement carries current of I = 100 A.

Using the principle of equal voltage across parallel resistances of R_G and R_{sh},

We have $I_G.R_G = (I - I_G) R_{sh}$, which gives us 1 Mark
$R_{sh} = I_G.R_G/(I - I_G) = 10 \times 10^{-3} \times 10/(100 - 10 \times 10^{-3})$ 1 Mark
= **0.0010001 ohms** is shunt resistance for using it as an ammeter to read 100A 1 Mark

2 e) Write equations for all powers. State their unit. Draw the power triangle.
Ans:
Power triangle:



Triangle 2 marks,

Units 1 mark,

OR equivalent diagram

Equations:
Active or True or Real Power, $P = V I \cos\phi$ or $P = I^2R$, measured in watt or Kilo-watt (kW) or megawatt (MW)
Reactive Power, $Q = V I \sin\phi$ or $Q = I^2X$, measured in VAr or KVAr or MVAr
Apparent Power, $S = V I$ or $S = I^2Z$, measured in VA or KVA or MVA

Equations 1 mark

2 f) Compare PMMC and MI instruments on any four points:
Ans:
Comparison of PMMC and MI instruments:

Points	PMMC instruments	MI instruments
Principle	When current carrying conductor is placed in a magnetic field, it experiences a force	Piece of iron is attracted /repelled by magnet or magnetic field.
Scale	Uniform	Non-uniform
Torque/Weight ratio	Higher	Lower
Application	PMMC instruments are used for only DC measurements	Used for DC as well as AC measurements
Cost	Higher cost for same range.	Lower cost for same range
Damping	Eddy current	Air friction
Sensitivity	More sensitive	Comparatively less sensitive

Any four points 1 mark each

3 **Attempt any FOUR of the following**: 16

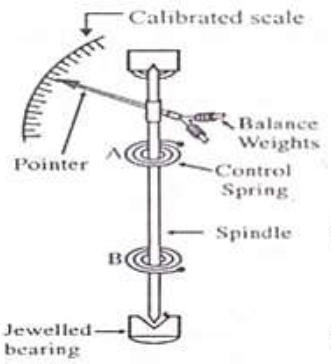
3 a) Describe spring control method of producing controlling torque in measuring instrument. Write any two properties required for spring material.

Ans:

A)Spring control method: Description 2 marks

As shown in the figure, the inner ends of the both springs are attahced to the spindle, while outer end of upper spring is attached to the lever and outer end of the lower spring is fixed.

With the deflection of the pointer, the springs are twisted in opposite direction to the motion of pointer and produce controlling torque.



1. Two phosphor bronze hair springs of spiral shapes are attached to the spindle of the moving system of the instrument.
2. They are wound in opposite direction
3. Pointer is attached to the spindle of the moving system

Diagram 1 mark

Properties of spring material: Any 2 Properties ½ mark each = 1 mark

1.Non Magnetic material
2.Low specific resistance
3.Low temperature cofficient of resistance

3 b) Write any four differences between CT and PT.

Ans:

Difference between CT and PT:

CT	PT
CT corresponds to current transformer	PT corresponds to potential transformer
CT primary is connected in series with load and secondary winding is connected to a low range ammeter.	PT primary is connected in parallel with high voltage of load and secondary winding is connected to a low range voltmeter.
Secondary winding is never open circuited when primary carries current.	No such restrictions are there for PT connection.
Used for Range extension of ammeter, wattmeter & energymeter.	Used for Range extension of voltmeter, wattmeter.
Specified by their burden and nominal current ratio.	Specified by their burden and nominal voltage ratio.
Measured value of current = (reading of low range ammeter) x	Measured value of voltage = (reading of low range voltmeter) x

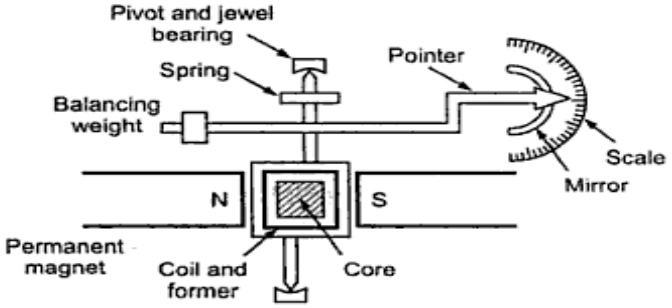
1 mark for each of any four differences = 4 marks

CT ratio	PT ratio
It is a step-up transformer.	It is a step-down transformer

3 c) Draw a neat labeled diagram of PMMC type instrument to show its construction.

Ans:

PMMC type instrument:

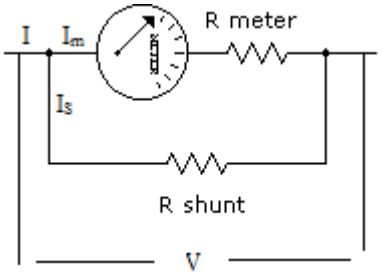


Or Equivalent diagram

4 marks for Labeled diagram, 3 marks for Partially labeled diagram 2 marks for Unlabeled diagram,

3 d) Derive equation for shunt resistance calculation in ammeter range extention.

Ans:



Let R_m = Resistance of ammeter
R_s = resitance of Shunt.
I = total current from mains
I_m = maximum rated current of ammeter
I_s = Current flowing through shunt,

1 mark for diagram

Then, $I = I_m + I_s$

Also $I_m R_m = I_s R_s$

$\therefore R_s = I_m R_m / I_s$ 1 mark

Subtitutig value of I_s from above equtations, we get

$R_s = I_m R_m / (I - I_m) = R_m / \{ (I / I_m) - 1\}$ 1 mark

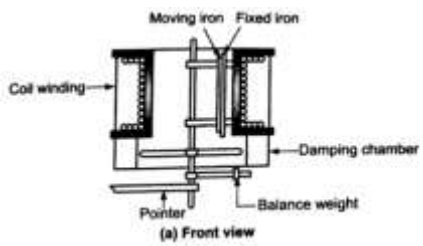
$= R_m / (M - 1)$

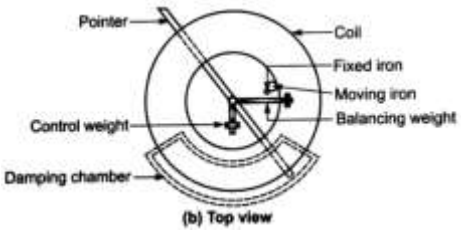
where $M = I / I_m$, is the ratio of main current to the full-scale deflection current i.e maximum rated current of ammeter, is called as multiplying power of shunt. 1 mark for equation of M

3 e) Draw a neat sketch of repultion type moving iron instrument.

Ans:

Sketch of Repulsion type moving iron instrument:





Any one labeled diagram 4 marks (partially labeled 3 marks) (unlabeled 2 marks)

3 f) Write any four advantages of digital energy meter over analog type.

Ans:

Advantages of digital energy meter over analog type:

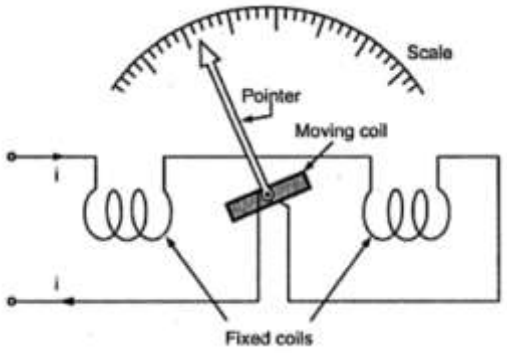
1) Easy to read.
2) High accuracy
3) High resolution.
4) No frictional losses as there are no moving parts.
5) No external adujstments.
6) Large frequency range due to absence of moving parts.
7) Less losses

1 mark for each of any four = 4 marks

4 **Attempt any FOUR of the following:** **16**

4 a) Draw a neat labeled diagram of dynamometer type wattmeter to measure power in 1 ϕ A. C. circuit.

Ans:



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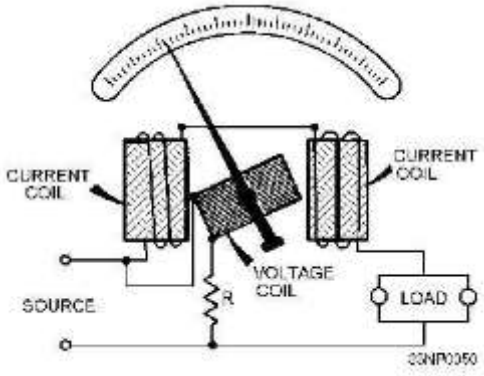


Any one labeled diagram 4 marks

(partially labeled 3 marks)

(unlabeled 2 marks)

4 b) State the effect of power factor variation on reading of wattmeter in two wattmeter method for 3-ϕ circuit.

Ans:

In two wattmeter method the readings of two wattmeters are given by equations:

$W_1 = V I \cos(30° + \phi)$ and $W_2 = V I \cos(30° - \phi)$

We will consider different cases of power factors

1. If power factor is unity i.e. p.f.=1 ($\phi = 0^\circ$)

$W_1 = V I \cos(30° + 0°)$ and $W_2 = V I \cos(30° - 0°)$

$W_1 = V I \cos 30°$ and also $W_2 = V I \cos 30°$

Thus both the wattmeters read equal.

If power factor is 0.5 lagging i.e. $\phi = 60^\circ$

$W_1 = V I \cos(30° + 60°)$ and $W_2 = V I \cos(30° - 60°)$

$W_1 = V I \cos 90°$ and $W_2 = V I \cos(-30°)$

$W_1 = V I (0)$ and $W_2 = V I \cos(-30°)$

$W_1 = 0$ and $W_2 = V I \cos(-30°)$

Thus it is observed that one of the wattmeter reads zero and all the power is

four cases with effect 1 mark each = 4 marks

measured by second wattmeter.

2. If power factor is between 0.5 and 0. i.e. is ϕ greater than 60^0 & less than 90^0. In this case one of the wattmeter gives positive reading and second wattmeter give negative reading.

Hence for taking reading of second wattmeter its pressure coil connections or current coil connections need to be interchanged**.**

3. If power factor is 0 i.e. $\phi = 90^\circ$

$W_1 = V\ I \cos(30° + 90°)$ and $W_2 = V\ I \cos(30° - 90°)$

$W_1 = V\ I \cos 120°$ and $W_2 = V\ I \cos(-60°)$

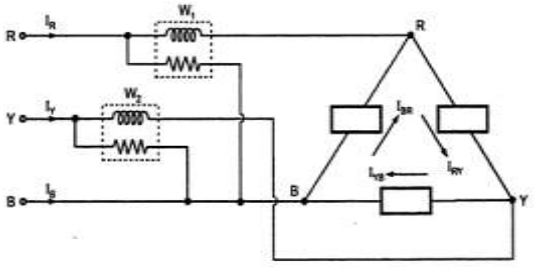
$W_1 = 0.5 \times V\ I$ and $W_2 = V\ I \times (-0.5)$

Thus it is observed that both the wattmeter reads equal and opposite power.

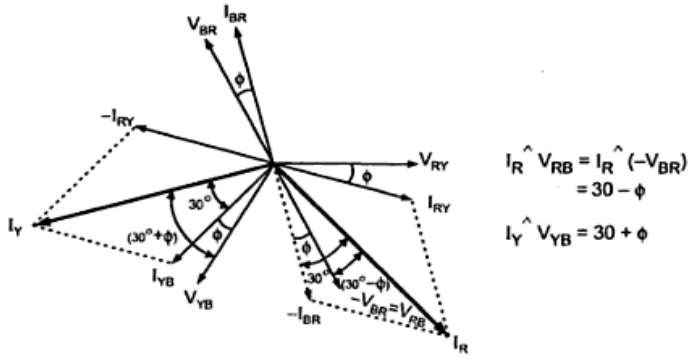
For leading power factors: - The readings of two watt meters only interchange.

4 c) Draw neat connection diagram to measure active power in 3ϕ circuit by using two wattmeter method. Also draw the relevant phasor diagram.

Ans:



2 marks for circuit diagram



2 marks for phasor diagram

OR

Equivalent cicuit and phasor diagram

4 d) Compare CC and PC of wattmeter on the basis of:-

(i) Connection
(ii) Status
(iii) Number of turns
(iv) Gauge of wire.

Ans:

Comparison between CC and PC:

Particulars	Current coil (CC)	Pressure coil (PC)
Connection	Connected in series with load	Connected in parallel with load
Status	It is fixed coil in wattmeter	It is moving coil in wattmeter.
No. of turns	It is having less number of turns	It is having more number of turns
Gauge of wire	Less	More

1 mark for each

4 e) Describe the connection error that occurs in dynamometer type wattmeter with a neat diagram.

Ans:

Error in wattmeter due to method of connection:

In uncompensated wattmeter , the reading of wattmeter includes the powerloss in coils.

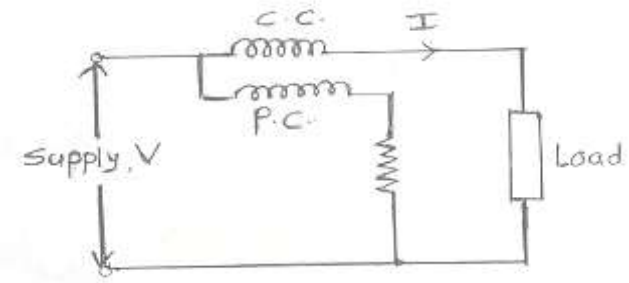
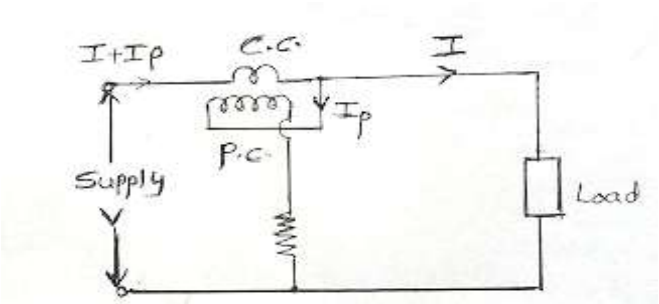


Diagram 2 marks

The error in measurement can be reduced by using this connection for loads having low current values.



Working 2 marks

By using compensating coil , the error due to current coil which carris the current of PC in addition to the load current is eliminated.

4 f) A 3-ϕ, 500V Induction motor has a power factor of 0.4. The input power is 30kW. Calculate readings of the wattmeter in two wattmeter method used to measure the input power.

Ans:

Given: V_L= 500V, P_{in} = 30 kW, p.f.= 0.4 (Lagging)

Find: W_1 , W_2

$P = \sqrt{3} V_L I_L \cos \emptyset$ 1 mark

$I_L = \frac{30 \times 10^3}{\sqrt{3} \times 500 \times 0.4}$ = 86.6 Amp 1 mark

$\cos \emptyset = 0.4 \quad \therefore \emptyset = 66.42°$

$W_1 = V_L I_L \cos(30° - ø) = 34,842.93$ W — 1 mark

$W_2 = V_L I_L \cos(30° + ø) = -4841.62$ W — 1 mark

5 Attempt any FOUR of the following: 16

5 a) Draw a neat sketch of 1ϕ induction type energy meter and write its principle of working.

Ans:

Single-phase induction type energy meter:

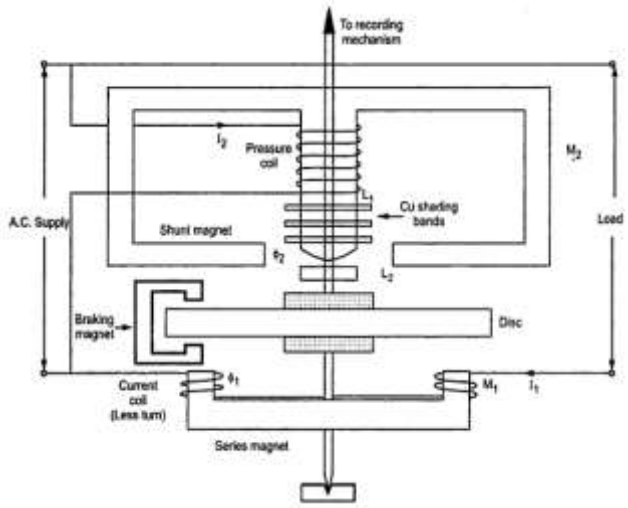


Diagram 2 marks

Working:- As shown in the diagram, the disc is placed between the two electromagnets ,eddy currents will be induced in the disc by two fluxes i.e. flux due to pressure coil and flux due to current coil, which will set up torque on the disc which is proportional to power causing the disc to rotate.

$T_d \alpha P \alpha V I \cos\phi$

&

$T_b \alpha N$ (speed of disc)

For steady speed of disc, $T_d = T_b$

Multiplying both sides by time t

Therefore, P x t = N x t

Therefore, Energy α Number of revolutions of the disc in time t.

Working 2 marks

5 b) Write the working of L-C-R meter with suitable sketch.

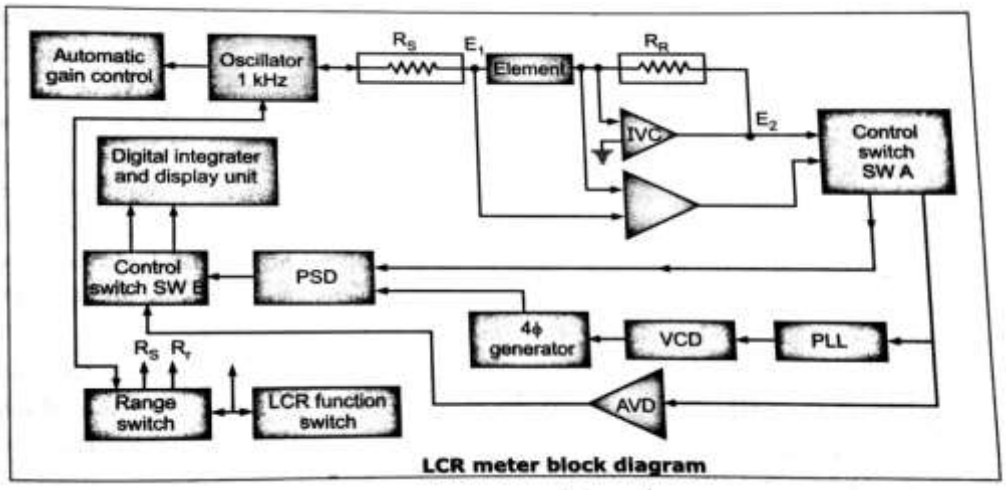
Ans:

LCR meter:

A LCR meter (Inductance L, Capacitance C, and Resistance R) test equipment used to measure the inductance, capacitance and, resistance of a component. It works on the principle of impedance measurement.

In general versions of LCR meter, these quantities are not measured directly, but determined from a measurement of impedance. The necessary calculations are, incorporated in the instrument's circuitry; the meter reads L, C and R directly with no human calculation required. It will determine the relative change in magnitude of the repetitive variations of the voltage and current known as amplitudes.

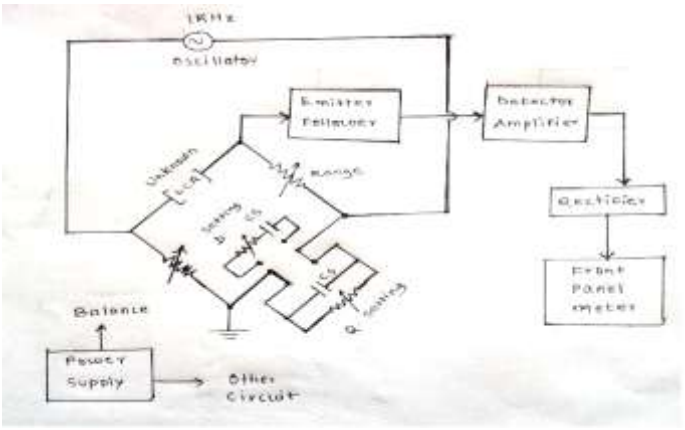
Working 2 marks



LCR meter block diagram

Diagram 2marks

OR



5 c) 1ϕ Energy meter has a constant of 6000 rev/kWh. A test was carried out with a resistive load for 1 min. during which meter made 40 revolutions. The voltage was 110 volt and current of 3 A. Find the percentage error.

Ans:

Given: K = 6000 rev/kwh, N = 40 rev, t = 60 sec, V = 110V, I = 3A

$\cos \emptyset = 1$, Find % error.

Actual energy consumed by the load = $\frac{V \times I \times \cos \emptyset \times t}{1000 \times 3600} = \frac{110 \times 3 \times 1 \times 60}{1000 \times 3600}$ 1 mark

$= 0.0055$ kWh

Energy recorded by the Energymeter = $\frac{N}{K} = \frac{40}{6000} = 0.00667$ kWh 1 mark

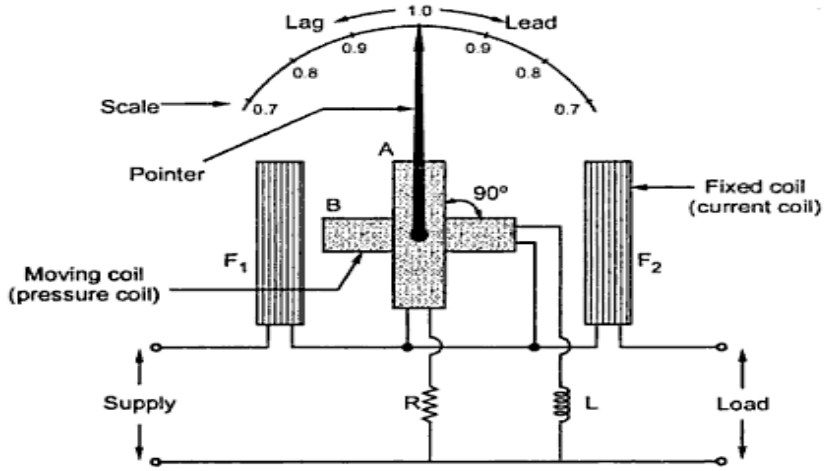
% Error = $\frac{Actual\ Energy\ Cosumed - Recorded\ energy}{Actual\ Energy\ Consumed} \times 100 = \frac{0.0055 - 0.00667}{0.0055} \times 100$ 2 marks

% E = - 21.27 %

5 d) With a neat sketch explain working of 1 ϕ dynamometer type power factor meter.

Ans:

Single phase dynamometer type power factor meter.



Single phase electrodynamometer type power factor meter

Labeled diagram 2 marks, Unlabeled diagram 1 mark

Working of 1 ϕ dynamometer type power factor meter :

The current coil is connected in series with load. Two pressure coils marked as A and B are connected across the supply terminals and take current I_A and I_B respectively. The current I_A is in phase with supply voltage V as its circuit is resistive. While I_B lags V by approximately 90° as its circuit is highly inductive. The magnetic field is produced by current coil and two pressure coils, carrying less current. Hence force is exerted on coils A and B. The coil winding are arranged such that the torques on them acts in opposite direction. When both torques on coil A and B, T_A and T_B respectively, become equal, the moving system becomes stationary and the pointer shows steady deflection corresponding to the power factor of the load. 2 marks

5 e) State the working principle of Weston type frequency meter with neat diagram.

Ans:

Weston frequency meter:

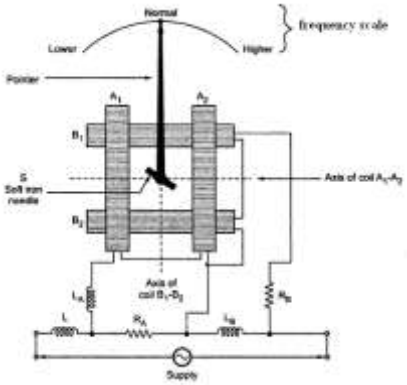


Diagram: labeled 2 marks,

Unlabeled 1 marks,

The mounting and connections are shown in the figure. Inductor L damps the harmonics in the current. When connected across the supply, coils A and B draw currents to produce magnetic fields that act on the soft iron needle to deflect it. The position of the needle depends on these currents. Under normal frequency (due to proper selection of R_A, R_B, L_A, L_B) two forces make the pointer to show normal frequency. When the frequency is other than normal, the reactances of L_A and L_B will be different with resistances unchanged, leading to deflections in either direction depending on the currents therein, due to changed impedances.

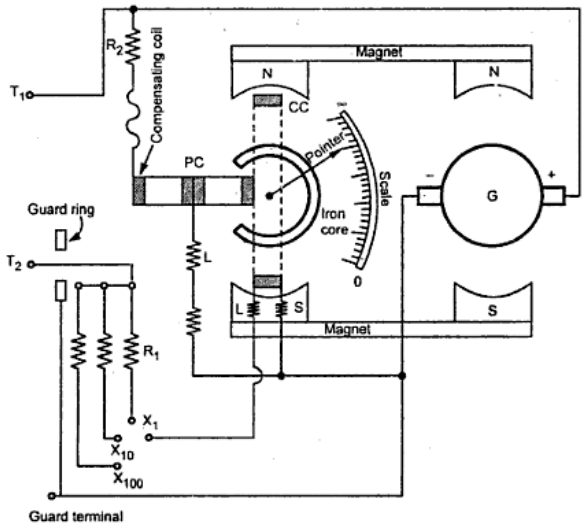
Operation 2 marks

5 f) Draw a neat labeled diagram to describe construction of megger.

Ans:

Construction:

The moving system consists of two coils, the control coil and the deflecting coil. They are mounted at an angle of 90° to one another and are connected in parallel with a hand-driven generator. Hand-driven generator is permanent magnet high voltage DC generator. The generator supplies a constant DC voltage to the coils. The windings of these two coils are adjusted such that the torques produced by them are in opposite direction. The two coils move in the air-gap between the poles of a permanent magnet. To make the magnetic field linking with the coils more uniform and radial, an iron ring is used. The control coil is connected in series with resistance R_2 while the deflecting coil is connected in series with the resistor L and resistance under measurement. .



Construction 2 marks

Diagram 2 marks

6 Attempt any FOUR of the following: 16

6 a) Name the method used to measure following resistances:-

(i) Low resistance

(ii) Medium resistance
(iii) Insulation resistance
(iv) Earth resistance.

Ans:

Following are the methods used to measure resistances:-

(i) Low resistance: 1.Voltmeter-Ammeter Method
2. Kelvin's Double bridge Method

(ii) Medium resistance: 1.Voltmeter-Ammeter Method
2. Wheatstone's Bridge Method
3. Substitution Method

(iii) Insulation resistance: 1. Ohmmeter
2. Megger
3. Loss of Charge Method

(iv) Earth resistance : 1. Fall of Potential Method
2. Earth tester

1 mark each = 4 Marks

6 b) 'PMMC instrument is not suitable to measure AC quantity'. State the reason.

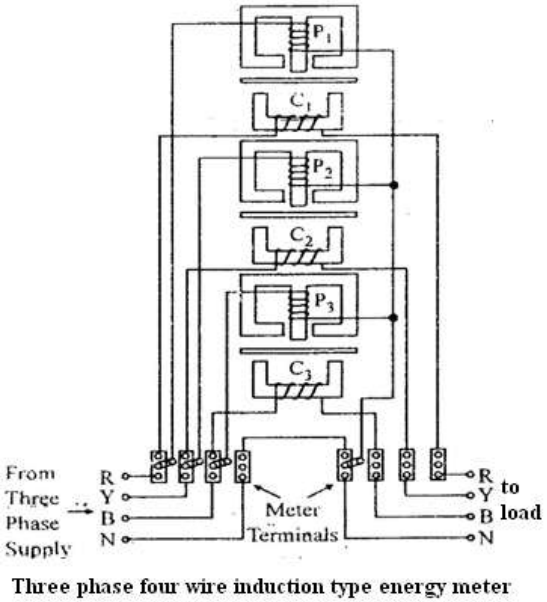
Ans:

The direction of force exerted on moving coil depends on the direction of current flowing through moving coil. If the direction of magnetic field is kept constant, it produces unidirectional torque if the current is unidirectional in the moving coil. Thus the D.C. current when passed through the coil; unidirectional torque is produced as the direction of current is constant. But in case of A.C. the direction of current reverses in alternate half cycles of A.C. Hence force exerted on moving coil in positive half cycle acts in opposite direction to that in negative half cycle. This makes the average torque acting on the coil in one cycle to zero. Hence the meter cannot read A.C. quantities.

4 marks for correct answer

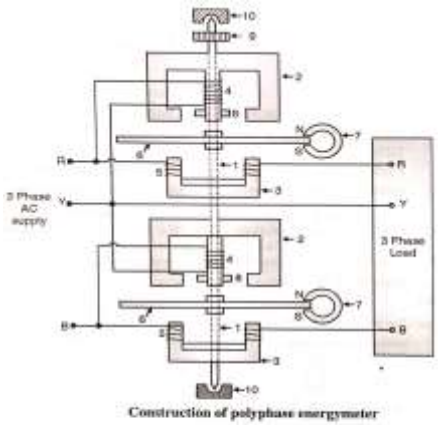
6 c) Draw a neat sketch of 3 ϕ induction type energy meter and label it.

Ans:



Three phase four wire induction type energy meter

OR



Construction of polyphase energymeter

1 – Spindle
2 – Shunt magnet
3 – Series magnet
4 – Pressure coil
5 – Current coil
6 – Aluminium disk
7 – Braking magnet
8 – Copper shedding band
9 – Registering mechanism
10 – Jewelled bearings

Fully labeled 4 marks, partial 1 to 3 marks proportional

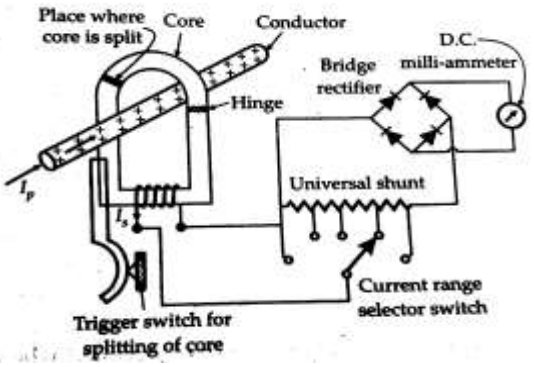
6 d) With neat diagram, explain the working of clip-on-meter.

Ans:

Working of Clip on meter:

Working 2 Marks

Clip on ammeters are used to measure the high current flowing through bus bar, cable or fuse holders carrying currents. They consist of split core current transformer whose secondary winding is connected to rectifier type moving coil instrument. The primary become conductor, whose current is to be measured. The split core gets aligned by the force of a spring tension. The core is covered with insulating material. Hence higher current through conductors can be measured. A selector switch is provided to select secondary number of turns which ultimately changes the current range. For measuring current the core is opened by pressing trigger shown and then clipped over the conductor carrying current. The dial will record the current directly.



Equivalent Diagram 2 Marks

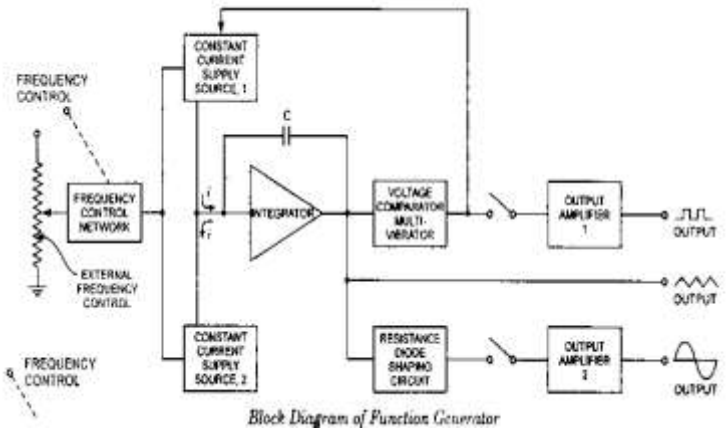
6 e) Draw a labeled block diagram of sine wave generator and state function of each block.

Ans:

Function Generator:

2 marks for function

- This instrument can deliver sine, triangular & square waves with frequency range of 0.01 Hz to 100 kHz.
- The frequency control network is governed by a frequency dial on the front panel of the instrument
- The frequency control voltage regulates two current sources.
- The upper current source supplies a constant current to the integrator whose output voltage increases with time.
- The voltage comparator multi-vibrator changes state at a predetermined level on the positive slope of the integrator's output voltage.
- The lower current source supplies a reverse current to the integrator so that its output voltage reaches a predetermined level on the negative slope of the integrator's output voltage.



Block Diagram of Function Generator

2 marks for block diagram

6 f) State any eight applications of CRO.

Ans:

Applications of CRO:

1) Measurement of phase and frequency.
2) Measurement of inductance and capacitance.
3) Tracing the waveform.
4) Determination of amplitude of variable quantity.
5) In radar & television.
6) For finding B-H curves.
7) For studying the heart beats etc.
8) To detect standing waves in transmission lines
9) To check faulty components in various circuits.
10) For tracing transistor curves.

½ mark each for any eight applications