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 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/figures 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 (as long as the assumptions are not incorrect).

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 A) Attempt any three of the following **12**

1 A) a) State different causes of over voltages in an electrical power system.

Ans:

Causes of over voltages:

a) Internal causes:
   i) Switching surges
   ii) Arcing ground
   iii) Insulation failures
   iv) Resonance

b) External causes:
   i) Direct Lightning strokes,
   ii) Lightning discharge near the line
   iii) Voltage induced due to change in atmospheric condition
   iv) Voltage induced due to frictional effects of small particles such as dirt, dust snow.

2 marks for internal causes and 2 marks for external causes

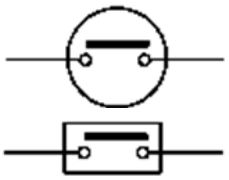
1 A) b) State function with their symbol.

i) Circuit Breaker ii) Lightning Arrester
iii) Earthing switch iv) Potential transformer

Ans:

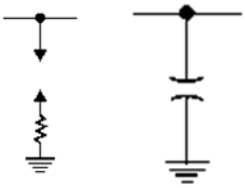
i) Circuit breaker:

To make or break a circuit manually or remotely under normal condition and to break circuit automatically under fault condition.



ii) Lightning arrester:

To divert the high voltage surges towards the earth, due to lightning or switching.



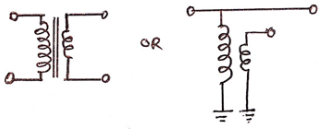
½ mark for each valid symbol + ½ mark for each function = 4 marks

iii) Earthing switch:

To discharge voltage on the line (due to charges of line capacitance) to earth after disconnecting line from live section.

iv) Potential Transformer

To step down the magnitude of line volatge for measurement, protection and control.



1 A) c) Define

i) Pick up Current. ii) Relay Time

iii) Plug setting multiplier iv) Reset Current

Ans: 1 mark for each definition.

i) Pickup current: The threshold value of operating current above which the relay operates. **OR**

It is the minimum current in the relay coil at which the relay starts to operate.

ii) Relay Time :- The time interval between occurrence of fault and closure of relay contacts.

iii) Plug setting multiplier: It is the ratio of fault current in relay coil to pick-up current.

PSM = (Fault current in relay coil) / (Pickup current)

iv) Reset current: The value of current below which the relay resets and comes back to its original state is called as reset current or dropout.

1 A) d) Give any four properties of SF_6 gas.

Ans:

Properties of SF_6 gas:

1) Stable at high temperature around 500 ^{0} C
2) Inert gas
3) Electronegative gas
4) Non-reactive with structured material up to 500 ^{0} C
5) Low arc time constant
6) Five times heavier compared to air
7) Very much better dielectric properties compared to air and oil.
8) Higher rate of rise of dielectric strength.
9) The products of decomposed gas at high temperatures recombine on cooling to form original gas.
10) For equal pressure the heat transfer capacity is more than twice of air.
11) Non-toxic gas
12) Non-flammable gas
13) Its thermal time constant is about 1000 times smaller than air
14) The SF_6 ions surround the arc and form an insulating barrier.

1 mark for each of any four points = 4 marks

1 B) Attempt any one of the following: **6 marks**

1 B) a) Two 11 KV,3-¢, 3000 KVA generators having reactance of 15% operate in parallel. The generator supply power to a transmission line through a 6000 KVA transformer of ratio 11/22 KV and having leakage reactance of 5%. Calculate fault current and fault KVA on H.T. side of transformer.

Ans:

Assume base KVA = 6000 KVA

% Reactance related to base KVA

% X = (Base KVA / Rated KVA) x % Reactance on Rated KVA

X_{G1} = (6000/3000) x 15%

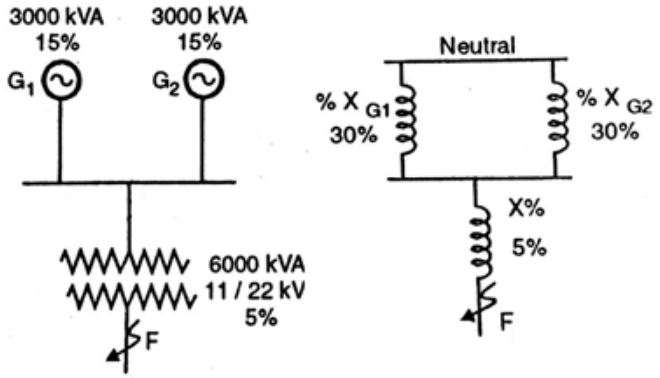
= 30 %

X_{G2} = 30 %

X_T = (6000/6000) x 5

1 mark for reactance computation on common base

= 5 %



1 mark

For Fault F (HT side)

Total reactance is $\%X = (X_{G1} \parallel X_{G2}) + X_T$

$= (30||30)+5 = 15 + 5$

$\% X = 20\ \%$

2 marks for stepwise computation of I_{SC}

Rated current at base KVA

$I = (6000 \times 1000) / (\sqrt{3} \times 22 \times 1000)$

$I = 157.45$ Amp.

$I_{SC} = I \times (100 / \% X)$

$= 157.45 \times (100 / 20)$

I_{SC} = 787.29 Amp

2 marks for stepwise computation of SC MVA

S.C. KVA = Base KVA x (100/ % X)

= 6000 x (100 /20)

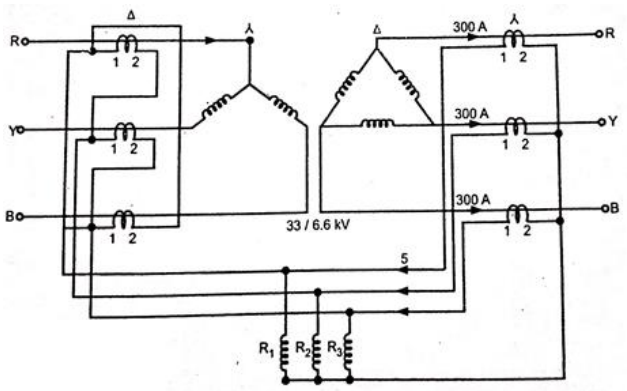
= 30000 KVA

S.C. MVA = 30 MVA

1 B) ii) A three phase, 33/6.6 KV, star-delta connected transformer is protected by Mertz-Price circulating current system. If the CT's on low voltage side have ratio of 300/5A. Determine ratios of CT's on high voltage side. Draw a neat diagram and indicate the given values at appropriate places.

Ans:

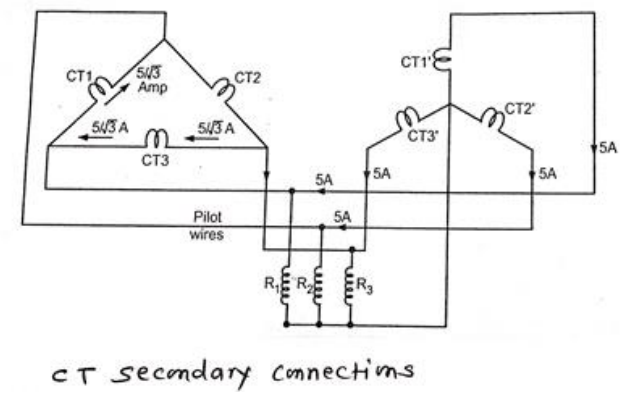
Suppose current flowing in secondary side of transformer is 300 amp. This current is primary current for the CT's connected to delta side of transformer. The secondary current of the CT will be 5 amp, since CT ratio is 300/5 A. 1 mark



1 mark for diagram

For differential protection scheme, when operating conditions are normal, the CT secondary

currents flowing through pilot wire from both groups must be equal.



CT secondary connections

2 mark for diagram

Refer above figure, here CT1, CT2, CT3 are in the primary side of transformer and these are connected in delta and $CT1^1$ $CT2^1$ $CT3^1$ are in secondary side of transformer and these are connected in star.

The pilot wire current = CT secondary current (Connected at delta side)

= 5 amp

The CTs connected in delta side should also send 5 amp in pilot wire so current induced in the CT's secondary should be 5 / √3 amp (for delta circuit line current is √3 times phase current)

Thus CT's connected in delta have a current of 5 / √3 amp in their secondary.

Primary apparent power = Secondary apparent power

$\sqrt{3}\ V_1 I_1 = \sqrt{3}\ V_2 I_2$ 1 mark

$\sqrt{3}\ (33 \times 1000) \times I_1 = \sqrt{3}\ (6.6 \times 1000) \times 300$

$I_1 = 60$ amp

This is primary current of main transformer and it is primary current of CT on H.V. side.

Primary current of HV side CT = 60 Amp

Secondary current of HV side CT = 5 / √3 amp 1 mark

Ratio is 60 : 5/√3 amp

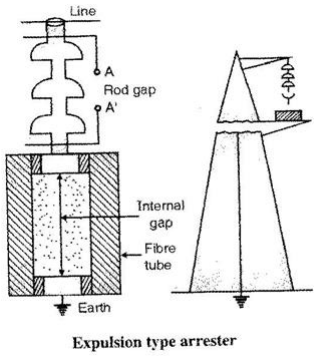
2 Attempt any four of the following **16**

2 a) Explain with neat diagram expulsion type lightning arrester.

Ans:

Expulsion type arrester :

It consists of a rod gap A-A' in series with second gap enclosed within the fiber tube. Under normal conditions supply voltage is insufficient to initiate the arc between the gap. On voltage surge arcing takes place across series gap A-A' and thus an arc is also struck between the electrodes in the tube. Due to production of gas, which carries all the ionized air around the arc and de-ionised effect takes place, thus the arc is quenched immediately.



Expulsion type arrester

Correct diagram 2 Marks

Explanation 2 Marks

2 b) Compare equipment earthing and neutral earthing.

Ans:

Sr. No.	Equipment earthing	Neutral earthing
1	Connection of the non-current carrying metallic parts of the electrical equipment to earth is called as equipment earthing.	Connection of the neutral point of three phase transformer, generators, motors etc. to earth is neutral earthing.
2	It is provided for protection of human being from electric shocks.	It is provided for eliminating arching ground and over voltage surge.
3	It has nothing to do with stability	Stability of the system is increased.
4	Equipment earthing is provided through Pipe earthing, Plate earthing.	Neutral earthing is provided through solid earthing, resistance earthing and reactance earthing.
5	It does not provide any means for protection system against earth fault.	It provides suitable means for earth fault protection system.
6	It is an equipment earthing.	It is a source or system earthing.

1 mark for each of any four points = 4 marks

2 c) Discuss the time-graded over current protection for ring main system.

Ans:

The ring main consists of various generating stations and substations interconnected by alternate routes. When the fault occurs in any section of the ring, that section can be disconnected for repairs and power is supplied from both ends of ring, maintaining the continuity of supply.

Figure represents the single line diagram of a typical ring main system, which consists of a generator and four sub-stations S_1, S_2, S_3, S_4. As the power can flow in both the directions under fault conditions, it is necessary to grade feeder protection in both directions round the ring with directional relays.

For proper isolation of faulty section only, the types of relays used and their time settings are shown in the figure.

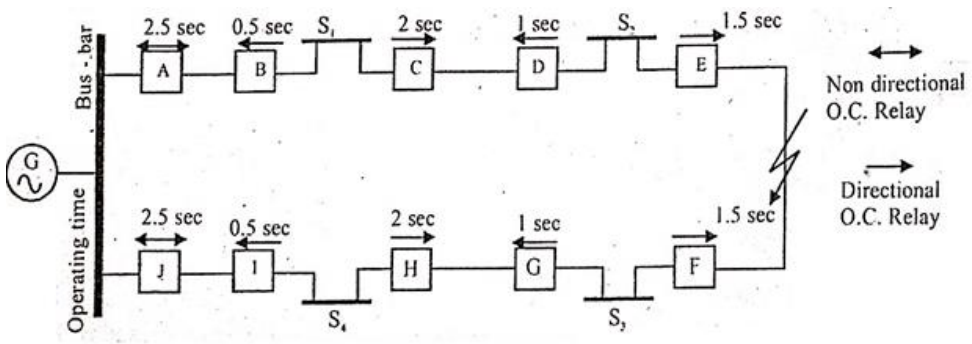


Diagram 2 marks

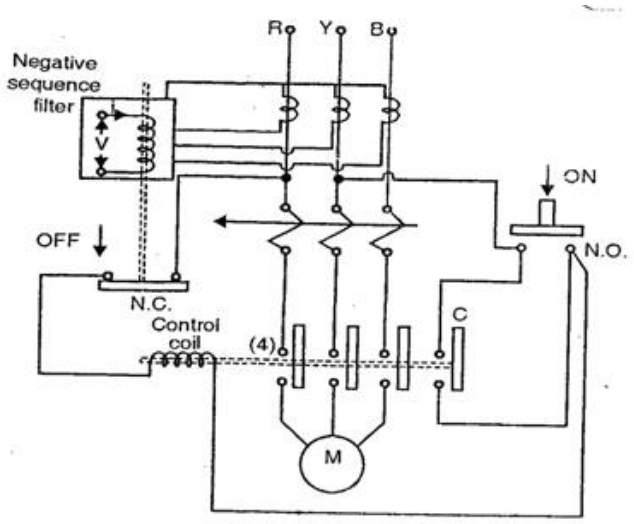
Explanation 2 Marks

Consider that fault takes place as shown in the figure.

In order to ensure selectivity, the circuit breakers at E & F should open to clear the fault there by maintaining other section intact. Actually the power is fed to the fault via two routes i.e. (i) From G around S_1, S_2 and (ii) from G

around S_4 and S_3.
The relays at A, B, C and D as well as J, I, H and G do not trip. Therefore, only relays at E and F operate before any other relay operates.

2 d) Draw neat sketch of single phase preventer for 3-ϕ induction motor.
Ans:



Labeled diagram 4 Marks

Partially Labeled diagram 2 Marks

2 e) State any four faults occur in power transformer and protection required.
Ans:

Sr.No.	Type of fault	Protection scheme suggested
1	Earth fault	1) Earth fault Relay 2) Differential Protection
2	Through faults (beyond protected zone)	1) HRC fuses 2) Graded time lag over current relay
3	High Voltage surges due to lightning	1) Horn gaps 2) Surge arrestor 3) RC surge suppressor
4	Overloads/ Overheating	1) Temperature relays 2) Thermal overload relays
5	Incipient faults: Phase to Phase , Phase to ground, low oil level, decomposition of oil	1) Buchholz' s relay
6	Saturation of magnetic core	1) Over fluxing protection 2) Overvoltage protection
7	Faults in tap changer	1) Percentage differential protection 2) Buchholz relay 3) High speed high set over current relay
8	Inter turn fault	1) Buchholz relay 2) Differential Protection

1 Mark each for any four = 4 Marks

2 f) A 3-phase 2-pole, 11KV, 10000 KVA alternator has neutral earthed through a resistance of 7 Ω. The machine has current balance protection which operates upon out of balance current exceeds 20% load of full load. Determine the percentage of winding protected against earth fault.

Ans:

Data Given: Alternator Voltage 11 KV = $11X10^3$ volts

10000 KVA = $10000 X 10^3$ VA

2 poles, 3-phase, out of balance current exceeds 20 % of full load

KVA = $\sqrt{3}$ KV I

I = $10000 / \sqrt{3} X 11 = 524.863$ A — 1 mark

Out of balance current for which relay operates

(CT Primary current) = (20/100) X 524.86 = 104.972 A — 1 mark

Phase voltage $V_{Ph} = \frac{11\times1000}{\sqrt{3}} = 6350.852\ volt$ — 1 mark

% of winding unprotected against earth fault from the neutral

$$= \frac{R \times CT\ primary\ current}{V_{ph}} \times 100 = \frac{7 \times 104.972 \times 100}{6350.852}$$

$$= 11.57\%$$ — 1 mark

3 Attempt any four of the following. **16**

3 a) What do you mean by " Insulation co-ordination"? state its importance.

Ans:

Insulation Co-ordination : It is the correlation of the insulation of electrical equipment and the lines with the characteristics of protective devices such that the insulation of the whole power system is protected from the excessive over voltages. — 2 marks

Importance : The insulation strength of various equipments like transformers , circuit breakers etc. should be higher than that of lightning arresters and other surge protective devices. The insulation Co-ordination is thus the matching of the volt time flash over and break down characteristcs of equipment and protective devices in order to obtain maximum protective margin at a reasonable cost. — 2 marks

3 b) List any eight faults occur in 3-ϕ I.M.

Ans:

1) Prolonged overloading
2) Single phasing
3) Stalling
4) Phase to phase faults / phase fault
5) Inter- turn faults
6) Earth faults
7) Reversal of phases
8) Failure of bearings/ Rotor Jam
9) Supply under-voltage
10) Unbalanced Supply Voltage
11) Faults in stator or associated circuit
12) Faults in rotor or associated circuit

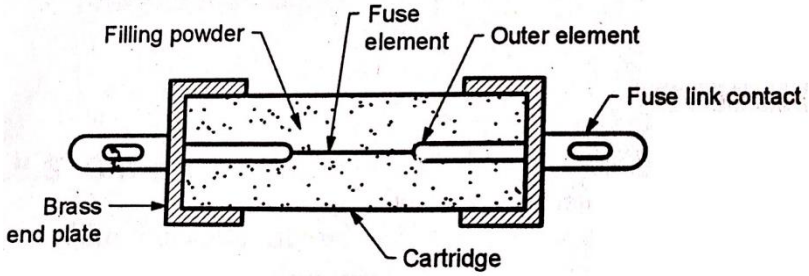
½ mark for each any 8 faults

3 c) Explain construction of H.R.C. fuse.

Ans:

Construction of H.R.C. Fuse: Figure shows the essential parts of a typical H.R.C. fuse. It mainly consist of a heat resisting ceramic body. Both the ends of the cermaic body consists of metal end caps. A silver current carrying element is welded to these metal end caps. The current carrying element is completely surrounded by the filling powder which may be plaster of parries, chalk, quartz or marble dust and acts as an arc quenching and cooling medium when fuse element blow off.

Explanation 2 Mark

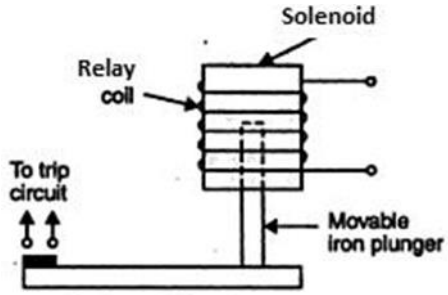


H.R.C. fuse

Diagram 2 Mark

3 d) Explain operation of Solenoid type relay.

Ans:



Solenoid relay

diagram 2 marks

During the normal operation the current in solenoid coil is not sufficient enough to pull the plunger up by magnetic force, whereas on overcurrent condition (Current exceeds pickup value) the magnetic pull of the solenoid coil overcomes the restraining force on the plunger (Spring or gravity) and pulls the plunger up to close the trip contacts. This operates the relay circuit causing the opening of the CB.

explanation 2 marks

3 e) Draw a neat diagram and explain distance protection for transmission line.

Ans:

Distance protection for transmission line:

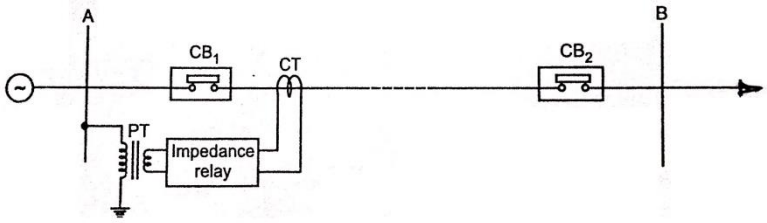
Distance protection scheme uses impedance relay. The relay operation is based on the impedance (or distance) between the relay and point of fault. Figure shows arrangement for distance protection for typical transmission line.

The voltage element of impedance relay receives supply from PT secondary and current element receives supply from CT secondary. It measures Impedance at relay location($Z = V / I$)

Explanation 2 marks

The protection zone of line is between A and B under normal working conditions, the impedance of line is Z_L. The impedance relay is so designed that, it operates only when line impedance becomes less than Z_L.

When fault occurs between points A & B, the impedance of line becomes less than Z_L and impedance relay operates which operates the CB and line is protected.



Distance protection scheme for typical transmission line

diagram 2 marks

4 A) Attempt any three of the following: 12

4 A) a) What is ELCB? Describe its working.

Ans:

Earth Leakage Circuit Breaker (ELCB):

Earth leakage circuit breaker is a safety device used in electrical installations with high earth impedance to prevent shocks and disconnect power under earth fault conditions. It works on principle of relaying when the current in the earth path exceeds a set value.

ELCB is used for protection against electric leakage in the circuit of 50 Hz or 60 Hz, rated voltage single phase: 240 V, 3-ph: 440V. Rated current up to 60 Amp.

When the earth fault occurs, the ELCB cuts off the power within the time of 0.1 sec. automatically to protect personnel.

Under normal conditions ($I_L – I_N$) = I_f is very low or nearly zero. The CT surrounding the phase and neutral senses the differential current under earth fault and actuates the CB to operate (open). The difference current I_f through fault path resistance R_e is the leakage to earth. If this value exceeds a preset value, then the CB opens. Normally it is around 35 mA for tripping in domestic installations with tripping time being as low as 25 msec.

explanation 3 marks

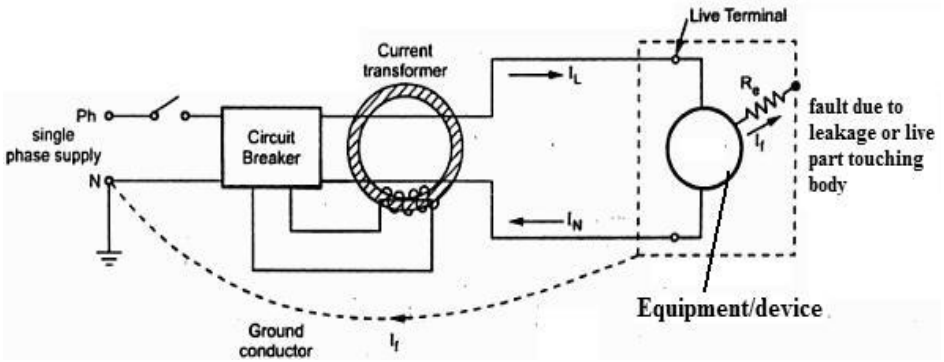


diagram 1 mark

4 A) b) State eight advantages of static relays.

Ans:

Advantages:

1) Low power required, hence less burden.
2) No motional parts hence bouncing, friction, erosion, arcing etc eliminated.
3) Not affected by gravity, may be used in any position.
4) Improved selectivity as resetting and over shoot times are reduced.
5) Lower operating times.

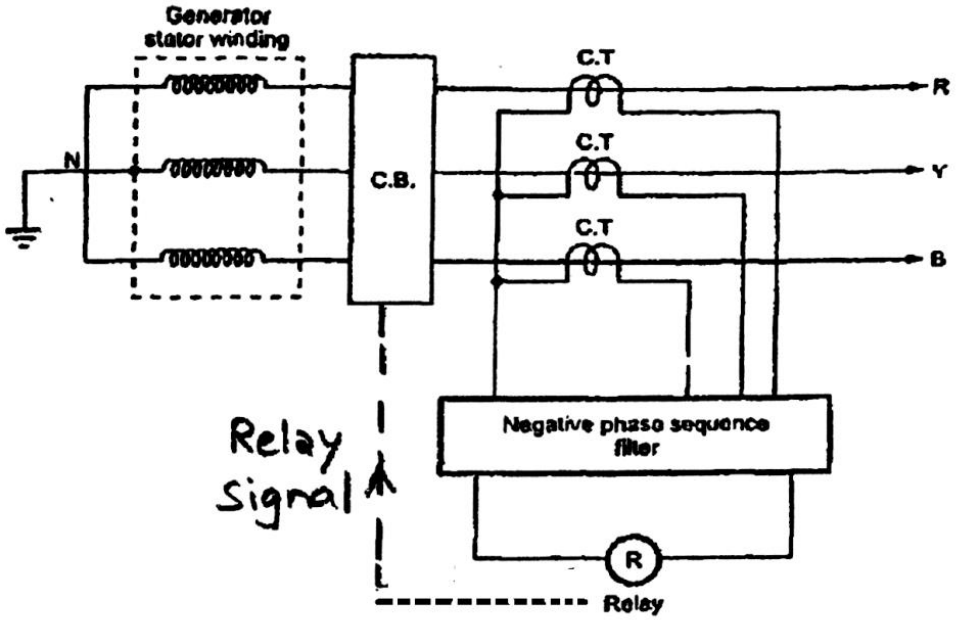
any Eight advantages 1/2 mark each

6) One static relay can be used for multiple purposes.
7) Higher torque /weight ratio.
8) Compact.
9) Good discriminating characteristics and reliability.
10) Suitable for reliable remote operation with PLCC.
11) Can be programmed as required.

4 A) c) Explain negative phase sequence protection of alternator.

Ans:

Negative phase sequence protection of alternator:



Negative sequence protection

figure
2 marks

Unbalanced loading on alternator mainly causes the negative sequence currents which generate the negative sequence components of magnetic fields. These fields rotate in opposite direction of the main field and induce emfs of double frequency in rotor winding causing overheating.

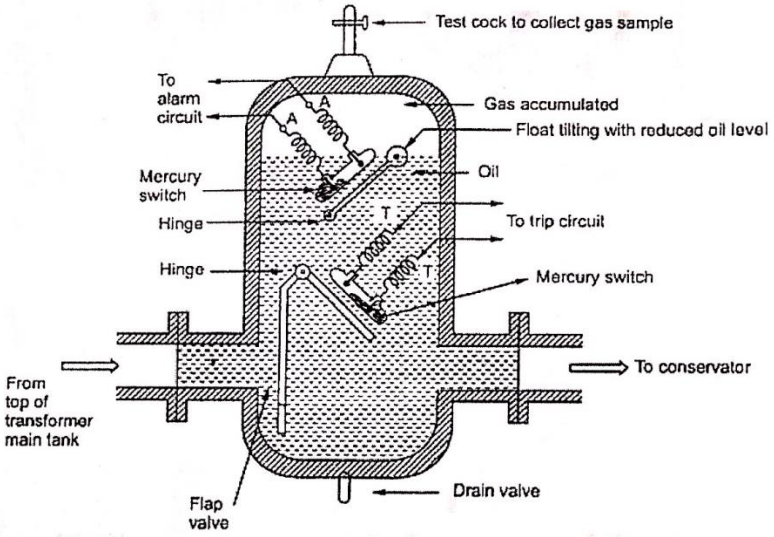
Figure shows a scheme for protection against negative phase sequence currents. Three CT's are connected in star and the secondaries are connected to negative sequence filter. The relay is connected to sequence filter. The negative sequence filters consists of number of inductors and resistors. This negative sequence filter detects the presence of negative sequence components due to unbalance and operates the relay which further operates CB.

Explanation
2 marks.

4 A) d) Draw neat sketch of Buchholz relay.

Ans:

Buchholz relay:



Terminals 'A' : are for alarm and Terminals 'T': are for tripping.

Buchholz relay

Labeled diagram 4 Marks

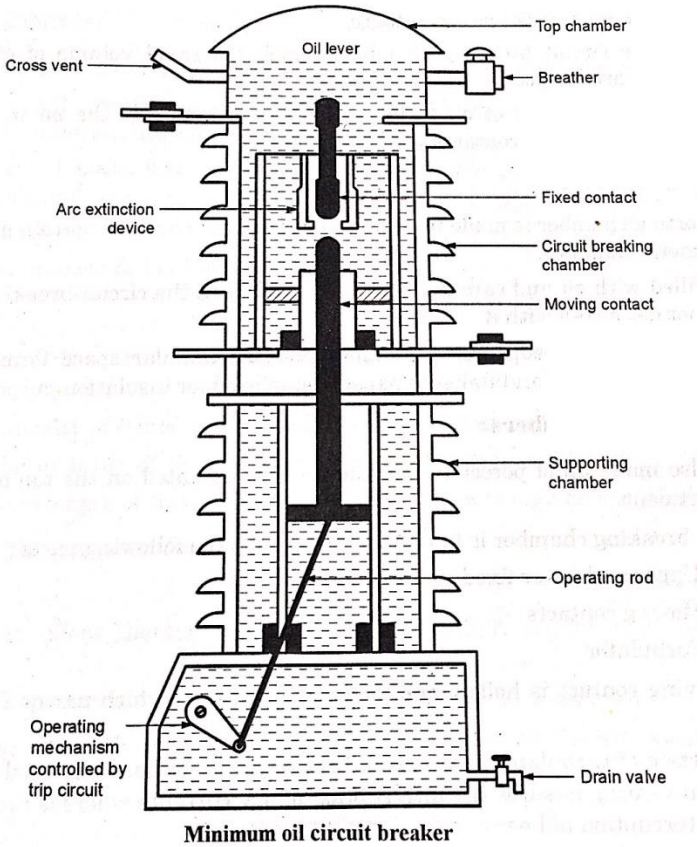
Partially Labeled diagram 2 Marks

4 B) Attempt any one of the following: **6**

4 B) a) Draw neat sketch of minimum oil circuit breaker.

Ans:

Minimum oil circuit breaker:



Minimum oil circuit breaker

Labeled diagram 6 Marks

Partially Labeled diagram 4 Marks

4 B) b) Explain microprocessor based over current relay.

Ans:

Microprocessor based over current relay:

The ac voltage proportional to the load current is converted in to dc through a precision rectifier. Thus the microprocessor accepts d. c. voltage proportional to the load current. The schematic diagram is shown in the figure. The output of rectifier is fed to the multiplexer. The output of multiplexer is fed to the A/D converter to obtain the signal in digital form. The A/D converter ADC 0800 has been used for this purpose. explanation 4 Marks

The microprocessor sends signal to the ADC for starting the conversion. The microprocessor reads the end of conversion signal to examine whether the conversion is over or not. As soon as conversion is over, the microprocessor reads the current signal in digital form and then compares it with the pickup value. The microprocessor first determines the magnitude of the fault current and then selects the corresponding time of operation from the look up table. Then it goes in delay subroutine and sends a trip signal to the circuit breaker after the predetermined time delay.

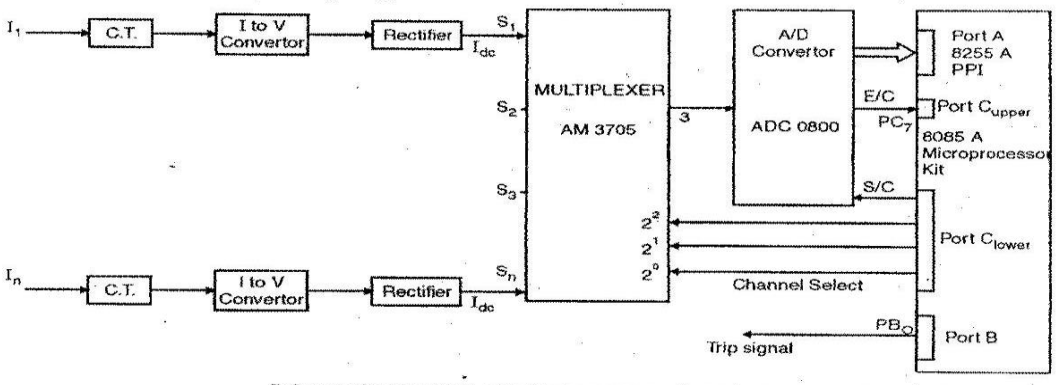


Diagram 2 marks

Schematic diagram of microprocessor based over current relay

5 Attempt any four of the following. 16

5 a) What is function current limiting reactor, give classification according to their arrangements?

Ans:

Function of current limiting rector:

Generally reactance of the system under fault condition is low and fault currents may rise to dangerously high values. In order to limit the fault current to reasonable magnitudes which the CB can handle, additional reactances (reactors) are connected in series with system at suitable points. 2 marks

Classification of reactors :

1) Generator reactors
2) Feeder reactors
3) Busbar reactors
   i) Ring Systems
   ii) Tie bar system

2 marks

5 b) Define the following terms:
i) Arc Voltage ii) Recovery Voltage
iii) Restriking Voltage iv) RRRV

Ans:

i) Arc Voltage: It is the voltage that appears across the contacts of circuit breaker during the arcing period.

ii) Recovery voltage: It is the normal frequency (50Hz) r.m.s. voltage that appears across the contact of the circuit breaker after final arc extinction. It is approximately equal to the system voltage.

iii) Restriking voltage : It is the transient voltage that appears across the contacts at or near current zero during arcing period.

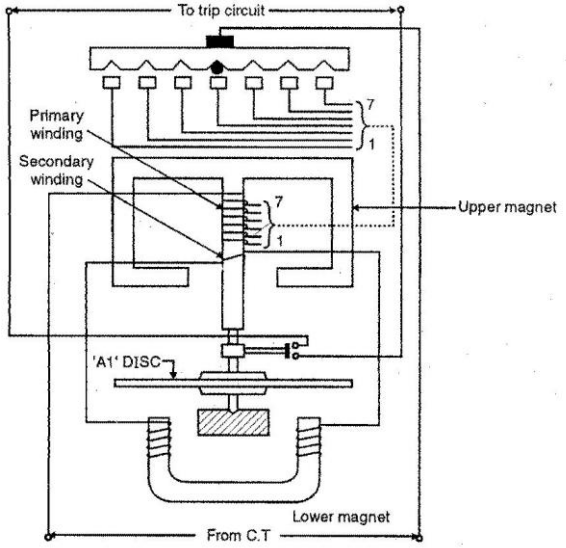
iv) RRRV: It is defined as the rate of increase of restriking voltage and is abbreviated by R.R.R.V. Usually, the restriking voltage is in kv and time in microseconds so that R RRV is in kV/μsec.

1 mark for each definition

5 c) Draw neat circuit diagram of induction type over current relay and label its different parts.

Ans:

Induction type over current relay:



Induction type over current relay (non – directional)

Labeled diagram 4 Marks

Partially Labeled diagram 2 Marks

5 d) State the protective devices used for the protection of alternator against:
i) Over voltage ii) Over Speed
iii) Motoring iv) Rotor over heating

Ans:

Fault	Protecting Devices
i) Over voltage	Lightning Arrester, Voltage Regulators
ii) Over Speed	(i) Mechanical centrifugal device (ii) Over frequency Relay
iii)Motoring	Reverse Power Relay

1 mark for each protection

iv) Rotor overheating	i) Thermal Relays ii) Temperature relays (Sound Alarm) iii) Negative sequence relay

5 e) State the protective devices used for the protection of transformer against :
i) High voltage surges due to lightning ii) Saturation of magnetic field
iii) Faults in tap changer iv) Decomposition of oil.

Ans:

Fault	Protecting Devices
(i) High voltage surges due to lightning	i) Lightning Arrester ii) Surge arrester iii) Surge Absorber
(ii) Saturation of magnetic field	i) Over voltage protection ii) Over fluxing protection
(iii) Faults in tap changer	i) Percentage differential protection ii) High Speed overcurrent relay
(iv) Decomposition of oil	i) Both low & high level alarm relays ii) Buchholz Relay

1 mark for each

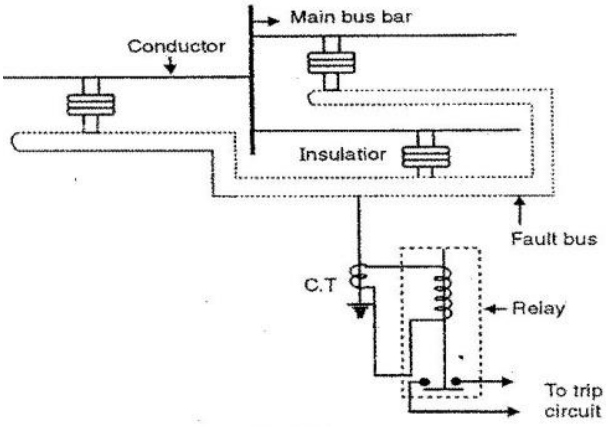
6 Attempt any four of the following. 16

6 a) Explain fault bus protection of busbar.

Ans:

Fault bus protection of busbar:

In this substation is so designed that every fault on the bus bar is converted to earth fault. Under normal operating conditions, there is no current flowing through the fault bus to ground and the relay remains inoperative. When any fault occurs on busbar involving a connection between conductor and earthed support structure, it will cause a flow of current to earth through the fault bus. This results in operation of relay to actuate trip coil of CB to trip the circuit.



Fault bus protection

Diagram 2 marks

explanation 2 marks

6 b) What are fundamental requirements of protective relaying?

Ans:

Fundamental requirements of protective relaying:

i) Selectivity: It is the ability of protective system to select correctly that part of system in trouble and disconnect the faulty part without disturbing the rest of the system.

ii) Speed: The relay system should disconnect the faulty section as fast as possible to prevent the electrical apparatus from damage and for system stability.

iii) Sensitivity: It is the ability of the relay system to operate with low value of

6 points = 4 marks

4 to 5 points = 3 marks

actuating quantity.

iv) Reliability: It is the ability of the relay system to operate under predetermined conditions.

v) Simplicity: The relay system should be simple so that it can be easily maintained.

vi) Economy: The most important factor in the choice of particular protection scheme is the economic aspect. The protective gear should not cost more than 5% of the total cost of equipment to be protected.

2 to 3 points = 2 marks

1 point = 1 mark

OR

Fundamental requirements :

1) Detect abnormal conditions
2) Disconnect abnormally operating part so as to prevent the subsequent fault.
3) Disconnect faulty part quickly so as to improve system stability, service continuity and system performance
4) Improve Transient stability

2 marks

Qualities of relay:

1) Selectivity.
2) Speed.
3) Sensitivity
4) Reliability / Trust worthiness.
5) Simplicity
6) Economical

½ mark each of any four = 2 marks

6 c) Write any four safety precautions while using C.T. and P.T.

Ans :

Safety precautions while using C.T. and P.T.:

1) CT secondary terminals should never be kept open. CTs must be energized only after connecting the burden across them.
2) PT secondary should never be shorted as they are designed for high impedance burdens (extremely low currents).
3) To be used as per the specified rating of voltage, current & burdens only. The burdens should never be exceeded when multiple ones are connected across one instrument transformer. They are designed to give the highest accuracy at the rated burdens only, else for lower and slightly higher burdens, ratio & phase angle errors are present and compensation is needed.
4) CTs for measurement must not be interchanged with those for protection and vice versa.
5) PTs for measurement must not be interchanged with those for protection and vice versa.

1 mark each any four = 4 marks

6 d) State eight advantages of VCB.

Ans:

Advantages of Vacuum Circuit Breaker (VCB):

1) No fire hazards.
2) Compact in size.
3) Reliable and longer life.
4) Operation is quite.

½ mark for each of any 8 advantages

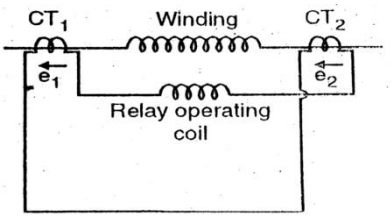
5) Low maintenance.
6) No generation of any gas.
7) They can interrupt any fault current
8) They can successfully withstand lightning surges
9) They have low arc energy
10) Require smaller power for control mechanism
11) Suitable for repeated operation
12) Less weight of moving parts
13) High speed of dielectric recovery
14) More suitable for interrupting capacitive & small inductive current without producing excessive transient over voltages.

6 e) Explain Volage differential relay.

Ans:

Volage differential relay:

Here two similar CTs are connected at either end of the element to be protected by means of pilot wires. The secondaries of CTs are connected in series with a relay such a way that under normal conditions their induced e.m.f. s are in opposition.



Voltage balance differential Relay

diagram 2 marks

explanation 2 marks

Under healthy conditions, because of equal incoming and outgoing currents, the secondary voltages of two CTs are balanced against each other and no current flows in relay operating coil. When a fault occurs in the protected zone , the currents in two primaries will differ and their secondary voltages will also differ causing a current to flow through relay operating coil and relay operates.

6 f) Explain the limitations of differential protection of transformer.

Ans:

Limitations of differential protection of transformer:

1) Due to the magnetization characteristics of the CTs used, the ratio errors change with respect to the circulating currents.
2) The pilot wires used may vary in length due to which the unbalance in the secondary circuit parameter (resistance) is created that results in improper scheme.
3) During heavy short circuit conditions the high currents create saturation of the flux in core of CTs that lead to abnormal relaying or unexpected behavior of the relaying circuit.
4) Tap changing may lead to change in settings & improper operation.
5) Inrush of magnetizing current may lead to inadvertent operation & hence the settings are done for higher values of fault current (higher imbalance) due to which accuracy of sensing & operation is decreased.

1 mark for each of any 4 limitations