Registration No.: .....

Bhartiya Skill Development University Jaipur

School of Electrical Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: ELE1301 **Time: 1 Hour**
Course Name: Automation and Control **Max. Marks: 20**

Instruction: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks. Scientific calculator is allowed. Draw neat and clean diagram.

Section – A

05X01 = 05 Marks

Q.1. Full form of the PLC is:
(a) Pneumatic Logic Controller (b) Pneumatic Logic Circuit
(c) Programmable Logic Controller (d) programmable logic circuit

Q.2. Compressed air and Hydraulics power is used in:
(a) Hard wire controlling (b) Pneumatic Controlling
(c) Manual Controlling (d) None of these

Q.3. The term automation was coined by:
(a) D.S. Harder (b) Richard E. Morley
(c) Thomas Alva Edison (d) None of these

Q.4. The father of PLC is:
(a) Aristotle (b) Richard E. "Dick" Morley
(c) Michael Faraday (d) Archimedes

Q.5. The programming use in PLC is:
(a) Ladder logic programing (b) C-programing
(c) JAVA (d) None of these

Section – B

03X02 = 06 Marks

Q.1. What is PLC? Give the applications of PLC.

Q.2. What is DCS system? Explain with diagram.

Q.3. Give the comparison between relay logic controlling and PLC controlling.

Section – C

03X03 = 09 Marks

Q.1. Explain the Automation with its evolution stages.

Q.2. Explain the Architecture of PLC.

Q.3. Explain the need and roles of automation.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: ELE1301 **Time: 1 Hour**

Course Name: Automation and Control **Max. Marks: 20**

Section A

1. Full form of the PLC is: -
   (C) Programmable Logic Controller
2. Compressed air and Hydraulics power is used in: -
   (B) Pneumatic Controlling
3. The term automation was coined by: -
   (A) D.S. Harder
4. The father of PLC is: -
   (B) Richard E. "Dick" Morley
5. The programming use in PLC is: -
   (A) Ladder logic programing

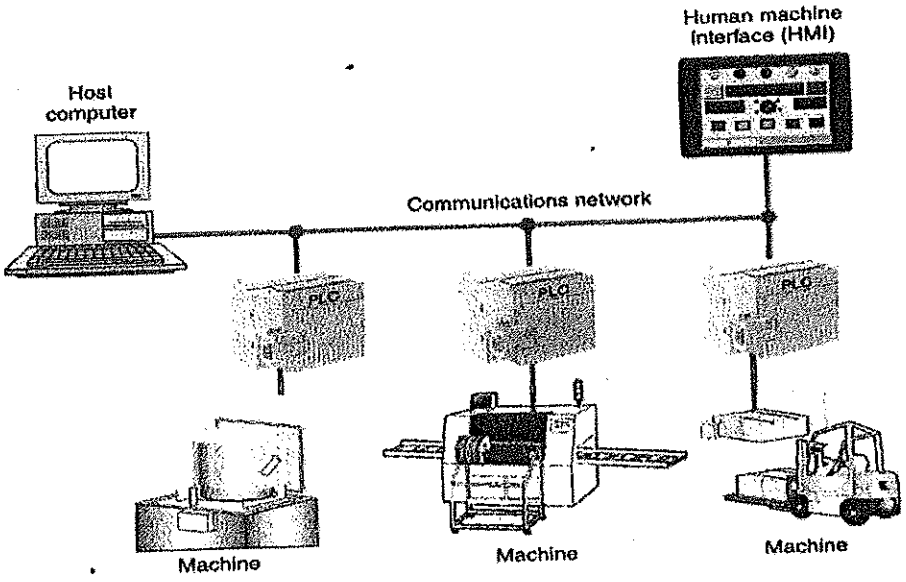
Section B

1. The programmable logic controller is an industrial computer that monitors input, make decisions based on its program and control the output to automate a process or machine. The automation of many different process, such as controlling machines or factory assembly lines, is done through the use of small computers called a programmable logic controller (PLCs). Manufacturer: ALLEN-BRADLEY, FUJI ELECTRIC, L&T, SIEMENS, MISTUBISHI, GENIUS, DELTA etc.

Applications of PLC: -

- Bottle filling plant
- Mixing plant
- Traffic light control
- Packing industries
- Manufacturing industries
- Smart power system
- Chemical plant etc.

2. Distributive control system(DCS): This is a network based system. Distributive control involves two or more PLCs communicating with each other to accomplish the complete control task. Each PLC controls different processes locally and the PLC are constantly exchanging information through communication link.



3. Comparison between relay logic and PLC controlling: -

Relay Logic	PLC
Hardwired logic Using relay switches	Software logic Using CPU and memory
Difficult to upgrade and maintain	Modular, easier to program
Limited in terms of speed size, complexity, and reliability	Superior in these terms
Dated technology	Current technology

Section C

1. Automation: - Automation is the technology by which a process or procedure is performed with minimum human assistance. Automation or automatic control is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, aircraft and other applications and vehicles with minimal or reduced human intervention.

   (a) **Manual Controlling**: In manual control system, the process operator observes the process condition and controls the system by doing manual adjustments. Heron of

Alexandria, a Greek mathematician, invented the first automatic door, which could open the gates to the city using a series of ropes and pulleys.

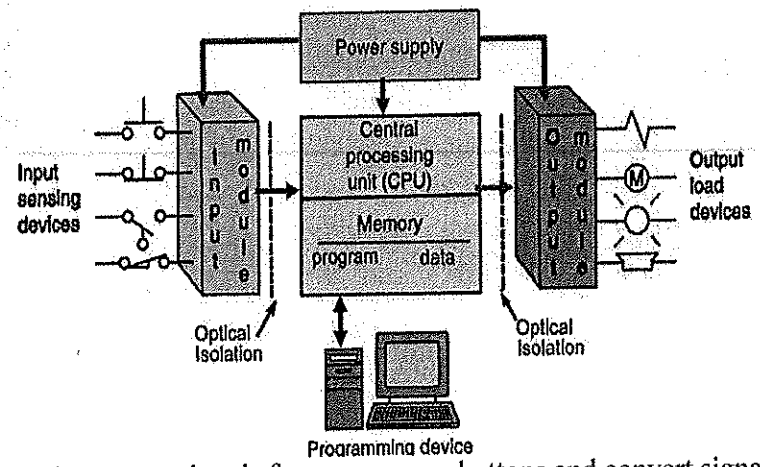
(b) **Pneumatic Controlling:** A pneumatic system is a collection of interconnected components using compressed air to do work for automated equipment. in this case the use of a gaseous media under pressure to generate, transmit and control power; typically using compressed gas such as air at a pressure of 60 to 120 pounds per square inch (PSI). Hydraulics is another form of fluid power, which uses a liquid media such as oil but at a much higher pressure with a typical range of 800 to 5000 PSI. EX. Hydraulic gates

(c) **Hard wire controller:** Hard-wired means the electrical cable is physically connected or wired into the household wiring. Ex. Hard wired counter, timer etc.

(d) **Electric logic gate controller:** A logic gate is an idealized or physical device implementing a Boolean function that, performs a logical operation on one or more binary inputs and produces a single binary output.

(e) **PLC:** A PLC is a Programmable Logic Controller. In other words, it is an industrial computer used as a standalone unit and can be used in a network of PLCs to automatically control a process or perform a specific function.

2. Architecture of PLC: -



- Input module accepts signals from sensors or buttons and convert signal into a logic signal. example: switches, push buttons, sensors etc.
- Output module convert control instructions or logic into mechanical output signal that can be used by output devices. example: lamps, alarm etc.
- Power supply:- It Provides the particular voltage needed to run the primary PLC components.
- Relay:- Relays are switches that open and close circuits electromechanically. Relays control one electrical circuit by opening and closing contacts in another circuit.
- The processor module consists of the central processing unit (CPU) and memory. In addition to a microprocessor, the CPU also contains at least an interface to a programming device and may contain interfaces to remote I/O and other communication networks.

- Programing device is used to develop, Download and upload the ladder logic program into the processor of PLC.

3. Need and Role of Automation: -

1) **Reduce Worker Fatigue and Effort or Labour Intensive Operation:** Typically, humans dislike banal, repetitive tasks. However, computer systems perform them without complaint.
2) **Prevent Products or Materials from Being Damaged or Destroyed**: Humans make mistakes when they fatigue. This embodies the sentiment of the "human condition." Mistakes using tools mean damaging raw materials, components, assemblies, and end products.
3) **Prevent Non-Conforming Product from Shipping:** Computers controlling robots do not forget steps. Neglecting to put in a screw requires a human touch.
4) **Increase Efficiency**: Improving processes for efficiency makes a company more competitive, but do people always do the same thing, in the same way, every time they do it? No, human variation exists. Automated systems allow for improvements that benefit from consistent execution.
5) **Collect Better Data**: Remove the accidental data entry or missed data point from logging. Different sensors regulate it.
6) **Improve Metrics:** Sending reliable data directly to a database provides an ongoing resource. Correlation of associated process data with pass/fail records provides insight rather than guessing "what is causing this?".
7) **Devise the Right Process Improvements**: Automated systems now collect reliable data. The database provides a searchable forum. It makes "continuous improvement," make changes with better information.
8) **Save Money:** Cost savings through making processes more regular and collecting data for making confident decisions.

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: ELE1302 **Time: 1 Hour**
Course Name: Electrical Machine Design Developer **Max. Marks: 20**

Instruction: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks. Scientific calculator is allowed.

Section – A

05X01 = 05 Marks

Q.1. Unit of permeance is:
(a) Wb (b) Tesla (c) Wb/Ampere (d) Ampere/Wb

Q.2. High resistivity materials are commonly used for:
(a) To make electronics circuits (b) Making of different type of windings of motor
(c) Electric heating devices (d) None of the above

Q.3. Class H insulator can withstand up to the temperature of:
(a) 155^0 C (b) 180^0 C (c) 90^0 C (d) 120^0 C

Q.4. Value of permeability of free space is:
(a) $4\pi*10^{-7}$ Meter/henry (b) $4\pi*10^{-8}$ Henry/meter
(c) $4\pi*10^{-7}$ Henry/meter (d) $4\pi*10^{-8}$ Meter/henry

Q.5. Magnetic flux has the analogy with ____ in electric circuit.
(a) Voltage (b) Current (c) Power (d) None of the these

Section – B

03X02 = 06 Marks

Q.1. Write short note on High conductivity materials.
Q.2. Write down the conditions of ideal insulting materials.
Q.3. Explain the basic structure of an electromagnetic rotating electrical machines.

Section – C

03X03 = 09 Marks

Q.1. Explain the limitations in design.
Q.2. Explain magnetic hysteresis B-H curve in detail.
Q.3. The stator of a machine has a smooth surface but its rotor has open type of slots with slots width W_s = tooth width, W_t = 12 mm, and the length of air gap L_g = 2 mm. Find the effective length of air gap if the Carter's coefficient = $1/(1+5L_g/W_s)$. There are no radial ducts.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills
3rd Semester, 1st In-Sem. Examination
B. Voc. Program, Summer Semester (2019-20)

Course Code: ELE1302 **Time: 1 hour**
Course Name: Electrical Machine Design Developer **Max Marks: 20**
Instruction:

Ans.1. (c)
Ans.2. (c)
Ans.3. (b)
Ans.4. (c)
Ans.5. (b)

Ans.1. High conductivity materials:

These materials are used for making all types of windings, apparatus and devices as well as for transmission and distribution of electrical energy.

Properties of high conductivity materials:

- Highest possible conductivity
- Least possible temperature coefficient of resistance
- Adequate mechanical strength.
- Rollability and draw ability which is important in manufacture of wires.
- Good weld ability and solder ability which ensure high reliability and low electrical resistance of the joints.
- Adequate resistance to corrosion.

Examples: Copper, aluminium, Iron and steel, etc.

Ans.2. Conditions of insulating materials:

An ideal insulating material should have:

- High dielectric strength, sustained at elevated temperatures.
- High resistivity or specific resistance.
- Low dielectric hysteresis.
- Good thermal conductivity.
- High degree of thermal stability.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Ans.3 Basic structure of an electromagnetic rotating electrical machines:

(2) M/c.

The basic structure of an electromagnetic rotating electrical M/c consists of the following parts :-

1.) Magnetic circuit :- It provides the path for the magnetic flux and consists of air gap, stator and rotor teeth and stator and rotor cores (yokes)

2.) Electric Circuit :- It consists of stator and rotor windings. The wdg of a x-former or a rotating M/c conveys electrical energy to or from the working region.

3.) Dielectric circuit :- It consists of insulation required to isolate one conductor from another and also the wdgs from the core.

4.) Thermal circuit :- The thermal circuit is concerned with mode and media for dissipation of heat produced inside the machine on account of losses.

5.) Mechanical parts :- It consists of frame, bearings and shafts.

Section – C

Ans.1 Limitations in design:

*Limitations in Design :-

1.) Saturation :- Electromagnetic M/c's use ferro-magnetic materials. The maximum allowable flux density to be used is determined by the saturation level of the ferro-magnetic material used. A high ~~flux~~ value of flux density results in increased excitation resulting in higher cost for the field system.

2.) Temperature Size :- The most vulnerable part of the M/c is its insulation. The operating life of a M/c depends upon the type of insulating material and the life of the insulating material depends upon the temperature rise.
→ If the insulating materials is operated beyond the maximum allowable temperature, its life is drastically reduced.

BSDU

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

3.) Insulation :- The insulating materials used in a M|c should be able to withstand the electrical, mechanical and thermal stresses which are produced in the machine.

→ The type of insulation is decided by the maximum operating temperature of the machine parts where it is put.

→ The size of insulation is not only decided by the maximum voltage stress but also by the mechanical stresses produced.

4.) Efficiency :- The η of a machine should be as high as possible to reduce the operating costs. In order to design a highly efficient M|c, the magnetic and electric loadings used should be small and this requires the use of large amount of material. Therefore, the capital cost of a M|c designed for high η is high while its running cost is low.

5.) Commutation :- The problem of commutation is important to know in the case of commutator M|c as commutation conditions limit the maximum O|P that can be taken from a machine.

6.) Standard specifications :- These specifications are the biggest strain on the design because both the manufacturer as well as the consumer cannot get away from them without satisfying them.

Ans.2. Magnetic hysteresis B-H curve:

Consider a coil wound on an iron core which is completely demagnetised. The field intensity in the coil is given by $H = IN/l$. The value of H can be increased or decreased by increasing or decreasing the current through the coil. When the current in the coil is zero, $H = 0$ and $B = 0$. If the current and hence the field strength H increases gradually, the flux density B in the core also increases. The relationship between B and H is represented by the curve OA shown in Fig. 7.13. At point A, the core becomes magnetically saturated and the field strength H reaches its highest value H_m corresponding to the maximum value of the magnetising current. At this point the flux density in the core has a maximum value of B_m.

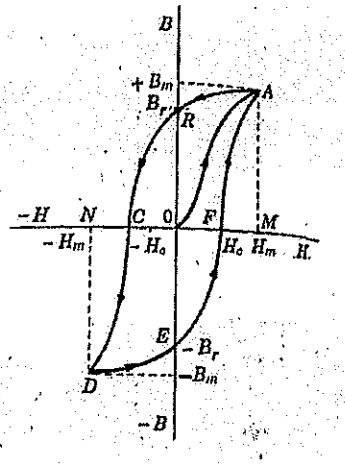


Fig. 7.13. Hysteresis loop.

If H is gradually reduced to zero, it will be seen that the corresponding values of B tend to *lag* behind the changes in H. This is called *magnetic hysteresis*. The B-H curve for the decreasing values is AR. It lies above the curve OA, for increasing values of B and H. At point B, when $H = 0$, B is not zero but has a value equal to OR. This shows that when the field strength is reduced to zero the core is not completely demagnetised. There still remains a certain flux, called the *residual flux density* or *remanent flux density*. This remaining flux density in the core when H has fallen from the *saturation value* H_m to zero is called *remanence* of the core material. It is denoted by B_r, In Fig. 7.13, B_r = OR. The residual flux density in the core is due to the fact that the domains do not entirely revert to their original disorder. Some domains still remain aligned after H is reduced to zero.

To demagnetise the core (*i.e.*, to remove the residual flux), H is reversed by reversing the current in the coil. The flux density falls to zero along the curve RC. At C, $H = H_c$ and $B = 0$. The demagnetising field strength H_c required to remove the residual flux density is called the *coercive*

force. The value of H_c when the material has been taken to saturation is called the *coercivity of the material*.

If H is further increased in the reversed direction to $-H_m$, the curve follows the path CD. Point D represents saturation in the reversed direction and $ND = -B_m$. If H is again gradually decreased to zero, the curve follows the path DE. At point E, $H = 0$, $B = -B_r$. To remove the residual flux, H is applied in the original positive direction and the curve follows the path EF. At point F, $H = H_c$ and $B = 0$. If H is further increased in this direction, the curve follows the path FA. The closed loop ARCDEFA obtained when the magnetic core is subjected to one complete cycle of magnetisation is called the *hysteresis loop*. To take the core through the complete cycle, an alternating magnetic field intensity of peak-to-peak value equal to NM is applied. If this alternating H is maintained, the core continues to follow similar cycles of magnetisation.

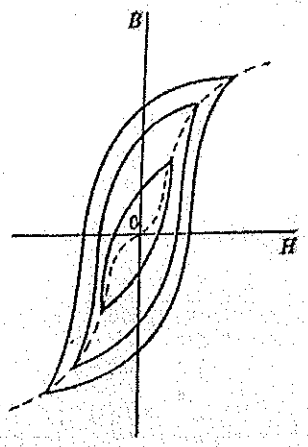


Fig. 7.14. Family of hysteresis loops.

Except at points A and D where B and H attain their maximum values, the flux density B lags behind H throughout the cycle. For example, at point F when $B = 0$, H has already reached a positive value $+H_c$. At point E, when $H = 0$, B has a negative value $-B_r$. The word *hysteresis* means lagging behind. The curve gets its name from the fact that the flux density (effect) lags being the magnetic field intensity H (cause).

Hysteresis results from reversals of flux of any value. For a given specimen, a number of hysteresis loops may be obtained, each for a different maximum value of H. All these loops lie within major or largest hysteresis loops corresponding to the saturation values of B and H. A family of such loops is shown in Fig. 7.14. The apexes of all minor loops lie on a curve called the *normal magnetisation curve* shown dotted in the figure.

Ans. 3.

Solution. Carter's co-efficient for slots

$$K_{cs} = \frac{1}{1+5\times 2/12} = 0.545$$

Slot pitch $y_s = W_s + W_t = 24$ mm.

From Eqn. 3.12, gap contraction for slots

$$K_{sg} = \frac{y_s}{y_s - K_{cs}W_s} = \frac{24}{24 - 0.545\times 12} = 1.37.$$

Since there are no ducts, gap contraction factor for ducts, $K_{gd} = 1$.

From Eqn. 3.26, total gap contraction factor $K_g = K_{gs} = 1.37 \times 1 = 1.37$.

$\therefore$ Effective gap length (see Eqn. 3.36) $l_{gs} = K_g l_g = 1.37 \times 2 = 2.74$ mm.

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Time: 1 Hour

Course Code: ELE 1303

Max. Marks: 20

Course Name: Electrical Circuit Analysis

Instruction: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks. Scientific calculator is allowed.

Section – A

05X01 = 05 Marks

Q.1. A branch in a network is said to be active when it contains a:
(a) Resistor (b) Inductor (c) Capacitor (d) Source

Q.2. Which of the element in the following is not bilateral?
(a) Resistor (b) Inductor (c) Capacitor (d) Transistor

Q.3. A node in a network is defined as a:
(a) Closed Path (b) Group of interconnected elements
(c) Junction point of two or more branches (d) All of these

Q.4. Any closed path formed by the branches in a network is called a:
(a) Loop (b) Mesh (c) Node (d) None of these

Q.5. Which of the following characteristic are attributed to an ideal independent voltage source?
(a) Independent of magnitude (b) Independent of the direction of flow of current
(c) Can absorb or deliver energy continuously at constant voltage (d) All of these

Section – B

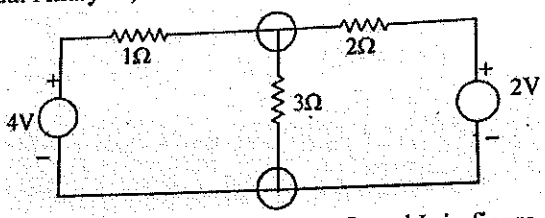
03X02 = 06 Marks

Q.1. Stat the Kirchhoff's laws.
Q.2. Differentiate between linear and non-linear elements. Also give examples of each.
Q.3. Differentiate between active elements and passive elemetns. Also give examples of each.

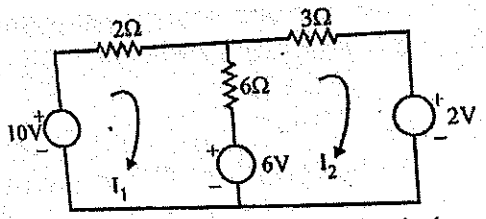
Section – C

03X03 = 09 Marks

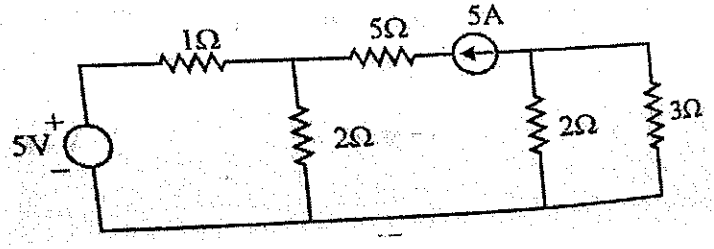
Q.1. Using Nodal Analysis, find I in 3Ω resitance as shown in figure.



Q.2. Using mesh current method, find current I_1 and I_2 in figure.



Q.3. Determine the current in all the elements of the circuit show in figure.



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills

Session: 2019-20 (Summer Semester)

B. Voc. Program, 3rd Semester,

1st In-Sem. Examination

Course Code: ELE 1303

Course Name: Electrical Circuit Analysis **Max. Marks: 20**

Section – A 05X01 = 05 Marks

1. A branch in a network is said to be active when it contains a:
   Ans. (d) Source
2. Which of the element in the following is not bilateral?
   Ans. (d) Transistor
3. A node in a network is defined as a:
   Ans. (c) Junction point of two or more branches
4. Any closed path formed by the branches in a network is called a:
   Ans. (a) Loop
5. Which of the following characteristic are attributed to an ideal independent voltage source?
   Ans. (d) All of these

Section – B 03X02 = 06 Marks

1. Stat the Kirchhoff's laws.

Ans. The Kirchhoff's laws are two in number, namely Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Laws (KVL). These laws are based on fundamental principle of conservation of energy and conservation of charge. So these are applicable to all types of circuits i.e. linear, nonlinear, etc.

1. Kirchhoff's Current Law (KCL): KCL states that "In any electrical network, the algebraic sum of all currents meeting i.e. terminating at a point (or node) at any instant is zero."

Alternatively, it states that "in any electrical network, the sum of all current flowing towards a junction (entering) is equal to the current flowing outwards from a junction (leaving)".

$$\sum \mathrm{I} = 0 \ \textit{or} \ \sum \text{current at a node} = 0$$

Or

$$\sum \text{Current entering at a node} = \sum \text{Current leaving the node}$$

2. Kirchhoff's Voltage Law (KVL): Kirchhoff's Voltage Law states that "the algebraic sum of all branch voltages around any closed path (loop) of a circuit is zero at all instants of time".

In other words, "The algebraic sum of EMF around a close loop in an electric circuit is equal to the algebraic sum of the voltage drops in the loop".

Mathematically $\sum_{i=1}^{N} V = 0$

Where N is number of elements in the path.

Or

$$\sum \text{EMF} + \sum \text{Voltage drop} = 0$$

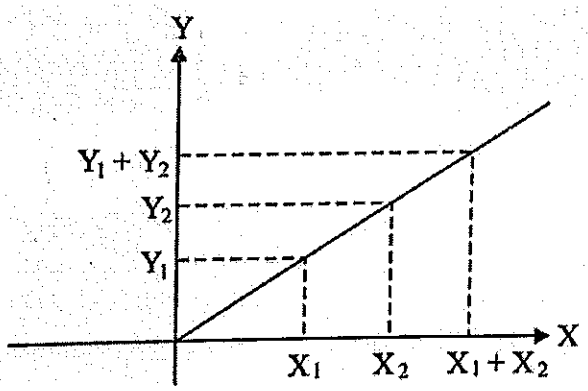
2. Differentiate between linear and non-linear elements. Also give examples of each.

Ans. **Linear Elements:** Linear elements are elements; whose output is directly proportional to the input. Consider an element A. Let for X_1 input, output is Y_1, for X_2 input, output is Y_2. Then if the element is linear and $X_1 + X_2$ is input, then output must be $Y_1 + Y_2$. This is known as the super position principle and the elements which follow super position principle are called linear elements. In electrical term, the elements whose value do not change with the change in current or voltage are called linear elements.

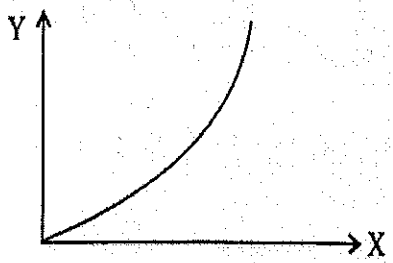
Examples: - Pure, R, L, C, etc.

Non Linear Elements: The elements which do not follow superposition principle are non-linear elements. In the non-linear elements the output is not directly proportional to the input.

Examples: Diode, Choke, etc.



Characteristic of Linear Parameter System



Characteristic of Non- Linear

3. Differentiate between active elements and passive elements. Also give examples of each.

Ans. Active Elements: The elements which are source of energy and always supply energy to the network are called active elements. The energy source can be supplying voltage or current. An element which can increase the power level of the circuit, is known as active elements. A transistor is an active element as it can amplify the power level in the circuit. Transformer is not an active element as it cannot modify the power level. Examples: batteries, cell, alternators, etc.

Passive Elements: The elements which either dissipate or store the energy are called passive elements. These elements have the property of absorbing/ dissipating or storing energy. These are able to return the energy previously stored in them. These elements are not able to return energy more than that stored in them. Examples: Resistance, inductance, capacitance, etc.

Section – C 03X03 = 09 Marks

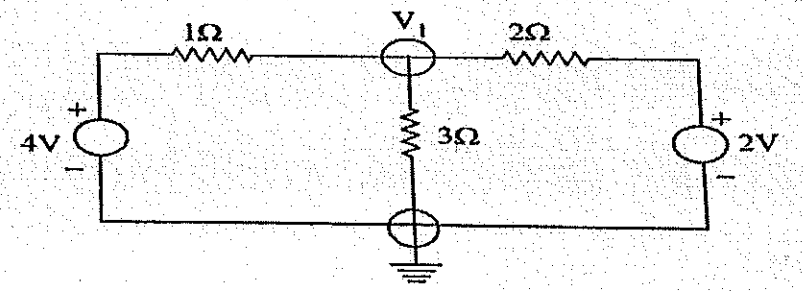
1. Using Nodal Analysis, find I in 3Ω resistance as shown in figure.

Ans.

Step 1 - The circuit has two nodes.

Step 2 - The bottom node is taken as reference node.

Step 3 - The remaining node voltage is assumed as V_1.



Step 4 - KCL equation at node V_1

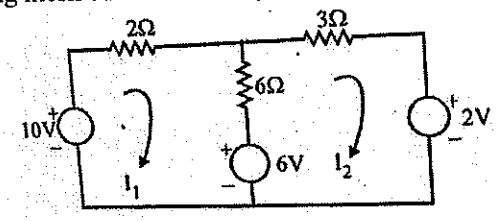
$$\frac{V_1-4}{1}+\frac{V_1}{3}+\frac{V_1-2}{2}=0;\ 6V_1-24+3V_1-6+2V_1=0$$

$$11V_1=30\ ;\ V_1=\frac{30}{11}V$$

So the current is 3Ω resistance.

$$I=\frac{V_1}{3}=\frac{30}{11\times 3}=\frac{10}{11}A$$

2. Using mesh current method, find current I_1 and I_2 in figure.



Ans.

. The circuit contains two loops. The loop currents are assumed as I_1 and I_2.

For loop I_1, current I_1 is assumed to be highest and writing KVL equation in I_1 loop.

$$+10-2I_1-6(I_1-I_2)-6=0$$

$$8I_1-6I_2=4 \quad \ldots(1)$$

In loop I_2, the KVL equation is (I_2 is highest)

$$+6-6(I_2-I_1)-3I_2-2=0$$

$$-6I_1+9I_2=4 \quad \ldots(2)$$

Now solving the equation (1) and (2)

$$72I_1-54I_2=36$$

$$\underline{-36I_1+54I_2=24}$$

$$36I_1 \qquad =60$$

$$I_1=\frac{5}{3}A$$

From equation (2),

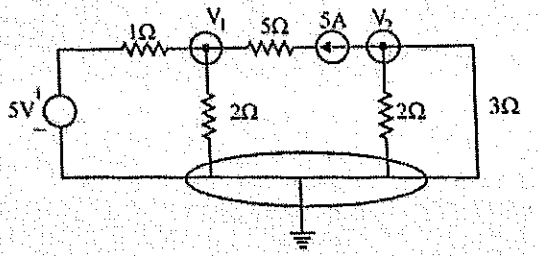
$$-6\times\frac{5}{3}+9I_2=4;\ 9I_2=14$$

$$I_2=\frac{14}{9}A$$

3. Determine the current in all the elements of the circuit show in figure.

Ans. Solutin Using node-voltage methos

Sol. The given circuit has 3 nodes and one node (bottom node) is taken as reference node. Assume the node voltages as V_1 and V_2.



KCL equation at node V_1

$$\frac{V_1-5}{1}+\frac{V_1}{2}-5=0 \quad \ldots(1)$$

KCL equation at node V_2

$$5+\frac{V_2}{2}+\frac{V_2}{3}=0 \qquad \text{...(2)}$$

$$\therefore \quad 30+3V_2+2V_2=0$$

$$V_2=-\frac{30}{5}=-6V$$

From equation (1)

$$2V_1-10+V_1-10=0;\ 3V_1=20$$

$$V_1=\frac{20}{3}V$$

So current in each element

$$I(1\Omega)=5-\frac{20}{3}=-\frac{5}{3}A \qquad \text{Ans. (towards } V_1\text{)}$$

$$I(2\Omega)=\frac{20/3}{2}=\frac{20}{6}=\frac{10}{3}A \qquad \text{Ans. (towards reference)}$$

$$I(5\Omega)=5A \qquad \text{Ans. (towards } V_1\text{)}$$

$$I(2\Omega)=\frac{V_2}{2}=-\frac{30}{5\times 2}=-3A \qquad \text{Ans. (towards reference)}$$

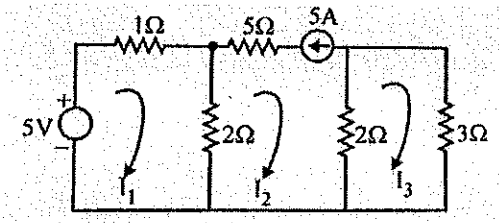
$$I(3\Omega)=-\frac{30}{5\times 3}=-2A \qquad \text{Ans. (towards reference)}$$

Using mesh-current method

Sol. The circuit has 3 loops and the currents are assumed as I_1, I_2 and I_3.

The current in the loop I_2 is constant because the branch have 5A current source, but the direction is opposite as assumed, so

$$I_2=-5A$$



The KVL equation in loop 1 (I_1)

$$+5-I_1-2(I_1-I_2)=0$$

$$I_1+2I_1-2I_2=5$$

$$3I_1+10=5$$

$$I_1=-\frac{5}{3}=-1.67A$$

The KVL equation in loop 3 (I_3)

$$-2(I_3-I_2)-3I_3=0$$

$$5I_3=-10$$

$$I_3=-2A$$

The current in each element

$$I(1\Omega)=-\frac{5}{3}A(I_1) \qquad \text{Ans.}$$

$$I(2\Omega)=(I_1-I_2)=-\frac{5}{3}+5=\frac{10}{3}A \qquad \text{Ans.}$$

$$I(5\Omega)=-5A\ (I_2) \qquad \text{Ans.}$$

$$I(2\Omega)=(I_2-I_3)=(-5+2)=-3A \qquad \text{Ans.}$$

$$I(3\Omega)=I_3=-2A \qquad \text{Ans.}$$

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: ELE 1304 **Time: 1 Hour**
Course Name: Electrical Measuring Instruments **Max. Marks: 20**

Instruction: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks. Scientific calculator is allowed.

Section – A

05X01 = 05 Marks

Q.1. The pointer of an indicating instrument is generally made up of:
(a) Copper (b) Aluminium (c) Silver (d) Soft steel

Q.2. The controlling torque of an indicating instrument _____ as the deflection of the moving system increases:
(a) remains uncharged (b) decreases
(c) Increases (d) None of these

Q.3. An ammeter is an_____ instrument.
(a) indicating (b) integrating (c) recording (d) any of these

Q.4. Shunts are generally made of:
(a) Copper (b) Aluminium (c) Silver (d) Magnesium

Q.5. PMMC instrument can be used for?
(a) AC (b) DC. (c) Both of these (d) None of these.

Section – B

03X02 = 06 Marks

Q.1. What is the working principle of permanent magnet moving coil?
Q.2. Explain indicating, recording and integrating type instruments with their applications.
Q.3. The measured and true values of resistance are 4.26Ω and 3.0Ω. Determine the absolute static error of measurement.

Section – C

03X03 = 09 Marks

Q.1. Explain the terms, deflecting torque, controlling torque and damping torque?
Q.2. The measured value of inductor is 2.06mH and its true value is 1.09mH. Determine the relative static error.
Q.3. Write the differences among absolute, relative and limiting errors?

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: ELE 1304
Course Name: Electrical Measuring Instruments **Max. Marks: 20**

Section – A

05X01 = 05 Marks

Q.1. **Ans. (b)** Aluminium

Q.2. **Ans. (c)** Increases

Q.3. **Ans. (a)** Indicating

Q.4. **Ans. (d)** Magnesium

Q.5. **Ans. (b)** DC

Section – B

03X02 = 06 Marks

Q.1. What is the working principle of permanent magnet moving coil?

Ans. PMMC stands for 'Permanent magnet moving coil'. It is one of the simple and most used instrument on board with sophisticated names. They are used on board to assist in regular maintenance of electrical equipment or when precise measurements are required. Apart from PMMC and permanent magnet moving coil; they are also known as D'alvanometer (A type of galvanometer based on D'Arsonval principles).

It is a simple machine which create stationary magnetic fields with two powerful permanent magnet. This is then used with the moving coil connected to the electric source to produce deflection torque; according to the popular theory of Fleming left hand rule.

Q.2. Explain indicating, recording and integrating type instruments with their applications.

Ans. **Indicating** instruments are those instruments which indicate the magnitude of a quantity being measured.

- **Recording** instruments give a continuous record of the quantity being measured over a specified period.
- **Integrating** instruments totalize events over a specified period of time. The summation, which they give is the product of time and an electrical quantity

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Q.3. The measured and true values of resistance are 4.26Ω and 3.0Ω. Determine the absolute static error of measurement.

Ans.3. Measured Value A_m= 4. 26Ω

True value A_t= 3.0Ω

Absolute static error is: δ= A_m- A_t

4.26-3= 1.26 Ω

Section – C

03X03 = 09 Marks

Q.1. Explain the terms, deflecting torque, controlling torque and damping torque?

Ans.1. Deflecting Torque: The deflecting torque causes the moving system to move from its zero position. The controlling torque (Tc) opposes the deflecting torque and increases with the deflection of the moving system. The pointer comes to rest at a position where the two opposing torques are equal.

Controlling Torque: The controlling torque performs two functions. Controlling torque increases with the deflection of the moving system so that the final position of the pointer on the scale will be according to the magnitude of an electrical quantity (i.e. current or voltage or power) to be measured.

Damping torque: In a measuring instrument, the damping torque is necessary to bring the moving system to rest to indicate steady reflection in a reasonable short time. It exists only as long as the pointer is in motion. Under the absence of damping torque the pointer oscillates for a short period of time and comes to steady position

Q.2. The measured value of inductor is 2.06mH and its true value is 1.09mH. Determine the relative static error.

Ans. Measured Value A_m= $2.06*10^{-3}$ H

True value A_t= $1.09*10^{-3}$ H

Absolute static error is: δ= A_m- A_t= $0.097*10^{-3}$

$\%t_r$= δ/ A_t = $0.97*10^{-3}$/ $1.09*10^{-3}$

8.89%

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Q.3. Write the differences among absolute, relative and limiting errors?

Ans:

Absolute Error

There are two types of error that are affected by the accuracy of measuring tools. The **absolute error** is defined as the absolute value (or magnitude) of the difference between the measured value and the true value. Thus, let:

- e_a = the absolute error
- x_m = the measured value
- x_t = the true value

The formula for computing absolute error is:

$e_a = | x_m - x_t |$

Relative Error

There is another type of error that is affected by the accuracy of measuring tools. The **relative error** is defined as the absolute error relative to the size of the measurement. All you need to do is divide the absolute error by the measured value. In addition to the variables, let:

- e_r = the relative error

Then the formula for computing relative error is:

- $e_r = e_a / x_m$

Limiting Error

Definition: The limited deviation of the measured value from the true value is known as the limiting error or guarantee error. Such type of error is fixed on the instrument. The magnitude of the limiting error depends on the design, material and the workmanship used for the construction of the instrument.

$$A_a = A_s \pm \delta A \ldots\ldots equ(1)$$

Where,
A_a – actual value
A_s – specified or rated value
δ_A – limiting error or tolerance

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills

Session: 2019-20 (Summer Semester)

B. Voc. Program, 3rd Semester,

1st In-Sem. Examination

Course Code: ELE 1305 **Time: 1 Hour**

Course Name: Introduction to Power System **Max. Marks: 20**

Instruction: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks. Scientific calculator is allowed.

Section – A

05X01 = 05 Marks

Q.1. Which of the following is not a requirement for site selection of hydroelectric power plant?

(a) Availability of water (b) Large catchment area

(c) Rocky land (d) Sedimentation

Q.2. Hydroelectric power plant is:

(a) Non-renewable source of energy (b) Conventional source of energy

(c) Non-conventional source of energy (d) Continuous source of energy

Q.3. The cost of fuel transportation is maximum in:

(a) Hydro-electric power plant (b) Steam power plant

(c) Nuclear power plant (d) Diesel power plant

Q.4. _____requires more space.

(a) Nuclear power plant (b) Hydro-electric power plant

(c) Thermal power plant (d) Diesel power plant

Q.5. Which process is responsible for production of energy in the Nuclear power plant?

(a) Nuclear fission reaction (b) Nuclear fusion reaction

(c) Exothermal chemical reaction (d) All of the above

Section – B

03X02 = 06 Marks

Q.1. Which is the biggest power plant in India? What is the installed capacity of that power plant?

Q.2. Which is the first nuclear power plant in India?

Q.3. Write the disadvantages of thermal power plant.

Section – C

03X03 = 09 Marks

Q.1. Write the advantages and disadvantages of hydro power plant?

Q.2. Draw the layout of thermal power plant and explain the functions of:
(i) Coal handling plant and (ii) Air preheater

Q.3. Draw the layout of hydro power plant and explain its working principle.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills

Session: 2019-20 (Summer Semester)
B. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: ELE 1305 **Time: 1 Hour**
Course Name: Introduction to Power System **Max. Marks: 20**

Section – A

05X01 = 05 Marks

Q.1. Which of the following is not a requirement for site selection of hydroelectric power plant?

(a) Availability of water (b) Large catchment area
(c) Rocky land (d) Sedimentation
Ans. (d)

Q.2. Hydroelectric power plant is:

(a) Non-renewable source of energy (b) Conventional source of energy
(c) Non-conventional source of energy (d) Continuous source of energy
Ans. (b)

Q.3. The cost of fuel transportation is maximum in:

(a) Hydro-electric power plant (b) Steam power plant
(c) Nuclear power plant (d) Diesel power plant
Ans. (c)

Q.4. _____requires more space.

(a) Nuclear power plant (b) Hydro-electric power plant
(c) Thermal power plant (d) Diesel power plant
Ans. (d)

Q.5. Which process is responsible for production of energy in the Nuclear power plant?

(a) Nuclear fission reaction (b) Nuclear fusion reaction
(c) Exothermal chemical reaction (d) All of the above
Ans. (a)

Section – B

03X02 = 06 Marks

Q.1. Which is the biggest power plant in India? What is the installed capacity of that power plant?

Ans. Vindhyachal Thermal Power Station in the Singrauli district of Madhya Pradesh, with an installed capacity of 4,760MW, is currently the biggest thermal power plant in India. It is a coal-based power plant owned and operated by NTPC.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Q.2. Which is the first nuclear power plant in India?

Ans. Tarapur Atomic Power Station (T.AP.S.) was the first nuclear power plant in India. The construction of the plant was started in 1962 and the plant went operational in 1969. The 320 MW Tarapur nuclear power station housed two 160 MW boiling water reactors (BWRs), the first in Asia.

Q.3. Write the disadvantages of thermal power plant.

Ans. DISADVANTAGES

- It pollutes the atmosphere due to producing large amount of smoke and fumes.
- Higher maintenance cost and operational cost.
- Huge requirement of water.

Section – C

03X03 = 09 Marks

Q.1. Write the advantages and disadvantages of hydro power plant?

Ans. ADVANTAGE

- No fuel charges.
- Less supervising staff is required.
- Maintenance & operation charges are very low.
- Running cost of the plant is low.
- The plant efficiency does not change with age.
- It takes few minutes to run & synchronize the plant.
- No fuel transportation is required.
- No ash & flue gas problem & does not pollute the atmosphere.
- These plants are used for flood control & irrigation purpose.
- Long life in comparison with the Thermal & Nuclear Power Plant.

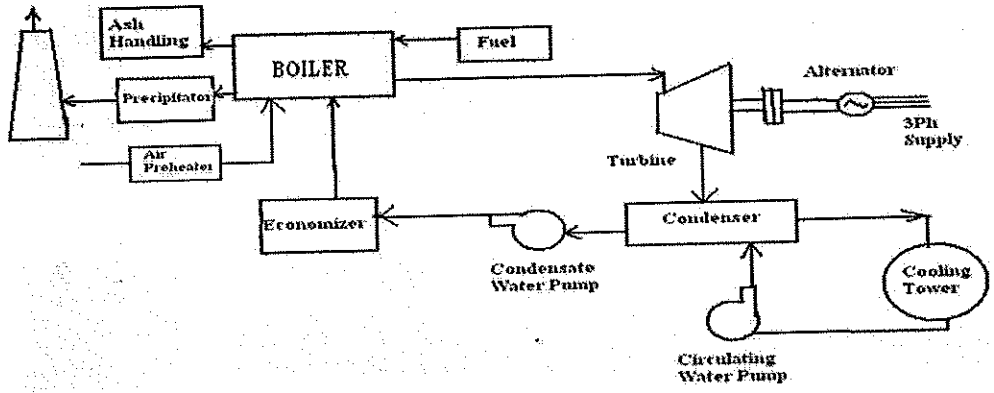
DISADVANTAGE

- The initial cost of the power plant is very high.
- Takes long time for construction of the dam.
- Generally, such plants are located in hilly area's far away from load center & thus they require long transmission lines & losses in them will be more.
- Power generation by hydro power plant is only dependent on natural phenomenon of rain. Therefore, at the time of drought or summer session the Hydro Power Plant will not work.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Q.2. Draw the layout of thermal power plant and explain the functions of:
(i) Coal handling plant and (ii) Air preheater

Ans.



COAL HANDLING PLANT

- Coal is transported to power station by rail or road and stored in coal storage plant and then pulverized.
- The function of coal handling plant is automatic feeding of coal to the boiler furnace.
- A thermal power plant burns enormous amounts of coal.
- A 200MW plant may require around 2000 tons of coal daily.

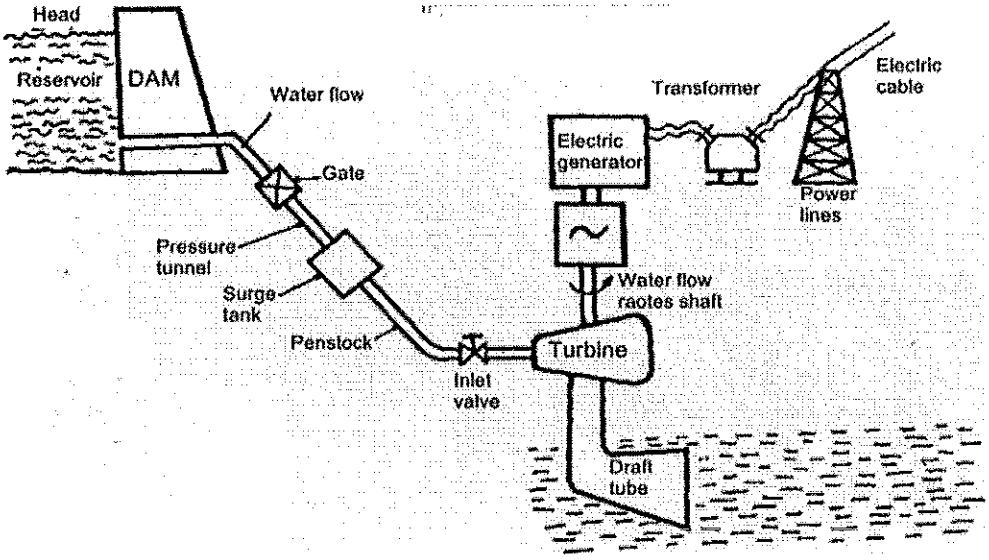
AIR PREHEATER

- The function of air preheaters is to preheat the air before entering to the furnace by utilizing some of the energy left in the flue gases before exhausting them to the atmosphere.
  After flue gases leave economizer, some further heat can be extracted from them and used to heat incoming heat. Cooling of flue gases by 20 degree centigrade increases the plant efficiency by 1%.

Q.3. Draw the layout of hydro power plant and explain its working principle.
Ans. In Hydro Power Plant the water is utilized to move the turbines which in turn run the electric generator's.

• The Potential energy of the water stored in the dam gets converted into the Kinetic Energy of the moving water in the penstock. And this Kinetic Energy gets converted into the Electrical Energy with the help of Turbine & Generator (T-G) combination.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY



Registration No.:.....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills

Session: 2019-20 (Summer Semester)

M. Voc. Program, 3rd Semester,

1st In-Sem. Examination

Course Code: ELE-2301 **Time: 1 Hour**

Course Name: Smart Grid Technology **Max. Marks: 20**

Instruction: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks. Scientific calculator is allowed.

Section – A

05X01 = 05 Marks

Q.1. Which one of the following device is used for improving the power factor of the system?

(a) Asynchronous Generator (b) Series Reactor

(c) Shunt Reactor (d) Synchronous Phase Modifier

Q.2. In which of the following condition does voltage unbalance occurs:

(a) When voltage magnitude in all the three phases are not identical

(b) When the phase angle between phases are not equal to 120 deg

(c) Both the options are correct

(d) None of these

Q.3. Which of the following is not a source of harmonic current?

(a) Computers (b) UPS system

(c) Capacitor switching (d) Resistive load

Q.4. Which one of the following is waveform distortion?

(a) DC offset (b) Electrical noise

(c) Notching (d) All the options are correct

Q.5. Filters are used to reduce which of the following:

(a) All the options are correct (b) Harmonics

(c) Voltage distortion (d) Voltage sag

Section – B

03X02 = 06 Marks

Q.1. What is Power Theory?

Q.2. What is distributed generation?

Q.3. Write the merits of smart electrical energy networks concept?

Section – C

03X03 = 09 Marks

Q.1. What are the need of active power flow control in transmission systems?

Q.2. Explain the benefit of energy storage system for assisting the power system operation?

Q.3. Explain the structure of the electrical power system with its fundamental problems.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY
School of Electrical Skills
Session: 2019-20 (Summer Semester)
M. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: ELE-2301 **Time: 1 Hour**
Course Name: Smart Grid Technology **Max. Marks: 20**

Section – A

05X01 = 05 Marks

Q.1. Which one of the following device is used for improving the power factor of the system?
(a) Asynchronous Generator (b) Series Reactor
(c) Shunt Reactor (d) Synchronous Phase Modifier
Ans: (d) Synchronous Phase Modifier

Q.2. In which of the following condition does voltage unbalance occurs:
(a) When voltage magnitude in all the three phases are not identical
(b) When the phase angle between phases are not equal to 120 deg
(c) Both the options are correct
(d) None of these
Ans: (c) Both the options are correct

Q.3. Which of the following is not a source of harmonic current?
(a) Computers (b) UPS system
(c) Capacitor switching (d) Resistive load
Ans: (d) Resistive load

Q.4. Which one of the following is waveform distortion?
(a) DC offset (b) Electrical noise
(c) Notching (d) All the options are correct
Ans: (d) All the options are correct

Q.5. Filters are used to reduce which of the following:
(a) All the options are correct (b) Harmonics
(c) Voltage distortion (d) Voltage sag
Ans: (b) Harmonics

Section – B

03X02 = 06 Marks

Q.1. What is Power Theory?
Ans. The term power theory of circuits can be understood as the state of knowledge on their power properties. In that sense it is a set of true statements, interpretations, definitions and equations describing these properties. The theory of power, understood that way, is a collective product of those who seek an answer to the question why a load with the active power P usually demands a power source with an apparent power S greater than its active power. This question is closely related to the need for interpretation of power phenomena in electric circuits. Another factor is of a practical nature – power theory attempts to answer the question how the apparent power of the source can be reduced without the reduction in the load active power.

Q.2. What is distributed generation?
Ans: Distributed generation (DG) is any electricity generating technology installed by a customer or independent electricity producer that is connected at the distribution system level of the electric grid. This includes all generation installed at sites owned and operated by utility customers, such as a solar photovoltaic systems serving a house or a cogeneration (or CHP) facility serving a college or university. It also covers any commercial-scale or net-metered generation that is connected to the grid at the distribution level (as opposed to the transmission level).

Q.3. Write the merits of smart electrical energy networks concept?
Ans: Summarizing, a modernized smart grid would create EPS that:
- ✓ Will reduce peak loads and generate reserve margins;
- ✓ Will delete capital costs of new T&D infrastructure as well as generating plants;
- ✓ Will lower T&D line losses together with operation and maintenance costs;
- ✓ Will redirect power flows, change load patterns, improve voltage profiles and stability;
- ✓ Will enable loads ESS and DG to participate in system operations;
- ✓ Through extensive monitoring, quick communications, and feedback control of operations, will have much more information about system rising problems before they affect service;
- ✓ Provide system utilities with advanced visualization tools to enhance their ability to oversee the system.

Section – C

03X03 = 09 Marks

Q.1. What are the need of active power flow control in transmission systems?
Ans. transmission systems has increased significantly. There are a number of reasons for this:

- ✓ Thermal issues are generally related to thermal limits caused, for example, by a change in the network configuration. Additionally, in a meshed power system, there can occur a situation where a low impedance line carries much more power than originally designed for, while parallel paths are underutilized. With power flow control, the stressed line can be relieved, resulting in better overall utilization of the network;
- ✓ In the future when, among others, private companies will operate transmission lines and sell energy to interested parties, the load flow will have to be controlled. One possibility is to use HVDC lines; another possibility is load flow control using FACTS devices in an AC network;
- ✓ Voltage and reactive power control issues—low voltage at heavily loaded transmission lines as well high voltage at lightly loaded lines are undesirable occurrences in transmission lines. The first can be a limiting factor responsible for reduced value of the transmitted power and the second can cause equipment damage. Both low voltage as well as high voltage can exceed the voltage limits and therefore corrective actions have to be taken. The corrective actions with utilization of selected FACTS devices include correcting the power factor and compensating reactive losses in lines by supplying reactive power;
- ✓ Loss reduction—generally, total losses in a system cannot be reduced to such an extent that the installation of power flow controllers is justified. Only the losses due to reactive power flow, which usually are quite small, are easily avoidable. A reduction of the losses due to active power flow would require a decrease of the line resistances. However, loss reduction in a particular area of the system is a relevant issue. Power transfers from one point to another will physically flow on a number of parallel paths and thereby impel

losses on lines that might belong to another utility, thus causing increased costs for that company. If the latter utility cannot accept these losses, power flow control can be a solution;

- ✓ Transient and dynamic stability control issues—transient stability describes the ability of the power system to survive after a major disturbance, while dynamic stability describes sustained or growing power swing oscillations between generators or a group of generators initiated by a disturbance (fault, major load changes etc.). The first phenomenon can be improved by synchronizing power flow between sending and receiving ends. A solution for the second phenomenon lies in the use of equipment that permits dynamic damping of such oscillations. In the first as well as the second situation, active power flow control can be a solution.

Summarizing, power flow control technologies have the abilities to solve both steady-state (better utilization of the transmission assets, minimization of losses, limit flows to contract paths etc.) and dynamic issues (dynamic dumping of the oscillations) of transmission systems.

Q.2. Explain the benefit of energy storage system for assisting the power system operation?
Ans. In order to realize as many ESS benefits as possible, T&D operators require a second, minute, hour and sometimes even multi-hour energy storage system. Benefits of well-penetrated ESS include these listed below.

1. **Electricity pricing:** Cheap electricity, accessible during periods when demand for electricity is low (low priced energy), stored in ESS can be sold at a later time when the price for energy is higher.
2. **Generation capacity:** For grids where electric generation capacity is tight, ESS could be used to compensate for the need to install new generation equipment. In other words, storage is used instead of adding central generation capacity.
3. **Transmission support, power quality and capacity reduction:** ESS may be used to support T&D systems by compensating for such anomalies as outages, voltage sags (storage provides a more reliable service). Additionally energy storage can be involved to protect against events which affect the quality of delivered energy (voltage and frequency variations, harmonics etc.). Finally, reducing capacity needs by storing cheap off-peak electric energy and then discharging it during peak demand periods can reduce the load on the grids and delay utility investments.
4. **Increased DG profits:** In many applications there is a need to provide for steady distributed generation; thus irregular DGs cannot be used to serve loads. In these cases, energy is stored when demand and prices for electricity are low so that energy can be used when demand and price is high, and/or when output from the normal source is low

Below are described five options among energy storage devices which could have some benefits for the operation as a whole EPS:

- ✓ Available now, sodium sulfur, lead acid or vanadium redox batteries provide up to 9 h of energy and can be used for peak shaving of loads, voltage control and dynamic stability improvement;
- ✓ Available beacon flywheels can be used for voltage and transient stability support or frequency regulation;
- ✓ Superconducting magnetic energy storage systems store energy in the magnetic field created by the flow of direct current in a superconducting coil,

cooled to a temperature below its superconducting temperature. These systems can provide voltage support and have enough real power to improve system dynamic properties;

- ✓ Compressed air energy storage provides GW of energy and can be used for frequency regulation;
- ✓ Ultra-capacitors are high energy and power density electrochemical devices. They are able to store energy like batteries for hours, but can quickly discharge the energy like capacitors.

Q.3. Explain the structure of the electrical power system with its fundamental problems.

Ans: Today's grids are primarily based on large power stations connected to transmission lines which supply power to distribution systems thus the overall image is still the same: one way power flow from the power stations, via the transmission and distribution systems, to the final customer (end-user).

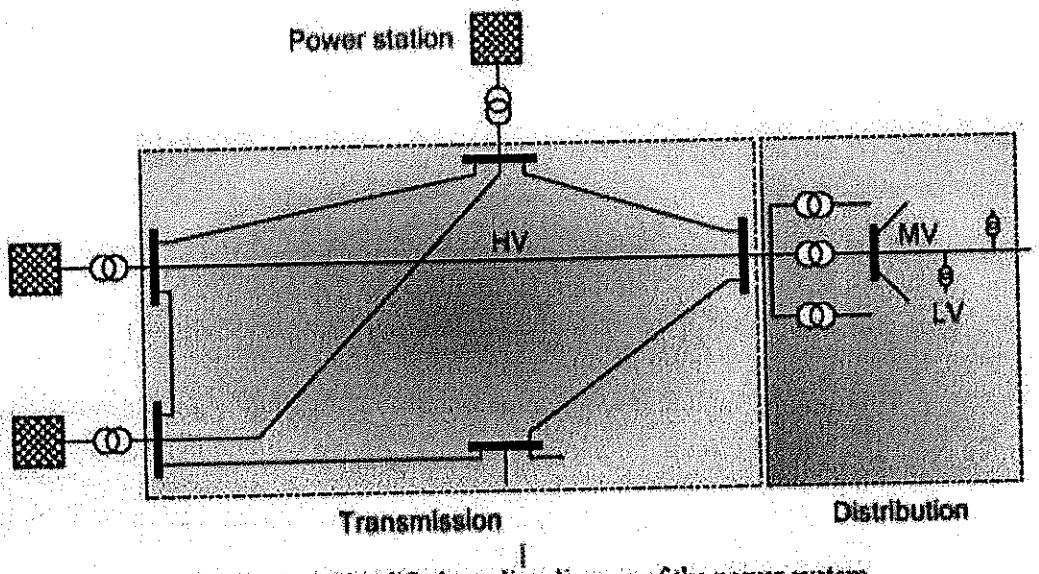


Figure 1.1. A simplified one-line diagram of the power system

The one-line diagram shown in Figure 1.1 illustrates today's Electrical Power System (EPS) and its major components: generation, transmission and distribution. Electric power is generated at power stations predominantly by synchronous generators that are mostly driven by steam or hydro turbines. Hence, the electric power generated at any such station usually has to be transmitted over a great distance, through transmission systems to distribution systems. The distribution networks distribute the energy from the transmission grid or small/local Distributed Resources (DR) to customers. The three mentioned components – generation, transmission and distribution – have different influences, individual and sometimes common, on the level of the quality of delivered electrical energy. There are many issues involved, such as the maintenance of power apparatus and system, the stability of the operation system, faults, distortions, loads non-linearities etc. One must understand the potential impact of failure within one component on the performance of the whole. For example, a failure in the generation component may lead to failure in the transmission system and in a consequent loss of load in the distribution system, while a failure in the transmission component may lead to failure in the generation component and subsequent loss of customer load in distribution. A failure in the distribution system rarely leads to failure in the other two components and causes very minimal, local losses of customer load. Some of these problems are related to power transmission systems and some of them to power distribution systems, but all are fundamental from the point of view of quality of delivered power.

Transmission Systems:

As noted earlier, transmission systems are being pushed ever closer to their stability and thermal limits and if the facilities are not suitably upgraded the power system becomes vulnerable to steady-state and transient stability problems. In such environments, transmission capacity becomes a virtue; therefore during the last few years interest in the possibilities for controlling power flows in transmission systems, dispersed generation or energy storage has increased significantly. There are a number of reasons for this: loss of system stability, power flow loops, high transmission losses, voltage limit violations and lack of ability to utilize transmission line capability up to the thermal limit. The limitations of the transmission system can take many forms and may include one or more of the following characteristics:

- ✓ Voltage magnitude;
- ✓ Thermal limits;
- ✓ Transient stability;
- ✓ Dynamic stability.

Voltage magnitude: In an AC power system, voltage is controlled by changing production and absorption of reactive power. There are a few reasons why it is necessary to handle reactive power and to control voltage. First, both customer and EPS equipment are designed to operate within a range of voltages. At low voltages, many types of equipment perform poorly; induction motors can overheat and be damaged, and some electronic equipment will not operate at all. High voltages can damage equipment and shorten its working life. Second, to maximize the amount of real power that can be transferred across a transmission system, reactive power flows must be minimized. Third, reactive power on transmission system causes real-power losses. Both capacity and energy must be supplied to replace these losses. Voltage control is complicated by two additional factors. First, the transmission system itself is a non-linear consumer of reactive power, depending on system loading. At very low levels of system load, transmission lines act as capacitors and increase voltages (the system consumes reactive power that must be generated). At high load levels, transmission lines absorb reactive power and thereby lower voltages (the system consumes a large amount of reactive power that must be replaced). The system's reactive power requirements also depend on the generation and transmission configuration. Consequently, system reactive requirements vary in time as load levels and load and generation patterns change. The EPS operator has several devices available that can be used to control voltages: for example, generators which inject reactive power into the power system, tending to raise system voltage, or which absorb reactive power, tending to lower system voltage. Additionally transformer tap changers can be used for voltage control. These arrangements can force voltage up (or down) on one side of a transformer, but it is at the expense of reducing (or raising) the voltage on the other side. The reactive power required to raise (or lower) voltage on a bus is forced to flow through the transformer from the bus on the other side. Fixed or variable taps often provide ±10% voltage selection.

Thermal limits: If the transmission line has not been loaded to its thermal limit (the thermal rating of normally designed transmission lines depends mainly on the voltage level at which they operate and the reactance) the power transfer capability can be increased by the use of, e.g., switchable capacitors and controlled reactors. Such devices can supply or absorb reactive power, respectively raising or lowering the voltage of the transmission line. Also series compensation is used to increase the capability of power transfer by reducing the reactance of the transmission line.

Transient and dynamic stability:. Transient stability refers to the ability of the power system to survive after a major disturbance, while dynamic stability refers to sustained or growing power swing oscillations between generators or a group of generators initiated by a disturbance (fault, major load changes etc.). The mitigation of these oscillations is commonly performed with Power System Stabilizers (PSSs) and sometimes in conjunction with Automatic Voltage Regulators (AVRs). Traditional solutions for upgrading electrical transmission system infrastructure have

been primarily in the form of new power plants, new transmission lines, substations, and associated equipment. However, as experience has proven, the process of authorizing, locating, and constructing new transmission lines has become extremely difficult, expensive and time-consuming. It is envisaged that, alternatively, Flexible Alternating Current Transmission System (FACTS), Energy Storage Systems (ESS) and Distributed Generation (DG) can enable the same objectives to be met. The potential benefits of employing the above-mentioned solutions include reduction of operation and transmission investment costs and implementation time compared to the construction of new transmission lines, increased system security and reliability, increased power transfer capabilities, and an overall enhancement of the quality of the electric energy delivered to customers.

Distribution Sysytem:

- ✓ With the emergence of computers, sensitive loads and modern communications, a reliable electricity supply with high quality voltage has become a necessity.
- ✓ A few years back, the main concern of consumers of electricity was reliability of supply per se. It is however not only simple supply reliability that consumers want today — they want an ideal AC line supply, that is, a pure sine wave of fundamental frequency and, in addition, a rated peak voltage value.
- ✓ Unfortunately the actual AC line supply that we receive differs from this ideal.

There are many ways in which the lack of quality power affects customers.

- ✓ Voltage sags and dips can cause loss of production in automated processes, and can also force a computer system or data processing system to crash. To prevent such events an Uninterrupted Power Supply (UPS) is often used, which in turn may generate harmonics.
- ✓ A consumer that is connected to the same bus that supplies a large motor load may have to face a critical dip in supply voltage every time the motor load is switched on. This may be quite unacceptable to many consumers.
- ✓ There are also very sensitive consumers, such as hospitals, air traffic control and financial institutions, that require clean and uninterrupted power.
- ✓ A sustained overvoltage can cause damage to household appliances. An undervoltage has the same effect as that of voltage sag.
- ✓ Voltage imbalance can cause temperature rises in motors.
- ✓ Harmonics, DC offset, can cause waveform distortions.
- ✓ Unwanted current harmonics flowing across the distribution network can cause losses and heating in transformers and Electromagnetic Interference (EMI).
- ✓ Interharmonics voltages can upset the operation of fluorescent lamps and television receivers. They can also produce acoustic noise.
- ✓ It can be concluded that the lack of quality power can cause loss of production, and damage to equipment.
- ✓ As with FACTS and other players in transmission systems, power electronics devices called Custom Power Systems (CUPS) together with ESS, DG and smart end-user appliances can be applied to the power distribution systems to increase reliability and quality of power supplied to customers.
- ✓ Through those technologies the reliability and quality of the power delivered can be improved in terms of reduced interruptions, reduced voltage, current variations and distortions. The proper use of these technologies will benefit all industrial, commercial and domestic customers.

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills
Session: 2019-20 (Summer Semester)
M. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: ELE-2302 **Time: 1 Hour**
Course Name: Advance Switch Gears and Protections **Max. Marks: 20**

Instruction: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks. Scientific calculator is allowed.

Section – A

05X01 = 05 Marks

Q.1. The probability of L-G fault occurrence in power system is
(a) 10-20% (b) 30-40% (c) 45-55% (d) 65-70%

Q.2. LLLG comes under the category of
(a) Symmetrical fault (b) Unsymmetrical fault
(c) Both a and b (d) None of these

Q.3. What is the actuating quantity for the relays?
(a) Magnitude (b) Frequency (c) Phase angle (d) All of these

Q.4. Standard CT ratios available:
(a) 200/5A (b) 50/5 A (c) Both a and b (d) None of these

Q.5. Circuit breakers usually operate under
(a) short circuit current (b) high conductivity.
(c) Low melting point (d) Any of these.

Section – B

03X02 = 06 Marks

Q.1. What are the objectives of power system protection?
Q.2. What is the distance protection? Discuss various zones of distance protection for power system with the help of line diagram.
Q.3. Explain Selectivity and Reliability of a digital protective relay.

Section – C

03X03 = 09 Marks

Q.1. Explain the power system protection components in detail with neat sketch.
Q.2. What are ratio and phase angle errors in CTs? Give causes and remedies for them.
Q.3. What is the functioning of protective relay? Illustrate with neat sketch.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills
Session: 2019-20 (Summer Semester)
M. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: ELE-2302 **Time: 1 Hour**
Course Name: Advance Switch Gears and Protections **Max. Marks: 20**

Section – A

05X01 = 05 Marks

Q.1. The probability of L-G fault occurrence in power system is
(a) 10-20% (b) 30-40% (c) 45-55% (d) 65-70%

Ans. (d)

Q.2. LLLG comes under the category of
(a) Symmetrical fault (b) Unsymmetrical fault
(c) Both a and b (d) None of these

Ans. (a)

Q.3. What is the actuating quantity for the relays?
(a) Magnitude (b) Frequency (c) Phase angle (d) All of these

Ans. (d)

Q.4. Standard CT ratios available:
(a) 200/5A (b) 50/5 A (c) Both a and b (d) None of these

Ans. (c)

Q.5. Circuit breakers usually operate under
(a) short circuit current (b) high conductivity.
(c) Low melting point (d) Any of these.

Ans. (a)

Section – B

03X02 = 06 Marks

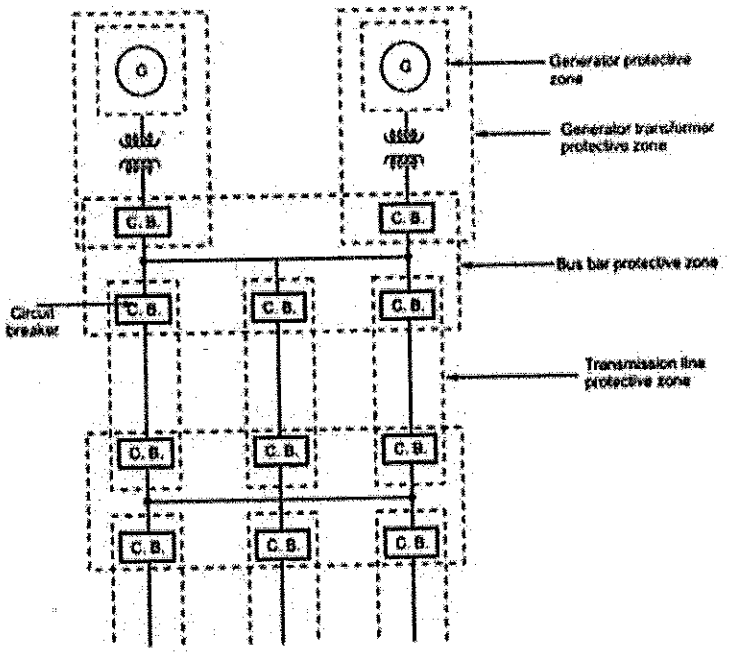
Q.1. What are the objectives of power system protection?

Ans. The objective of power system protection is to isolate a faulty section of electrical power system from rest of the live system so that the rest portion can function satisfactorily without any severe damage due to fault current. Actually circuit breaker isolates the faulty system from rest of the healthy system and these circuit breakers automatically open during fault condition due to its trip signal which comes from protection relay. The main philosophy about protection is that no protection of power system can prevent the flow of fault current through the system, it only can prevent the continuation of flowing of fault current by quickly disconnect the short circuit path from the system. For satisfying this quick disconnection the protection relays should have following functional requirements.

Q.2. What is the distance protection? Discuss various zones of distance protection for power system with the help of line diagram.

Ans. The circuit breakers are placed at the appropriate points such that any element of the entire power system can be disconnected for repairing work, usual operation and maintenance requirements and also under abnormal conditions like short circuits. Thus a protective covering is provided around rich element of the system.

The various components which are provided with the protective zone are generators, transformers, transmission lines, bus bars, cables, capacitors etc. No part of the system is left unprotected. The figure below shows the various protective zones used in a system.



Q.3. Explain Selectivity and Reliability of a digital protective relay.

Ans.

Reliability

The most important requisite of protective relay is reliability. They remain inoperative for a long time before a fault occurs; but if a fault occurs, the relays must respond instantly and correctly.

Selectivity

The relay must be operated in only those conditions for which relays are commissioned in the electrical power system. There may be some typical condition during fault for which some relays should not be operated or operated after some definite time delay hence protection relay must be sufficiently capable to select appropriate condition for which it would be operated.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Section – C

03X03 = 09 Marks

Q.1. Explain the power system protection components in detail with neat sketch.

Ans.

There are three principle components of a protection system:

1. Transducer
2. Protective relay
3. Circuit breaker

These components are described briefly in the following paragraphs.

Transducers

The transducer serves as a sensor to detect abnormal system conditions and to transform the high values of short-circuit current and voltage to lower levels. The main sensors used are the current transformer (CT) and the potential transformer (PT).

The current transformer is designed to provide a standard continuous secondary current of 5 A. Standard CT ratios available include 50/5, 100/5, 150/5, 200/5, 250/5, 300/5, 400/5, 500/5, 600/5, 800/5, 900/5, 1000/5, 1200/5, 1500/5, and 2000/5. During fault conditions, the short-circuit currents could reach over 10 times normal for short periods of time without damaging the CT windings. The current transformer has a primary winding that usually consists of one turn and a secondary winding of several turns. It is, therefore, unsafe to open- circuit the secondary of a CT whose primary is energized.

The potential transformer is designed to operate at a constant standard secondary voltage of 120 V. For low-voltage applications, the PT is just like any other two-winding voltage transformer. For primary voltages in the HV and EHV levels, a capacitor voltage-divider circuit is used together with the PT. The primary voltage is impressed across the series-connected capacitors. The PT is used to measure the voltage of a few kilovolts across the capacitor of the smaller capacitance value.

Protective Relays

A protective relay is a device that processes the signals provided by the transducers, which may be in the form of a current, a voltage, or a combination of current and voltage. These signals arise as a result of a faulted condition such as a short circuit, defective equipment or lines, lightning strikes, or surges.

The protective relay can initiate or permit the opening of various interrupting devices or sound an alarm. There are two main classifications of protective relays based on their construction: electromechanical and solid state.

The electromechanical relay develops an electromagnetic force or torque from the signal provided by the transducer; this force or torque is used to physically open, or close, a set of contacts to permit or initiate the tripping of circuit breakers or actuate an alarm.

The solid-state, or static, relay is energized by the same signals as in an electromechanical relay. However, there is no physical opening, or closing, of the relay contacts. Instead, the switching of the relay contacts is simulated by causing a solid-state device to change its status from conducting (closed position) to non-conducting (open position).

Electromechanical relays predate the solid-state relays. A majority of power system installations still use electromechanical relays. The improved reliability, versatility, and faster response (as low as one-quarter cycle) of solid-state relays have made them more attractive.

Some electromechanical relays have been replaced by solid-state relays, and in newer installations, a mixture of both types would usually be found.

Circuit Breakers

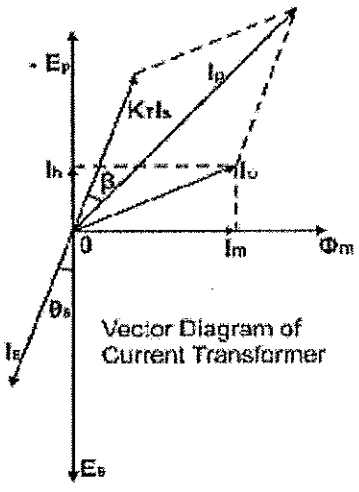
A circuit breaker is a mechanical device used to energize and interrupt an electric circuit. It should be able to open and close quickly, maybe in the order of a few milliseconds.

It should be able to carry the rated current continuously at the nominal voltage, and it must be able to withstand the large short-circuit current (called its momentary rating) that flows during the first cycle after a fault occurs.
The circuit breaker must be able to interrupt a large short-circuit current called its interrupting rating. The momentary rating is about 1.6 times the interrupting rating because the former includes the effect of the DC component of the transient short-circuit current.
When the current-carrying contacts of the circuit breaker are opened, an electric field appears across the contacts that ionize the medium between them, and an arc is established between the contacts. The circuit breaker must be able to extinguish, or interrupt, this arc as quickly as possible.
The arc is made to take an elongated path, cooled, and finally extinguished when the AC current feeding the arc passes through its zero value. Sometimes, the arc is extinguished in the air, oil, sulfur hexa-flouride (SF6), or a vacuum.

Q.2. What are ratio and phase angle errors in CTs? Give causes and remedies for them.

Ans.

In an actual CT, errors with which we are connected can best be considered through a study of phasor diagram for a CT



I_s – Secondary current.

E_s – Secondary induced emf.

I_p – Primary current.

E_p – Primary induced emf.

K_T – Turns ratio = Numbers of secondary turns/number of primary turns.

I_0 – Excitation current.

I_m – Magnetizing component of I_0.

I_w – Core loss component of I_o.

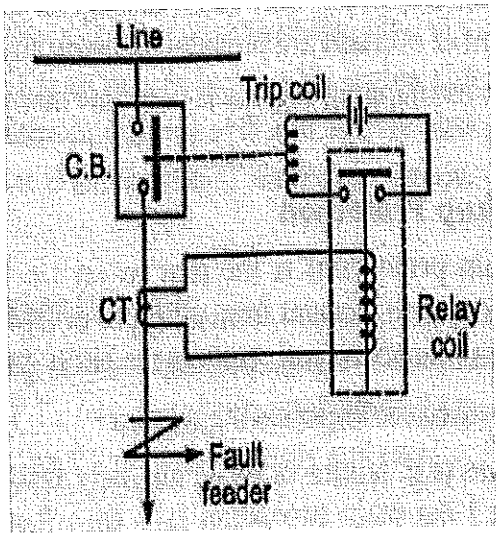
Φ_m – Main flux.

From above phasor diagram it is clear that primary current I_P is not exactly equal to the secondary current multiplied by turns ratio, i.e. K_TI_s. This difference is due to the primary current is contributed by the core excitation current. The **error in current transformer** introduced due to this difference is called current error of CT or sometimes **ratio error in current transformer**.

$$\text{Hence, the percentage current error} = \frac{|I_p| - |K_T.I_s|}{I_p} X\ 100\ \%$$

Q.3. What is the functioning of protective relay? Illustrate with neat sketch.

Ans. When short circuit occurs at point F on transmission line CT current increases. This increases Current in CT coil which closes trip coil of circuit breaker and CB contacts get opened. Thus faulty section is isolated.



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.:.....

School of Electrical Skills
Session: 2019-20 (Summer Semester)
M. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: ELE-2316 **Time: 1 Hour**
Course Name: Design, Estimation and Costing of Industrial Electrical System (SE-IV) **Max. Marks: 20**

Instruction: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks. Scientific calculator is allowed

Section – A

05X01 = 05 Marks

Q.1. Which of the following information is required for a good estimation?
(i) Availability of products (ii) Sources of production, vendor selection
(iii) New products and their quality (iv) Prices and the discounts provided for each product
(a) i and ii (b) ii, iii and iv (c) i, ii, iii and iv (d) only iv

Q.2. What is meant by contingencies?
(a) The list of required components are included in this category
(b) The list of vague and unforeseen items is included in this category
(c) The list of components along with their discounted price is included in this category
(d) Both (A) and (C)
(d) None of these

Q.3. Which of the following mode of tendering is used by purchase department?
(i) Open tendering (ii) Limited tender (iii) Spot tendering (iv) Global tendering
(v) Proprietary tender
(a) i, iii and iv (b) i, ii, iii and v (c) i and iv only (d) i, ii, iii, iv and v

Q.4. What is meant by petty purchase?
(a) An item purchased from market by purchase assistant with proper formal order.
(b) An item purchased from market by purchase assistant without proper formal order.
(c) A single tendering purchase
(d) None of these

Q.5. Which of the following statements is false?
(a) The central purchasing department (as the purchasing organization) of a corporate group is not assigned to a company code.
(b) The central purchasing organization needs to be assigned to a plant even if it does not create any orders.

Section – B

03X02 = 06 Marks

Q.1. Explain the term contingencies.
Q.2. Explain the term overhead charges.
Q.3. Explain the term Profit.

Section – C

03X03 = 09 Marks

Q.1. Give the purchase objectives and functions of an organization.
Q.2. Define estimating and costing and explain the procedure to recording of estimates.
Q.3. What is meant by "Global tendering", "Limited tender", and "Single tender".

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills

Session: 2019-20 (Summer Semester)

M. Voc. Program, 3rd Semester,

1st In-Sem. Examination

Course Code: ELE-2316 **Time: 1 Hour**

Course Name: Design, Estimation and Costing of Industrial Electrical System (SE-IV) **Max. Marks: 20**

Instruction: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks. Scientific calculator is allowed

Section – A

05X01 = 05 Marks

Q.1. Which of the following information is required for a good estimation?

(i) Availability of products (ii) Sources of production, vendor selection

(iii) New products and their quality (iv) Prices and the discounts provided for each product

(a) i and ii (b) ii, iii and iv (c) i, ii, iii and iv (d) only iv

Ans: (c) i, ii, iii and iv

Q.2. What is meant by contingencies?

(a) The list of required components are included in this category

(b) The list of vague and unforeseen items is included in this category

(c) The list of components along with their discounted price is included in this category

(d) Both (A) and (C)

(d) None of these

Ans: (b) The list of vague and unforeseen items is included in this category

Q.3. Which of the following mode of tendering is used by purchase department?

(i) Open tendering (ii) Limited tender (iii) Spot tendering (iv) Global tendering

(v) Proprietary tender

(a) i, iii and iv (b) i, ii, iii and v (c) i and iv only (d) i, ii, iii, iv and v

Ans: (d) i, ii, iii, iv and v

Q.4. What is meant by petty purchase?

(a) An item purchased from market by purchase assistant with proper formal order.

(b) An item purchased from market by purchase assistant without proper formal order.

(c) A single tendering purchase

(d) None of these

Ans: (a) An item purchased from market by purchase assistant without proper formal order.

Q.5. Which of the following statements is false?

(a) The central purchasing department (as the purchasing organization) of a corporate group is not assigned to a company code.

(b) The central purchasing organization needs to be assigned to a plant even if it does not create any orders.

Ans: (b) The central purchasing organization needs to be assigned to a plant even if it does not create any orders.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Section – B

03X02 = 06 Marks

Q.1. Explain the term contingencies.

Ans: This is for vague and foreseen items. The amount is provided under the head of contingencies to cover the unforeseen expenditure such as to cover extra costs on account of delays in delivery, minor accidents and foreseen variations from the plants of the estimating department. The amount to be allowed is too variable and depends upon the exactness of the specifications. The looser the specifications, the more doubtful the conditions in which it will be carried out and greater the risk of delays and difficulties and of the need of exceptional measures such as overtime, the greater obviously must be the allowance to cover them. It is usually expressed as a percentage of total cost (material + labour cost), say, 5%. The contingencies fully compensate additional material cost, labour cost and other allied expenses which could not be accounted for. Such expenses may be due to natural calamities such as floods, earthquakes, stroms, hailstorms etc.

Q.2. Explain the term overhead charges.

Ans: The overhead charges or standing charges of the business cover all expenditure necessary to carry out the business, in addition to the special expenditure, incurred in carrying out a particular job. These can be classified under the following headings: Rent of offices and workshop; Allowances for the wear and tear of buildings, plant and machinery (depreciation); Wages of clerical staff; General expenses; Rates and taxes; Lighting and heating; Advertising; Insurance; Postage and telephone; Carriage and general travelling expenses; Legal costs and bad debts etc. These charges cannot be charged against any one contract, however large these are, these are spread proportionately against all the jobs big and small. To arrive at the true cost of the job, a definite percentage (10 to 15%) is added to the net cost of each estimate.

Q.3. Explain the term Profit.

Ans: This is usually added in the form of percentage to the gross or true cost of the job in order to determine the selling price of the job. This amount is purely on the discretion of the contractor, and his decision is usually governed by the following factors:

i. Size of the job with him.
ii. Degree of competition.
iii. The state of turnover and
iv. His anxiety to secure a particular job and so on.

If estimate has been prepared accurately, definite percentage has been allowed for contingencies and standing charges then, however, small the percentage of profit is added, it will be a profit and never loss.

Section – C

03X03 = 09 Marks

Q.1. Give the purchase objectives and functions of an organization.

Ans: Purchase Objective: the purchase procedure enlists the following objectives:

1. To purchase competitively and wisely authorized requirements as per desired specifications from approved/reliable sources at available reasonable prices within the time schedule to support the project plans.
2. To ensure that fair and open purchase practices are followed and a healthy and good relationship develops with suppliers/vendors to foster the commercial interests of the firm/organization in the local, national and international market, if need be.
3. To ensure timely formulation and commitment of purchase budget requirements (including foreign exchange requirements, if any).

4. To serve as information centre on materials knowledge-prices, sources of supply, detailed technical specifications, catalogues etc. for all departments of the organization.
5. To ensure that investment made on inventory is at an optimum level.
6. Training of purchase personnel in the latest-techniques of materials management.
7. To keep management/concerned authority appraised of the likely shortfalls in purchase performance by introducing appropriate reporting systems with a view to seek management's/concerned authority intervention at the right time.

Purchase Functions: Purchase department is responsible for the following activities:

1. Creation of a comprehensive and continuously updated list of selected reliable vendors.
2. Maintenance of vendor evaluation and rating records on the proforma [Format I]

FORMAT I— VENDOR HISTORY CARD

Regn. No. _____ Dt. of Opening. _____ Purchase Gp. _____

Name of the firm _____

Postal Address _____

_____

Telephone No. _____ Fax No. _____

E-mail ID _____

Contact Person Name _____ Designation _____

S.No.	Order No. & Date	Description	No. of Items	Value	Date Delivery Due	Date Delivery Made	Quality	Remarks

3. Conducting market surveys with a view to establish/develop new reliable and better sources of supply by making available information on latest products/developments.
4. Analysis bids/offers for decision-making by the competent Technical Authority.
5. Arranging negotiations with the suppliers/vendors, when necessary.
6. Issue of Purchase Order in time.
7. Obtaining Government clearances/licenses, where necessary.
8. Follow-up of Purchase Orders to ensure arrival of materials, ensure after-sales service during warranty and post-warranty periods.
9. Finalization of rate contracts for regular stock items.
10. To work out procurements lead time for various categories of items and advice to indenting departments to enable timely action in initiating purchase requests.
11. Maintaining library of product catalogues, manufacturer's/distributor's price lists etc.
12. Maintaining updated information regarding Govt. laws on sales tax, excise, customs duty, service tax, income tax etc.
13. Submission of M/S reports on performance of purchase.
14. Entering into service contracts for transport, customs clearance, advertising, packing, material handling etc.
15. Entering into Transit Insurance agreements for goods in transit.

Q.2. Define estimating and costing and explain the procedure to recording of estimates.

Ans: Definition of Estimating and Costing:

Estimating is the technique of calculating or computing the various and the expected expenditure to be incurred on a particular work or project.

In case the fund available are less than the estimated cost the work is done in part or by reducing it or specifications are altered, the following requirement are necessary for preparing an estimate

a) Drawing like plan, elevation and sections of important points.
b) Detailed specifications about workmanship & properties of materials etc.
c) Standard schedule of rates of the current year.

Need for Estimating and Costing:

1. Estimate given and idea of the cost of the work and hence its feasibility can be determined i. e. whether the project could be taken up with in the fund available or not.
2. Estimate gives an idea of time required for the completion of the work
3. Estimate is required to invite the tenders and Quotations and to arrange contract.
4. Estimate is also required to control the expenditure during the execution of work.
5. Estimate decides whether the proposed plan matches the funds available or not.

Procedure of Estimating or Method of Estimating:

Estimating involves the following operations

1. Preparing detailed Estimate.
2. Calculating the rate of each unit of work.
3. Preparing abstract of estimate.

Data required to prepare an Estimate

1. Drawing i. e. plans, elevations, sections etc.
2. Specifications.
3. Rates.

Drawings: If the drawings are not clear and without complete dimensions the preparation of estimation become very difficult. So, it is very essential before preparing an estimate.

Specifications:

a) **General Specifications:** This gives the nature, quality, class and work and materials in general terms to be used in various parts of work. It helps no form a general idea of building.
b) **Detailed Specifications:** These gives the detailed description of the various items of work laying down the Quantities and qualities of materials, their proportions, the method of preparation workmanship and execution of work.

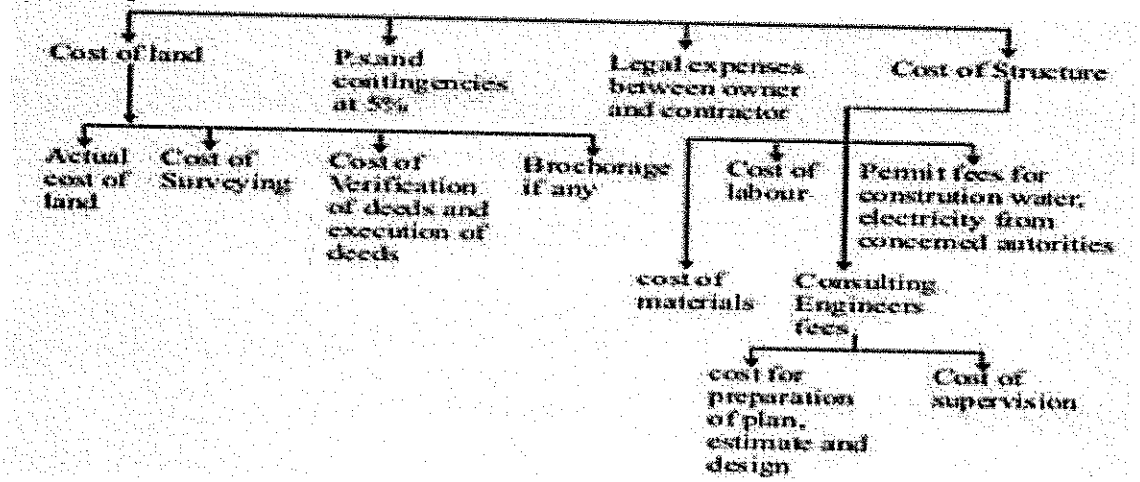
Rates: for preparing the estimate the unit rates of each item of work are required.

1. For arriving at the unit rates of each item.
2. The rates of various materials to be used in the construction.
3. The cost of transport materials.
4. The wages of labour, skilled or unskilled of masons, Electricians, Carpenters, Mazdoor etc.

Complete Estimate:

Most of people think that the estimate of a structure includes cost of land, cost of materials and labour. But many other direct and indirect costs included and is shown below.

The Complete Estimate



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Recording of Estimates: All the estimate must be written in a book, kept for this sole purpose. It is preferable to write estimates on loose sheets in order to file them with the contract papers. With the help of estimates prepared on loose sheets and collected in the book form, actual costs of the complete job can be more easily compared with the estimated costs- an essential operation. A loose-leaf book is not an essential, but it is preferable and convenient to write the estimates on loose sheets collected in the book form. It allows revised and supplementary estimates to be kept with the original and also allows alphabetical or other desired group. In case of writing estimates in a book other than loose-leaf one, it should be indexed. The most convenient ruling for estimate book is shown below:

S. No.	Description of material with complete specification	Quantity Required		Rate			Amount		Remarks
		Quantity	Unit	₹	P	Per	₹	P	

Q.3. What is meant by "Global tendering", "Limited tender", and "Single tender".

Ans: Global tendering: Where items to be procured are not indigenously available, **Global tendering** shall be resorted to. Advertisements may be released in leading National Newspapers as well as in the Indian Trade Journal/Indian Export Services Bulletin. In addition, copies of the tender documents may be made available to the Indian Embassies in potential vendor countries abroad for issuing to the tenderers besides making the documents available to the Trade Commissioners of Foreign Embassies in India.

Limited Tender: Only the most likely and suitable sources are addressed. To invite adequate competition, it is necessary that at least five sources of supply are addressed. The suppliers to be addressed shall be decided based on past experience. The selection of suppliers shall be carefully made based on vendor rating or past experience. It is preferable to include the name of last suppliers also.

Single tender: When the purchase is finalized on the basis of a single offer or an offer from a single source is invited, this is called a '**Single Tender Purchase**'. Common occasions of this category are given below:

a) When market research reveals that there is only one known reliable source of supply.
b) When the management in the interest of real long term economy and quality assurance and assured service standards of delivery etc. standardize on a particular brand/make.
c) There is a single party ready to undertake the risk of provisioning/development of item required and the value of order is such that it is not economical to develop alternative sources of supply.
d) The manufacturer/Government has canalized the supply only through a single source.
e) The item is known to be in short supply and its stocks happen to be available only with one source at the time of purchase.
f) Supplies from fair price shops, super-bazars, Government, Semi-Government, Co-operative undertakings.
g) Direct purchase from reputed manufacturers or their accredited dealers.

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills
Session: 2019-20 (Summer Semester)
M. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: ELE-2317 **Time: 1 Hour**
Course Name: Application of Power Electronics to Power System (SE-III) **Max. Marks: 20**
Instruction: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks. Scientific calculator is allowed.

Section – A

05X01 = 05 Marks

Q.1. FACTS devices are generally used for to compensate_____ of the transmission line?

(a) Reactance (b) Resistance (c) Conducatnce (d) None of these

Q.2. FACTS devices are generally deals with:

(a) Apparent power (b) Active Power (c) Reactive power (d) Load Angle

Q.3. Full form of UPFC is:

(a) Unified Power Flow Controller (b) Unified Power Factor Controller

(c) Unified Power Flow Compensator (d) Unique Power Flow Controller

Q.4. Which of the following is a power electronic switching device?

(a) SCR (b) MOSFET (c) BJT (d) All of these

Q.5. FACTS mainly find application in following areas:

(a) Power transmission (b) Power Quality

(c) Railway Grid Connection (d) All of these

Section – B

03X02 = 06 Marks

Q.1. What is the necessity of compensation?

Q.2. Explain the objectives of FACTS controllers in the power system network.

Q.3. What do you mean by Thyristor switched capacitor?

Section – C

03X03 = 09 arks

Q.1. Briefly explain about static VAR compensator (SVC).

Q.2. Briefly explain about Static Synchronous Compensator (STATCOM).

Q.3. Briefly explain the working of Series Controller.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills
Session: 2019-20 (Summer Semester)
M. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: ELE-2317 **Time: 1 Hour**
Course Name: Application of Power Electronics to Power System (SE-III) **Max. Marks: 20**

Section – A

05X01 = 05 Marks

1. FACTS devices are generally used for to compensate_____ of the transmission line?
   (a) Reactance (b) Resistance (c) Conducatnce (d) None of these
   Ans. (a)
2. FACTS devices are generally deals with:
   (a) Apparent power (b) Active Power (c) Reactive power (d) Load Angle
   Ans. (c)
3. Full form of UPFC is:
   (a) Unified Power Flow Controller (b) Unified Power Factor Controller
   (c) Unified Power Flow Compensator (d) Unique Power Flow Controller
   Ans. (a)
4. Which of the following is a power electronic switching device?
   (a) SCR (b) MOSFET (c) BJT (d) All of these
   Ans. (d)
5. FACTS mainly find application in following areas:
   (a) Power transmission (b) Power Quality
   (c) Railway Grid Connection (d) All of these
   Ans. (d)

Section – B

03X02 = 06 Marks

Q.1. What is the necessity of compensation?

Ans.

The reactive power through the system can significantly improve the performance / parameters of the power system as follows

- Voltage profile
- Power angle characteristics
- Stability margin
- Damping to power oscillations

Q.2. Explain the objectives of FACTS controllers in the power system network.

Ans.

Better the control of power flow (Real and Reactive) in transmission lines.

- Limits SC current
- Increase the load ability of the system
- Increase dynamic and transient stability of power system
- Load compensation
- Power quality improvement

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Q.3. What do you mean by Thyristor switched capacitor?

Ans.

TCSC is a capacitive reactance compensator, which consists of series capacitor bank shunted by a thyristor-controlled reactor.

Section – C

03X03 = 09 arks

Q.1. Briefly explain about static VAR compensator (SVC).

Ans. Static VAR Compensator is an electrical device, commonly known as SVCs, or shunt connected devices, vary the reactive power output by controlling or switching the reactive impedance components by means of power electronics devices. The SVC regulates voltage at its terminals by controlling the amount of reactive power injected into or absorb from the power system. The term "STATIC" refers to the fact that the SVC has no moving parts. Hence it requires low maintenance.

Q.2. Briefly explain about Static Synchronous Compensator (STATCOM).

Ans.

A static synchronous generator operated as a shunt connected static VAR compensator whose capacitive or inductive output current can be controlled independent of the ac system voltage.

Its ac output voltage is controlled such that it is just right for the required reactive current flow for any ac bus voltage dc capacitor voltage is automatically adjusted as required.

Q.3. Briefly explain the working of Series Controller.

Ans.

Series controller could be a variable impedance, such as impedance, such on capacitor, reactor etc.

All series controllers inject a voltage in series with the line. As long on the voltage is in phase quadrature with the line current, series controlled only supplies reactive power. Any other phase relationship will involve real power as well.

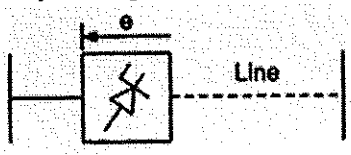


Fig. 5.14 Sereis controller

Series controller control the current/power flow and damp oscillation.