SET-A

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Electrical Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, 3rd Semester,

1st In-Sem. Examination

Course Code: ELE 1301 **Time: 1 Hour**

Course Name: Automation & 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.

Section – A

05X01 = 05 Marks

1. When a relay is NOT energized?
   (a) There is an electrical path through the NO contacts
   (b) There is an electrical path through the NC contacts
   (c) Neither the NO or the NC contacts have an electrical path
   (d) Both the NO and the NC contacts have an electrical path

2. PLC can be _____ in plant to change the sequence of operation.
   (a) only programmed (b) only reprogrammed
   (c) programmed and reprogrammed (d) able to give a set point

3. The NOR gate output will be high if the two inputs are:
   (a) 00 (b) 01 (c) 10 (d) 11

4. The function of NOT gate is to:
   (a) Stop signal (b) Invert input signal
   (c) Act as a universal gate (d) None of the above

5. What type of process would a Cement plant be most likely to use?
   (a) Continuous flow (b) Batch (c) Job shop (d) Discrete

Section – B

03X02 = 06 Marks

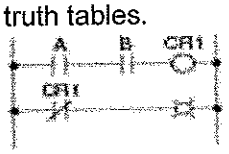
1. What are the difference between Fixed and Modular PLCs.
2. What do you mean by terms (a) automation and (b) control?
3. Differentiate between continuous flow production and batch production.

Section – C

03X03 = 09 Marks

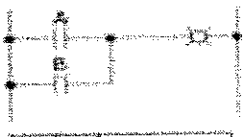
1. Explain architecture of PLC with block diagram.
2. List out benefits of PLCs.
3. Identify each of these logic functions by name (AND, OR, NOR, etc.) and complete their respective truth tables.

(a)



A	B	Output
0	0	
0	1	
1	0	
1	1	

(b)



A	B	Output
0	0	
0	1	
1	0	
1	1	

A

Answer Key Set – A

Course Code: ELE 1301 Course Name: Automation & Control

School of Electrical Skills, Session: 2020-21 (Summer Semester)

B. Voc. Program, 3rd Semester, 1st In-Sem. Examination

Section – A

1.(b) There is an electrical path through the NC contacts

2. (c) programmed and reprogrammed

3. (a) 00

4. (b) Invert input signal

5. (a) Continuous flow

Section – B

1. Difference Between Fixed and Modular PLCs? Name any two manufacturers of PLC?

	Fixed PLCs	Modular PLCs
Name	Compact PLC is also known as Fixed PLC.	Modular PLC is also known as Rack-Mounted PLC.
I/O	In Compact PLC, the number of inputs and outputs are fixed. Because I/O capabilities are decided by the manufacturer but not by the user.	In Modular PLC, the number of input and output are not fixed. Inputs and outputs can be added to the modular PLC systems by the user.
Module	It has inputs and outputs modular fitted with CPU.	In this PLC, several components are fitted on chassis or rack or bus with different slots.
Use	It is useful for smaller applications and most suitable for domestic purposes.	It is used for industrial purposes and also for future industrial expansion and growth.

Manufacturers- Siemens, Toshiba, Rockwell Automation

2. (a) Automation- The word 'Automation' is derived from Greek words "Auto"(self) and "Matos" (moving). Automation therefore is the mechanism for systems that "move by itself". Automation is a set of technologies that results in operation of machines and systems without significant human intervention and achieves performance superior to manual operation

(b) Control- Control is a set of technologies that achieves desired patterns of variations of operational parameters and sequences for machines and systems by providing the input signals necessary. Control Systems are used in Industrial Automation to regulate how devices operate in real time.

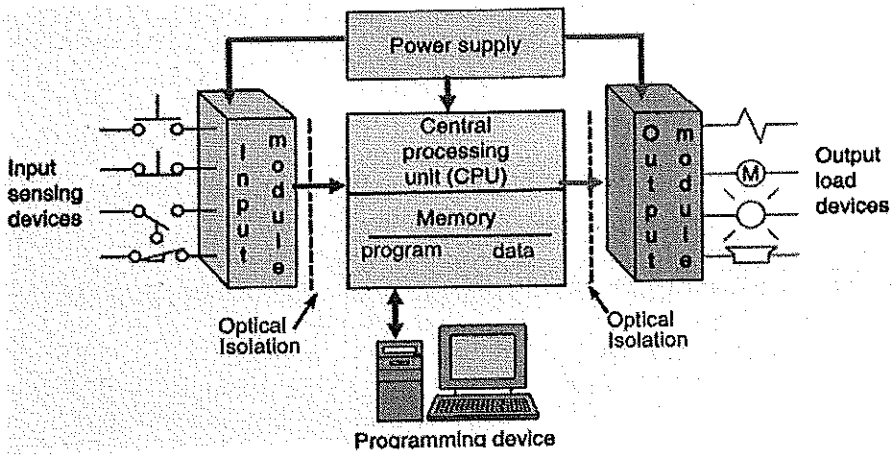
3. **Continuous Flow Process**- Manufactured product is in continuous quantities i.e., the product is not a discrete object. Moreover, for such processes, the volume of production is generally very high, while the product variation is relatively low. Typical examples of such processes include Oil Refineries, Iron and Steel Plants, Cement and Chemical Plants.

Batch Production: In a batch production process the product is either discrete or continuous. However, the variation in product types is larger than in continuous-flow processes. The same set of equipment is used to manufacture all the product types. However for each batch of a given product type a distinct set of operating parameters must be established. This set is often

referred to as the "recipe" for the batch. Typical examples here would be Pharmaceuticals, Casting Foundries, Plastic moulding, Printing etc.

Section C

1. Architecture of PLC-



(a) Input module accepts signals from sensors or buttons and convert signal into a logic signal. example: switches, push buttons, sensors etc.

(b) Output module convert control instructions or logic into mechanical output signal that can be used by output devices. example: lamps, alarm etc.

(c) Power supply- It Provides the particular voltage needed to run the primary PLC components.

(d) Relay- Relays are switches that open and close circuits electromechanically. Relays control one electrical circuit by opening and closing contacts in another circuit.

(e) 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.

2. PLCs Advantages or Benefits

Higher Reliability: Once the program written and tested it can be easily downloaded into other PLC's memory. It requires lesser and simpler wiring compared to conventional hard wired circuits employed. Hence reliability of the system increases significantly with PLCs.

More Flexibility: It is easier to create a new program module or change an existing program in PLC compared to hard wired circuitry system. These software program modules can be changed whenever required. User can modify the programs in the field and if required, security

can be enhanced by hardware interlocks such as key locks and software features such as passwords.

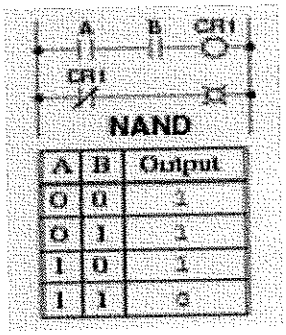
Lower Cost: PLCs were originally designed to replace relay control logic which is not economical and complex especially for large control circuits. With PLCs the cost savings have been so significant that the relay control becomes uneconomical except for some power applications. Generally, if the application consists of more than half a dozen control relays, PLCs are least expensive to install.

Communication Capability: Communication capability of PLC with the other controllers and computers in the system is one of the main advantages compared to relay control circuit. Functions such as Supervisory control, data acquisition from the field, monitoring devices and process parameters associated with the field and downloading and uploading of programs can be easily possible with the PLC compared to hardwired circuits.

Faster Response: PLCs are designed for high speed and for the real time applications. Response time for PLCs are much smaller compared to relay logic circuits. The programmable controllers operate in real time i.e, an event taking carrying out at field will result in execution of operation of output.

Easy to Troubleshoot: PLCs have inbuilt diagnostics and override functions that helps the user to easily trance the software and hardware errors.

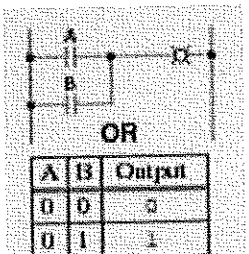
3. (a)



NAND

A	B	Output
0	0	1
0	1	1
1	0	1
1	1	0

(b)



OR

A	B	Output
0	0	0
0	1	1
1	0	1
1	1	1

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

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School of Electrical Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, 3rd Semester,

1st In-Sem. Examination

Course Code: ELE 1302 **Time: 1 Hour**

Course Name: Electrical Machine – I **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. Lamination of a transformer core is made of:

(a) Cast Iron (b) Silicon Steel (c) Aluminum (d) Cat Steel

Q.2. Power Transformer are designed to have maximum efficiency at:

(a) Full load (b) 75% load (c) 50% load (d) No load

Q.3. The normal value of the armature resistance (in ohms) of a D.C. motor is:

(a) .005 (b) 0.5 (c) 10 (d) 100

Q.4. The current drawn by a 120 V D.C. motor of armature resistance 0.5 ohms and back emf of 110 V is _____ amperes.

(a) 20 (b) 60 (c) 240 (d) 6

Q.5. If the pole flux of a DC motor approached zero, its speed will:

(a) Approach zero (b) Be very high

(c) Not change (d) Approach a stable value

Section – B

03X02 = 06 Marks

Q.1. Calculate the rating (kVA) of transformer having following parameters.

(a) No. of turns in primary winding – 400

(b) No. of turns in secondary winding – 800

(c) Primary voltage – 415 Volts

(d) Secondary winding current – 80 Amperes

Q.2. What are the various assumptions made for an ideal transformer?

Q.3. What is the need of a starter for starting DC motor?

Set - A

Section – C

03X03 = 09 Marks

Q.1. List the details available on the plate fixed on the transformer.

Q.2. A 220-V DC machine has an armature resistance of 0.5 Ω. If the full-load armature current is 20 A, find the induced e.m.f. when the machine acts as (i) generator (ii) motor. Assume current flowing in the shunt field is zero.

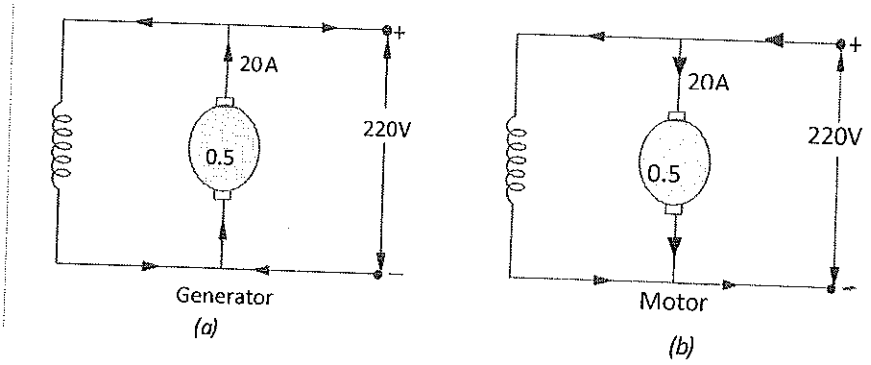

Fig. - 1

Q.3. In a rotating electrical machine, having 2 poles on the stator and 4 poles on the rotor, show that net electromagnetic torque developed is zero.

Set - A

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills

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Course Code: ELE 1302 **Time: 1 Hour**

Course Name: Electrical Machine – I **Max. Marks: 20**

Section – A

05X01 = 05 Marks

Q.1. Lamination of a transformer core is made of:

(a) Cast Iron (b) Silicon Steel (c) Aluminum (d) Cat Steel

Ans. (b)

Q.2. Power Transformer are designed to have maximum efficiency at:

(a) Full load (b) 75% load (c) 50% load (d) No load

Ans. (a)

Q.3. The normal value of the armature resistance (in ohms) of a D.C. motor is:

(a) .005 (b) 0.5 (c) 10 (d) 100

Ans. (b)

Q.4. The current drawn by a 120 V D.C. motor of armature resistance 0.5 ohms and back emf of 110 V is _____ amperes.

(a) 20 (b) 60 (c) 240 (d) 6

Ans. (a)

Q.5. If the pole flux of a DC motor approached zero, its speed will:

(a) Approach zero (b) Be very high

(c) Not change (d) Approach a stable value

Ans. (b)

Section – B

03X02 = 06 Marks

Q.1. Calculate the rating (kVA) of transformer having following parameters.

(a) No. of turns in primary winding – 400
(b) No. of turns in secondary winding – 800
(c) Primary voltage – 415 Volts
(d) Secondary winding current – 80 Amperes

Ans.

Turn ratio = 800/400 = 2

Secondary Voltage = 2* 415 = 830 Volts

kVA rating = 830*80/1000 = 66.4 kVA

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Q.2. What are the various assumptions made for an ideal transformer?

Ans. For a transformer to be an ideal one, the various assumptions are as follows:

1. Winding resistances are negligible
2. All the flux set up by the primary links the secondary windings, i.e. all the flux is confined to the magnetic core.
3. The core losses (hysteresis and eddy current losses) are negligible.
4. The core has constant permeability, i.e. the magnetization curve for the core is linear.

Q.3. What is the need of a starter for starting DC motor?

Ans. When the DC motor is at rest, there is no back EMF in the armature. At that time, when the DC voltage is applied to the armature a huge amount of current flows in the armature as the armature resistance is very low. This high value of current in the armature can cause serious damage to the armature of the DC motor. To avoid this, a starter is used to start the DC motor in which a certain value of resistance (For Resistance Starter) is inserted in series with the armature, which is gradually reduced. When the motor fully picks up the speed, the resistance is fully removed from the circuit and the motor works as desired. The rate at which the resistance in the armature circuit is reduced depends upon the rate at which the back EMF in the motor increases. The main aim being to limit the starting current to avoid damage to the motor.

Section – C

03X03 = 09 Marks

Q.1. List the details available on the plate fixed on the transformer.

Ans. Details on the Plate fixed on the Transformer

1. Single/Three Phase transformer
2. KVA rating
3. HV winding Voltage
4. HV winding Current
5. LV winding Voltage
6. LV winding Current
7. Losses in watts– at Full load, at Half load
8. Vector Group (how the primary and secondary windings are connected and also about whether Neutral is earthed or not earthed)
9. % Impedance or Impedance Voltage (It is the supply voltage as a percentage of rated voltage, that is required to circulate the rated current through the transformer, keeping the other side of the transformer winding short circuited)
10. Serial No of Transformer
11. Date/Year of manufacturing
12. Volume and weight of the Cooling oil if used
13. Permissible rise in temperature of the oil and windings under loaded conditions
14. Customer (If made to order)
15. Order No and date (if made to order)
16. Total weight of the transformer
17. The standards it complies for manufacturing (IS:1180 etc)

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Q.2. A 220-V DC machine has an armature resistance of 0.5 Ω. If the full-load armature current is 20 A, find the induced e.m.f. when the machine acts as (i) generator (ii) motor. Assume current flowing in the shunt field is zero.

Ans.

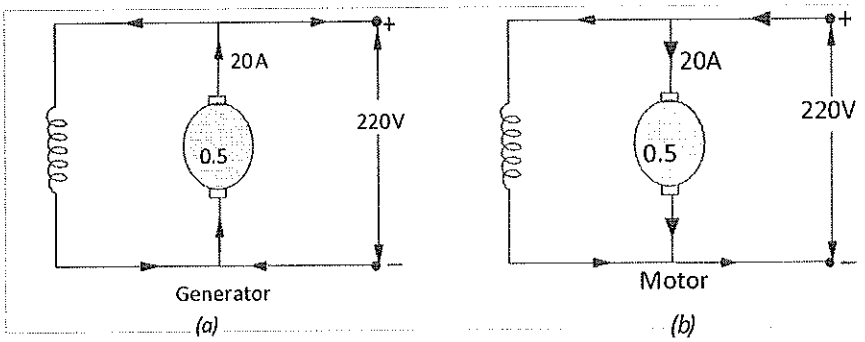


Fig. - 1

Solution. As shown in Fig. 1, the DC machine is shunt-connected. In each case, shunt current is zero as given in the question.

(a) As Generator [Fig. 1 (*a*)] $E_g = V + I_a R_a = 220 + 0.5 \times 20 =$ **230 V**

(b) As Motor [Fig 1 (*b*)] $E_b = V - I_a R_a = 220 - 0.5 \times 20 =$ **210 V**

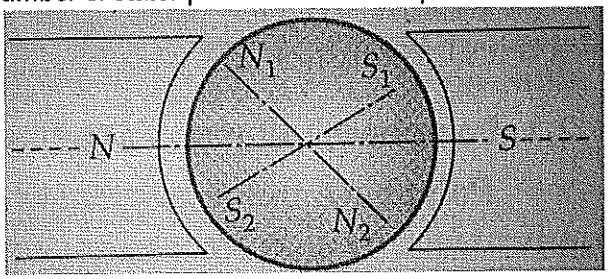
Q.3. In a rotating electrical machine, having 2 poles on the stator and 4 poles on the rotor, show that net electromagnetic torque developed is zero.

Ans. An electrical machine with 2-pole stator and 4-pole rotor is illustrated in the figure. The rotor poles are equally spaced, i.e. the alternate north and south poles are space displaced by 90^0 mechanical (or 180^0 electrical).

First consider rotor poles N_1 and N_2. Since the torque angle between N_1, N is equal to the torque angle between N_2, S; the force of repulsion (clockwise) between N, N_1 is balanced by the force of attraction (anti-clockwise) between N_2, S. Similarly, the torque angles between N_1, S and N, N_2 are equal and force of attraction (clockwise) between N_1, S is balanced by force of repulsion (anti-clockwise) between N, N_2. Therefore, net electromagnetic torque due to rotor poles N_1 and N_2 is zero.

Now consider the rotor poles S_1 and S_2. The torque angles between N, S_1, and S, S_2, are equal, therefore the force of attraction (anti-clockwise) between N, S_1 is balanced by force of repulsion (clockwise) between S, S_2. Similarly, the force of attraction (clockwise) between N, S_2 is balanced by force of repulsion (anti-clockwise) between S, S_1. Therefore, no electromagnetic torque is developed due to rotor poles S_1 and S_2.

Hence the resultant electromagnetic torque developed due to 2-stator poles and 4 rotor poles is zero. In view of this, it is essential that in all rotating electrical machines, the number of rotor poles be equal to the number of stator poles for the development of electromagnetic torque.



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Electrical Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, 3rd Semester,

1st In-Sem. Examination

Course Code: ELE1303 **Time: 1 Hour**

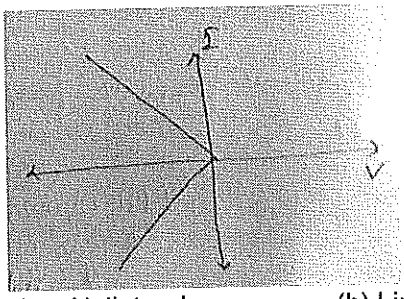
Course Name: Electric Circuit & Drawing **Max. Marks: 20**

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

1. Is it advisable to connect different value of voltage sources in a parallel circuit without resistance in between them?
   (a) Maybe (b) Yes (c) No (d) None of these
2. KCL works on the principle of:
   (a) Charge conservation (b) Energy conservation
   (c) Power conservation (d) None of these
3. Unit of Power is:
   (a) Watt (b) Horse Power (c) Kilo Watt (d) All of these
4. Active elements have:
   (a) Positive slope coefficient (b) Negative slope coefficient
   (c) Positive slope in 1st quadrant only (d) None of these
5. Characteristics of given graph is:

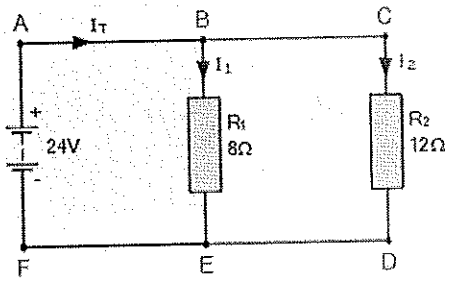


(a) Non-linear, Active, Unilateral (b) Linear, Passive, Bilateral
(c) Non-linear, Passive, Bilateral (d) None of these

Section – B

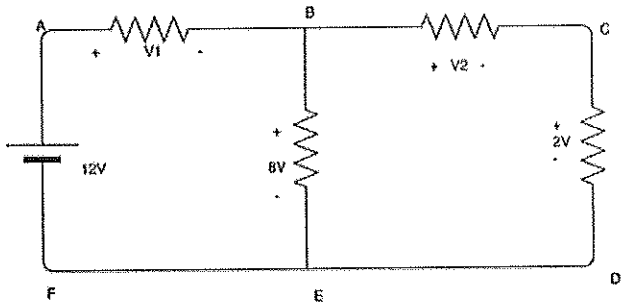
03X02 = 06 Marks

1. Calculate value of I_T as shown in the given figure.

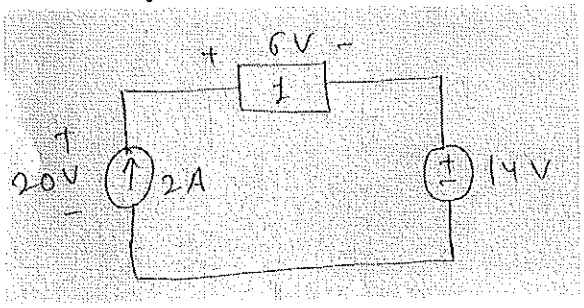


Set-A

2. Calculate the values of V1 and V2 from the figure.



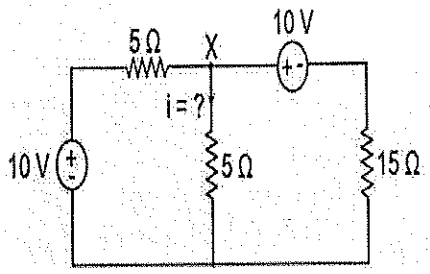
3. Calculate power absorbed by the circuit elements in the given circuit.



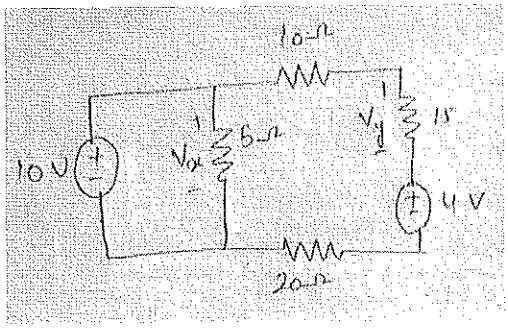
Section – C

03X03 = 09 Marks

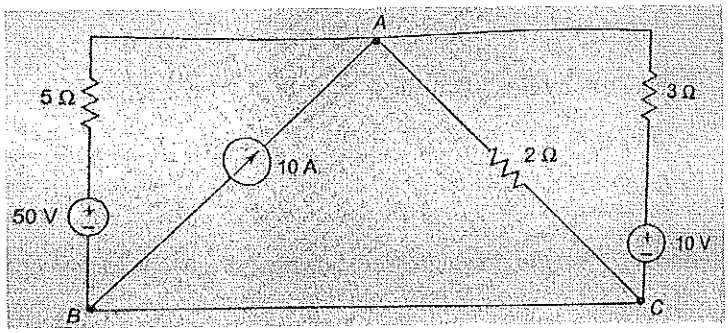
1. Using Source transformation method, calculate the value of I shown in the figure.



2. Calculate the values of V_X & V_Y shown in the given circuit.



3. Find power delivered by 50volt source using source transformation.



Answer Key – Set – A

Course Code: ELE1303, Course Name: Electric Circuit & Drawing

School of Electrical Skills, 3rd Semester, 1st In-Sem. Examination

B. Voc. Program, Summer Semester (2020-21)

Section - A

A.1 c

A.2 c

A.3 d

A.4 b

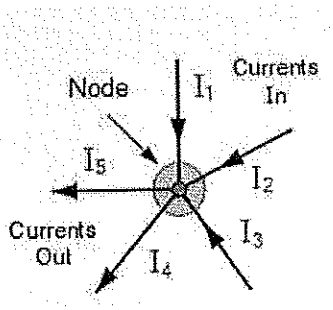
A.5 d

Section-B

Ans.1 Kirchhoff's Law Statement

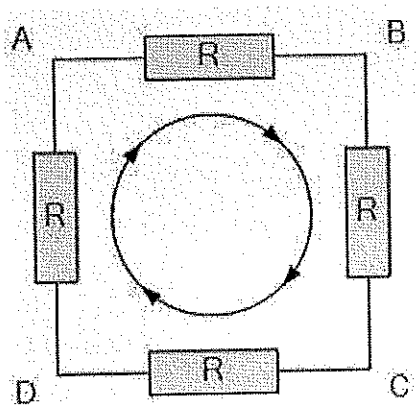
Kirchhoff's laws are one of the fundamental laws that find applications in electrical engineering for formulating the circuits. There are two laws that make up the Kirchhoff's law and they are:

- **Kirchhoff's Current Law (KCL):** KCL is also known as Kirchhoff's first law or junction rule. The principle of this law is to conserve the electric charge. The law states that the amount *of current flowing into a node/junction is equal to the sum of currents flowing out of it.* For performing the nodal analysis in Ohm's law, KCL is used.



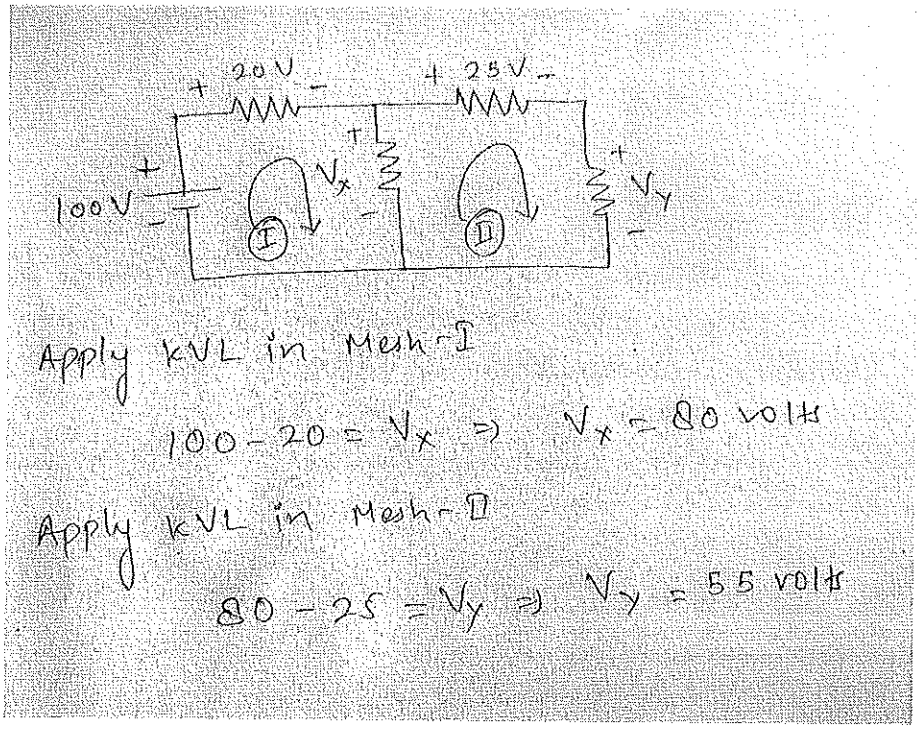
$$I_1 + I_2 + I_3 + (-I_4 + -I_5) = 0$$

- **Kirchhoff's Voltage Law (KVL):** KVL is also known as Kirchhoff's second law or loop law. The principle of this law is to conserve energy. The law states that the *sum of voltages in a closed-loop is zero.* The total amount of energy gained is equal to the energy lost per unit charge.



$$V_{AB} + V_{BC} + V_{CD} + V_{DA} = 0$$

Ans.2



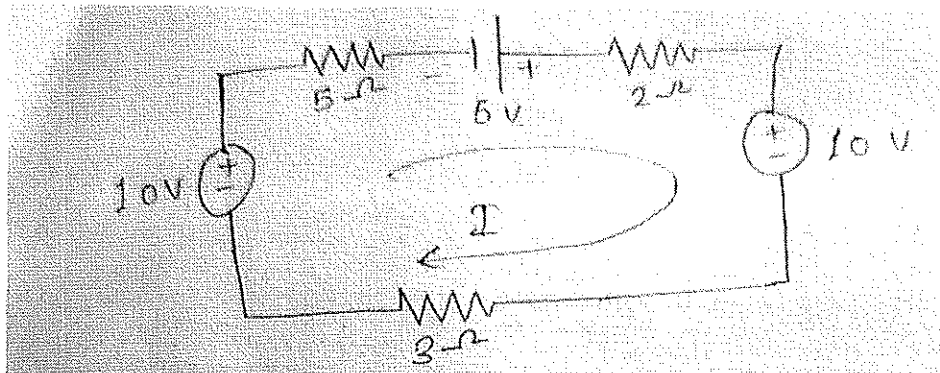
Apply KVL in Mesh-I

$100 - 20 = V_x \Rightarrow V_x = 80$ volts

Apply KVL in Mesh-II

$80 - 25 = V_y \Rightarrow V_y = 55$ volts

Ans.3



Apply KVL,

$$10 - 5I + 5 - 2I - 10 - 3I = 0$$

$$\Rightarrow \quad 5 = 10I$$

$$I = \frac{5}{10} = 0.5 \text{ Amp.}$$

Answer Key – Set – A

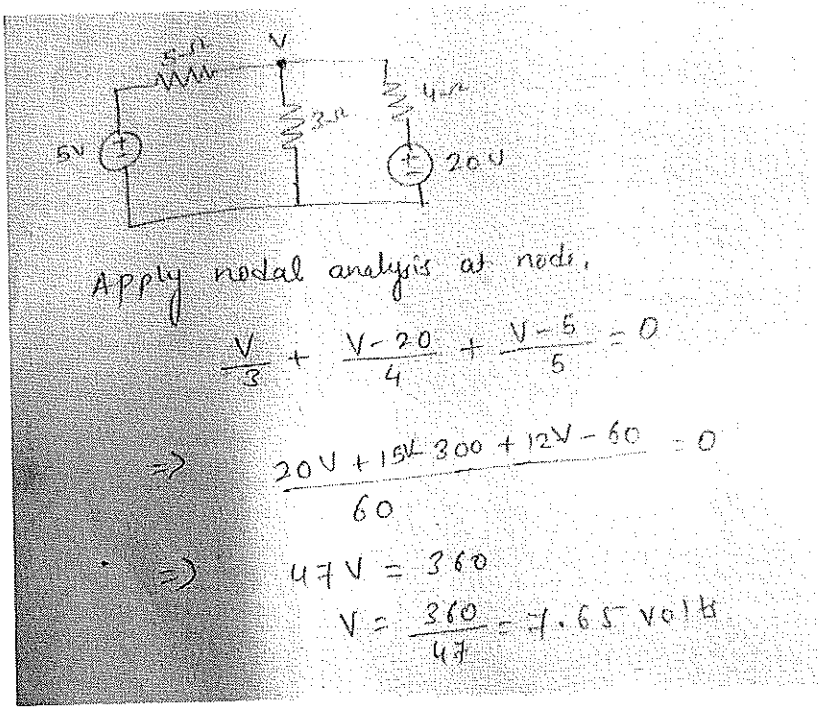
Course Code: ELE1303, Course Name: Electric Circuit & Drawing

School of Electrical Skills, 3rd Semester, 1st In-Sem. Examination

B. Voc. Program, Summer Semester (2020-21)

Section-C

Ans.1



Apply nodal analysis at node,

$$\frac{V}{3} + \frac{V-20}{4} + \frac{V-5}{5} = 0$$

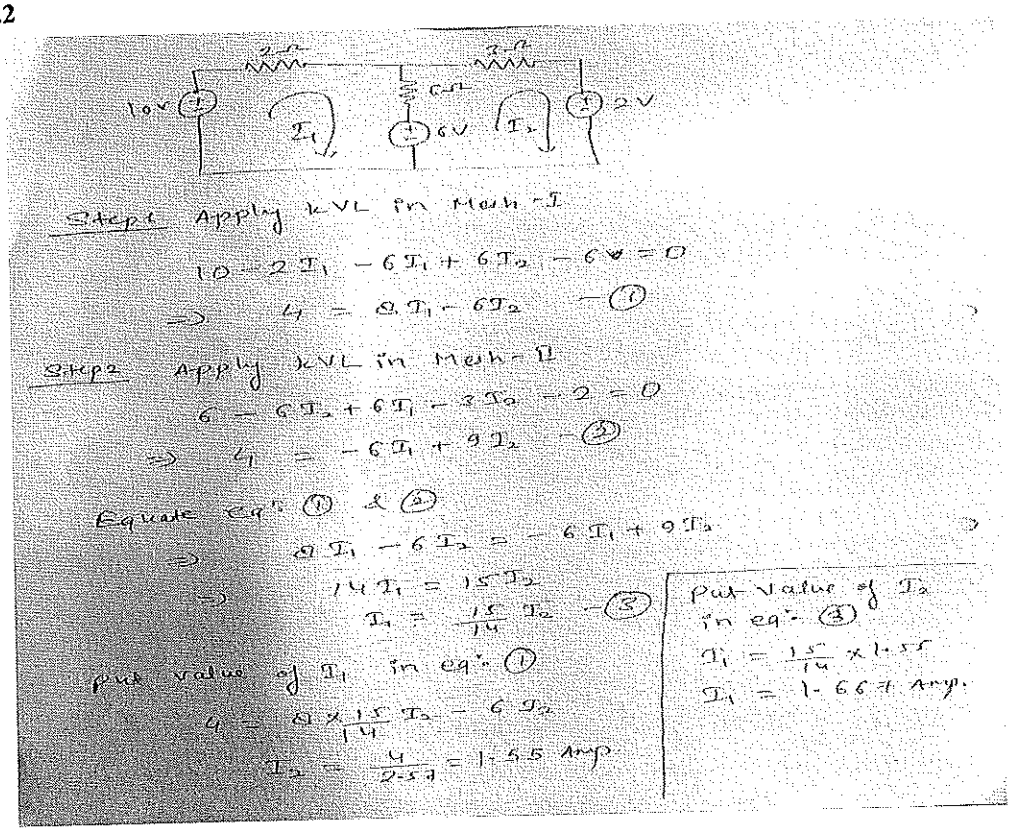
$$\Rightarrow \frac{20V + 15V - 300 + 12V - 60}{60} = 0$$

$$\Rightarrow 47V = 360$$

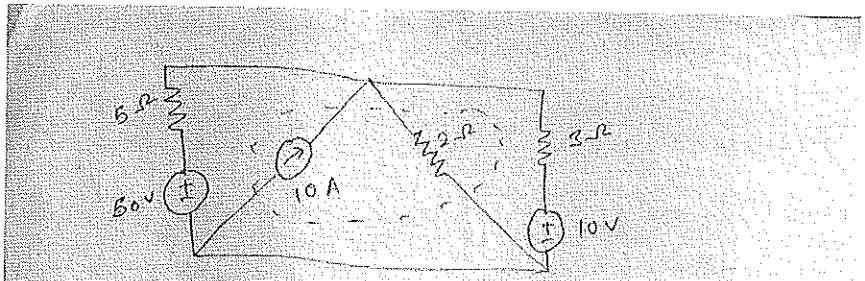
$$V = \frac{360}{47} = 7.65 \text{ volts}$$

Current in 3-ohm resistor = V/3 = 7.65/3 = 2.55 amps

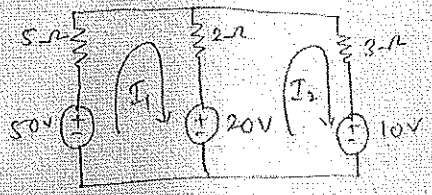
Ans.2



Ans.3



Perform source transformation of 10A & 2Ω



Apply KVL in Mesh-I

$50 - 5I_1 - 2I_1 + 2I_2 - 20 = 0$

$\Rightarrow 30 = 7I_1 - 2I_2$ — (1)

Apply KVL in Mesh-II

$20 - 2I_2 + 2I_1 - 3I_2 - 10 = 0$

$\Rightarrow 10 = -2I_1 + 5I_2$ — (2) $\times 3 \Rightarrow 30 = -6I_1 + 15I_2$ — (3)

Equate eq^n (1) & (3)

$\Rightarrow 7I_1 - 2I_2 = -6I_1 + 15I_2$

$\Rightarrow 13I_1 = 17I_2$

Put value of I_1 in eq^n (1)

$\Rightarrow 30 = 7 \times \frac{17}{13} I_2 - 2I_2$

$I_2 = 4.19$ Amp.

$P_{ab.\,by\,10V} = 10 \times 4.19 = 41.9$ watt

$P_{del.} = -P_{ab.} = -41.9$ watt

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Electrical Skills
Session: 2020-21 (Summer Semester)
B. Voc. Program, III Semester,
1st In-Sem. Examination

Course Code: ELE1304 **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

1. Which of the following is not an integrating instrument?
   (a) Ampere-hour meter (b) Watt-hour meter
   (c) Voltmeter (d) All of the above

2. A pointer of an electrical instrument once deflected returns to zero position, when the applied current/ voltage is removed due to:
   (a) Action of gravity (b) Mass of the pointer
   (c) Controlling Torque (d) Damping Torques

3. What is the number of significant figures in 0.310×10^3?
   (a) 2 (b) 3 (c) 4 (d) 6

4. Which of the following is not the fundamental quantity?
   (a) Mass (b) Length (c) Velocity (d) Time

5. Centimeter per second is the unit of speed in
   (a) S.I. system (b) F.P.S. system
   (c) M.K.S. system (d) C.G.S. system

Section – B

03X02 = 06 Marks

1. Classify following physical quantities as fundamental and derived quantities: Mass, velocity, length, and force.
2. Define error and state basic types of error.
3. Explain indicating and recording type of instrument.

Section – C

03X03 = 09 Marks

1. Distinguish between gross error and systematic error. Write down two possible sources of systematic error.
2. Draw the block diagram of an instrument system and explain the different functions of different functional elements.
3. In a series of successive measurements in an experiment, the readings of the period of oscillation of a simple pendulum were found to be 2.63s, 2.56 s, 2.42s, 2.71s and 2.80s. Calculate
   (i) the mean value of the period of oscillation
   (ii) the absolute error in each measurement
   (iii) the percentage error.

Answer Key Set – A

Course Code: ELE1304, Course Name: Electrical Measuring Instruments

School of Electrical Skills, Session: 2020-21 (Summer Semester)

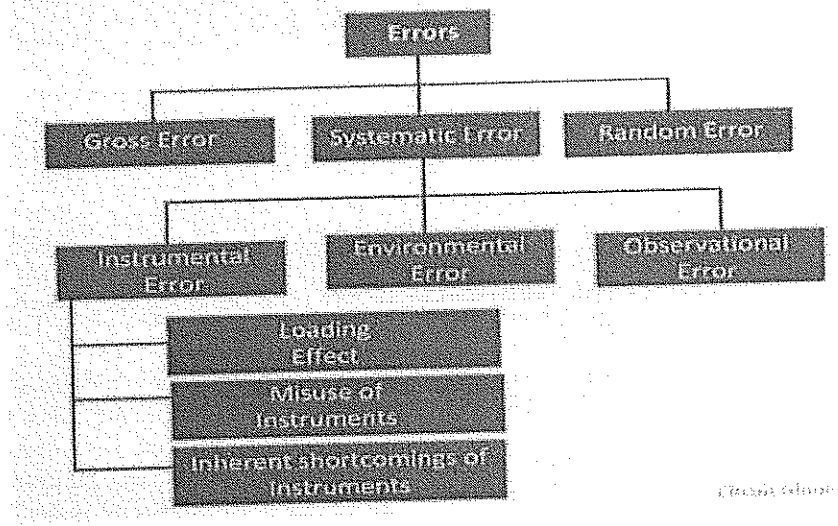
B. Voc. Program, III Semester, 1st In-Sem. Examination

Section – A

1. (c) Voltmeter
2. (c) Controlling Torque
3. (b) 3
4. (c) Velocity
5. (d) C.G.S. system

Section – B

1. Fundamental- Mass, length
   Derived- velocity, force
2. Error- The measurement error is defined as the difference between the true or actual value and the measured value. The true value is the average of the infinite number of measurements, and the measured value is the precise value.



3. **Indicating Instrument**– The instrument which indicates the magnitude of the measured quantity is known as the indicating instrument. The indicating instrument has the dial which moves on the graduated dial. The voltmeter, ammeter, power factor meter are the examples of the indicating instrument.
   Recording Instrument– The instrument records the circuit condition at a particular interval of time is known as the recording instrument. The moving system of the recording instrument carries a pen which lightly touches on the paper sheet. The movement of the coil is traced on the paper sheet. The curve drawn on the paper shows the variation in the measurement of the electrical quantities.

Section – C

1. **Gross Errors**- These errors are due to the gross blunder on the part of the experimenters or observers. These errors are caused by mistake in using instruments, recording data and calculating measurement results. For example: A person may read a pressure gage indicating 1.01 N/m2 as 1.10 N/m2. Someone may have a bad habit of memorizing data at a time of reading and writing a number of data together at later

time. This may cause error in the data. Errors may be made in calculating the final results. Another gross error arises when an experimenter makes use (by mistake) of an ordinary flow meter having poor sensitivity to measure low pressure in a system.

Systematic Errors- These are inherent errors of apparatus or method. These errors always give a constant deviation. On the basis of the sources of errors, systematic errors may be divided into following sub-categories:

(a) Constructional Error - None of the apparatus can be constructed to satisfy all specifications completely. This is the reason of giving guarantee within a limit. Therefore, manufacturers always mention the minimum possible errors in the construction of the instruments.

(b) Errors in Reading or Observation- Following are some of the reasons of errors in results of the indicating instruments:

(i) Construction of the Scale: There is a possibility of error due to the division of the scale not being uniform and clear.

(ii) Fitness and Straightness of the Pointer: If the pointer is not fine and straight, then it always gives the error in the reading.

(iii) Parallax: Without a mirror under the pointer there may be parallax error in reading.

(iv) Efficiency or Skill of the Observer: Error in the reading is largely dependent upon the skill of the observer by which reading is noted accurately.

2. Different functional elements are-

a) Medium: It is the input to a measurement system. It supplies energy to the primary sensing element.

b) Measured Quantity: This is also called measurand. This is the physical variable whose measurement is under consideration.

c) Primary Sensing Element: Primary sensing element receives energy/input from the medium to be measured and produces a proportional output. The output from the primary sensing element is usually a physical variable such as displacement or voltage. Thus primary sensing element is a primary transducer which converts one physical variable into another. An intermediate transducer may also be used after primary transducer if a second transduction is desired. However, the sensor should extract a very small amount of energy from the medium because the medium should not be disturbed appreciably when the sensing element is inserted.

d) Variable Conversion Element: After sensing the measurand, it is to be converted to a more suitable variable while preserving its original contents. So, a variable conversion element is employed which acts as an intermediate transducer.

e) Variable Conversion Element: After sensing the measurand, it is to be converted to a more suitable variable while preserving its original contents. So, a variable conversion element is employed which acts as an intermediate transducer.

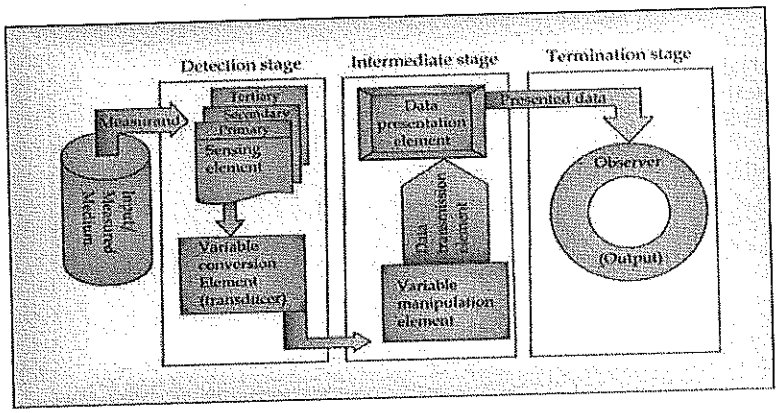
f) Variable Manipulation Element: This element forms as an intermediate stage in a measuring system. Most of the times, though the sensed signal (input) is converted to measurable output signal, it may not be in readable/ transmittable format due to noise or too large/small size etc. Therefore, it has to be manipulated to a desired level by modifying or filtering or amplifying or reducing the signal provided the physical nature of variable remains unchanged during this stage.

g) Data Transmission Element: The next step of the measuring system after the signal is manipulated is transmission. If the various functional elements of a

measuring system are separated spatially, then it is necessary to transmit signals from one element to another element. The data transmission element carries out this function. It is very important functional element particularly, when a remote controlled operation is desired.

h) Data Presentation Element: When the information about the quantity that is measured is transmitted, there should be an element to receive it and communicate to the observer (human) in a desirable form. This information obtained is often used in one or more of the following three ways.

- Monitoring a process or operation
- Controlling a process or operation and
- Analysis of an experiment



Generalized Input-Output Model of a Measuring System

3. (i)

(i) $T_m = \frac{t_1 + t_2 + t_3 + t_4 + t_5}{5}$

$= \frac{2.63 + 2.56 + 2.42 + 2.71 + 2.80}{5}$

$T_m = \frac{13.12}{5} = 2.624s$

$T_m = 2.62s$ (Rounded off to 2nd decimal place)

(ii)

$\Delta T_1 = 2.62 - 2.63 = -0.01s$

$\Delta T_2 = 2.62 - 2.56 = +0.06s$

$\Delta T_3 = 2.62 - 2.42 = +0.20s$

$\Delta T_4 = 2.62 - 2.71 = -0.09s$

$\Delta T_5 = 2.62 - 2.80 = -0.18s$

(iii)

$S_T = \frac{\Delta T_m}{T_m} = \frac{0.11}{2.62} = 0.0\ 419$

$S_T = 0.04$

Percentage error in T = $0.04 \times 100 = 4\%$

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Electrical Skills

Session: 2020-21 (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

1. Which process is responsible for production of energy in the Nuclear power plant?
   (a) Nuclear fission reaction (b) Nuclear fusion reaction
   (c) Both (a) and (b) (d) None of these
2. Which of the following material is not used for overhead line insulators?
   (a) Porcelain (b) Glass (c) PVC (d) Steatite
3. The cost of fuel transportation is maximum in:
   (a) Hydro-electric power plant (b) Coal fired thermal power plant
   (c) Nuclear power plant (d) Diesel power plant
4. .....requires more space:
   (a) Nuclear power plant (b) Hydro-electric power plant
   (c) Coal fired thermal power plant (d) Diesel power plant
5. A transmission line consists of 9 discs of suspension insulator in each string. What is the operating voltage of the transmission line?
   (a) 11 KV (b) 33 KV (c) 66 KV (d) 132 KV

Section – B

03X02 = 06 Marks

1. List the various properties of insulating materials.
2. What do you understand by the Non-Conventional power plants? Give some examples.
3. List the various disadvantages of Nuclear Power plants.

Section – C

03X03 = 09 Marks

1. Draw and explain the single line diagram of power system.
2. Draw the layout of thermal power plant and explain the function of:
   (i) Coal handling unit (ii) Air preheater.
3. Explain the Pin type insulator.

Set - A

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Answer Key Set – A

Course Code: ELE 1305, Course Name: Introduction to Power System

School of Electrical Skills, Session: 2020-21 (Summer Semester)

B. Voc. Program, III Semester, 1st In-Sem. Examination

Section – A

05X01 = 05 Marks

1. **Ans. (a)**
2. **Ans. (c)**
3. **Ans. (b)**
4. **Ans. (c)**
5. **Ans. (d)**

Section – B

03X02 = 06 Marks

1. List the various properties of insulating materials.

Ans. It should have high insulation resistance ,high dielectric strength ,good mechanical properties ,non-hygroscopic, capable of being operated at high temperatures ,low thermal resistance and low power factor.

2. What do you understand by the Non-Conventional power plants? Give some examples.

Ans. Energy generated by using wind, solar, small hydro, tides, geothermal heat and biomass is known a non-conventional energy. All these sources are renewable process of energy generation and do not cause environmental pollution. Our country has been endowed with adequate natural resources.

3. List the various disadvantages of Nuclear Power plants.

Ans. DISADVANTAGES

- The biggest challenge of nuclear power plant is to store the used fuel, as it would cover up a piece of land for a large number of years.
- You have to keep an eye on the waste storage plant, for it to be safe and check for radiation to be under limit.
- There is always a chance of nuclear accident as in Fukushima, Japan due to tsunami. The bad effects of radiation remain for a long time, over generations.

This energy has got so much of power in it, that if it goes into wrong hands it could destroy human race from earth.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Answer Key Set – A

Course Code: ELE 1305, Course Name: Introduction to Power System

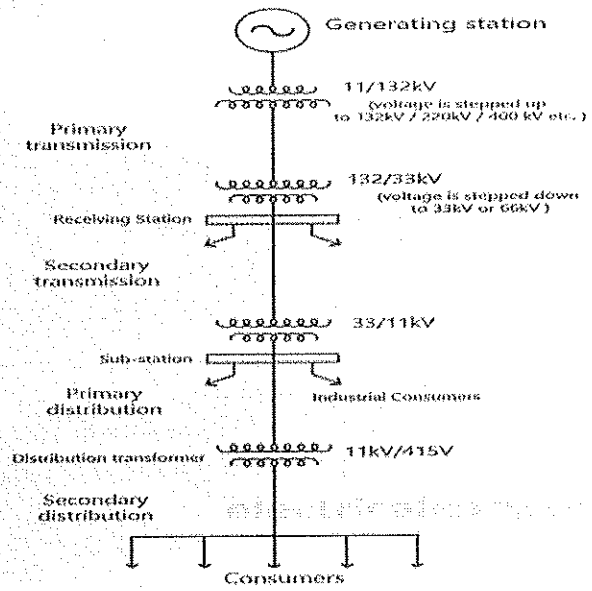
School of Electrical Skills, Session: 2020-21 (Summer Semester)

B. Voc. Program, III Semester, 1st In-Sem. Examination

Section – C

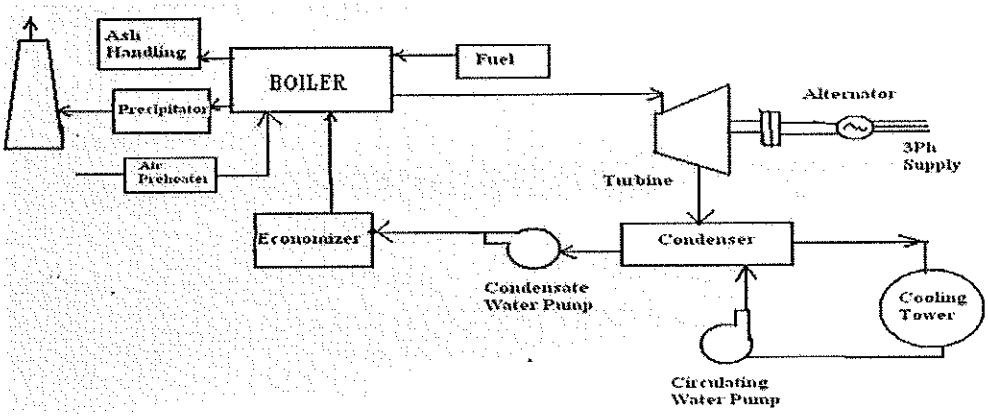
03X03 = 09 Marks

1. Draw and explain the single line diagram of power system.



2. Draw the layout of thermal power plant and explain the function of:

(i) Coal handling unit (ii) Air preheater.



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%.

3. Explain the Pin type insulator.

Ans. The pin insulator is used in power distribution for the voltage up to 33kV. It is placed on the cross arm of the supporting tower. The pin insulator has grooves on the upper end for keeping the conductor. The conductor is tied to the insulator on the top groove on straight line positions and side groove in angle positions by annealed binding wire of the same material as that of the conductor. A lead thimble is cemented into the insulator body to receive the pin.