Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills
Session: 2021-22 (Winter Semester)
B. Voc. Program, 5th Semester,
1st In-Sem. Examination

Course Code: ELE 1501 **Time: 1 Hour**
Course Name: Fundamental of Power Electronics **Max. Marks: 20**

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

Section – A

05X01 = 05 Marks

1. The arrow direction in the diode symbol indicates:
   (a) Direction of electron flow.
   (b) Direction of hole flow (Direction of conventional current)
   (c) Opposite to the direction of hole flow
   (d) None of the above
2. The knee voltage (cut in voltage) of Si diode is:
   (a) 0.2 V (b) 0.7 V (c) 0.8 V (d) 1.0 V
3. When the diode is forward biased, it is equivalent to:
   (a) An off switch (b) An On switch (c) A high resistance (d) None of these
4. Under normal reverse bias voltage applied to diode, the reverse current in Si diode:
   (a) order of μA (b) 100 mA (c) 1000 μA (d) None of these
5. Avalanche breakdown in a diode occurs when:
   (a) Potential barrier is reduced to zero (b) Forward current exceeds certain value
   (c) Reverse bias exceeds a certain value (d) None of these

Section – B

03X02 = 06 Marks

1. Draw the V-I characteristics of PN-junction diode.
2. What is barrier potential?
3. A forward potential of 10V is applied to a Si diode. A resistance of 1 KΩ is also in series with the diode. Determine the value of current.

Section – C

03X03 = 09 Marks

1. Explain the working principle of PN-junction diode?
2. Distinguish between intrinsic and extrinsic semiconductor.
3. A diode carries forward current of 60 mA when forward voltage applied is 0.2 V. Find its D.C. forward resistance. If it carries reverse current of 25 μ-A when reverse voltage is 60V, find its D.C. reverse resistance.

Course Name :- Fundamental of Power Electronics

Subject code :- ELE1501

Semester : ELE 5th sem

Solution of 1st. In-sem exam

~~Set - A~~

Section - A

1 Ans :- (b)

2. Ans :- (b)

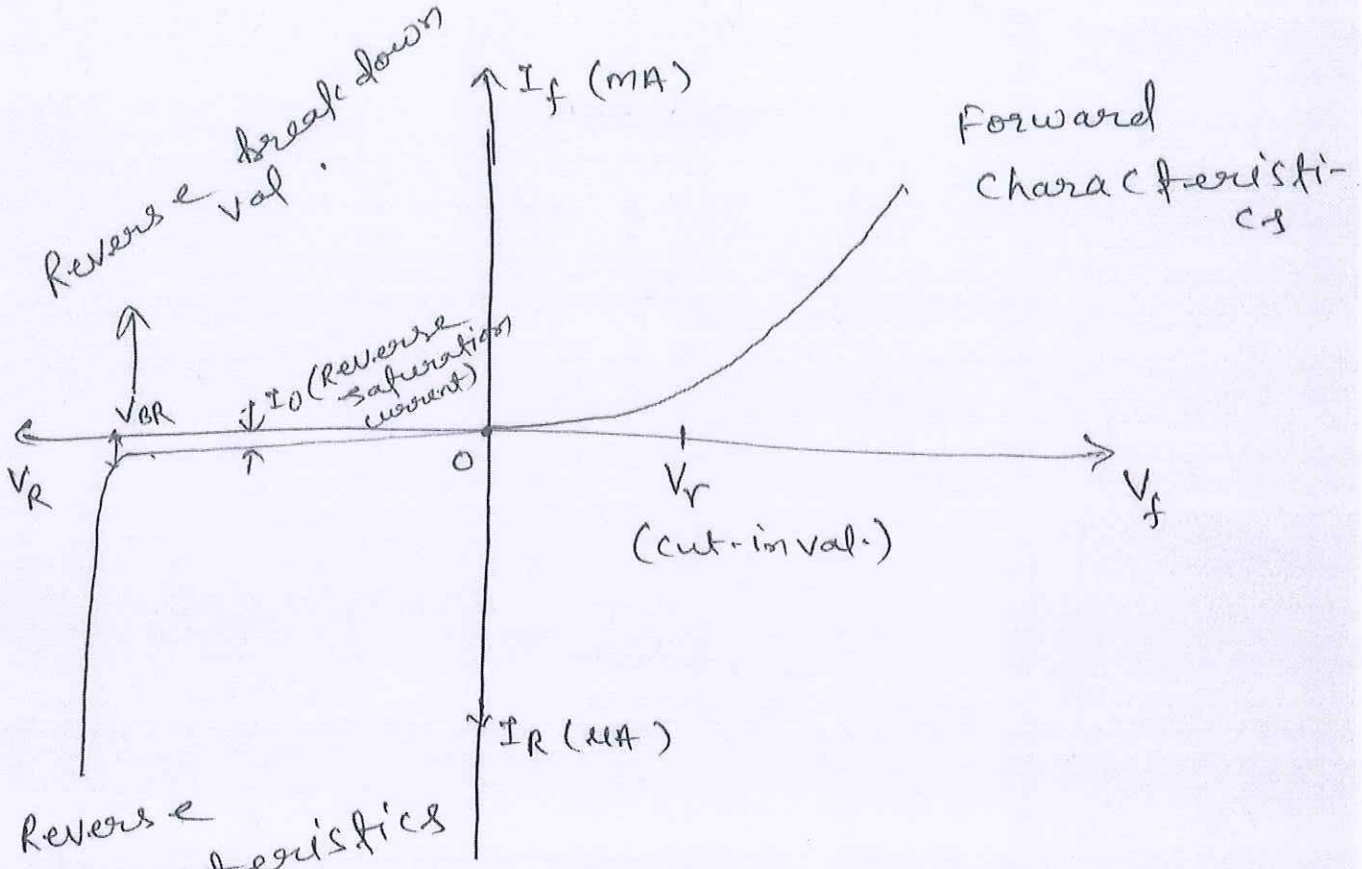
3. Ans :- (b)

4. Ans :- (a)

5. Ans :- (c)

Section - B

1 Ans:



(V-I. characteristics of diode)

2. Ans:

Due to immobile positive charges on n-side and negative charges on P-side, there exists an electric potential across the pn-junction.

across the junction, which is called barrier potential.

3. Ans:-

given $V_f = 10V$

$R = 1 \times 10^3 \Omega$

since for silicon diode the barrier potential is 0.7 V.

So, drop in forward val. = $10 - 0.7$
$= 9.3V$

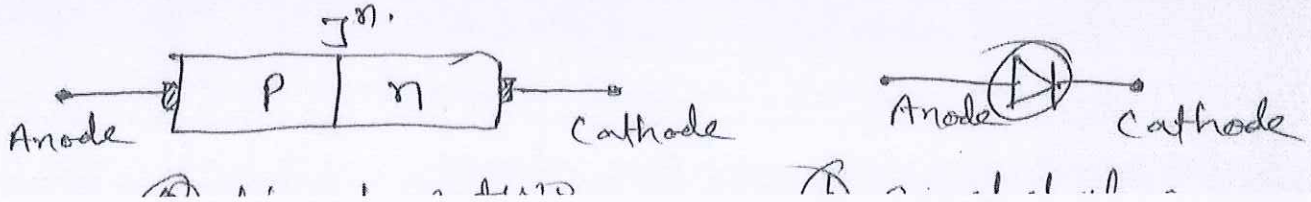
So, current $I = \frac{V}{R} = \frac{9.3}{1 \times 10^3}$

$= 9.3 mA$.

Section - C

1 Ans:-

The Pn-junction forms a popular semiconductor device called Pn-junction diode.



Here P-region act as anode and n-region act as cathode. The arrow in the symbol indicates the direction of conventional current flow.
The diode only conduct during forward biasing ~~conduction~~ Condition and in Reverse bias it act as an open switch.

2. Ans:

A semiconductor in their pure form is called intrinsic semiconductor. Free electrons and holes in the intrinsic semiconductor are two charge carriers which is same in their concentration.

~~Doped~~ semiconductor material is called extransic semiconductor. The doping increases the conductivity of basic intrinsic semiconductors.
depending upon the types of doping

3. Ans: -

since, it is given

$V_f = 0.2\,V$, $I_f = 60\,mA$, $V_R = 60\,V$

$I_R = 25\,\mu A$

$\therefore R_f = \frac{V_f}{I_f} = \frac{0.2}{60 \times 10^{-3}} = 3.33\,\Omega.$

$R_r = \frac{V_R}{I_R} = \frac{60}{25 \times 10^{-6}} = 2.4\,M\Omega.$

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.:.....

School of Electrical Skills
Session: 2020-21 (Winter Semester)
B. Voc. Program, 5th Semester,
1st In-Sem. Examination

Course Code: ELE 1502 **Time: 1 Hour**

Course Name: Substation Practices and Supervision **Max. Marks: 20**

Instruction: Answer all questions from each and every section. Section A, each question carries one mark, section B, each question carries two marks and in section C, each question carries three marks.

Section – A

05X01 = 05 Marks

1. Which of the following equipment is not installed in a substation?
   (a) Shunt reactors (b) Exciters
   (c) Voltage transformers (d) Series capacitors.

2. Which range of voltage comes under the category of ultra-high voltage?
   (a) 1 kV and above (b) Voltage between 11 kV and 66 kV
   (c) Voltage between 132 kV and 400 kV (d) Above 400 kV.

3. The size of Gas Insulated Substation is significantly small compared to conventional substation because:
   (a) High electronegative property of SF6 gas
   (b) High dielectric property of SF6 gas
   (c) High Insulation property of SF6 gas
   (d) All the above

4. Which of the following is usually not the generating voltage?
   (a) 6.6 kV (b) 9.9 kV
   (c) 11 kV (d) 13.2 kV.

5. Which is equipment is installed first in the substation for taking the supply from transmission line system?
   (a) Circuit breaker (b) Lightning arrester
   (c) Current transformer (d) Transformer

Section – B

03X02 = 06 Marks

1. Draw the key diagram for 33 kV substation.
2. What do you mean by indoor substation?
3. What do you mean by outdoor substation?

Section – C

03X03 = 09 Marks

1. Define substation. Classify the substations according to the operating voltages and their important features.
2. List the various functions of a substation.
3. Write the advantages and disadvantages of outdoor substations over indoor substations.

Answer Key

Registration No.:.....

School of Electrical Skills
Session: 2020-21 (Winter Semester)
B. Voc. Program, 5th Semester,
1st In-Sem. Examination
Course Code: ELE 1502

Course Name: Substation Practices and Supervision

Section – A

05X01 = 05 Marks

1. Which of the following equipment is not installed in a substation?
   (a) Shunt reactors **(b) Exciters**
   (c) Voltage transformers (d) Series capacitors.
2. Which range of voltage comes under the category of ultra-high voltage?
   (a) 1 kV and above (b) Voltage between 11 kV and 66 kV
   (c) Voltage between 132 kV and 400 kV **(d) Above 400 kV.**
3. The size of Gas Insulated Substation is significantly small compared to conventional substation because
   (a) High electronegative property of SF6 gas
   (b) High dielectric property of SF6 gas
   (c) High Insulation property of SF6 gas
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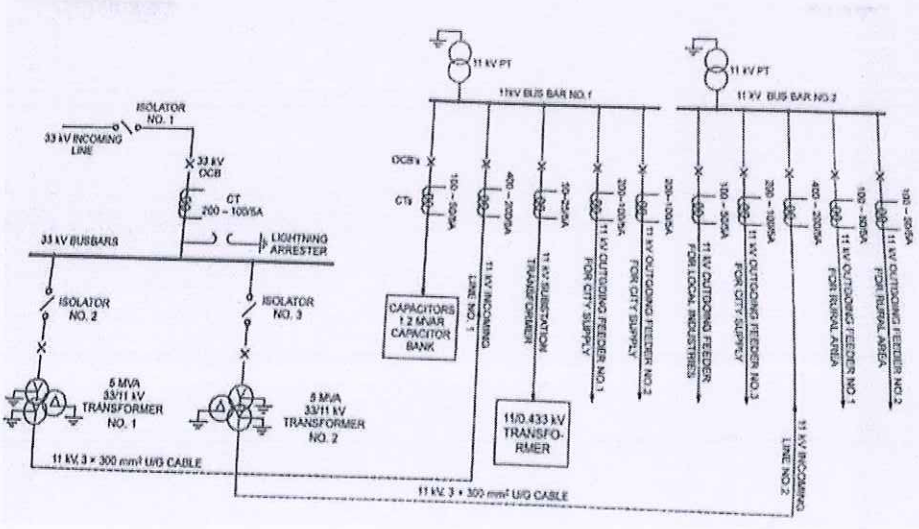
   (a) Circuit breaker **(b) Lightning arrester**
   (c) Current transformer (d) Transformer

Section – B

03X02 = 06 Marks

1. Draw the key diagram for 33 kV substation.
   Ans:



2. What do you mean by indoor substation?

Ans: In an indoor substation the equipments lie in a room. An indoor arrangement becomes necessary when enough outdoor space is not available. In case of indoor type, the cost of the transformer and other equipments are less as compared to an outdoor type. Moreover, the conditions for inspection and maintenance are better. However, the cost of the building necessary for housing the equipments may be very high.

3. What do you mean by outdoor substation?
Ans: In outdoor substations all equipment lie in open air. Outdoor substations provide large air clearances that may be required between high voltage terminals and equipments. This is the reason that for 33 kV and above, outdoor substations are recommended. The high voltage equipments should be able to withstand worst weather conditions. However, the measuring meters, relays and control devices (which are operated at low voltage and low current levels) are housed inside a building.

Section – C

03X03 = 09 Marks

1. What is substation? Classify the substations according to the operating voltages and their important features.
Ans: Substation: A power substation is a subsidiary station of an electricity generation, transmission and distribution system where voltage is transformed from high or medium to low or the reverse using transformers. Electric power flows through several substations between generating plant and consumer changing the voltage level in several stages. At first substations were connected to only one power station where the generator was housed and were subsidiaries of that power station.
Generally, electrical substation is a point in distribution system where:
   - A place where several electrical equipments are installed and used for electrical energy in power system.
   - A place where the safety of the system is providing by automatically protection scheme.
   - A place where one or several incoming and outgoing circuit are met at one or more busbar system and controlled by high voltage switching equipment which is used for switching.
   - A place where voltage value is changed and controlled.
   - A place where load is distributed, controlled and protected

Classification of Substation on the basis of operating voltage: The substations, according to operating voltage, may be categorized as

1. High Voltage Substations (HV Substations): involving voltages between 11 kV and 66 kV.
2. Extra High Voltage Substations (EHV Substations): involving voltages between 132 kV and 400 kV.
3. Ultra High Voltage Substations (UHV Substations): operating on voltage above 400 kV.

Classification of Substation on the basis of importance:

1. Grid Substations: these are the substations from where bulk power is transmitted from point to another point in the grid. These are important because any disturbance in these substations may cause the failure of the grid.

2. Town Substations: these substations step-down the voltages at 33/11 kV for further distribution in the towns and any failure in such substations results in the failure of supply for whole of the town.

2. What are the functions of a substation?

Ans: The functions of an electric substations are:

- ✓ It receives electric energy from an incoming line at a voltage and supplies the same to outgoing lines at a reduced voltage level employing power transformers.
- ✓ It acts as a connection point for local networks.
- ✓ It regulates voltage to compensate for system voltage drop by injecting reactive power to the transmission or distribution circuits.
- ✓ It acts as a monitoring point for control centre using current and potential transformers.
- ✓ It acts as a switchyard for switching electric transmission and distribution circuits into and out of the system using bus bars, circuit-breakers and isolators.
- ✓ It protects the electric system insulation against abnormal over voltages caused due to lightning and switching, employing protective devices like surge diverters.
- ✓ It protects the system equipments against abnormal short-circuit currents employing relays and circuit-breakers.

3. What are the advantages and disadvantages of outdoor substations over indoor substations?

Ans: The outdoor substations have the following main advantages over indoor substations

i. All the equipment is within view and therefore fault location is easier.
ii. The extension of the installation is easier, if required.
iii. The time required in erection in erection of such substations is lesser.
iv. The smaller amount of building materials (steel-concrete) is required.
v. The construction work required is comparatively smaller and cost of the switchgear installation is low.
vi. There is practically no danger of a fault which appears at one point being carried over to another point in the installation because the apparatus of the adjoining connections can be spaced liberally, without any appreciable increase in costs.
vii. Repairing work is easy.

The Disadvantages of Outdoor installations in comparison of Indoor installations are:

i. The various switching operations with the isolators, as well as supervision and maintenance of the apparatus is to be performed in the open air during all kinds of weather.

ii. More space is required for the substation.

iii. Protection devices are required to be installed for protection against lightning surges.

iv. The length of control cables required is more.

v. The influence of rapid fluctuation in ambient temperature and dust and dirt deposits upon the outdoor substation equipment makes it necessary to install apparatus specially designed for outdoor service and, therefore, more costly.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Electrical Skills

Session: 2020-21 (Winter Semester)

B. Voc. Electrical Skills, 5th Semester,

1st In-Sem. Examination

Course Code: ELE 1503 **Time: 1 Hour**

Course Name: Electrical Machines-II **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. RMF Means
   (a) Rotating Motive Force (b) Rotating Magnetic Field
   (c) Rotating Mechanical force (d) None

2. Mechanical Losses are
   (a)core losses (b) Friction & Windage losses
   (c) Both A&B (d) None of these

3. Synchronous Speed (Ns)
   (a) 120f/P (b) 120P/f (c) Both A&B (d) None of these

4. What is the coupling field used between the electrical and mechanical systems in energy conversion devices?
   (a) Magnetic field (b) Electric field
   (c) Magnetic field or Electric field (d) None of the mentioned

5. An electro-mechanical energy conversion device is one which converts _____
   (a) Electrical energy to mechanical energy only
   (b) Mechanical energy to electrical energy only
   (c) Electrical to mechanical and mechanical to electrical
   (d) None of the mentioned

Section – B

03X02 = 06 Marks

1. Define AC motor.

2. List the various applications of the AC machines.

3. Define: (a) Dynamically Induced EMF (b) Statically Induced EMF

Section – C

03X03 = 09 Marks

1. Write the advantages and disadvantages of the AC machines?

2. Explain the Faraday's law of Electromagnetic Induction.

3. Describe the principal of energy-conversion. From a consideration of the various energies involved, develop the model of an electromechanical energy-conversion device.

Answers Key

Course Code: ELE1503, Course Name: Electrical Machine-II
School of Electrical Skills, Session: 2020-21 (Winter Semester)
B. Voc. Program, V Semester, 1st In-Sem. Examination

Section – A

05X01 = 05 Marks

1. RMF Means
   (b) Rotating Magnetic Field
2. Mechanical Losses are
   (b) Friction & Windage losses
3. Synchronous Speed (Ns)
   (a) 120f/P
4. What is the coupling field used between the electrical and mechanical systems in energy conversion devices?
   (c) Magnetic field or Electric field
5. An electro-mechanical energy conversion device is one which converts _____
   (c) Electrical to mechanical and mechanical to electrical

Section – B

03X02 = 06 Marks

1. Define AC motor.

Ans: Definition: The motor that converts the alternating current into mechanical power by using an electromagnetic induction phenomenon is called an AC motor. This motor is driven by an alternating current. The stator and the rotor are the two most important parts of the AC motors. The stator is the stationary part of the motor, and the rotor is the rotating part of the motor. The AC motor may be single phase or three phase.

2. List the various applications of the AC machines.

Ans: Applications of AC machines:

1. In high power filed.
2. In machine tools
3. In electric and hybrid motors
4. In permanent magnet motors
5. In house hold appliances (hair dryer, vacuum cleaner, blenders etc.)
6. In light industries
7. In fixed application such as clocks and timer.

3. Define: (a) Dynamically Induced EMF (b) Statically Induced EMF

Ans.

(a) Dynamically Induced EMF

Here the EMF is induced by moving the flux with respect to the coil or by moving the coil with respect to flux. In either way there involves the physical movement of coil or the flux.

(b) Statically Induced EMF

If the EMF is induced without the physical movement of coil or magnet, then it is called statically induced EMF.

In other words ***"EMF induced in a coil due to change in its own flux linked with it is called self indued EMF".***

Answers Key

Course Code: ELE1503, Course Name: Electrical Machine-II
School of Electrical Skills, Session: 2020-21 (Winter Semester)
B. Voc. Program, V Semester, 1st In-Sem. Examination

Section – C

03X03 = 09 Marks

1. **Write the advantages and disadvantages of the AC machines?**

   Ans: Advantages of AC machines:

   1. Voltage can be stepped up or down in AC machines
   2. Energy loss is less
   3. Simple slip ring is used
   4. High voltage
   5. Overall good efficiency
   6. Less parts to fail

   Disadvantages of AC machines:

   1. Supplied EMF opposed by back EMF
   2. Insulation and shielding are needed by wires
   3. Frequency should continue with 50 Hz for operation

2. **Explain the Faraday's law of Electromagnetic Induction.**

   Ans: FARADAYS LAWS OF ELECTROMAGNETIC INDUCTION

   Michael Faraday, a British Scientist as stated 2 laws related to electromagnetic induction.

   Faraday's First Law of Electromagnetic Induction:

   "Whenever the flux linking with a coil changes, an EMF is induced in the coil"

   Faraday's Second Law of Electromagnetic Induction :

   "The magnitude of induced EMF is directly proportional to rate of change of flux linkages"

   $$e = d\phi/dt$$

   Where, e = induced EMF in the coil Φ = flux linking with the coil.

   If the coil has N turns, then $e = N\, d\phi/dt$

   Lenz's Law :

   "The direction of induced EMF is such that it always opposes the cause"

   By considering the effect due to Lenz's Law, we can write induced EMF as

   $$e = -N\, d\phi/dt$$

3. **Describe the principal of energy-conversion. From a consideration of the various energies involved, develop the model of an electromechanical energy-conversion device.**

   Ans: An electromechanical energy conversion device is the device that converts electrical energy into mechanical energy or, mechanical energy into electrical energy. Electromechanical energy conversion takes place via the medium of a magnetic field or an electric field, but most practical converters use magnetic field as the coupling medium between electrical and mechanical systems, this is because the electric

storing capacity of the magnetic field is much higher than that of the electric field. Electromechanical energy converters are either gross-motion devices such as microphones, loudspeakers, electromagnetic relays, and certain electrical measuring instruments, etc.

DC, induction and synchronous machines are used extensively for electromechanical energy conversion. When the conversion takes place from electrical to mechanical form, the device is called the motor, and when the mechanical energy is converted to electrical energy, the device is called a generator. In these machines, conversion of energy from electrical to mechanical form or from mechanical to electrical from results from the following two electromagnetic phenomena:

1. When a conductor is allowed to move in a magnetic field, a voltage is induced in the conductor.
2. When a current-carrying conductor is placed in a magnetic field, then a mechanical force is experienced by the conductor.

Conservation of energy

According to the principle of conservation of energy, energy can neither be created nor be destroyed it can only be transformed from one state to another.

In an energy conversion device, the total input energy is equal to the sum of the following three components:

Thus, with an electromechanical conversion device, the energy balance equation can be written as

$$\begin{bmatrix}\text{Electrical}\\ \text{energy}\\ \text{input}\end{bmatrix} = \begin{bmatrix}\text{Energy to}\\ \text{electrical}\\ \text{losses}\end{bmatrix} = \begin{bmatrix}\text{Energy to field}\\ \text{storage in the}\\ \text{electrical system}\end{bmatrix} = \begin{bmatrix}\text{Mechanical}\\ \text{energy}\\ \text{output}\end{bmatrix}$$

The above equation is for motor action. For generator action, the energy balance equation is written as

$$\begin{bmatrix}\text{Total mechanical}\\ \text{energy input}\end{bmatrix} = \begin{bmatrix}\text{Electrical energy}\\ \text{output}\end{bmatrix} + \begin{bmatrix}\text{Total energy}\\ \text{stored}\end{bmatrix} + \begin{bmatrix}\text{Total energy}\\ \text{dissipated}\end{bmatrix}$$

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Electrical Skills

Session: 2020-21 (Winter Semester)

B. Voc. Program, V Semester,

1st In-Sem. Examination

Course Code: ELE1505 **Time: 1 Hour**

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

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

Section – A

05X01 = 05 Marks

1. _____accepts signals from sensors or buttons and convert signal into a logic signal: -
   (a) Output module (b) Input module
   (c) Input & Output module (d) None of these
2. The full form of STI instruction is: -
   (a) Selectable timed interrupt (b) Selectable temporary interrupt
   (c) Suitable timed interrupt (d) None of these
3. The JSR instruction is an _____ instruction: -
   (a) Input (b) temporary
   (c) Output (d) None of these
4. The first instruction in the subroutine file is: -
   (a) SBR (b) JSR
   (c) RET (d) None of these
5. The programming used in PLC is: -
   (a) Ladder logic programing (b) C-programing
   (c) JAVA (d) None of these

Section – B

03X02 = 06 Marks

1. Explain the Architecture of PLC.
2. Explain the following evolution stages.
   (a) Manual Controlling (b) Pneumatic Controlling
   (c) Hard wire Controlling (d) Logic Gate Controlling
3. Explain the JMP instruction with the help of ladder logic program.

Section – C

03X03 = 09 Marks

1. Discuss the need and role of Automation in industries.
2. Explain the subroutine function using JSR, SBR & RET instructions.
3. Make a PLC program to change the preset value of timer using move instruction.

Answers Key

Course Code: ELE1505, Course Name: Advance Automation and Control
School of Electrical Skills, Session: 2020-21 (Winter Semester)
B. Voc. Program, Vth Semester, 1st In-Sem. Examination

Section – A

05X01 = 05 Marks

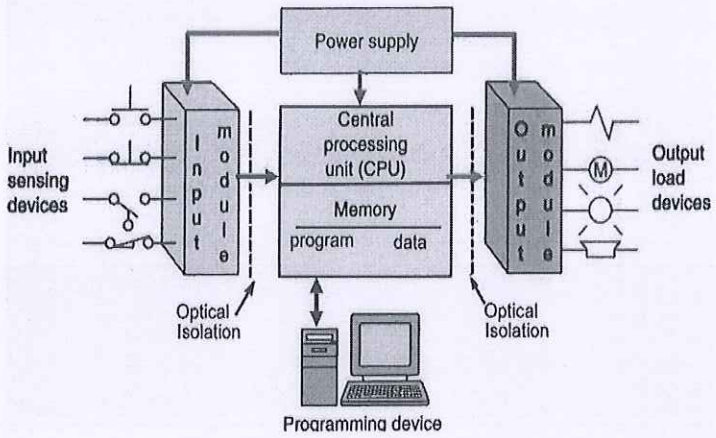
1. _____accepts signals from sensors or buttons and convert signal into a logic signal: -
   (b) Input module
2. The full form of STI instruction is: -
   (a) Selectable timed interrupt
3. The JSR instruction is an _____ instruction: -
   (c) Output
4. The first instruction in the subroutine file is: -
   (a) SBR
5. The programming used in PLC is: -
   (a) Ladder logic programing

Section – B

03X02 = 06 Marks

Q.1 Explain the Architecture of PLC.

Ans. **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.

Q.2 Explain the following evolution stages.

(a) Manual Controlling **(b) Pneumatic Controlling**

(c) Hard wire Controlling **(d) Logic Gate Controlling**

Ans.

(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).

(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.

Q3. Explain the JMP instruction with the help of ladder logic program.

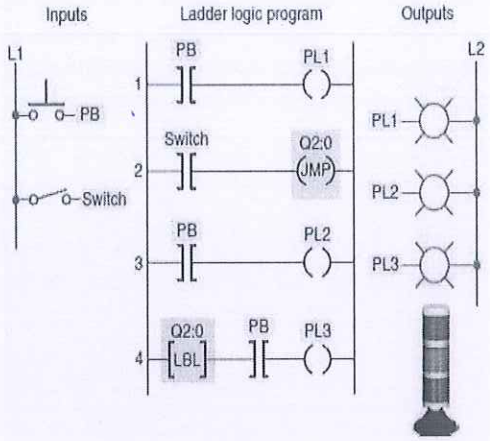
Ans. Jump Instruction

When the jump instruction is used, the PLC will not execute the instructions of a rung that is jumped. The jump instruction is often used to jump over instructions not pertinent to the machine's operation at that instant. In addition, sections of a program may be programmed to be jumped should a production

fault occur. Some manufacturers provide a skip instruction, which is essentially the same as the jump instruction.

Answers Key

Course Code: ELE1505, Course Name: Advance Automation and Control
School of Electrical Skills, Session: 2020-21 (Winter Semester)
B. Voc. Program, Vth Semester, 1st In-Sem. Examination



Jump (JMP) operation.

The operation of the program can be summarized as follows:

- When the switch is open the jump instruction is not activated.
- With the switch open, closing PB turns on all three pilot lights.
- When the switch is closed the jump (JMP) instruction will activate.
- With the switch closed, pressing PB turns on pilot lights PL1 and PL3 only.
- Rung 3 is skipped over during the PLC program scan so PL2 is not turned on.

Section – C

03X03 = 09 Marks

Q1. Explain the need and role of Automation.

Ans. Need and role of automation

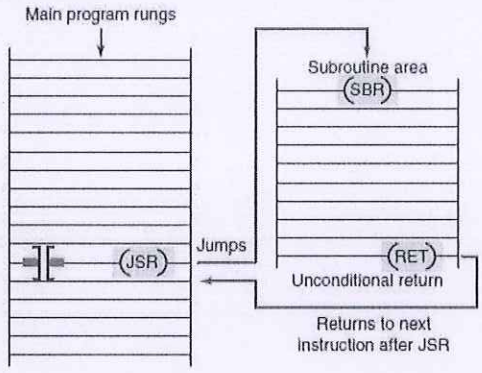
1. **Reduce Worker Fatigue and Effort or Labour Intensive Operation:** Typically, humans dislike banal, repetitive tasks. However, computer systems perform them without complaint.
2. **Prevent Products or Materials from Being Damaged or Destroyed:** Humans make mistakes when they fatigue. This embodies 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.

Q.2 Explain the subroutine function using JSR, SBR & RET instructions.

Ans. Subroutine Functions

When a subroutine is called from the main program, the program is able to escape from the main program and *go to* a program *subroutine* to perform certain functions and *then return* to the main program. In situations in which a machine has a portion of its cycle that must be repeated several times during one machine cycle, the subroutine can save a great deal of duplicate programming.



Main program with a call from a subroutine.

Jump to Subroutine (JSR) —The JSR instruction is an output instruction that causes the scan to jump to the program fi le designated in the instruction. It is the only parameter entered in the instruction. When rung conditions are true for this output instruction, it causes the processor to jump to the targeted subroutine file. Each subroutine must have a unique file number.

Subroutine (SBR) —The SBR instruction is the first input instruction on the first rung in the subroutine file. It serves as an identifier that the program file is a subroutine. This file number is used in the JSR instruction to identify the target to which the program should jump. It is always true, and although its use is optional, it is still recommended.

Return (RET) —The RET instruction is an output instruction that marks the end of the subroutine file. It causes the scan to return to the main program at the instruction following

the JSR instruction where it exited the program. The scan returns from the end of the file if there is no RET instruction. The rung containing the RET instruction may be conditional if this rung precedes the end of the subroutine. In this way, the processor omits the balance of a subroutine only if its rung condition is true.

Q.3 Make a PLC program to change the preset value of timer using move instruction.

Ans.

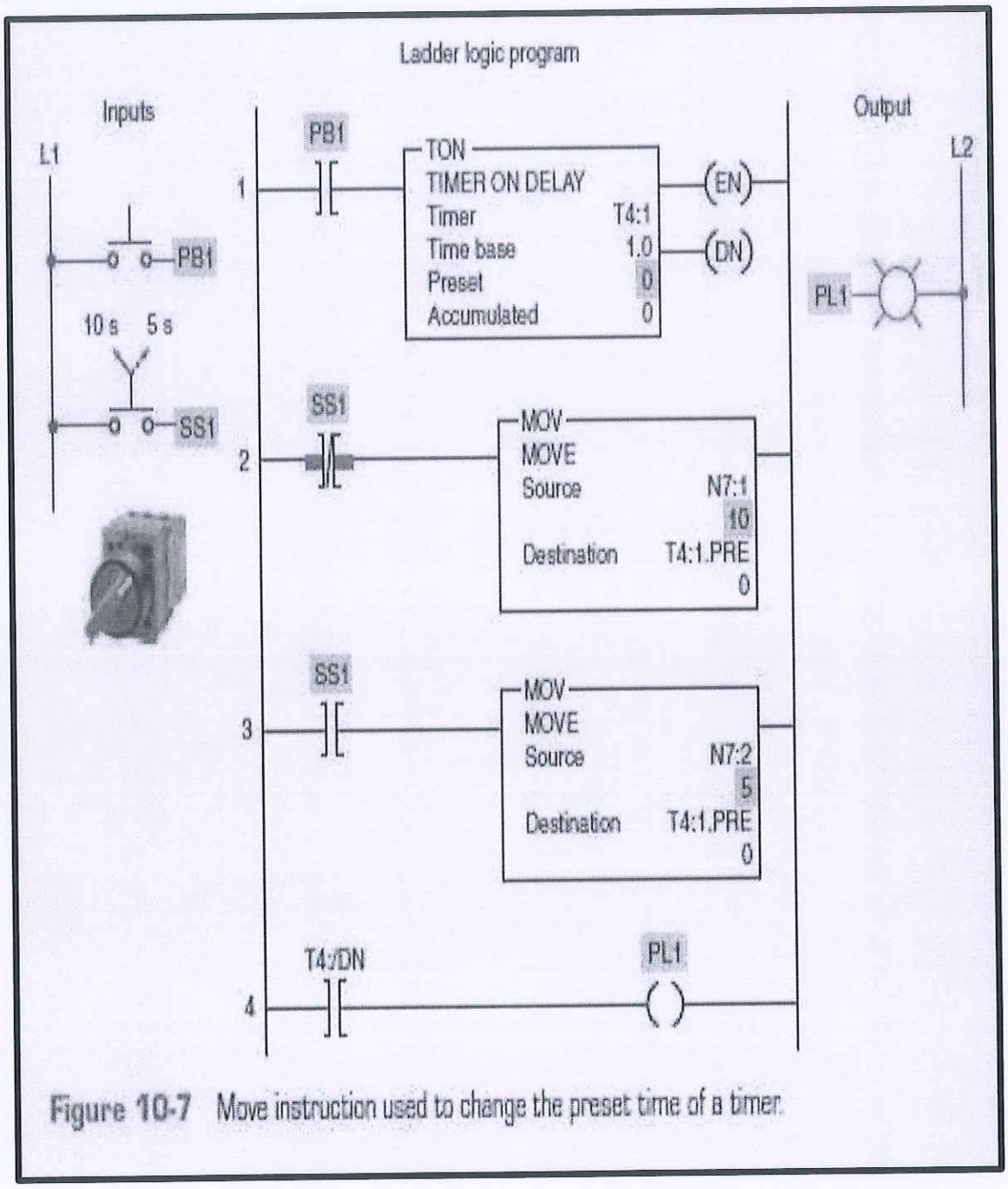


Figure 10-7 Move instruction used to change the preset time of a timer.