

THEORY 1 <sup>ST</sup> - IN-SEM EXAMINATION			
SESSION: 2022-23(SUMMER SEMESTER)			
<b>B.Voc</b>	<b>Semester</b>	5 <sup>th</sup>	
<b>Course name</b>	Fundamentals of Power Electronics		
<b>Course code</b>	ELE1501		
<b>Date</b>			
<b>Name of the Student</b>		<b>Reg. No.</b>	

INSTRUCTIONS
<ul style="list-style-type: none"> <li>• Maximum Marks: <b>20</b></li> <li>• Duration of Examination: <b>01 Hour</b></li> <li>• Attempt all questions.</li> </ul>

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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- Diode allows electric current when it is:
  - forward biased
  - reverse biased
  - open-circuited
  - none of these
- The n-region has a greater concentration of \_\_\_\_\_ as compared to the p-region in a p-n junction.
  - Holes
  - Electrons
  - Both (a) & (b)
  - Phonons
- The cut in voltage of Si diode is:
  - 0.2 V
  - 0.7 V
  - 0.8 V
  - 1.0 V
- Which of the below-mentioned statements is false regarding a p-n junction diode?
  - Diode are uncontrolled devices
  - Diodes are rectifying devices
  - Diodes are unidirectional devices
  - Diodes have three terminals
- The knee voltage (cut in voltage) of the Ge diode is:
  - 0.3 V
  - 0.7 V
  - 0.8 V
  - 1.0 V

<b>2. Section B</b> (03 short answer type questions, each question carries 02 marks)	<b>03×02 = 06</b>
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- Define the term Power Electronics.
- What is a potential barrier in a p-n junction diode?
- What are the applications of power electronics?

<b>3. Section C</b> (03 long type questions, each question carries 03 marks)	<b>03×03 = 09</b>
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- What are the advantages and disadvantages of a power electronic converter?
- With a neat diagram explain the concept of a power electronic controller.
- A forward potential of 10V is applied to a p-n junction diode. A resistance of 1KΩ is also in series with the diode. Determine the value of the current.

*Richa*



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<b>SESSION: 2022-23(SUMMER SEMESTER)</b>		
<b>B.Voc</b>	<b>Semester</b>	5 <sup>th</sup>
<b>Course name</b>	Fundamentals of Power Electronics	
<b>Course code</b>	ELE1501	

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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1. Diode allows electric current when it is:  
Ans: (a) forward biased
2. The n-region has a greater concentration of \_\_\_\_\_ as compared to the p-region in a p-n junction.  
Ans: (b) Electrons
3. The cut in voltage of Si diode is:  
Ans: (b) 0.7 V
4. Which of the below-mentioned statements is false regarding a p-n junction diode?  
Ans: (d) Diodes have three terminals
5. The knee voltage (cut in voltage) of the Ge diode is:  
Ans: (a) 0.3 V

<b>2. Section B</b> (03 short answer type questions, each question carries 02 marks)	<b>03×02 = 06</b>
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1. Define the term Power Electronics.  
Ans: Power electronics can be defined as the use of electronic devices to control and convert electric power. Therefore, every application of power electronics involves some aspect of control.
2. What is a potential barrier in a p-n junction diode?  
Ans: The potential difference required for the electrons to be passed across the electric field is called the potential barrier. The barrier potential of a P-N junction depends on the type of material, amount of doping and temperature of the semiconductor. For silicon it is about 0.7V, for germanium, it is about 0.3V.
3. What are the applications of power electronics?  
Ans: A whole lot of power electronics applications that we use in our daily life, such as a fan regulator, air-conditioning, induction cooking, light dimmer, emergency lights, vacuum cleaners, personal computers, UPS, battery charges, etc., are the major applications of power electronics.

<b>3. Section C</b> (03 long type questions, each question carries 03 marks)	<b>03×03 = 09</b>
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1. What are the advantages and disadvantages of a power electronic converter?  
Ans: The advantages and disadvantages of power electronics converters are as follows:

- ❖ Advantages of power electronic converter :
  - a. Long life
  - b. Small size
  - c. High efficiency because of loss is low in power semiconductor devices
  - d. High reliability of power-electronic converter system
  - e. Less maintenance due to the absence of any moving part

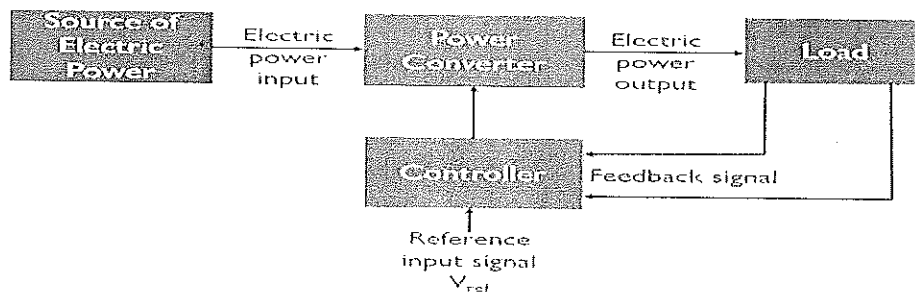
- ❖ Disadvantages of power electronic converter :
  - a. Complexed design
  - b. Regeneration of power is difficult in power electronic systems
  - c. AC to DC and AC converters operate at a low input power factor under certain operating conditions. In order to avoid a low pf, some special measures have to be adopted
  - d. Power electronic controllers have low overload capacity. As such, Increase the cost of power electronic controller
  - e. Power electronic converter circuits have a tendency to generate harmonics in the supply system as well as in the load circuit

2. With a neat diagram explain the concept of a power electronic controller.

Ans:

The processing or converting of electric power is achieved through a power electronics converter also known as **power converters** or **switching converters**.

The figure below represents the block diagram of a power electronics-based system:



**Block Diagram of Power Electronics based system**

As it is clear from the above figure that here we are having a power electronics converter and controller along with some interfacing units. The power converters change one form of electric power into some other form with the use of a power semiconductor device. While power controllers are the ones that are responsible for producing control signals relative to turning on or off of the switching devices present within the circuit. The complete operation of the system will provide the desired signal of a particular frequency as shown in the block diagram given above.

3. A forward potential of 10V is applied to a p-n junction diode. A resistance of 1KΩ is also in series with the diode. Determine the value of the current.

Ans:

Given the diode is a non-ideal Si diode so it has a knee voltage of 0.7 V, and a forward voltage of 10 V is applied.

The ideal diode in forward bias acts as a short circuit.



The current through the series resistor  $I = \frac{10-0.7}{1k\Omega} = 9.3 \text{ mA}$

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SESSION: 2022-23(SUMMER SEMESTER)			
<b>B.Voc</b>	<b>Semester</b>	5 <sup>th</sup>	
<b>Course name</b>	Substation Practices and Supervision		
<b>Course code</b>	ELE 1502		
<b>Date</b>			
<b>Name of the Student</b>		<b>Reg. No.</b>	

INSTRUCTIONS
<ul style="list-style-type: none"> <li>• Maximum Marks: <b>20</b></li> <li>• Duration of Examination: <b>01 Hour</b></li> <li>• Attempt all questions.</li> </ul>

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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- Pole mounted sub stations are used for..... distribution
  - Primary
  - Secondary
  - Both A and B
  - None of the above
- For cost and safety the outdoor substations are installed for voltages above
  - 11 KV
  - 33 KV
  - 66 KV
  - 132 KV
- Which of the following quantity is/ are change in sub stations?
  - Voltage
  - AC to DC
  - frequency
  - all of the above
- Classification of substation can be
  - according to service requirement
  - According to constructional features
  - Both A and B
  - neither A nor B
- A substations in a power system used for changing voltage level is known as
  - Transformer substation
  - potential transformer
  - Protection transformer
  - none of the above

<b>2. Section B</b> (03 short answer type questions, each question carries 02 marks)	<b>03×02 = 06</b>
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- What are the functions of a substation?
- Draw the key diagram for 33 kV substation.
- What do you mean by indoor and outdoor substations?

<b>3. Section C</b> (03 long type questions, each question carries 03 marks)	<b>03×03 = 09</b>
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- What is substation? Classify the substations according to the operating voltages and importance features.
- How jumpering of conductors is done?
- What are the advantages and disadvantages of Outdoor Substations Over Indoor Substations?

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THEORY 1 <sup>st</sup> - IN-SEM EXAMINATION		
SESSION: 2022-23(SUMMER SEMESTER)		
B.Voc	Semester	5 <sup>th</sup>
Course name / Module	Substation Practices and Supervision	
Course code	ELE 1502	

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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- Pole mounted sub stations are used for..... distribution
  - Primary
  - Secondary
  - Both A and B
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- For cost and safety the outdoor substations are installed for voltages above
  - 11 KV
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  - 132 KV
- Which of the following quantity is/ are change in sub stations?
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  - neither A nor B
- A substations in a power system used for changing voltage level is known as
  - Transformer substation
  - potential transformer
  - Protection transformer
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<b>2. Section B</b> (03 short answer type questions, each question carries 02 marks)	<b>03×02 = 06</b>
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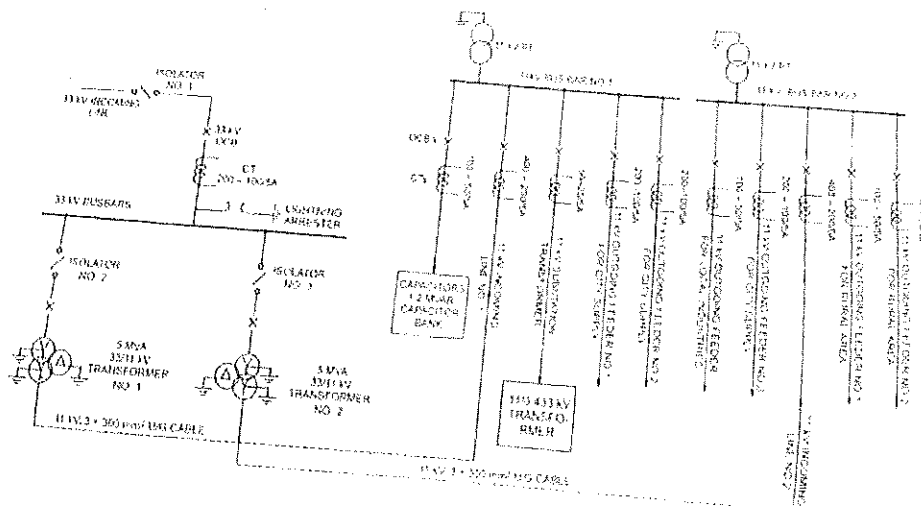
- What are the functions of a substation?

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.

- Draw the key diagram for 33 kV substation.

Ans:



3. What do you mean by indoor and outdoor substations?

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.

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.

3. Section C (03 long type questions, each question carries 03 marks) 03x03 = 09

1. What is substation? Classify the substations according to the operating voltages and importance 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 provides 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 are distributed, controlled and protected

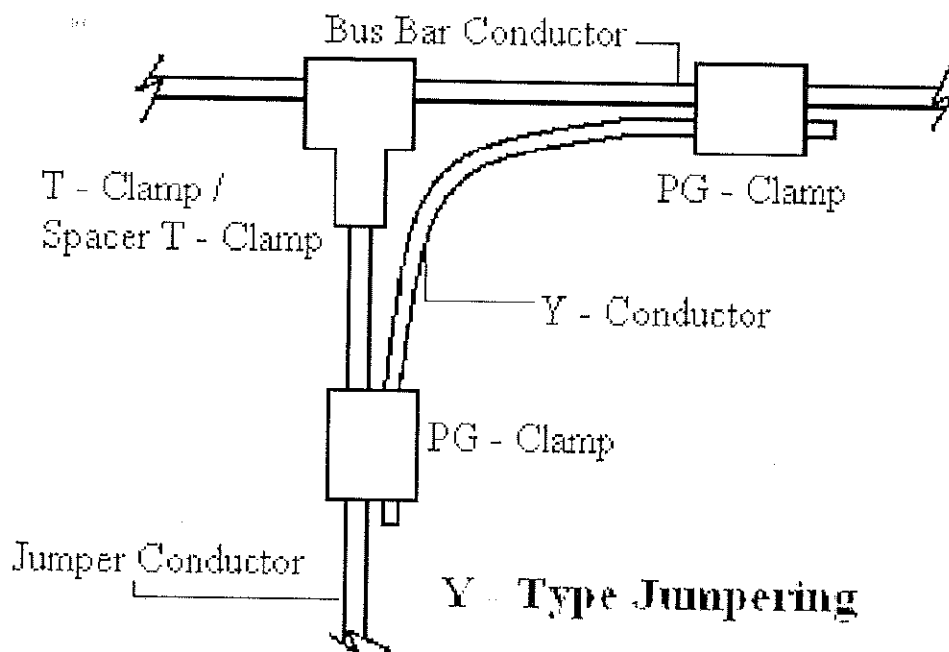
**Classification of Substation on the basis of operating voltage:** The substations, according to operating voltage, may be categorized as

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. How jumpering of conductors is done?

Ans: The jumpers connecting different sections of the bus bars as well as those connecting equipment to bus bars shall be of Y-type. A typical diagram of Y-type jumpering is given below.



For making Y-type jumpers, the jumper conductor (s) shall be first connected to the bus bar conductor (s) using T-Clamp/Spacer T-Clamp which is suitable for clamping the respective conductors, i.e., bus bar conductor (s) and the jumper conductor (s). Thereafter, the bus bar conductor (s) shall be again connected with the jumper conductor(s) using properly curved & shaped Y-conductor (s) and 2 nos. PG-clamps as shown in the diagram above. The jumpering between equipment shall be done with single/twin/quadruple conductors as per the terminal connectors provided on the equipment. In case of jumpers for twin and quadruple conductors, the spacers shall also be fitted at a suitable spacing on the jumpers in order to maintain their shape.

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.**

THEORY 1 <sup>st</sup> - IN-SEM EXAMINATION		
SESSION: 2022-23 (SUMMER SEMESTER)		
<b>B.Voc</b>	<b>Semester</b>	5 <sup>th</sup>
<b>Course name</b>	Advance Automation And Control	
<b>Course code</b>	ELE 1505	
<b>Date</b>		
<b>Name of the Student</b>		<b>Reg. No.</b>

INSTRUCTIONS
<ul style="list-style-type: none"> <li>• Maximum Marks: <b>20</b></li> <li>• Duration of Examination: <b>01 Hour</b></li> <li>• Attempt all questions.</li> </ul>

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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- \_\_\_\_\_ is used to develop, download and upload the ladder logic program into the processor of PLC.
  - Programing device
  - Input module
  - Output module
  - None of these
- Program control instruction is: -
  - JMP
  - MCR
  - TND
  - All of these
- In the \_\_\_\_\_ we use the hydraulic and liquid pressure for control the process.
  - Hard wired controlling
  - Pneumatic controlling
  - Logic gate controlling
  - None of these
- JSR is \_\_\_\_\_ instruction.
  - Input
  - Output
- The first instruction of the subroutine file is: -
  - JSR
  - SBR
  - RET
  - None of these

<b>2. Section B</b> (03 short answer type questions, each question carries 02 marks)	<b>03×02 = 06</b>
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- Write short note on temporary end (TND) instruction.
- What are the data compare instructions. ?
- Write short note on forcing external input and output address in PLC.

<b>3. Section C</b> (03 long type questions, each question carries 03 marks)	<b>03×03 = 09</b>
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- Explain the subroutine functions (JSR, SBR, RET) using ladder logic program.
- Explain the MCR instruction with ladder logic program.
- What are the data transfer instruction. Explain the MOV instruction with PLC program.



THEORY 1 <sup>st</sup> - IN-SEM EXAMINATION		
SESSION: 2022-23 (SUMMER SEMESTER)		
B.Voc	Semester	5 <sup>th</sup>
Course name	Advance Automation And Control	
Course code	ELE 1505	

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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- \_\_\_\_\_ is used to develop, download and upload the ladder logic program into the processor of PLC.  
(a) Programing device
- Program control instruction is: -  
(d) All of these
- In the \_\_\_\_\_ we use the hydraulic and liquid pressure for control the process.  
(b) Pneumatic controlling
- JSR is \_\_\_\_\_ instruction.  
(b) Output
- The first instruction of the subroutine file is: -  
(b) SBR

<b>2. Section B</b> (03 short answer type questions, each question carries 02 marks)	<b>03×02 = 06</b>
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**1. Write short note on temporary end (TND) instruction.**

**Ans.** The *temporary end (TND)* instruction is an output instruction used to progressively debug a program or conditionally omit the balance of your current program file or subroutines. When rung conditions are true, this instruction stops the program scan, updates the I/O, and resumes scanning at rung 0 of the main program file.

**2. What are the data compare instructions.**

**Ans.** These instructions compare the data stored in two or more words (or registers) and make decisions based on the program instructions. Numeric values in two words of memory can be compared for each of the basic data compare instructions shown in Figure 10-19, depending on the PLC. Actually the accumulated numeric data in one memory word was compared to the preset value of another memory word on each scan of the processor. When the processor saw that the accumulated value was equal to the preset value, it switched the output on or off. Comparison instructions are used to test pairs of values to determine if a rung is true.

Name	Symbol
Equal to	(=)
Not equal to	(≠)
Less than	(<)
Greater than	(>)
Less than or equal to	(≤)
Greater than or equal to	(≥)

**3. Write short note on forcing external input and output address in PLC.**

**Ans.** The force function is essentially a manual override control function. Forcing allows the PLC user to turn an external input or output on or off from the keyboard of the programming device. This is accomplished regardless of the actual state of the field device. The forcing capability allows a machine or process to continue operation until a faulty field device can be repaired. It is also valuable during start-up and troubleshooting of a machine or process to simulate the action of portions of the program that have not yet been implemented.

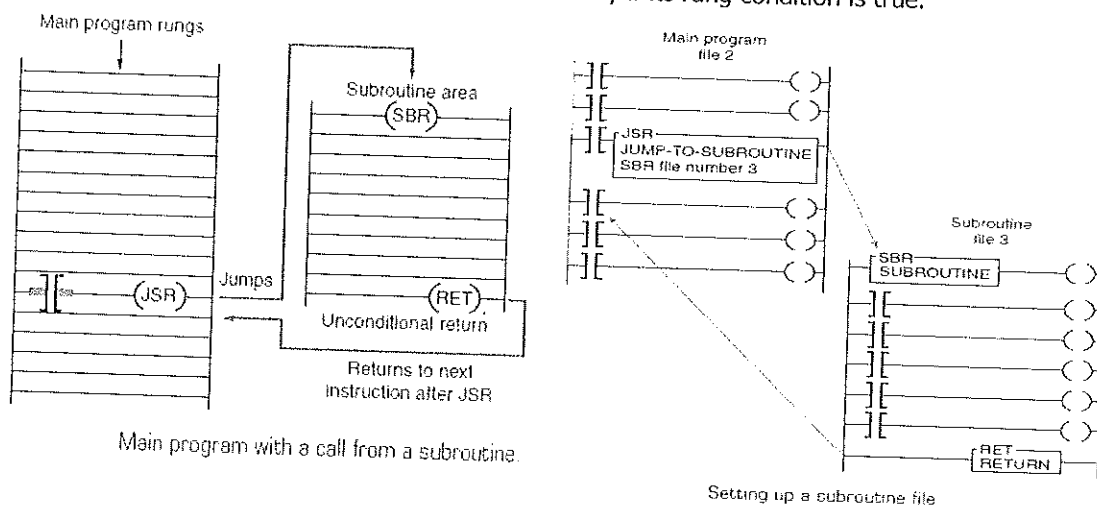
3. Section C (03 long type questions, each question carries 03 marks)	03×03 = 09
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**1. Explain the subroutine functions (JSR, SBR, RET) using ladder logic program.**

**Ans. Jump to Subroutine (JSR)** —The JSR instruction is an output instruction that causes the scan to jump to the program file 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.



**2. Explain the MCR instruction with ladder logic program.**

**Ans.** The operation of the program can be summarized as follows:

When the MCR instruction is false, or de-energized, all non-retentive (non-latched) rungs below the MCR will be de-energized even if the programmed logic for each rung is true.

- All *retentive* rungs will remain in their *last state*.
- The MCR instruction establishes a zone in the user program in which all non-retentive outputs can be turned off simultaneously.
- *Retentive* instructions should not normally be placed within an MCR zone because the MCR zone maintains retentive instructions in the last active state when the instruction goes false.
- An off-delay timer will start timing when in a de-energized MCR zone.

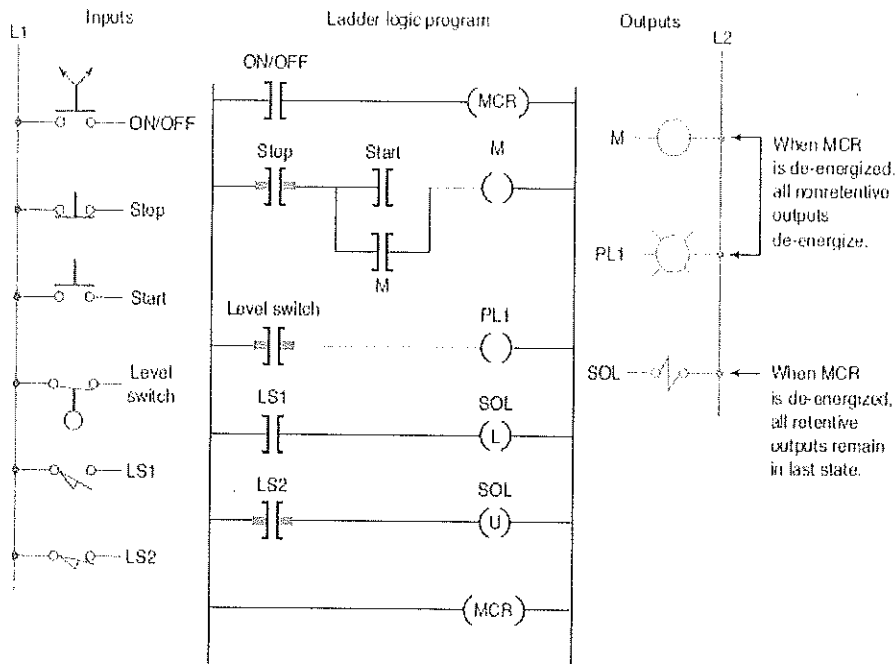


Figure 9-3 Master Control Reset (MCR) instruction.

**3. What are the data transfer instruction. Explain the MOV instruction with PLC program.**

**Ans.** Figure 10-4 shows an example of the MOV instruction. The operation of the program can be summarized as follows:

- When the rung is true, input switch A closed, the value stored at the source address, N7:30, is copied into the destination address, N7:20.
- When the rung goes false, input switch A opened, the destination address will retain the value unless it is changed elsewhere in the program.
- The source value remains unchanged and no data conversion occurs.

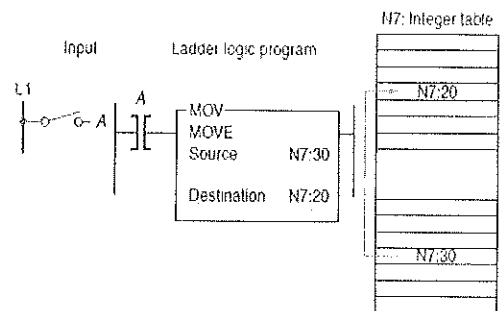


Figure 10-4 SLC 500 block-formatted move instruction.

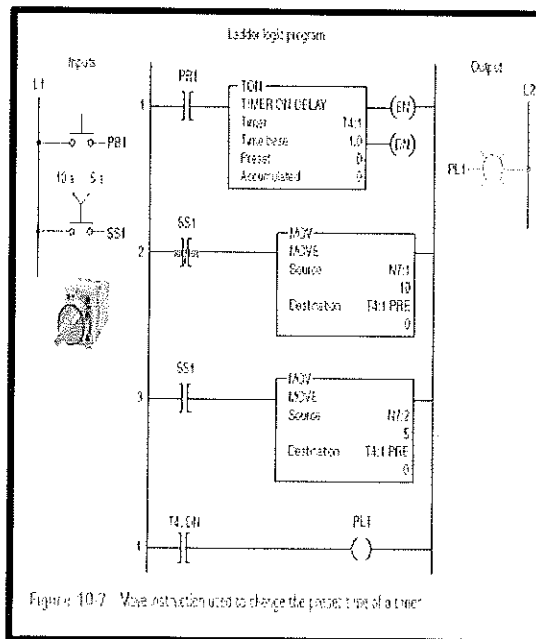


Figure 10-7 Move instruction used to change the preset time of a timer



THEORY 1 <sup>st</sup> - IN-SEM EXAMINATION			
SESSION: 2022-23(SUMMER SEMESTER)			
B.Voc	Semester	5th	
Course name	Electrical Machine II		
Course code	ELE1506		
Date			
Name of the Student		Reg. No.	

INSTRUCTIONS
<ul style="list-style-type: none"> <li>Maximum Marks: <b>20</b></li> <li>Duration of Examination: <b>01 Hour</b></li> <li>Attempt all questions.</li> </ul>

<b>1. Section A</b> (05 objective type questions, each question carries 01 mark)	<b>05×1 = 05</b>
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- Generator is a machine which converts
  - Electrical to mechanical
  - Mechanical to electrical
  - Both a & b
  - None of these
- Which machine converts electrical energy to mechanical energy
  - Motor
  - Generator
  - Alternator
  - All of these
- Which motor is used most widely
  - Synchronous motor
  - Induction Motor
  - DC Motor
  - All of these
- Which generator is mostly used for electrical energy generation
  - Synchronous Generator
  - Induction generator
  - DC Generator
  - All of these
- Every generator can operate as a motor and vice versa
  - True
  - False

<b>a) Section B</b> (03 short answer type questions, each question carries 02 marks)	<b>03×02 = 06</b>
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- Define Electrical Machines and also discuss how they classify.
- Define EMF and MMF.
- Write in brief about energy conversion.

<b>b) Section C</b> (03 long type questions, each question carries 03 marks)	<b>03×03 = 09</b>
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- Write the difference between concentrated winding and distributed windings.
- Write the classification of AC machines.
- Derive the EMF equation.

*Rishi Pathi*





4)	Slot in the armature is equal to the number of poles	A number of poles is not equal to a number of slots.
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2. Write the classification of AC machines.

Ans:

A. Synchronous Machine

- Synchronous Generator (Alternator):

A primary source of energy. An alternator is an electrical generator that converts mechanical energy to electrical energy in the form of alternating current. For reasons of cost and simplicity, most alternators use a rotating magnetic field with a stationary armature. Occasionally, a linear alternator or a rotating armature with a stationary magnetic field is used. In principle, any AC electrical generator can be called an alternator, but usually the term refers to small rotating machines driven by automotive and other internal combustion engines

- Synchronous Motor:

Used as motors as well as power factor compensators (synchronous condensers). A synchronous motor (short for synchronous electric motor) is an AC motor where the rotation of the rotor (or shaft) is synchronized with the frequency of the supply current. That is, the rotation period of the rotor is equal to the rotation field of the machine it is inside of.

B. Asynchronous (Induction) Machine

- Induction Motor:

Most widely used electrical motors in both domestic and industrial applications. An **induction motor** (also known as an **asynchronous motor**) is a commonly used AC electric motor. In an induction motor, the electrical current in the rotor needed to produce torque is obtained via electromagnetism induction from the rotating magnetic field of the stator winding. The rotor of an induction motor can be a squirrel cage rotor or wound type rotor.

- Induction Generator:

Due to lack of a separate field excitation, these machines are rarely used as generators. An induction generator or asynchronous generator is a type of alternating current (AC) electrical generator that uses the principles of induction motors to produce electric power. Induction generators operate by mechanically turning their rotors faster than synchronous speed. A regular AC induction motor usually can be used as a generator, without any internal modifications. Because they can recover energy with relatively simple controls, induction generators are useful in applications such as mini hydro power plants, wind turbines, or in reducing high-pressure gas streams to lower pressure.

3. Derive the EMF equation?

Ans:

**EMF Equation (Electric machine theory)**

- A wire loop is placed in magnetic field
- $N$  is the number of turns in the loop
- $l$  is length of loop
- $D$  is width of the loop
- $B$  is magnetic flux density
- $\omega$  is number of revolutions per second
- A wire loop is placed in a magnetic field
- The magnetic flux through the loop changes by the position.

$$\phi(t) = B D l \cos(\omega t)$$

$$\omega = 2\pi f$$

$$e(t) = -N \frac{d\phi(t)}{dt}$$

$$e(t) = N B D l \frac{d(\cos \omega t)}{dt}$$

$$e(t) = N B D l \omega \sin(\omega t)$$

- The induce voltage is an ac voltage
- The voltage is sinusoidal
- The rms value of the induced voltage loop is

$$E_{rms} = \frac{E_{max}}{\sqrt{2}}$$

$$E = \frac{E_{max}}{\sqrt{2}} \quad \text{where } E_{max} = \omega N B l \phi = 2\pi f N B l \phi$$

$$\therefore E = \frac{E_{max}}{\sqrt{2}} = \sqrt{2} \pi f \phi = 4.44 F N B l \phi$$