BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Electrical Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, 5th Semester,

1st In-Sem. Examination

Course Code: ELE1501 **Time: 1 Hour**

Course Name: Fundamentals of Power Electronics **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. Full form of the BJT is: -
   (A) Bipolar Junction Transformer (B) Bipolar Jump Transistor
   (C) Bipolar Junction Transistor (D) None of these
2. Full form of the SCR is: -
   (A) Serial Controlled Rectifier (B) Silicon Controlled Rectifier
   (C) Serial Controlled Relay (D) None of these
3. _____ converts constant to variable DC or variable DC to constant DC: -
   (A) Rectifier (B) Inverter
   (C) Chopper (D) Cycloconverter
4. Buck converter is used to _____ DC supply: -
   (A) Step up (B) Step Down
   (C) Both (A) & (B) (D) None of these
5. The efficiency of full wave rectifier is: -
   (A) 25% (B) 81%
   (C) 51% (D) 95%

Section – B

03X02 = 06 Marks

1. Explain the power electronics converter with the help of block diagram.
2. What are the various applications of power electronics?
3. Describe the following components with their symbols: -
   (A) SCR (B) TRIAC

Section – C

03X03 = 09 Marks

1. Explain the single phase half wave rectifier with the help of diagram.
2. Explain the Buck converter and its operation.
3. If the switching square wave has a period of 10μs, the input voltage is 9V and the ON time is half of the periodic time, i.e. 5μs, then what will be the output voltage of the boost converter?

for Registrar
21/10/20

A

Answers Key – Set A

Course Code: ELE1501

Course Name: Fundamentals of power electronics

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

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

Section A

1. Full form of the BJT is: -

   (C). Bipolar Junction Transistor
2. Full form of the SCR is: -

   (B) Silicon Controlled Rectifier
3. _____ converts constant to variable DC or variable DC to constant DC: -

   (C) Chopper
4. Buck converter is used to _____ DC supply: -

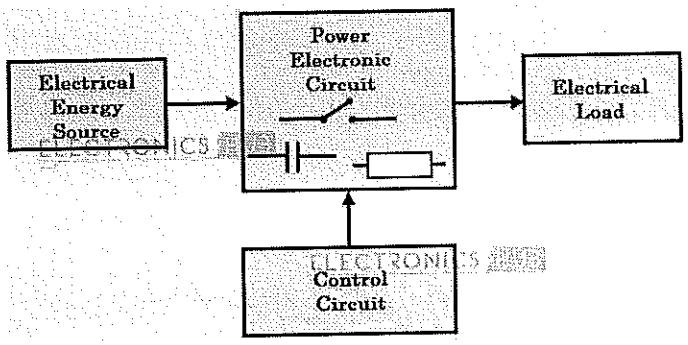
   (B) Step Down
5. The efficiency of full wave rectifier is: -

   (B) 81%

Section B

Ans.1 Block Diagram of power electronic Converters

- The block diagram of a power electronic converter is shown in figure. It consists of an electrical energy source, power electronic circuit, a control circuit and an electric load. This converter changes one form of electrical energy to other form of electrical energy.



- The power electronic circuit consists of both power part and control part. Power part transfers the energy from source to load and it consists of power electronic switches (SCR or TRIAC), transformers, electric choke, capacitors, fuses and sometimes resistors.
- The control circuit or block regulates the elements in the power part of the converter. This block is built with a complex low power electronic circuit that consists of either analog or digital circuit assembly.

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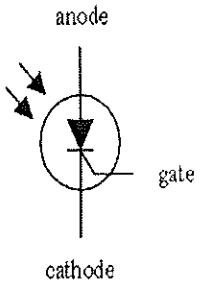
- Power electronic converters perform various basic power conversion functions. This converter is a single power conversion stage that can perform any of the functions in AC and DC power conversion systems.

Ans.2 Applications of Power Electronics

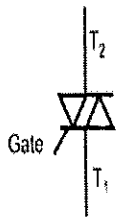
- Industrial
- Transportation
- Utility systems
- Power supplies for all kinds of electronic equipment
- Residential and home appliances
- Space technology
- Other applications

Ans.3 (A) SCR: Silicon Controlled Rectifier



It has three terminals namely Anode (A), cathode(K) and Gate(G).
When the Anode terminal is positive with respect to cathode (K) terminal device is in forward blocking mode. Now if the voltage is applied to the gate terminal with respect to the cathode, the device will start to conduct. As the name indicates it is made up of silicon. It works as a rectifier. Its operation as a rectifier is controllable.

Ans.3 (B) TRIAC: Triode for Alternating Current

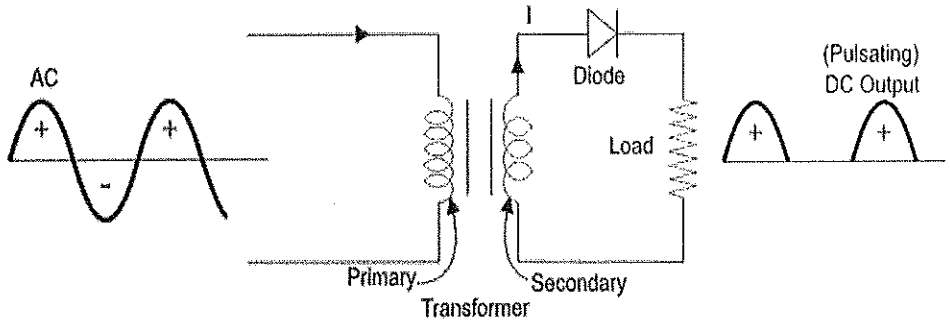


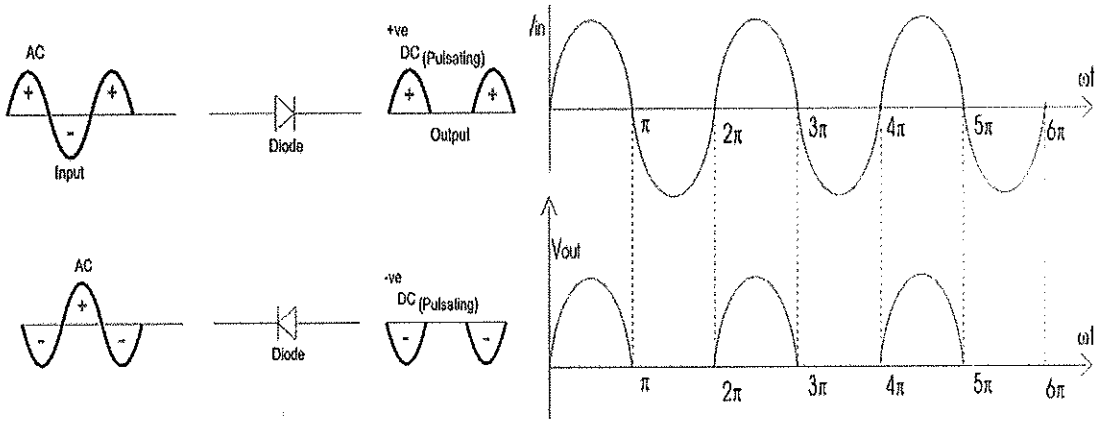
It is a five layer device. It has three terminals namely Terminal-1, Terminal-2 and gate.

Section C

Ans.1 Single phase half-wave rectifier

- The half wave rectifier is a type of rectifier that rectifies only half cycle of the waveform. The half rectifier consists a step down transformer, a diode connected to the transformer and a load resistance connected to the cathode end of the diode.
- The circuit diagram of half wave transformer is shown below:





- The main supply voltage is given to the transformer which will increase or decrease the voltage and give to the diode. In most of the cases we will decrease the supply voltage by using the step down transformer here also the output of the step down transformer will be in AC. This decreased AC voltage is given to the diode which is connected serial to the secondary winding of the transformer, diode is electronic component which will allow only the forward bias current and will not allow the reverse bias current. From the diode we will get the pulsating DC and give to the load resistance RL.

Working of Half Wave Rectifier:

- The input given to the rectifier will have both positive and negative cycles. The half rectifier will allow only the positive half cycles and omit the negative half cycles. So first we will see how half wave rectifier works in the positive half cycles.

Positive Half Cycle:

- In the positive half cycles when the input AC power is given to the primary winding of the step down transformer, we will get the decreased voltage at the secondary winding which is given to the diode.
- The diode will allow current flowing in clock wise direction from anode to cathode in the forward bias (diode conduction will take place in forward bias) which will generate only the positive half cycle of the AC.

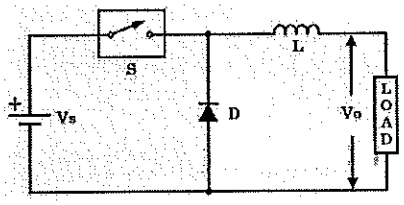
- The diode will eliminate the variations in the supply and give the pulsating DC voltage to the load resistance RL.

Negative Half Cycle:

- In the negative half cycle, the current will flow in the anti-clockwise direction and the diode will go in to the reverse bias. In the reverse bias the diode will not conduct so, no current in flown from anode to cathode, and we cannot get any power at the load resistance.
- Only small amount of reverse current is flown from the diode but this current is almost negligible. And voltage across the load resistance is also zero.

Ans.2 Step-down Chopper or Buck converter

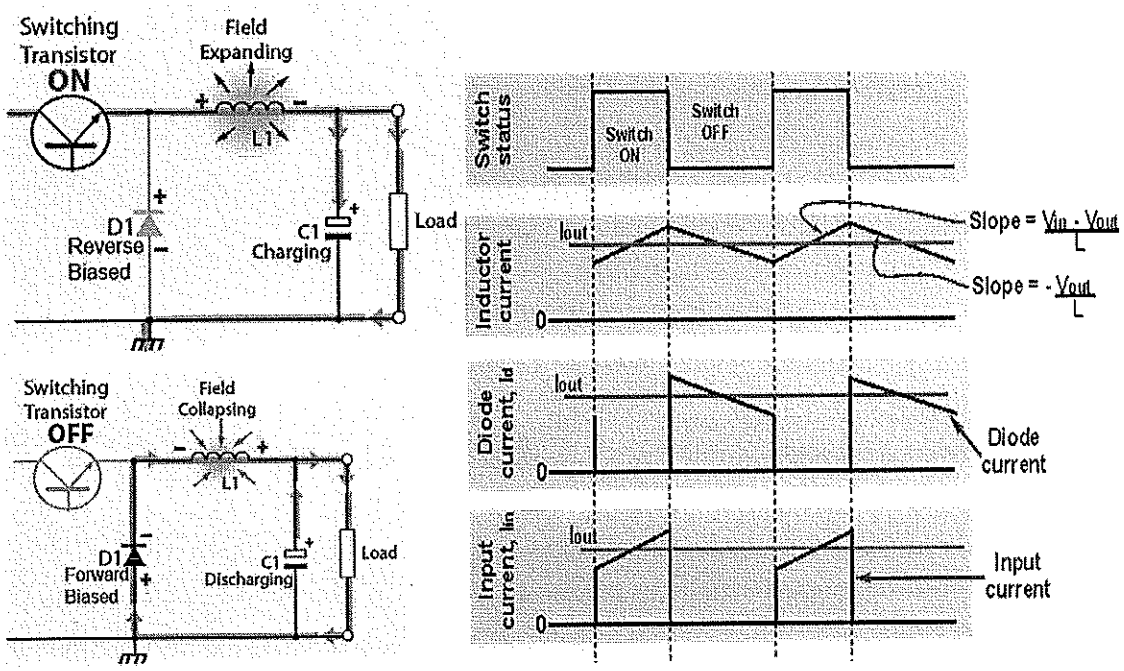
- A step-down chopper produces an average output voltage lower than the input DC voltage. The circuit for this converter is shown in figure below.
- Here the switching component is a thyristor that switches the input voltage to the load when it is triggered at particular instants.
- A diode acts as a freewheeling diode that allows the load current to flow through it when thyristor is turned OFF. If this diode is absent, a high induced EMF in inductance may cause damage to the switching device.



- The average output voltage of the converter is varied by controlling turn ON/OFF periods of thyristor. When thyristor is turned ON, the output voltage is same as the input voltage and if it is turned OFF, the output voltage is zero.
- The output voltage is equal to (TON / T) Vin. So, by controlling the duty ratio K = (TON / T), the output voltage will be increased.

Buck Converter Operation

- The buck Converter circuit consists of the switching transistor, together with the flywheel circuit (Dl, L1 and C1). While the transistor is on, current is flowing through the load via the inductor L1. The action of any inductor opposes changes in current flow and also acts as a store of energy. In this case the switching transistor output is prevented from increasing immediately to its peak value as the inductor stores energy taken from the increasing output; this stored energy is later released back into the circuit as a back e.m.f. as current from the switching transistor is rapidly switched off.



Ans.3 If the switching square wave has a period of 10µs, the input voltage is 9V and the ON is half of the periodic time, i.e. 5µs, then the output voltage will be:

$V_{OUT} = 9/(1- 0.5) = 9/0.5 = 18V$ (minus output diode voltage drop)

Because the output voltage is dependent on the duty cycle, it is important that this is accurately controlled.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.:.....

School of Electrical Skills

Session: 2020-21 (Summer 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 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. In order to improve the power factor ..... is employed in the substation.
   (a) Synchronous reactor (b) Series capacitors
   (c) Synchronous condenser (d) None of the above

2. In substation which of the device is a carrier communication device:
   (a) CVT (b) Earth conductor
   (c) Wave trap (d) Lightning arrestor

3. Which of the following device is employed in substation to limit the short circuit current in the power system?
   (a) Shunt condenser (b) Reactor
   (c) Series capacitor (d) Shunt capacitor

4. Which of the following busbar arrangement is generally employed in distribution system?
   (a) One-end-half breaker arrangement
   (b) Main and transfer arrangement
   (c) Ring main distribution system
   (d) Single busbar arrangement system

5. Bus coupler circuit breaker is utilized in a substation for
   (a) Joining the transmission line with station bus-bar
   (b) Joining main and transfer bus in a substation
   (c) Joining the generator with transfer
   (d) Joining the neutral of the generator with earth

Section – B

03X02 = 06 Marks

1. For distribution network, which type of Switching scheme is employed and why?
2. What are the functions of a substation?
3. What are the objectives of Indian Electricity Grid Code (IEGC) or Grid Code?

Section – C

03X03 = 09 Marks

1. What are the advantages and disadvantages of Outdoor Substations Over Indoor Substations?
2. What do you mean by power system security? Classify the level of power system security.
3. How stringing of shield/earth wire is done in a substation?

A

Answer Key – Set – A
Course Code: ELE 1502,
Course Name: Substation Practices and Supervision
School of Electrical Skills, Session: 2020-21 (Summer Semester)
B. Voc. Program, 5th Semester, 1st In-Sem. Examination

Section – A

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Section – B

03X02 = 06 Marks

1. For distribution network, which type of Switching scheme is employed and why?
   Ans: For distribution network Ring Main busbar scheme is employed. It has the provision that if power interruption occurs to one bus section due to maintenance or fault, power can be fed the bus from other side of the power system.

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 objectives of Indian Electricity Grid Code (IEGC) or Grid Code?

Ans. Ans: The IEGC brings together a single set of technical and commercial rules, encompassing all the Utilities connected to/or using the inter-State transmission system (ISTS) and provides the following:

- ✓ Documentation of the principles and procedures which define the relationship between the various Users of the inter-State transmission system (ISTS), National Load Despatch Centre, as well as the Regional and State Load Despatch Centres
- ✓ Facilitation of the optimal operation of the grid, facilitation of coordinated and optimal maintenance planning of the grid and facilitation of development and planning of economic and reliable National / Regional Grid
- ✓ Facilitation for development of power markets by defining a common basis of operation of the ISTS, applicable to all the Users of the ISTS.
- ✓ Facilitation of the development of renewable energy sources by specifying the technical and commercial aspects for integration of these resources into the grid.

Section – C

03X03 = 09 Marks

1. 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.

2. What do you mean by power system security? Classify the level of power system security.

Ans: Practically, the power system needs to be secured. We need to protect it from the black out or any internal or external damage. The operation of the power system is set to be normal only when the flow of power and the bus voltages are within the limits even though there is a change in the load or at the generation side. From this we can say that the security of the power system is an important aspect with respect to the continuation of its operation.

A very important aspect of the power system security is its ability to withstand the effect of contingency which is actually an output of either a generator, bus bars, transmission line, transformer etc. The contingency analysis technique is being widely used to predict the affect of the failures in the equipment used in power system. It is quite necessary task so as to keep the power system safe and secured. Though maintaining the security in power system is a challenging work for the engineers but it is even equally important to maintain the state of operation.

Power system security can be divided into two major functions.

1. Security control

2. Security assessment

Security control :- It determines the exact and proper security constraint scheduling which is required to obtain the maximized security level.

Security assessment :- It gives the security level of the system in the operating state.

The levels of power system security are classified into 5 states:-

1. **Normal**
2. **Alert**
3. **Emergency**
4. **Extreme emergency**
5. **Restorative**

Usually the operation power system in the normal state where the voltages and the frequency of the system are within the range and no overloaded condition occurs.

The system is transferred into the next state that is the emergency state if any sort of disturbance occurs. The system variables are not within the specified limits.

The control action which takes place during the emergency state includes generation tripping, generation run backup etc.

The system goes back to the further state when the extreme emergency comes into action that is occurrence of extreme disturbance. In this case the power system is in up stable state and may lead to shutting down of the major parts of the power system. Control action should be powerful such that the shedding of the load of the unimportant load are needs to be done.

3. How stringing of shield/earth wire is done in a substation?

Ans: Sub Station is shielded against direct lightning strokes by overhead shield wire/earth wire. The methodology followed for system upto 400 kV is by suitable placement of earth wire so as to provide coverage to all the station equipment. Generally, an angle of shield of 60° for zones covered by two or more wires and 45°for single wire is considered adequate.

The shield/earth wire shall be handled with care to prevent scratches on it or damage to the strands of the wire. When the shield/earth wire is to be taken from drums, small lengths can be unwound from the drum. For longer lengths, the wire drum shall be placed on a turn table or jacked up on a suitable size of steel shaft. The shield/earth wire shall be paid out in a manner so that there are no scratches or damages caused to the shield/earth wire due to rubbing on the sides of the drum.

The earth wire shall be strung from one peak to another peak of the structures as per layout of the GSS.

The tension hardware shall be assembled as per the relevant drawings.

The shield/earth wire shall be fitted and tightened in the clamp of the tension hardware on one side. Thereafter, the complete hardware assembly along with the shield/earth wire shall be hoisted up and fixed on the peak of the structure at one end.

Sagging arrangement shall be made on the other end and the shield/earth wire shall be tensioned. Measurement of length of shield/earth wire required shall be made thereafter and the shield/earth wire shall again be released so that it is returned to the ground. The shield/earth wire shall be cut to the marked length after adding the length of the wire required for jumpering and fitted in the clamp of the tension hardware at the marked point. The shield/earth wire along with tension hardware set shall then be pulled up again and connected to the peak of the structure.

Adjustment of tension in the earth wire may be done, if required, to ensure equal sag of all the earth wires in adjacent or parallel sections.

As far as possible, rather than cutting the earth wire, it should be allowed to pass through the tension hardware clamp to go to the next terminating point and so on. It will avoid joints in the earth wire and save earth wire clamps.

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills

5st Semester, 1st In-Sem. Examination

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

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. The emf induced in the rotor of an induction motor is proportional to:
   (a) Voltage applied to stator (b) Relative velocity between flux and rotor conductors
   (c) Both (a) and (b) (d) Slip

2. If the stator frequency of an induction motor is Fs, and S is slip, then the rotor frequency Fr is given by:
   (a) Fr=S*Fs (b) Fr=S/Fs (c) Fr=1/S*Fs (d) None of these

3. The synchronous speed of an induction motor is defined as:
   (a) Natural speed at which a magnetic field rotates
   (b) The speed of a synchronous motor
   (c) The speed of an induction motor at no load
   (d) None of these

4. In an induction motor, rotor runs at a speed:
   (a) Equal to the speed of stator field
   (b) Lower than the speed of stator field
   (c) Higher than the speed of stator field
   (d) Having no relation with the speed of stator field

5. For an induction motor, given f=50 Hz, Ns=1500 rpm the number of poles in the machine is:
   (a) 1 (b) 2 (c) 3 (d) 4

Section – B

03X02 = 06 Marks

1. Define slip in induction motor?

2. Briefly state the similarities of a transformer and an induction motor?

3. Explain Principle of operation of a transformer?

Section – C

03X03 = 09 Marks

1. With the help of neat sketch, explain how rotating magnetic field is developed in an induction motor.

2. Explain Fleming's left-hand rule for motors.

3. Calculate the rotor frequency of a 4 pole 50 Hz induction motor in following condition:
   a. At stand still
   b. Motor is running at 500 rpm in same direction of filed

A

Answer Key Set – A

Course Code: ELE 1503 Course Name: Electrical Machines - II

School of Electrical Skills, 5st Semester, 1st In-Sem. Examination

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

Section – A

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   (a) 1 (b) 2 (c) 3 **(d) 4**

Section – B

03X02 = 06 Marks

1. Define slip in induction motor?

$$S = \frac{Ns - Nr}{Ns} \text{ rpm}$$

Where s is the *slip*

Notice that : if the rotor runs at synchronous speed

$$s = 0$$

if the rotor is stationary

$$s = 1$$

Slip may be expressed as a percentage by multiplying the above eq. by 100, notice that the slip is a ratio and doesn't have units

2. Briefly state the similarities of a transformer and an induction motor?

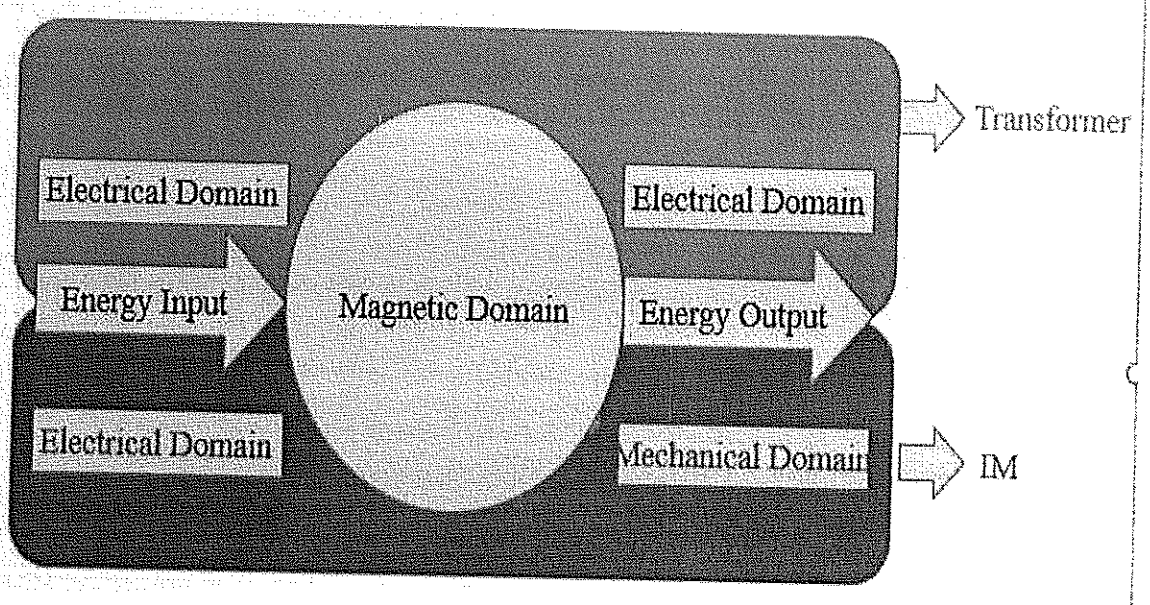
BSDU

Answer Key Set – A

Course Code: ELE 1503 Course Name: Electrical Machines - II

School of Electrical Skills, 5st Semester, 1st In-Sem. Examination

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



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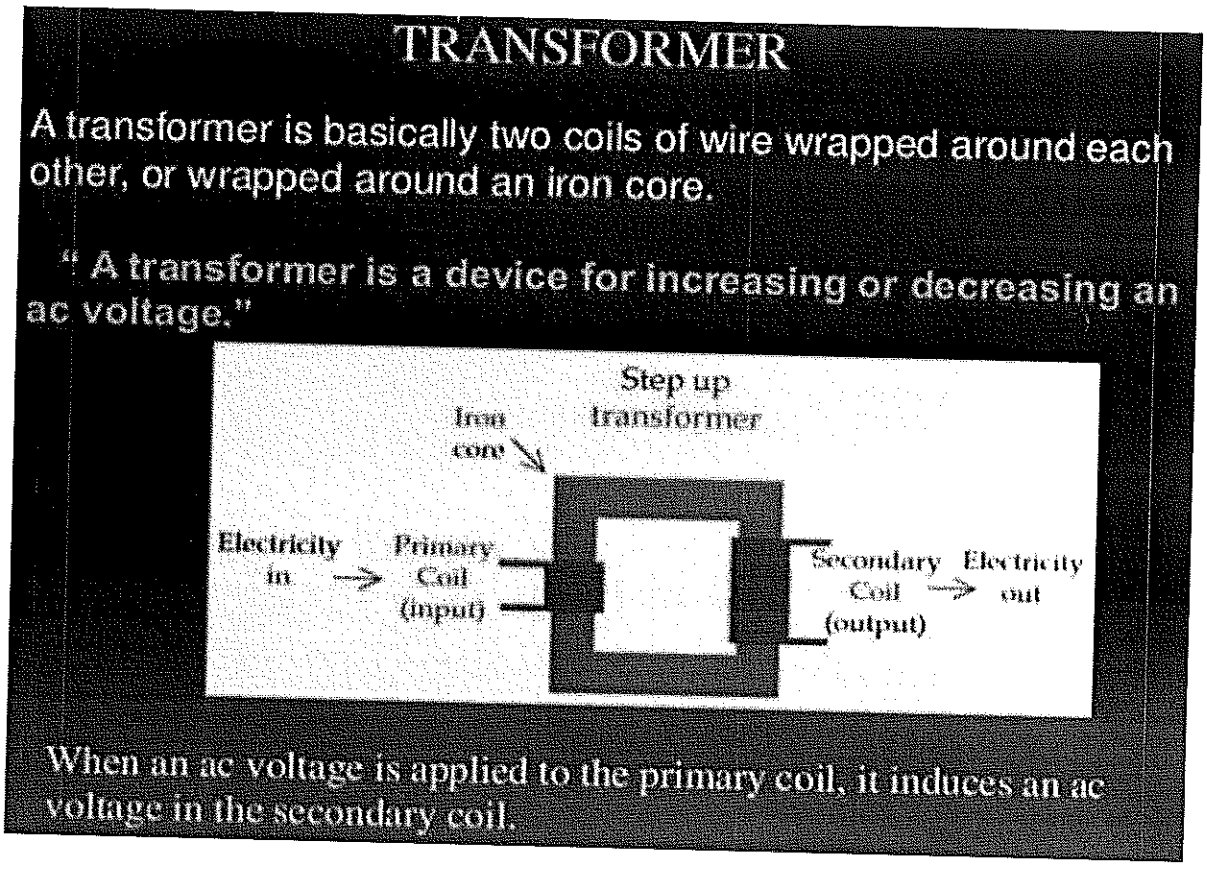


Answer Key Set – A

Course Code: ELE 1503 Course Name: Electrical Machines - II

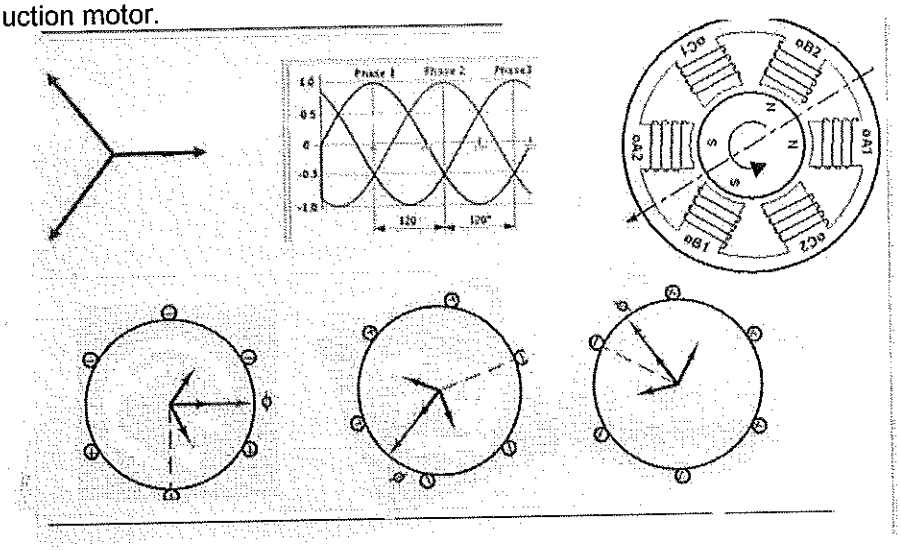
School of Electrical Skills, 5st Semester, 1st In-Sem. Examination

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

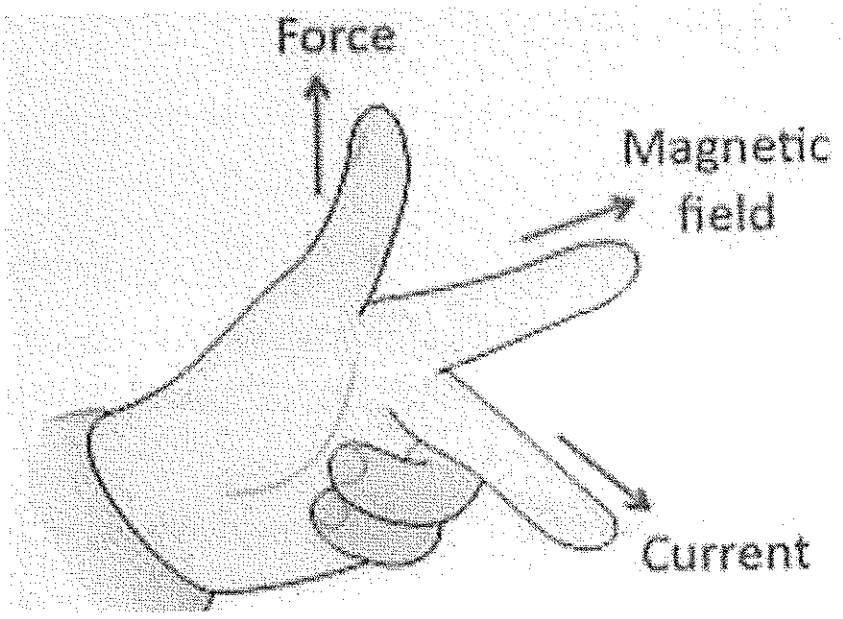
Section – C

03X03 = 09 Marks

1. With the help of neat sketch, explain how rotating magnetic field is developed in an induction motor.



2. Explain Fleming's left-hand rule for motors.
   The left hand is held with the thumb, index finger and middle finger mutually perpendicular to each other (at right angles:)
   - The Thumb represents the direction of Motion resulting from the force on the conductor
   - The First finger represents the direction of the magnetic Field
   - The Second finger represents the direction of the Current.



3. Calculate the rotor frequency of a 4 pole 50 Hz induction motor in following condition:
   a. At stand still
   b. Motor is running at 500 rpm in same direction of filed

➢ A 4 pole 50Hz IM

Calculate the rotor frequency in following condition

➢ At stand still

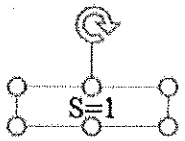
$$Ns=\frac{120f}{P}$$

$$=\frac{120*50}{4}=1500 \text{ rpm}$$

At stand still Nr=0

$$S=\frac{Ns-Nr}{Ns}$$

$$S=\frac{1500-0}{1500}$$



Rotor frequency $fr = s * fs = 1 * 50 = 50Hz$

➢ A 4 pole 50Hz IM

Calculate the rotor frequency in following condition

➢ Motor is running at 1450rpm in same direction of filed

$$Ns=\frac{120f}{P}$$

$$=\frac{120*50}{4}=1500 \text{ rpm}$$

Here, Nr= 1450

$$S=\frac{Ns-Nr}{Ns}$$

$$S=\frac{1500-1450}{1500} \qquad S= 0.033$$

Rotor frequency $fr = s * fs =$ 0.033 $* 50 =$ 1.666 Hz

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills

Session: 20--21 (Summer Semester)

B. Voc. Program, 5th 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 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. Full form of the DCS is:
   (a) Direct control System (b) Distance control System
   (c) Distributive control System (d) None of these
2. Full form of the PAC is:
   (a) Programmable automation controllers (b) Pneumatic automatic controllers
   (c) Pre-automation controllers (d) None of these
3. Full form of SMPS is:
   (a) Switched Mode Power Supply (b) Starter Mode Power Supply
   (c) Standard Mode Power Supply (d) None of these
4. The function of Relay is:
   (a) Programming (b) Convert 230 VAC to 24VDC
   (c) Protection (d) None of these
5. Full form of the HMI is:
   (a) Human Machine Instrument (b) Human Machine Interface
   (c) Human Motor Interface (d) None of these

Section – B

03X02 = 06 Marks

1. What are the applications of PLC?
2. What is a Batch process system? Explain with the help of a diagram.
3. Give the comparisons between PLC and DCS.

Section – C

03X03 = 09 Marks

1. Differentiate between PLC and computer in terms of Software and hardware.
2. Explain the main features of DCS system.
3. Explain the evolution of PLC.

Answer Key Set – A

Course Code: ELE1505 Course Name: Advance Automation and Control

School of Electrical Skills, Session: 20[illegible]-21 (Summer Semester)

B. Voc. Program, 5th Semester, 1st In-Sem. Examination

Section – A

05X01 = 05 Marks

1. Full form of the DCS is:
   (a) Direct control System (b) Distance control System
   (c) Distributive control System (d) None of these
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   (a) Switched Mode Power Supply (b) Starter Mode Power Supply
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   (a) Programming (b) Convert 230 VAC to 24VDC
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5. Full form of the HMI is:
   (a) Human Machine Instrument **(b) Human Machine Interface**
   (c) Human Motor Interface (d) None of these

Section – B

03X02 = 06 Marks

1. What are the applications of PLC?

Ans.

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

2. What is a Batch process system? Explain with the help of a diagram.

Ans.

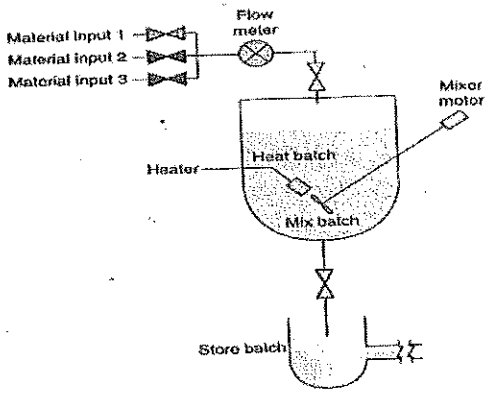
Batch process: There is no flow of product material from one station of process to another. Instead, a set amount of each of the inputs to the process is received in a batch, and then same operation is performed on the batch to produce a product. For example: Food, paint, and fertilizers etc.

Answer Key Set – A

Course Code: ELE1505 Course Name: Advance Automation and Control

School of Electrical Skills, Session: 2019-20 (Summer Semester)

B. Voc. Program, 5th Semester, 1st In-Sem. Examination



3. Give the comparisons between PLC and DCS.

Ans.

Sr. no.	PLC	DCS
1	PLCs are primarily used for small applications and sequential control.	DCS are used for large applications and closed loop control
2	PLCs are much cost-effective for both small and large applications.	DCS are very costly for small applications.
3	PLCs are better for logic, are faster and have more rugged I/O.	DCS are superior in communication redundancy and data security.
4	This system is more easier to design.	This system is more difficult to design.

Answer Key Set – A

Course Code: ELE1505 Course Name: Advance Automation and Control

School of Electrical Skills, Session: 2019-20 (Summer Semester)

B. Voc. Program, 5th Semester, 1st In-Sem. Examination

Section – C

03X03 = 09 Marks

1. Differentiate between PLC and computer in terms of Software and hardware.

Ans.

The architecture of a **PLC** is basically the same as that of a personal computer. A personal computer (PC) can be made to operate as a programmable logic controller if you provide some way for the computer to receive information from devices such as pushbuttons or switches. We also need a program to process the inputs and decide the means of turning load devices off and on. However, PLC is a specially designed computer to operate in an industrial environment. The main difference between computer and PLC are list below on two sections hardware and software.

Hardware:

- The PLC comes with its program language built into its memory and has no the permanently attached keyboard CD drive or monitor. While computers are permanently attached to a keyboard and other hardware.
- Computers are complex computing machines capable of executing several programs or tasks simultaneously and in any order. Most PLCs, on the other hand, execute a single program in an orderly and sequential fashion from first to last instruction.

Software:

- PLC software that allows the user to monitor and control the process is also called a human machine interface (HMI). It enables the user to view a process—or a graphical representation of a process—on a monitor, determine how the system is running, trend values, and receive alarm condition.
- Programmable automation controllers (PAC) combine PLC ruggedness with PC functionality. Using PACs, you can build advanced systems incorporating software capabilities such as advanced control, communication, data logging, and signal processing with rugged hardware performing logic, motion, process control, and vision.

2. Explain the main features of DCS system.

Ans. **Main features of DCS are:**

- Distributive control permits the distribution of the processing task among several controllers.
- Each PLC control its associated machine or process.
- High speed communication among the computers is done through CAT-5 or CAT-6 twisted pair wires, single coaxial cables, fiber optics, or the Ethernet.
- Depending on the process, one PLC failure would not halt the complete process.
- DCS is supervised by a host computer that may perform monitoring/supervising functions such as report generation and storage of data.

3. Explain the evolution of PLC.

Ans.

Evolution of PLC:

- Before the days of the PLC the only way to control machinery was through the use of relays. Relays work by utilizing a coil that, when energized, creates a magnetic force to effectively pull a switch to the ON or OFF position. When the relay is de-energized, the switch releases and returns the device to its standard ON or OFF position. But Troubleshooting would take hours, and because coils would fail and contacts would wear out, there was need for lots of troubleshooting. These machines had to follow a strict maintenance schedule and they took up a lot of space.
- Then Tom began working as a controls designer, automating metal working machinery and equipment with industrial relays, pneumatic plunger timers, and electro-mechanical counters. Also included were fuses, control transformers, motor starters, overload relays, pushbuttons, selector switches, limit switches, rotary drum sequencers, pilot lights, solenoid valves, etc.
- Then Dick Morley, the father of the PLC, "The programmable controller" was detailed on New Year's Day, 1968."