Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills

Session: 2019-20 (Summer 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 section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks. Scientific calculator is allowed.

Section – A

05X01 = 05 Marks

Q.1. The 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

Q.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

Q.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

Q.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

Q.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

Q.1. Draw the V-I characteristics of pn-junction diode?
Q.2. What is barrier potential?
Q.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

Q.1. Explain the working principle of pn-junction diode?
Q.2. Distinguish between intrinsic and extrinsic semiconductor
Q.3. A diode carries forward current of 60-mA when forward voltage applied is 0.2V. Find its D.C. forward resistance.
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 :- ELE 1501

Semester : ELE 5th sem

Section-A

1 Ans :- (b)

2. Ans :- (b)

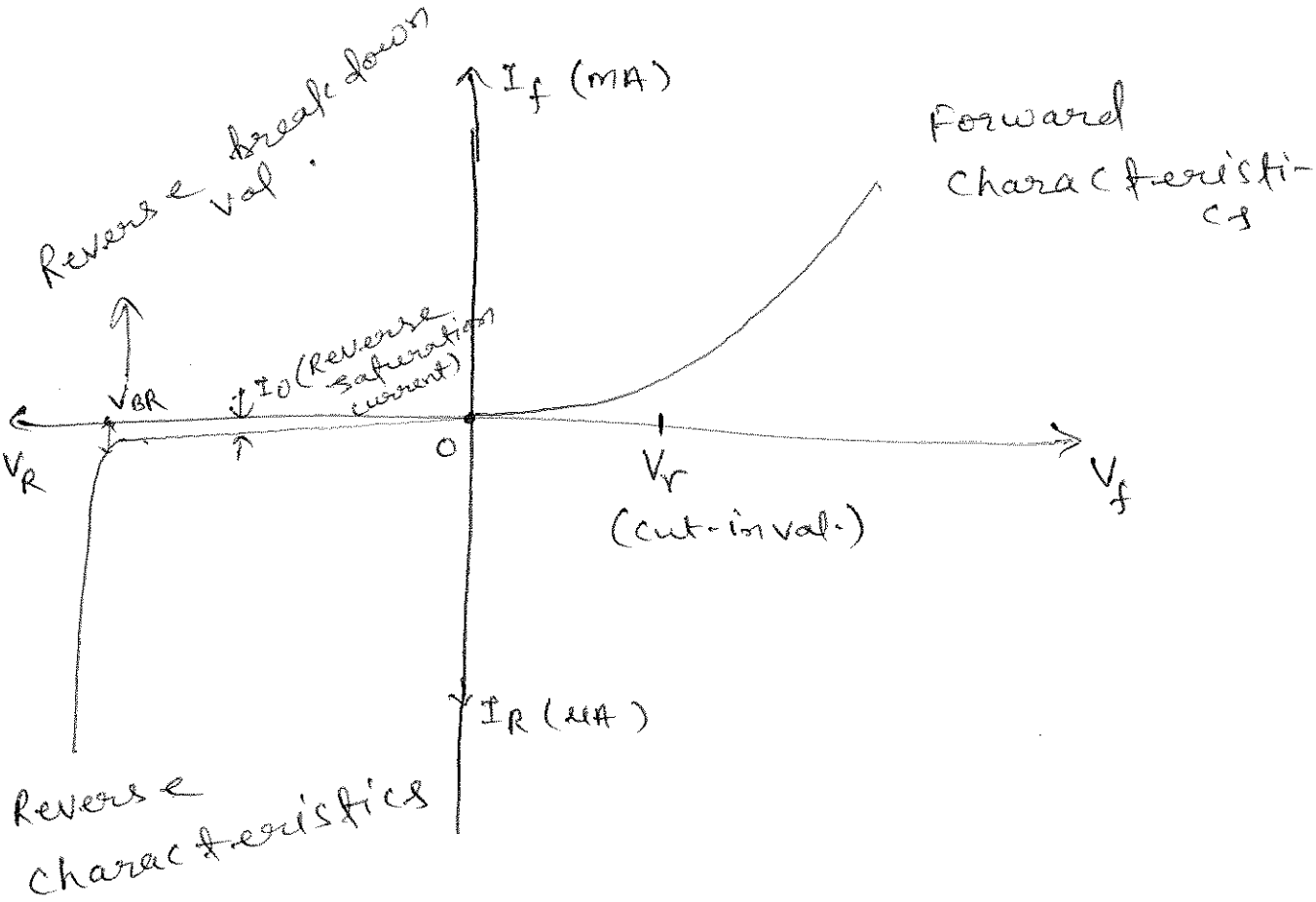
3. Ans :- (b)

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 field across the pn-junction. This creates potential difference

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. = $10 - 0.7$
$= 9.3V$

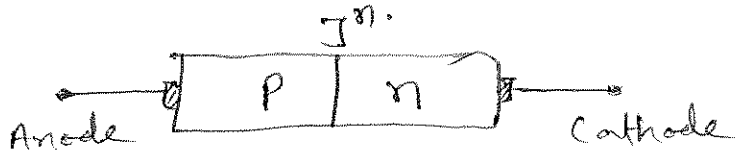
So, current $I = \frac{V}{R} = \frac{9.3}{1 \times 10^3}$

$= 9.3 mA$.

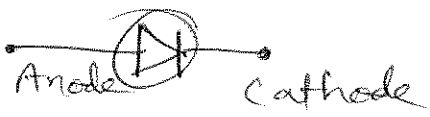
Section - C

1 Ans:-

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



(a) fig. show two electrods.



(b) symbol of a 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 n-type and p-type extransic semiconductor is possible.

3. Ans: -

Since, it is given

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

$I_R = 25\,\mu A$

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

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

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BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills

Session: 2019-20 (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

Q.1. At what pressure, the SF_6 gas is being filled in the whole installation of GIS substations?
(a) 3 kg / cm^2 (b) 5 kg / cm^2 (c) 3 kg / m^2 (d) 5 kg / m^2

Q.2. Which material is used for indoor bus bar?
(a) Copper (b) Aluminium (c) Silver (d) Both (A) and (B)

Q.3. What are the types of substations suitable for voltage 66 kV and above?
(a) Conventional outdoor (b) SF^6 gas insulated metal enclosed substation
(c) Hybrid substation (d) Only b and c (d) All of these

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

Q.5. Which of the following distribution system is not used normally?
(a) 3 phase-4 wire (b) 3 phase-3 wire
(c) Single phase - 3 wire (d) Single phase -4 wire.

Section – B

03X02 = 06 Marks

Q.1. State any four types of substations according to the service.
Q.2. What do you mean by Indoor Substation?
Q.3. What the meaning of Outdoor Substation?

Section – C

03X03 = 09 Marks

Q.1. What is substation? Classify the substations according to the operating voltages and their important features.
Q.2. What are the functions of a substation?
Q.3. What are the advantages and disadvantages of Outdoor Substations Over Indoor Substations?

Answer Key (ELE 1502)

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

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B. Voc. Program, 5th Semester,

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

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

Q.1. At what pressure, the SF_6 gas is being filled in the whole installation of GIS substations?

(a) 3 kg / cm^2 (b) 5 kg / cm^2 (c) 3 kg / m^2 (d) 5 kg / m^2

Ans: (c) 3 kg / m^2

Q.2. Which material is used for indoor bus bar?

(a) Copper (b) Aluminium (c) Silver (d) Both (A) and (B)

Ans: (a) Copper

Q.3. What are the types of substations suitable for voltage 66 kV and above?

(a) Conventional outdoor (b) SF^6 gas insulated metal enclosed substation

(c) Hybrid substation (d) Only b and c (d) All of these

Ans: (e) All of these

Q.4. Which of the following is usually not the generating voltage?

(a) 6.6 kV (b) 9.9 kV (c) 11kV (d) 13.2 kV

Ans: (b) 9.9 kV

Q.5. Which of the following distribution system is not used normally?

(a) 3 phase-4 wire (b) 3 phase-3 wire

(c) Single phase - 3 wire (d) Single phase -4 wire.

Ans: (d) Single phase-4 wire.

Section – B

03X02 = 06 Marks

Q.1. State any four types of substations according to the service.

Ans: The substations, according to the service rendered are: Transformer substations, switching substations, converting substations and Frequency changing substations.

Q.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.

Q.3. What the meaning of 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

Q.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.

Q.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.

Q.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.

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BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills

Session: 2019-20 (Summer Semester)

B. Voc. Program, 5th Semester,

1st In-Sem. Examination

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

Course Name: Electrical Machines **Max. Marks: 20**

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

Section – A

05X01 = 05 Marks

Q.1. The 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

Q.2. 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

Q.3. Three-phase induction motor is mainly suitable for which of the following application:

(a) For running different machine tools where several speeds are required

(b) For running paper machine requiring exact speed control

(c) For running rolling mills needing exact speed control

(d) None of these

Q.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

Q.5. For an induction motor, given f=50 Hz, Ns=1500 rpm then the number of poles in the machine will be:

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

Section – B

03X02 = 06 Marks

Q.1. Define slip in induction motor.

Q.2. Briefly state the similarities of transformer and induction motor.

Q.3. Explain Faraday's law of electromagnetic induction.

Section – C

03X03 = 09 Marks

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

Q.2. Can the induction motor run at the synchronous speed? If not, then why?

Q.3. Calculate the rotor frequency of A 4 pole 50Hz induction motor in following condition:

i. At stand still

ii. The motor is running at 1450 rpm in same direction of the filed.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of Electrical Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 5th Semester,
1st In-Sem. Examination

Course Code: ELE 1503 **Time: 1 Hour**
Course Name: Electrical Machines **Max. Marks: 20**

Section – A 05X01 = 05 Marks

Q.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

Ans. (c)

Q.2. 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

Ans. (a)

Q.3. Three-phase induction motor is mainly suitable for which of the following application:
a. For running different machine tools where several speeds are required
b. For running paper machine requiring exact speed control
c. For running rolling mills needing exact speed control
d. None of these

Ans. (a)

Q.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

Ans. (b)

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

Ans. (d)

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Section – B

03X02 = 06 Marks

Q.1. Define slip in induction motor.

Ans.

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

Where s is the *slip*

Notice that : if the rotor runs at synchronous speed

$$s = 0$$

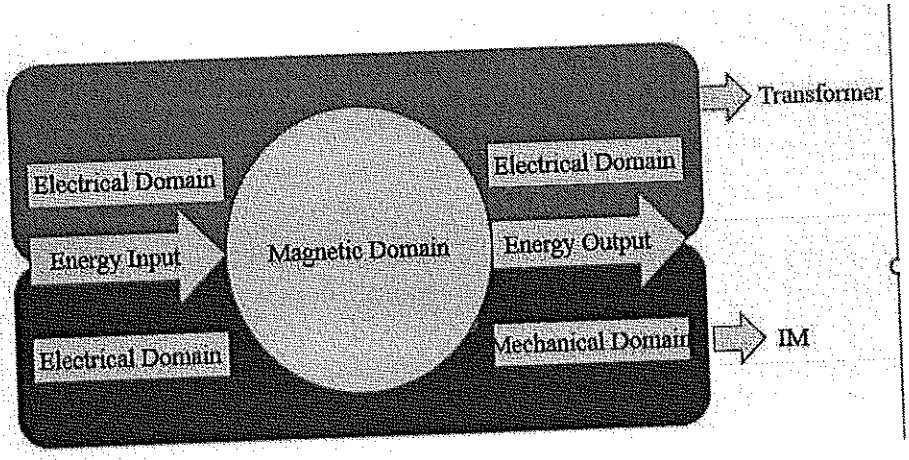
if the rotor is stationary

$$s = 1$$

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

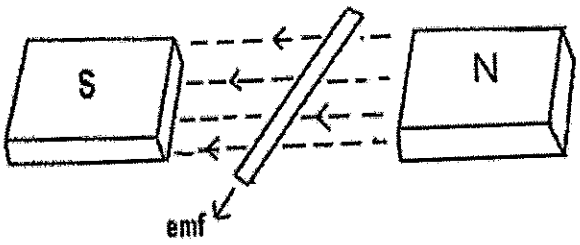
Q.2. Briefly state the similarities of transformer and induction motor.

Ans.



Q.3. Explain Faraday's law of electromagnetic induction.

Ans.



Faraday's First Law:

Whenever a conductor is placed in a varying magnetic field an EMF gets induced across the conductor (called as induced emf), and if the conductor is a closed circuit then induced current flows through it.

Magnetic field can be varied by various methods -

1. By moving magnet
2. By moving the coil
3. By rotating the coil relative to magnetic field

Faraday's Second Law:

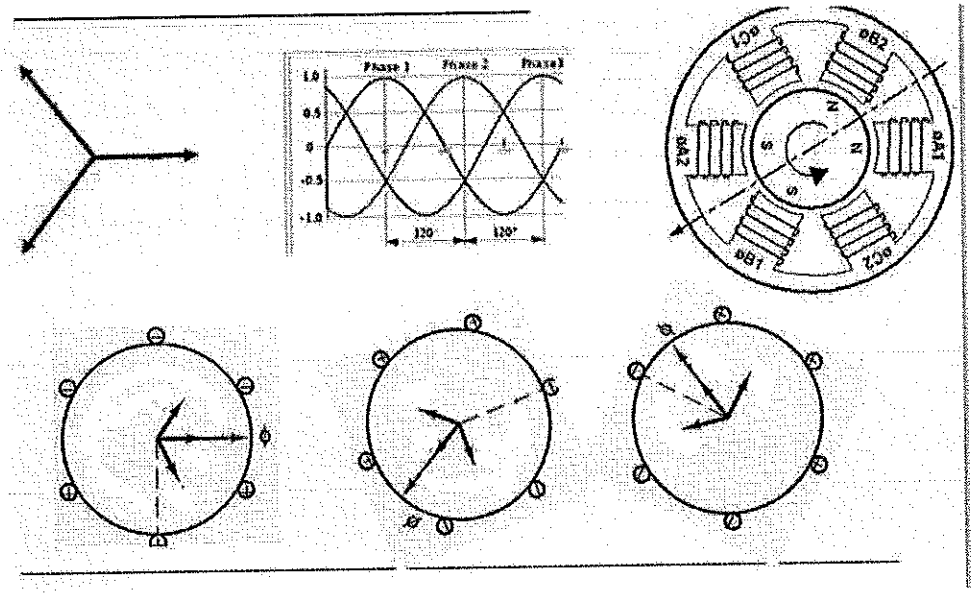
Faraday's second law of electromagnetic induction states that, the magnitude of sinduced emf is equal to the rate of change of flux linkages with the coil. The flux linkages is the product of number of turns and the flux associated with the coil

Section – C

03X03 = 09 Marks

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

Ans.



Q.2. Can the induction motor run at the synchronous speed? If not, then why?

Ans. If rotor runs at the synchronous speed, which is the same speed of the rotating magnetic field, then the rotor will appear stationary to the rotating magnetic field and the rotating magnetic field will not cut the rotor. So, no induced current will flow in the rotor and no rotor magnetic flux will be produced so no torque is generated and the rotor speed will fall below the synchronous speed

When the speed falls, the rotating magnetic field will cut the rotor windings and a torque is produced

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Q.3. Calculate the rotor frequency of A 4 pole 50Hz induction motor in following condition

i. At stand still
ii. The motor is running at 1450 rpm in same direction of the filed.

Ans.

➢ A 4 pole 50Hz IM

Calculate the rotor frequency in following condition

➢ At stand still

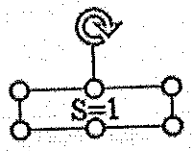
$$Ns=\frac{120f}{P}$$

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

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

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

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

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: 2019-20 (Summer Semester)

B. Voc. Program, 5th Semester,

1st In-Sem. Examination

Course Code: ELE 1504 **Time: 1 Hour**

Course Name: Solar PV Technology **Max. Marks: 20**

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

Section – A

05X01 = 05 Marks

Q.1. The solar or photo voltaic cell converts:

(a) Chemical energy to electrical energy (b) Solar radiation into electrical energy

(c) Solar radiation into thermal energy (d) Thermal energy into electrical energy

Q.2. What is meant by the Standard Test Condition (STC):

(a) Radiation: 1,000W/m^2, temperature: 25°C, and Air Mass: 1.5

(b) Radiation: 1,000W/m^2, temperature: 20°C, and Air Mass: 1.5

(c) Radiation: 1,024W/m^2, temperature: 25°C, and Air Mass: 1.5

(d) Radiation: 1,000W/m^2, temperature: 18°C, and Air Mass: 1.0

Q.3. If a PV cell produces 0.5 V, then four PV cells connected in series will produce:

(a) 2.0 V (b) 0.5 V (c) 2.5 V (d) 1.0 V

Q.4. What is the total output power, if four PV cells of 0.5V connected in series and A single PV cell produces 1A current?

(a) 2.0 W (b) 0.5 W (c) 2.5 W (d) 1.0 W

Q.5. Solar PV systems can be:

(a) connected to the power grid (b) used to sell power to the grid

(c) a stand-alone source of electricity (d) all of above

Section – B

03X02 = 06 Marks

Q.1. List the types of renewable energy sources.

Q.2. Define solar constant.

Q.3. What is photovoltaic effect?

Section – C

03X03 = 09 Marks

Q.1. State the need of renewable energy sources.

Q.2. Distinguish between renewable and non-renewable energy sources.

Q.3. What is difference between solar thermal conversion and solar photovoltaic conversion?

Course Name: Solar Photovoltaic technology

Course Code: ELE1504

Semester: ELE_5th semester

Section - A

1. Ans: – (b)
2. Ans: – (a)
3. Ans: – (a)
4. Ans: – (a)
5. Ans: – (d)

Section - B

1. Ans: -

The following are the renewable energy sources

(i) Solar energy
(ii) Wind energy
(iii) Tidal energy
(iv) Geothermal energy

2. Ans: -

The amount of solar energy received in unit time and unit area, perpendicular to sun radiation is called solar constant.
The value of solar constant is about 1367 w/m^2.

3. Ans: -

The conversion of light energy in to electrical energy via Photovoltaic cell is called photovoltaic effect.

Section - C

1. Ans: —

The following reason, that describe why renewable energy sources are needed.

(i) Increasing demand of energy / power.

(ii) Depletion of conventional sources of energy at faster rate.

(iii) To conserve the present source of energy.

(iv) Environmental acceptance

(v) Suitable for remote area

2. Ans: —

Renewable energy sources are those sources of energy which are refilled as they are consumed.

Ex: Solar, wind, tidal, etc.

These energy sources are pollution free.

Non-renewable energy sources are those sources of energy which are depleted as they are consumed.

Ex:- coal, oil, natural gass etc.

these energy sources are responsible for pollution in the environment.

3. Ans:-

Conversion of solar energy radiation in to heat is called solar thermal conversion.

Conversion of solar energy radiation, directly in to electrical energy is called solar PV conversion.