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. When the diode is reverse biased, it is equivalent to:
(a) Zero resistance (b) An On switch (c) A high resistance (d) None of these

Q.2. The knee voltage (cut in voltage) of Ge diode is:
(a) 0.3 V (b) 0.7 V (c) 0.8 V (d) 1.0 V

Q.3. 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.4. The arrow symbol in the diode 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.5. A PN junction acts as a:
(a) Controlled switch (b) Bidirectional switch
(c) Unidirectional switch (d) None of these

Section – B

03X02 = 06 Marks

Q.1. Draw the V-I characteristics of typical Si-diode?

Q.2. Define the terms:
(a) Barrier potential (b) Ohmic contact

Q.3. A forward potential of 5V is applied to a Si diode. A resistance of 2 KΩ is also in series with the diode. Determine the value of current.

Section – C

03X03 = 09 Marks

Q.1. Explain the operation of forward biased PN-junction diode?

Q.2. Explain the types of semiconductors?

Q.3. A diode carries forward current of 50-mA when forward voltage applied is 0.2V. Find its D.C. forward resistance.
It carries reverse current of 20 μ-A when reverse voltage is 50V, find its D.C. reverse resistance.

21/9/19

Course code : ELE 1501

Course Name : Fundamental of Power electronics

Semester : ELE 5th - semester

Section - A

1. Ans :- (c)

2. Ans :- (a)

3. Ans :- (a)

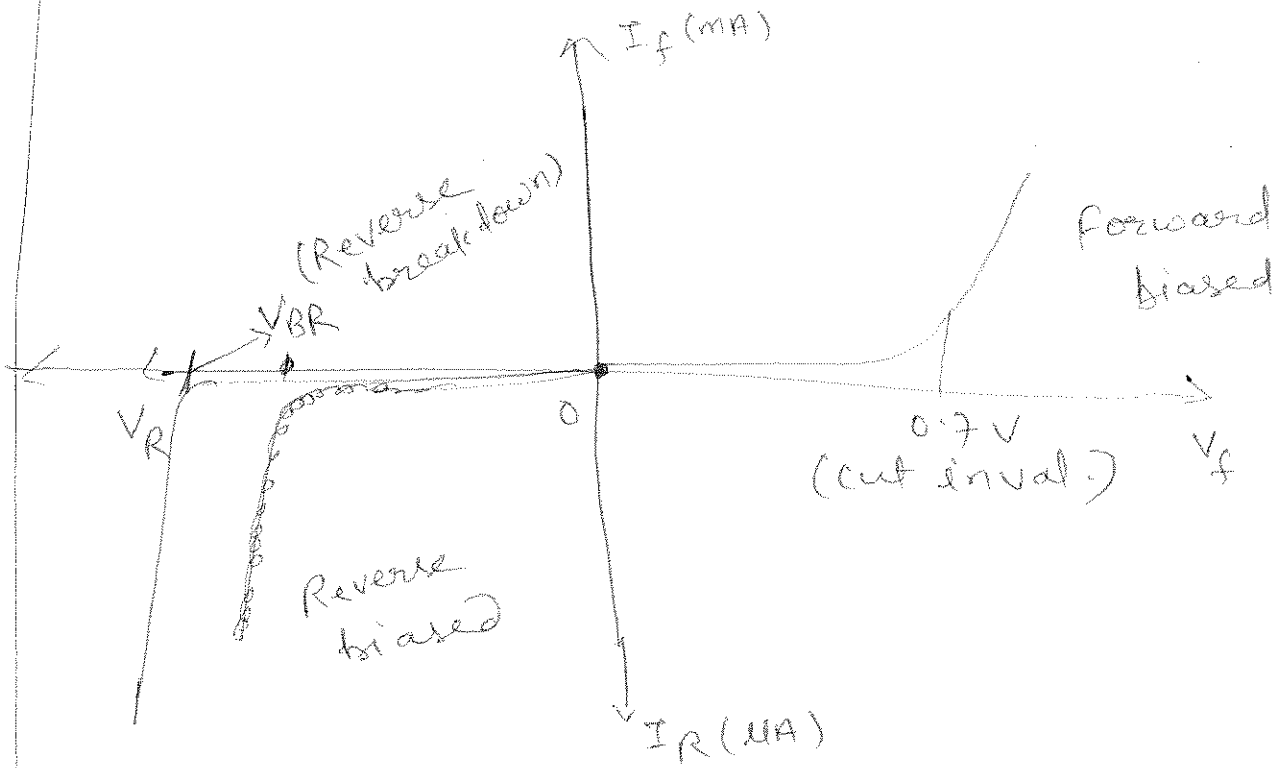
4. Ans :- (b)

5. Ans :- (c)

Section - B

1 Ans :—

VI - characteristics of Si - diode



2. Ans : —

(a) Barrier potential :- Due to immobile positive charges on n-side and negative charges on P-side, there exists an electric field across the junction. this creates potential difference across the junction which is called barrier potential.

(b) ohmic contact :— To connect n and P-region to external

terminals, a metal is applied to heavily doped n- and p-type semiconductor regions. such a contact between a metal and a heavily doped semiconductor is called ohmic contact.

3 Ans:

$V = 5V$

$R = 2k\Omega$

drop in potential due to si-diode

$= 5V - 0.7V$

$= 4.3V$

current $I = \frac{V}{R} = \frac{4.3}{2 \times 10^3} = 2.15 mA$. Ans.

Section - C

Ans:

(Forward biasing of pn-Jn diode)

If external d.c. voltage is connected in such a way that the p-region is connected to +ve of d.c. voltage and n-region is connected to

negative of the d.c. voltage, the biasing condition is called forward biasing.

In forward biasing diode conducts, for a particular value of forward voltage as the depletion region becomes very narrow and large number of majority charge carriers cross the junction.

( )

2. Ans:

There are two types of semiconductor

(I) Intrinsic semiconductor

(II) extrinsic semiconductor.

(I) Intrinsic semiconductor:-

Semiconductor in their pure form is called intrinsic semiconductor.

( )

(II) extrinsic semiconductor:-

Doped semiconductor material is called extrinsic semiconductor.

Doping increases the conductivity

of semiconductor.

There are two types of extrinsic semiconductors

(i) n-typ (ii) P-type.

3. Ans:

$I_f = 50mA$

$V_f = 0.2V$

$R_{f_{DC}} = \frac{0.2}{50 \times 10^{-3}} = 0.004 \times 10^{+3}$

$= 4\Omega$ Ans.

$I_R = 20 \times 10^{-6} A$

$V_R = 50 V$

$R_{f_{DC}} = \frac{50}{20 \times 10^{-6}} = 2.5 \times 10^6 = 2.5 M\Omega$

So, $R_{f_{DC}} = 4\Omega$

$R_{r.DC} = 2.5 M\Omega$

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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. Which of the following equipment is not installed in a substation?

(a) Shunt reactors (b) Exciters

(c) Voltage transformers (d) Series capacitors.

Q.2. A balanced 3 phase, 4 wire AC system, the phase sequence is RYB. If the voltage of R phase is. 230 < 0° V, then for Y phase:

(a) 230 < 0 V (b) 230 < 60° V (c) 230 < 90°V (d) 230 < 120° V.

Q.3. 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.

Q.4. 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

Q.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

Q.1. List out the equipment used in a substation.

Q.2. State the relative merits of indoor substations.

Q.3. State the relative merits of outdoor substations.

Section – C

03X03 = 09 Marks

Q.1. What do you understand by a substation? What are the factors which are to be considered for the selection of a site of the substation?

Q.2. Classify the substations according to the nature of duties and service rendered.

Q.3. Draw the key diagram for 33 kV substation.

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Course Code: ELE-1502 **Time: 1 Hour**
Course Name: Substation Practices and Supervision **Max. Marks: 20**

Section – A

05X01 = 05 Marks

1. **Ans: (b)** Exciters
2. **Ans: (d)** 230 < 120° V.
3. **Ans: (d)** Above 400 kV.
4. **Ans: (d) All the above**
5. Ans: (b) Lightning arrester

Section – B

03X02 = 06 Marks

Ans.1. Equipment used in a substation are Transformer (s); Bus-Bars; Circuit breakers; CTs; PTs; Insulators; Isolators; Switchgears (Fuses, air-break switches etc.); Protective Relays; Surge arresters; Cables; Fire-fighting equipment; Batteries; Earthing arrangement; Wave traps; Reactors etc.

Ans.2. Merits of Indoor Substation: Less requirement of space, less maintenance and control cable length; protection from lightning; flexibility in installation, no dust and dirt.

Ans.3. Merits of Outdoor Substations: No building requirement, short erectionn time; Easy fault finding due to visibility of equipment; Easy repair work; Easier installation/extension; Availability of sufficient space between equipments.

Section – C

03X03 = 09 Marks

Ans.1.

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.

Factors which are to be considered for a selection of a site of a substation are:

- ✓ Locating the site for a substation assumes prime importance in the planning of a distribution system. The most economical position of the substation is the load centre. The load centre is the centre of gravity of the loads to be supplied.
- ✓ For such a location of the substation, the cost of conductor material and power loss in lines will be minimum, other specifications remaining same.

Other considerations for locating a substation are:

- ➢ There should be enough space for accessing incoming and outgoing lines.
- ➢ There should be space for future expansion.
- ➢ The municipal rules should permit the type of building necessary for the substation.
- ➢ The cost of land is reasonable.

The following factors are also considered while making site selection for a substation:

- ✓ Type of Plant
- ✓ Availability of suitable and sufficient land (400 kV-50 Acres, 220 kV-25 acres, 132 kV-10 acres)
- ✓ Communication facility
- ✓ Atmospheric pollution
- ✓ Availability of essential amenities to the staff
- ✓ Draining facility

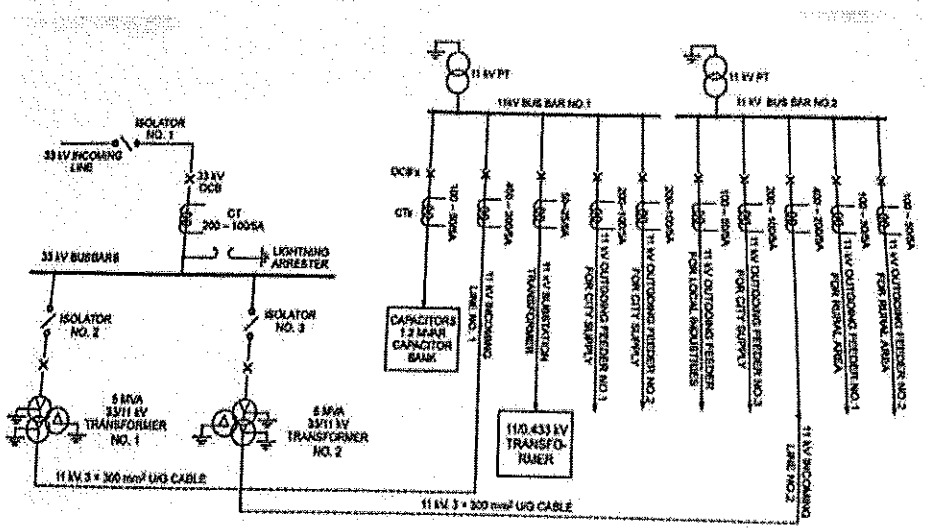
Ans.2. The substations, on the basis of nature of duties, may be classified into the following three categories:

1. Step-Up or Primary Substations: Such substations are usually associated with generating stations. The generated voltage, which is usually low (11 or 33 kV), is stepped up to primary transmission voltage so that huge blocks of power can be transmitted over long distances to the load centres economically.
2. Primary Grid Substations: Such substations are located at suitable load centres along the primary transmission lines. In these substations, the primary transmission voltages are stepped down to different suitable secondary voltages. The secondary transmission lines are carried over to the secondary substations situated at the load centres where the voltage is further stepped down to sub-transmission or primary distribution voltages.
3. Step-Down or Distribution Substations: Such substations are located at the load centres, where the sub-transmission/primary distribution voltage is stepped down to secondary distribution voltage (415/240 V). These are the substations which feed the consumers through distribution network and service lines.

The substations, according to service rendered are:

1. Transformer Substations: Transformer are installed on such substations to transform the power from one voltage level to another level as per needs.
2. Switching Substations: Such substations are meant for switching operation of power lines without transforming the voltage. At such substations different connections are made between various transmission lines.
3. Converting Substations: Such substations are meant for either converting AC to DC or DC to AC vice versa or converting frequency from higher to lower or vice versa.

Ans.3.



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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. Natural speed at which a magnetic field rotates is defined as:

(a) Synchronous speed of an induction motor
(b) The rotor speed of an induction motor
(c) The speed of an induction motor at no load
(d) None of these

Q.2. If the stator frequency of an induction motor is Fs, 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

Q.3. 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) Lower than the speed of synchronous speed (d) Both b and c

Q.4. For an induction motor, given f=60 Hz, Ns=1800 rpm the number of poles in the machine is:

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

Q.5. 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

Section – B

03X02 = 06 Marks

Q.1. Prove that the slip of an induction motor is equal to one at standstill condition.

Q.2. On what speed an induction motor can run, why?

Q.3. Differentiate between transformer and induction motor.

Section – C

03X03 = 09 Marks

Q.1. An 8-pole, 3-phase, 60 Hz, star connected induction motor has a slip of 5%. Calculate full load speed of motor.

Q.2. Explain the torque slip characteristics of three phase induction motor.

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

i. Motor is running at 500 rpm in opposite direction of filed
ii. Motor is running at 2000 rpm in same direction of filed

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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

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

Section – B

03X02 = 06 Marks

Ans. 1.

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

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

Ans. 2.

Less than Synchronous Speed. 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.

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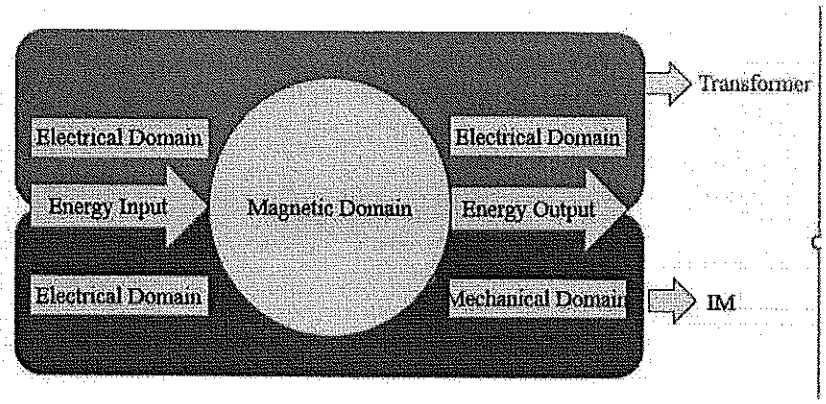
Ans. 3.



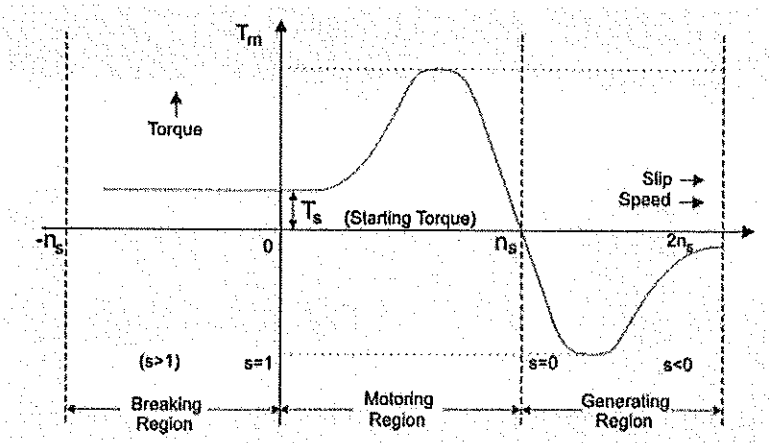
Section – C

03X03 = 09 arks

Ans. 1.

In Induction Motor,
Speed Ns=(120* frequency)/(No.of poles)
Speed Ns= (120*60)/8=900 rpm.
So the slip S= (Ns-N)/Ns
0.05= (900-N)/900
N= 855 rpm

Ans. 2.



Torque Slip Curve for Three Phase Induction Motor

The torque slip curve for an induction motor gives us the information about the variation of torque with the slip. The slip is defined as the ratio of difference of synchronous speed and actual rotor speed to the synchronous speed of the machine. The variation of slip can be obtained with the variation of speed that is when speed varies the slip will also vary and the torque corresponding to that speed will also vary.

Motoring Mode

In this mode of operation, supply is given to the stator sides and the motor always rotates below the synchronous speed. The induction motor torque varies from zero to full load torque as the slip varies. The slip varies from zero to one. It is zero at no load and one at standstill. From the curve it is seen that the torque is directly proportional to the slip.

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That is, more is the slip, more will be the torque produced and vice-versa. The linear relationship simplifies the calculation of motor parameter to great extent.

Generating Mode

In this mode of operation induction motor runs above the synchronous speed and it should be driven by a prime mover. The stator winding is connected to a three phase supply in which it supplies electrical energy. Actually, in this case, the torque and slip both are negative so the motor receives mechanical energy and delivers electrical energy. Induction motor is not much used as generator because it requires reactive power for its operation.

That is, reactive power should be supplied from outside and if it runs below the synchronous speed by any means, it consumes electrical energy rather than giving it at the output. So, as far as possible, induction generators are generally avoided.

Braking Mode

In the Braking mode, the two leads or the polarity of the supply voltage is changed so that the motor starts to rotate in the reverse direction and as a result the motor stops. This method of braking is known as plugging. This method is used when it is required to stop the motor within a very short period of time. The kinetic energy stored in the revolving load is dissipated as heat. Also, motor is still receiving power from the stator which is also dissipated as heat. So as a result of which motor develops enormous heat energy. For this stator is disconnected from the supply before motor enters the braking mode.

Ans. 3.

- A 4 pole 50Hz IM

Calculate the rotor frequency in following condition

- Motor is running at 500 rpm in opposite direction of filed

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

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

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

Here, Nr=-500

$$S=\frac{1500-(-500)}{1500} \qquad S=1.33$$

Rotor frequency $fr = s * fs = 1.33 * 50 = 66.5Hz$

- A 4 pole 50Hz IM

Calculate the rotor frequency in following condition

- Motor is running at 2000 rpm in same direction of filed

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

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

Here, Nr=2000

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

$$S=\frac{1500-(2000)}{1500} \qquad S=-0.33$$

Rotor frequency $fr = s * fs = -0.33 * 50 = -16.66Hz$

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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 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. If a PV cell produces 0.7 V, then four PV cells connected in series will produce:

(a) 2.8 V (b) 0.5 V (c) 2.5 V (d) 1.0 V

Q.3. What is the total output power, if three PV cells of 0.6V connected in series and a single PV cell produces 1A current?

(a) 1.8 W (b) 0.5 W (c) 2.5 W (d) 1.0 W

Q.4. Sunlight reaches the earth through

(a) Direct radiation (b) Diffuse Radiation (c) Scattered radiation (d) All of the above

Q.5. A Standard Test Condition (STC) is:

(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

Section – B

03X02 = 06 Marks

Q.1. What are limitations of solar energy?

Q.2. Distinguish between solar thermal conversion and solar photovoltaic conversion.

Q.3. What is photovoltaic cells?

Section – C

03X03 = 09 Marks

Q.1. Explain the advantages of solar energy.

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

Q.3. Define the terms:

(a) Photovoltaic effect (b) Solar constant

Course code :- ELE1504

Course Name :- Solar PV Technology

Semester :- ELE 5th semester

Section - A

1 Ans :- (b)

2. Ans :- (a)

3. Ans :- (a)

4. Ans :- (d)

5. Ans :- (a)

Section-B

1 Ans: The following are the limitations of solar energy:-

(i) Availability of solar energy depends on weather conditions.

(ii) Large area required to collect the energy.

(iii) It is not available during rainy days.

2. Ans:

Conversion of solar energy radiation into heat is called solar thermal conversion.

Conversion of solar energy radiation directly into electrical energy is called solar PV conversion.

3. Ans:

Energy conversion devices which converts sunlight directly into electricity by photovoltaic effect are called solar cell.

Section - C

1 Ans: The following are the advantages of solar energy

(i) It is very large inexhaustible energy.

(ii) It is freely available.

(iii) It is clean and free from environment pollution.

(iv) It can be utilize without highly specialized skills

(v) It can be used at remote areas also.

2. Ans: —

A source of energy which are refilled as they are consumed is called renewable energy sources.

ex:- solar, wind, etc.

A source of energy which are depleted as they are consumed.

ex:- coal, oil, etc.

3. Ans:

(a) photovoltaic effect :—

Conversion of light energy directly in to electric energy via solar

cell is called photovoltaic effect.

(b) solar constant :- The amount of 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/m².