



Registration No.: .....

# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Question Paper Format

School of HVAC&R Skills

1<sup>st</sup> Semester, 2<sup>nd</sup> In-Sem. Examination

B. Voc. Program, Winter Semester (2018-19)

Course Code: HVA-1101

Time: 1 Hour

Course Name: Basic of Refrigeration and Air-Conditioning

Max. Marks: 20

Instruction: Attempt all questions.

## Section – A

05X01 = 05 Marks

1. The ratio of heat extracted in the refrigerator to the work done on the refrigerant is called:
  - a) The coefficient of performance of refrigeration
  - b) The coefficient of performance of the heat pump
  - c) Relative coefficient of performance
  - d) Refrigerating efficiency
2. The efficiency of the Carnot heat engine is 80%. The COP of refrigerator operating on the reversed Carnot cycle is equal to:
  - a) 0.25
  - b) 0.40
  - c) 0.60
  - d) 0.80
3. In which direction does heat flow?
  - a) From a cold substance to cold substance
  - b) Up
  - c) Down
  - d) From a warm substance to a cold substance
4. ----- is the time rate of doing work.
  - a) Power
  - b) Work
  - c) Heat
  - d) Temperature
5. In the closed stationary system, the total energy is:
  - a) Kinetic energy
  - b) Potential energy
  - c) Internal energy
  - d) Sensible energy

## Section – B

03X02 = 06 Marks

1. What is the property of thermodynamic system? Write down any four properties of thermodynamic system.
2. Derive the mathematical equation for work done by the closed system.
3. Differentiate between steady flow process and uniform flow process with an examples.



Registration No.: .....

## BHARTIYA SKILL DEVELOPMENT UNIVERSITY

### Section – C

03X03 = 09 Marks

1. Differentiate between quasi static process and reversible process. What is entropy? Write mathematical formula for entropy.
2. (a) Explain different forms of energy. Write down the expression for the total energy of a system.  
(b) Explain with a neat sketch specific heat at constant pressure and specific heat at constant pressure.
3. Write the definition of the 1<sup>st</sup> law of thermodynamics and 2<sup>nd</sup> law of thermodynamics. Derive the mathematical expression for 1<sup>st</sup> law of thermodynamics and 2<sup>nd</sup> law of thermodynamics.



# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of HVAC&R Skills

1<sup>st</sup> Semester, <sup>2<sup>nd</sup></sup> In-Sem. Examination

B. Voc. Program, <sup>winter</sup> Summer Semester (2018-19)

**Course Code:** HVA-1101

**Time:** 1 Hour

**Course Name:** Basic of Refrigeration and Air-Conditioning

**Max. Marks:** 20

**Instruction:** (Attempt all questions.)

## Section A

- 1) a
- 2) a
- 3) d
- 4) a
- 5) c

## Short answer: Section B

- 1) properties are the coordinate to describe the state of the system. T, P, V, Density
- 2)  $dW = PdV$
- 3) Properties are invariant with time and property are invariant with position.

## Long answer question Section C

- 1) Infinite slow process is quasi static process and the process which traces back is called reversible process. Degree of randomness is called entropy  $dQ = Tds$
- 2). Energy in stored and energy in transit Energy total is kinetic energy+ potential energy internal energy.  
Specific heat at constant pressure increase internal energy and specific heat constant volume increase enthalpy of the system
3. energy can neither be created nor be destroyed but it can transform from one place to another It is impossible to construct a device which operate on thermodynamically cycle which transfer heat from body at cooler to body at heater,



**BHARTIYA SKILL DEVELOPMENT UNIVERSITY****Question Paper****School of HVAC&R****I Semester, 2<sup>nd</sup> In-Sem. Examination****B. Voc. Program, Winter Semester (2018-19)****Course Code: HVA1102****Time: 1 Hour****Course Name: Assembly & Installation of Refrigerator****Max. Marks: 20**

- Instruction:**
1. Attempt all Questions.
  2. Be precise while answering the questions.

**Section – A**

05X01 = 05 Marks

1. In a vapor compression system, the condition of refrigerant is dry saturated vapor:
  - a. Before entering the compressor
  - b. Before entering the condenser
  - c. After leaving the compressor
  - d. After leaving the condenser
2. Expansion Device is responsible for:
  - a. High Temperature & High Pressure
  - b. Low Temperature & High Pressure
  - c. Low Temperature & Low Pressure
  - d. None of these
3. Clamp meter is used for measuring:
  - a. Temperature
  - b. Pressure
  - c. Resistance
  - d. All of the above
4. Which component divides your VCRS as high side and low side?
  - a. Compressor
  - b. Condenser
  - c. Expansion device
  - d. Evaporator

5. Which is the correct arrangement of components in a VCRS:
- Evaporator – Compressor – condenser – Expansion Device
  - Evaporator – Condenser - Compressor – Expansion Device
  - Evaporator – Expansion Device -Condenser – Compressor
  - Expansion Device - Evaporator – Condenser - Compressor

### **Section – B**

03X02 = 06 Marks

- Write the name of five tools in the tool bag of an HVAC&R Technician.
- Write down the general safety rules for an HVAC&R Technician.
- Write down the name of accessories used in a refrigerator.

### **Section – C**

03X03 = 09 Marks

- Which refrigerant is used in a domestic refrigerator and which portion represents sub cooling liquid region?
- Explain the process of defrosting in freezer of refrigerator.
- Explain refrigeration system? Which type of evaporator is used in a freezer of refrigerator?



# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

## School of HVAC&R

I Semester, 2<sup>nd</sup> In-Sem. Examination

B. Voc. Program, Winter Semester (2018-19)

Course Code: HVA1102

Time: 1 Hour

Course Name: Assembly & Installation of Refrigerator

Max. Marks: 20

### Answer sheet

#### Section – A

05X01 = 05 Marks

1. In a vapor compression system, the condition of refrigerant is dry saturated vapor  
Before entering the compressor
2. Expansion Device is responsible for...  
Low Temperature & Low Pressure
3. Clamp meter is used for measuring...  
Resistance
4. Which component divides your VCRS as high side and low side?  
Expansion device
5. Which is the correct arrangement of components in a VCRS.  
Evaporator – Compressor – condenser – Expansion Device

#### Section – B

03X02 = 06 Marks

1. Write the name of five tools in the tool bag of an HVAC&R Technician.
  - a. clamp meter
  - b. Electric tester
  - c. Thermometer
  - d. Pressure Guage
  - e. Megger
2. Write down the general safety rules for an HVAC&R Technician.
  - a. use proper safety tools



## BHARTIYA SKILL DEVELOPMENT UNIVERSITY

- b. Don't touch electrical equipment directly.
  - c. Check the tools before its use.
  - d. Don't use already damage tools
3. Write down the name of accessories used in a refrigerator.
- a. OLP
  - b. Relay
  - c. Capacitor
  - d. Timer

### Section – C

03X03 = 09 Marks

1. Which refrigerant is used in a domestic refrigerator and which portion represents sub cooling liquid region?

Modern refrigerators usually use a refrigerant called **HFC-134a** (1,1,1,2-Tetrafluoroethane), which does not deplete the ozone layer. Region from **exit of condenser to entry of expansion device** represents the subcooled liquid region.

2. Explain the process of defrosting in freezer of the refrigerator?

The process of removing the ice or frost from the evaporator or freezer is called as defrosting.

#### Various Methods of Defrosting

##### 1. Manual Defrosting

This is the oldest method of defrosting used in the earliest refrigerators that had no automatic defrost systems. When the householder sees the layer of ice on the evaporator coil of the freezer, they simply shut down the refrigerator and keep its doors open. Since the compressor has stopped there is no more formation of the cooling effect and the cabinet of refrigerator starts getting heated. The ice on the evaporator coil starts melting and gets completely removed after certain period of time thus completing the process of defrosting.

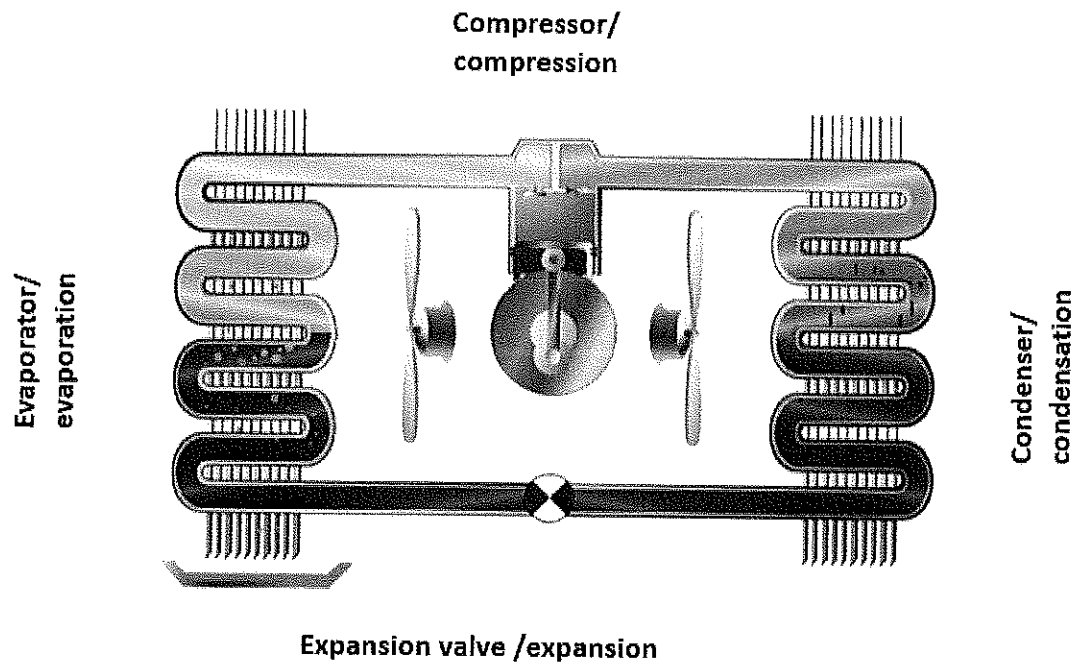
##### 2. Automatic Defrosting ( Defrosting timer)

The modern day refrigerators are fitted with thermostat that enables the user to set certain temperature in the freezer compartment as per their requirement. Besides this, there is a small plastic tray below the freezer compartment where the excess water from freezer is collected.

## BHARTIYA SKILL DEVELOPMENT UNIVERSITY

When the temperature set by the user is attained the thermostat stops supply of power to the compressor and there is halt in production of the cooling effect

3. Explain refrigeration system? Which type of evaporator is used in freezer of the refrigerator?



- ✓ Fin type evaporator in domestic refrigerator and flooded type evaporator in commercial refrigeration system.
- ✓ In refrigeration system temperature is much lower than air conditioning system.

( )

( )

**BHARTIYA SKILL DEVELOPMENT UNIVERSITY****School of HVAC&R****I Semester, 2<sup>nd</sup> In-Sem. Examination****B. Voc. Program, Winter Semester (2018-19)****Course Code: HVA1103****Time: 1 Hour****Course Name: Assembly and Installation of Air-conditioning****Max. Marks: 20****Instructions:**

1. Attempt all Questions.
2. Each question of Section – A carries 01 marks.
3. Each question of Section – B carries 02 marks.
4. Each question of Section – C carries 03 marks.

**Section – A**

05X01 = 05 Marks

1. Very common thermometer consists of a small amount of \_\_\_\_\_ in an evacuated capillary tube:
  - A. Cold water.
  - B. Mercury,
  - C. Nitrogen.
  - D. All of the above
2. Unit of work is:
  - A. Meter
  - B. Watt,
  - C. Joule
  - D. Pascal
3. Unit of power is \_\_\_\_:
  - A. Meter,
  - B. Pascal,
  - C. Joule,
  - D. Watt.
4. If the heat flows out of the system, it is taken as:
  - A. Positive,
  - B. Negative,
  - C. Neither A nor B,
  - D. Both A and B.

5. Internal energy is the energy in \_\_\_\_\_:
- A. Center of matter,
  - B. High-side,
  - C. Storage
  - D. High- and low-side.

**Section – B**

03X02 = 06 Marks

1. What are Macroscopic and Microscopic energy modes?
2. What is Enthalpy?
3. Where does condenser installed in split AC?

**Section – C**

03X03 = 09 Marks

1. Describe the Vapour compression refrigeration system.
2. Write the basic procedure in installation of Air conditioners.
3. Describe the charging method of refrigerant in split AC.

**BHARTIYA SKILL DEVELOPMENT UNIVERSITY****School of HVAC&R**I Semester, 2<sup>nd</sup> In-Sem. Examination

B. Voc. Program, Winter Semester (2018-19)

(Answer Key)

Course Code: HVA1103

Time: 1 Hour

Course Name: Assembly and Installation of Air-conditioning

Max. Marks: 20

**Instructions:**

1. Attempt all Questions.
2. Each question of Section – A carries 01 mark..
3. Each question of Section – B carries 02 marks.
4. Each question of Section – C carries 03 marks.

**Section – A**

05X01 = 05 Marks

1. Very common thermometer consists of a small amount of \_\_\_\_\_ in an evacuated capillary tube?  
A. Cold water.  
**B. Mercury,**  
C. Nitrogen.  
D. All of the above
2. Unit of work is:  
A. Meter  
B. Watt,  
**C. Joule**  
D. Pascal
3. Unit of power is \_\_\_\_:  
A. Meter,  
B. Pascal,  
C. Joule,  
**D. Watt.**
4. If the heat flows out of the system, it is taken as:  
A. Positive,  
**B. Negative,**  
C. Neither A nor B,

D. Both A and B.

5. Internal energy is the energy in \_\_\_\_\_:

- A. Center of matter,
- B. High-side,
- C. **Storage**
- D. High- and low-side.

### Section – B

03X02 = 06 Marks

1. What is Macroscopic and Microscopic energy mode?

**Macroscopic energy mode:** includes macroscopic kinetic and potential energy.

**Microscopic energy mode:** refers to the energy stored in molecular and atomic structure of the system and known as molecular internal energy or simply internal energy.

2. What is Enthalpy.

Enthalpy is defined as

$$H = U + pV$$

Where

$H =$  enthalpy

$U =$  internal energy

$p =$  pressure

$V =$  volume

Enthalpy is an extensive property but specific enthalpy(h) is intensive.

3. Where does condenser installed in split AC?

In ODU

## BHARTIYA SKILL DEVELOPMENT UNIVERSITY

### Section – C

03X03 = 09 Marks

1. Describe the Vapour compression refrigeration system.

Ans: The vapor-compression uses a circulating liquid refrigerant as the medium which absorbs and removes heat from the space to be cooled and subsequently rejects that heat elsewhere. A typical, single-stage vapor-compression system. All such systems have four components: a compressor, a condenser, a thermal expansion valve (also called a throttle valve or metering device), and an evaporator. Circulating refrigerant enters the compressor in the thermodynamic state known as a saturated vapor and is compressed to a higher pressure, resulting in a higher temperature as well.

2. Write the basic procedure in installation of Air conditioners.

Ans

- Select an unobstructed location on your interior wall to mount the indoor air conditioning unit.
- Secure the mounting plate to the interior wall.
- Create a hole in the wall to fit the piping.
- Check the electrical connections.
- Connect the pipes.

3. Describe the charging method of refrigerant in split AC.

The outdoor unit is also prefilled with the refrigerant or the gas from the factory. Most of the gas is filled in the condenser coil at very high pressure. Since the gas is filled at high pressure sufficiently large quantity of gas can be filled in the condenser, which is good enough to produce the desired cooling effect in the room.

Since the refrigerant is already present in the air conditioning system, we don't have charge the extra gas, however, if the distance between the indoor and the outdoor units is large, some external gas charging may be necessary. The gas present within the outdoor unit has to be released to the whole system including the refrigerant tubing and the indoor unit. Thus in the new split unit there is no actual gas charging in real sense, it is only distributing the gas compressed in the outdoor unit to the whole air conditioning system.

( )

( )

**BHARTIYA SKILL DEVELOPMENT UNIVERSITY****School of HVAC&R****I Semester, 2<sup>nd</sup> In-Sem. Examination****B. Voc. Program, Winter Semester (2019-20)****Course Code: HVA1004 1104****Time: 1 Hour****Course Name: Sheet Metal and Welding****Max. Marks: 20****Instruction:**

1. Attempt all Questions.
2. Each question of Section – A carries 01 mark.
3. Each question of Section – B carries 02 mark.
4. Each question of Section – C carries 03 mark.

**Section – A**

05X01 = 05 Marks

1. What Gas mixture generally used for Oxy-fuel gas welding?
  - a. Oxygen and Acetone
  - b. Oxygen and Acetylene
  - c. Nitrogen and Acetylene
  - d. Nitrogen and Oxygen
2. Gases that do not chemically react are called:
  - a. Inactive Gases
  - b. Active Gases
  - c. Inert Gases
  - d. Passive Gases
3. Heat Generation in welding can be expressed as:
  - a.  $Q = I^2RT$
  - b.  $Q = IR^2T$
  - c.  $Q = IRT^2$
  - d.  $Q = I^2RT^2$
4. The ratio of Acetylene to Oxygen is approximately for neutral flame used in gas welding:
  - a. 1 : 10
  - b. 10 : 1
  - c. 1 : 1
  - d. 1 : 2



## BHARTIYA SKILL DEVELOPMENT UNIVERSITY

5. The gap between the electrode and the work piece should be about?

- A. Electrode Diameter
- B. Core wire Diameter
- C. Electrode Diameter X 2
- D. Core wire Diameter X 1.5

### Section – B

03X02 = 06 Marks

1. Classify all the flame characteristics in oxy fuel welding.
2. Write down the welding joint types with neat sketches.
3. What is a protective equipment? Write the name of four protective equipment used in welding.

### Section – C

03X03 = 09 Marks

1. Describe the designation of Mild steel electrode in MMA. Explain what do you by E 6013 and E 7018.
2. Describe the welding testing methods in detail.
3. State the purpose and process of tack welding with a neat sketch.

**BHARTIYA SKILL DEVELOPMENT UNIVERSITY****Answer Key****School of HVAC&R****I Semester, 2<sup>nd</sup> In-Sem. Examination****B. Voc. Program, Winter Semester (2019-20)****Course Code: HVA1004****Time: 1 Hour****Course Name: Sheet Metal and Welding****Max. Marks: 20****Instruction:**

1. Attempt all Questions.
2. Each question of Section – A carries 01 mark.
3. Each question of Section – B carries 02 marks.
4. Each question of Section – C carries 03 marks.

**Section – A**

05X01 = 05 Marks

1. What Gas mixture generally used for Oxy-fuel gas welding?
  - a. Oxygen and Acetylene
2. Gases that do not chemically react are called:
  - a. Inert Gases
3. Heat Generation in welding can be expressed as:
  - a.  $Q = I^2RT$
4. The ratio of Acetylene to Oxygen is approximately for neutral flame used in gas welding:
  - a. 1 : 1
5. The gap between the electrode and the work piece should be about:
  - a. Core wire Diameter

**Section – B**

03X02 = 06 Marks

1. Classify all the flame characteristics in oxy fuel welding.

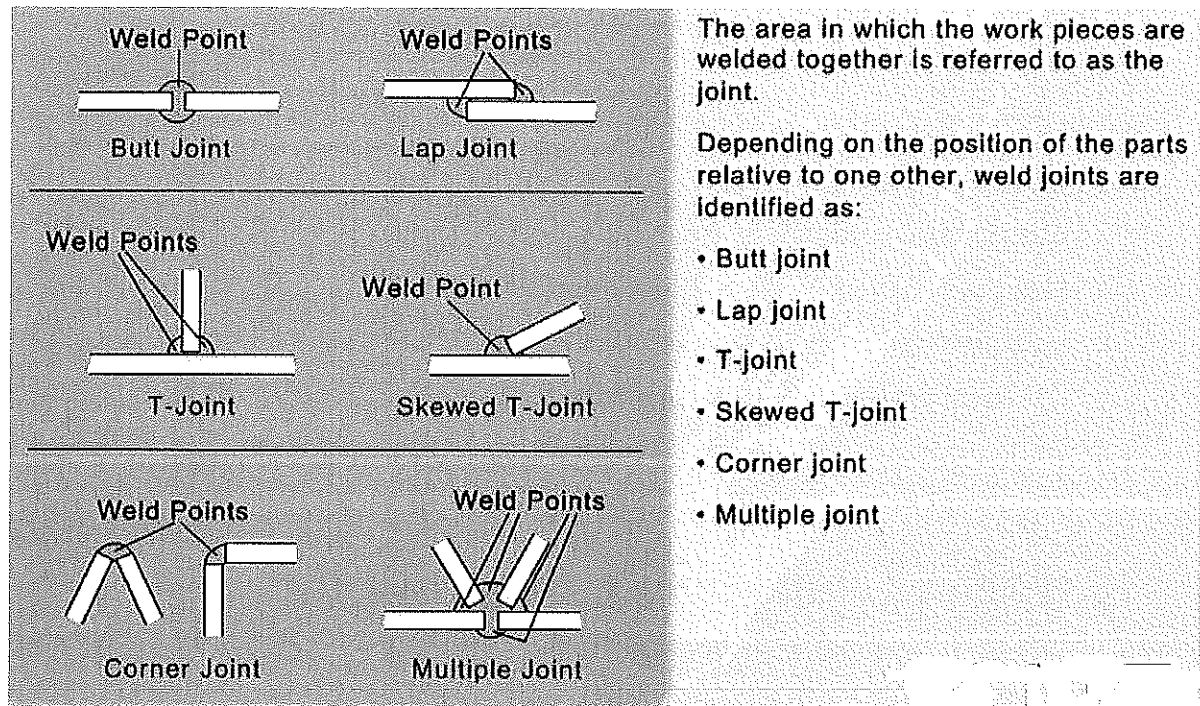
Ans: Neutral flame (1:1)

Carburizing flame (Higher acetylene)

Oxidizing flame (Higher oxygen)

## BHARTIYA SKILL DEVELOPMENT UNIVERSITY

2. Write down the welding joint types with neat sketch.



3. What is protective equipment? Write name of four protective equipment used in welding.

Ans: Gloves

Helmet

Goggles

Apron

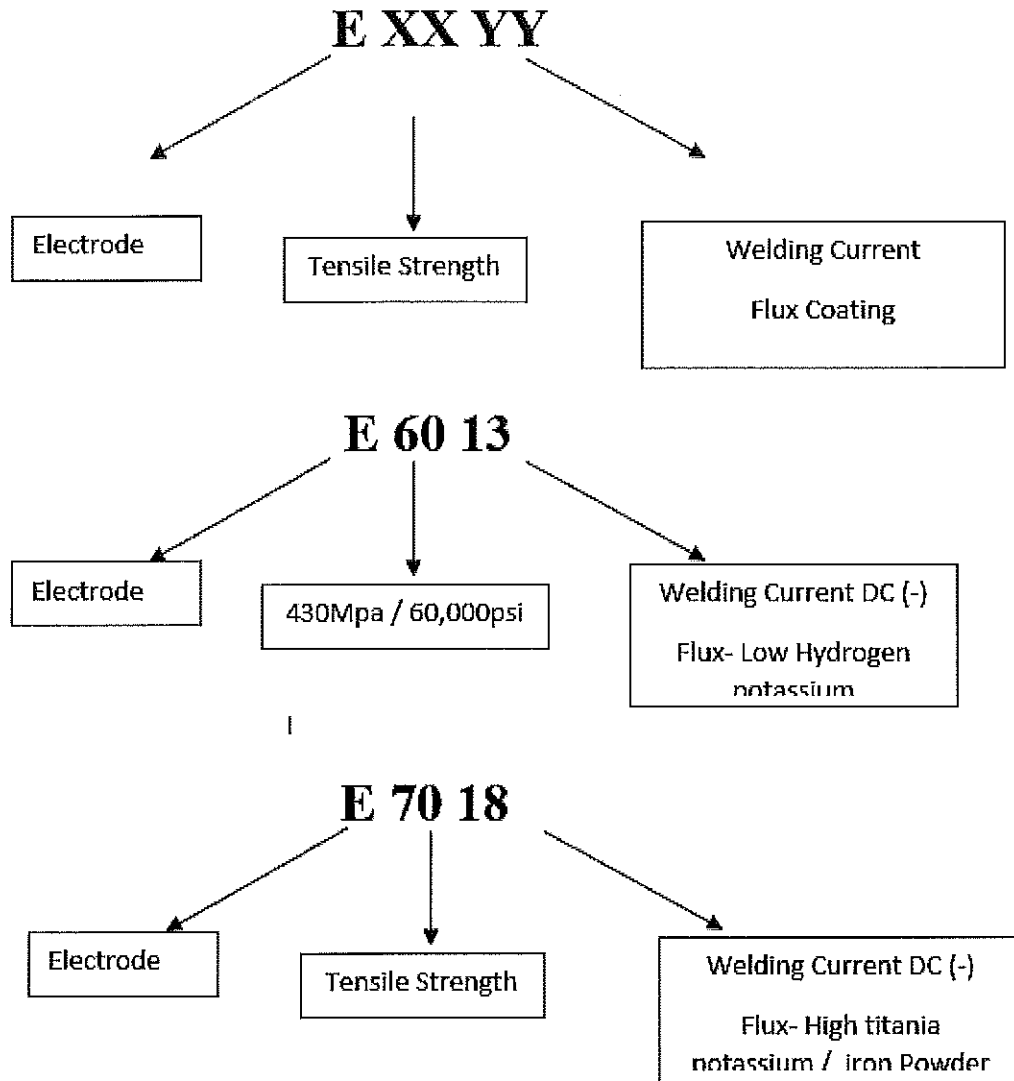
Ear plug

### Section – C

03X03 = 09 Marks

1. Describe the designation of Mild steel electrode in MMA. Explain what do you by E 6013 And E 7018.

# BHARTIYA SKILL DEVELOPMENT UNIVERSITY



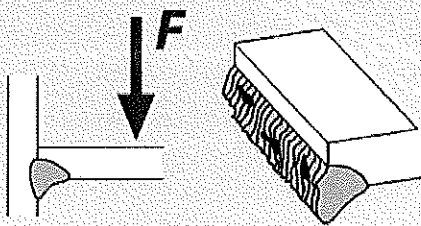
2. Describe the welding testing methods in detail.

### Weld Seam Inspection Procedures

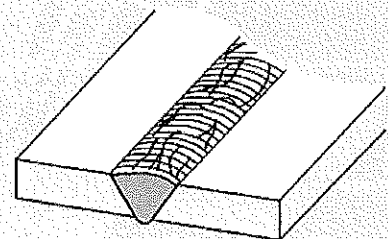
Inspection procedures are divided into two basic types: destructive and non-destructive.

You will be presented with more detail about the various procedures on the following pages.

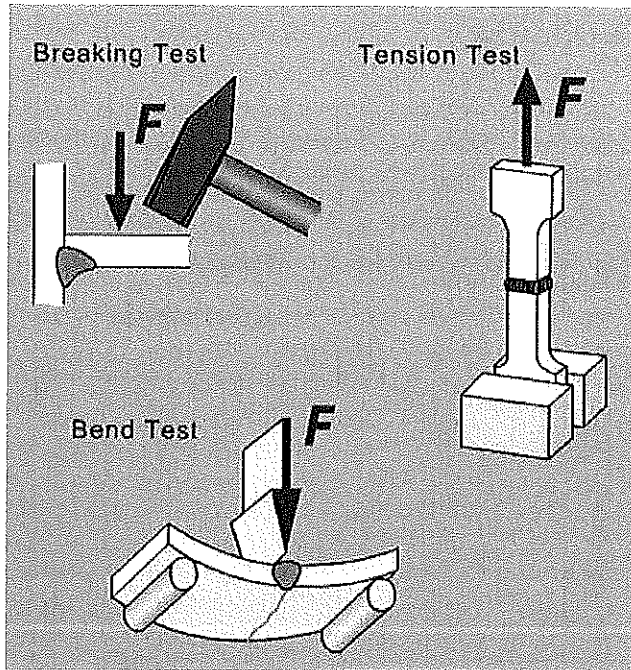
Destructive Inspection Procedure



Non-Destructive Inspection Procedure



## BHARTIYA SKILL DEVELOPMENT UNIVERSITY



### Destructive Weld Seam Inspection Procedures

Destructive weld seam inspection procedures are used, for example, to verify the mechanical strength of a welded joint.

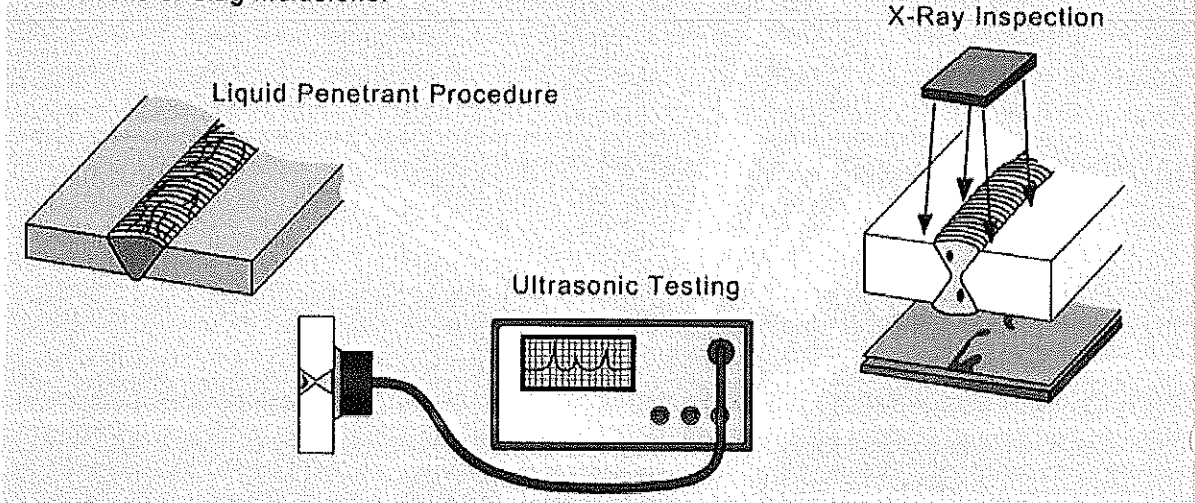
During the breaking test, the weld seam is mechanically broken, for example, in a press or by means of hammer blows.

During the bend test, the weld seam is bent in a press until it breaks.

During the tension test, flat or round stock is stretched until it breaks.

### Non-Destructive Weld Seam Inspection Procedures

Non-destructive weld seam inspection procedures can be used to identify structural defects in the seam, such as cracks or slag inclusions.



3. State the purpose and process of tack welding with neat sketch.

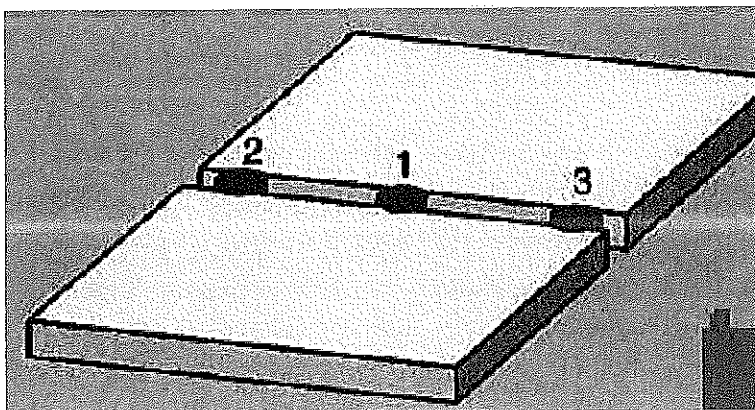
## BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Prior to performing welding, the parts to be welded must be correctly aligned in terms of form and dimensions.

To ensure that they cannot move about, they are briefly attached to one another in certain positions. This process is called tack welding.

The tack welding procedure comprises the following work steps:

- ▶ **Aligning**  
When aligning the parts, it is important to ensure an even root gap.
- ▶ **Clamping**  
The parts are clamped in the correct position using clamping tools or fixtures (locking pliers, mitre clamps).
- ▶ **Tack welding**  
During tack welding, the aligned and clamped parts are connected with short spot welds.



( )

( )

**BHARTIYA SKILL DEVELOPMENT UNIVERSITY**

School of HVAC & R Skills  
First Semester, 2<sup>nd</sup> In-Sem. Examination  
B. Voc. Program, Winter Semester (2018-19)

**Course Code: HVA 1105****Time: 1 Hour****Course Name: RAC Electrical****Max. Marks: 20**

**Instruction:** All questions are compulsory. 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 can be used.

**Section – A**

05X01 = 05 Marks

- Digital multimeter is used for \_\_\_\_\_.
  - measuring AC and DC current, voltage and resistance
  - measuring AC current and voltage
  - measuring DC current and resistance
  - measuring AC voltage and resistance
- What are the types of conduits available?
  - PVC conduit
  - Flexible conduit
  - Heavy gauge steel screwed conduit
  - All of these
- The unit of magnetic flux is:
  - Henry
  - Weber
  - ampere-turn/ weber
  - ampere/metre
- Permeability in magnetic circuit corresponds to -----in electrical circuit:
  - Resistance
  - resistivity
  - conductivity
  - conductance
- The property of a material which opposes the creation of magnetic flux in it is known as:
  - Reluctivity
  - magneto motive force
  - permeance
  - reluctance

**Section – B**

03X02 = 06 Marks

- Explain Faraday's law of electromagnetic induction.
- Briefly explain the following:
  - Reluctance
  - Permeability
- What are the advantages and disadvantages of Casing Capping Wiring?

**Section – C**

03X03 = 09 marks

- Derive the expression for the relationship between line current and phase current, line voltage and phase voltage in a star connected system.
- Write note on different types of house wiring in brief.
- Draw a sine wave and explain the following.
  - Cycle
  - Time period
  - Frequency
  - Amplitude.

( )

( )

**BHARTIYA SKILL DEVELOPMENT UNIVERSITY**

School of HVAC & R Skills  
First Semester, 2<sup>nd</sup> In-Sem. Examination  
B. Voc. Program, Winter Semester (2018-19)

Course Code: HVA 1105

Course Name: RAC Electrical

**Section – A**

05X01 = 05 Marks

1. Digital multimeter is used for \_\_\_\_\_.
- a. measuring AC and DC current, voltage and resistance
  - b. measuring AC current and voltage
  - c. measuring DC current and resistance
  - d. measuring AC voltage and resistance

Ans. (a)

2. What are the types of conduits available?
- a. PVC conduit
  - b. Flexible conduit
  - c. Heavy gauge steel screwed conduit
  - d. All of these

Ans. (d)

3. The unit of magnetic flux is:
- a. Henry
  - b. Weber
  - c. ampereturn/ weber
  - d. amper/metre

Ans. (b)

4. Permeability in magnetic circuit corresponds to -----in electrical circuit.
- a. Resistance
  - b. resistivity
  - c. conductivity
  - d. conductance

Ans. (c)

5. The property of a material which opposes the creation of magnetic flux in it is known as.
- a. Reluctivity
  - b. magneto motive force
  - c. permeance
  - d. reluctance

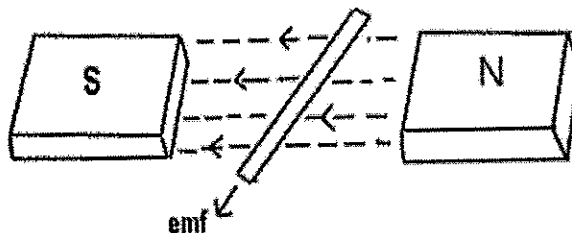
Ans. (d)

**Section – B**

03X02 = 06 Marks

1. Explain Faraday's law of electromagnetic induction.

Ans.



**BHARTIYA SKILL DEVELOPMENT UNIVERSITY**

**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 induced 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.

**2. Briefly explain following.**

- a. Reluctance
- b. Permeability

**Ans.**

**Reluctance**

The obstruction offered by a magnetic circuit to the magnetic flux is known as reluctance. As in electric circuit, there is resistance similarly in the magnetic circuit, there is a reluctance, but resistance in an electrical circuit dissipates the electric energy and the reluctance in magnetic circuit stores the magnetic energy. Also in an electric circuit, the electric field provides the least resistance path to the electric current. Similarly, the magnetic field causes the least reluctance path for the magnetic flux. It is denoted by S.

**Permeability**

The magnetic permeability is defined as the property of the material to allow the magnetic line of force to pass through it. In other words, the magnetic material can support the development of the magnetic field.

The permeability of the material is equal to the ratio of the field intensity to the flux density of the material. It is expressed by the formula shown below.

$$\mu = \frac{B}{H}$$

Where, B – magnetic flux density  
H – magnetic field intensity

**3. What are the advantages and disadvantages of Casing Capping Wiring?**

**Ans.**

**Advantages of Casing Capping Wiring:**

- Stay for long time in the field due to strong insulation of capping and casing.
- It is safe from oil, Steam, smoke and rain.
- No risk of electric shock due to covered wires and cables in casing & capping.

**Disadvantages Casing Capping Wiring:**

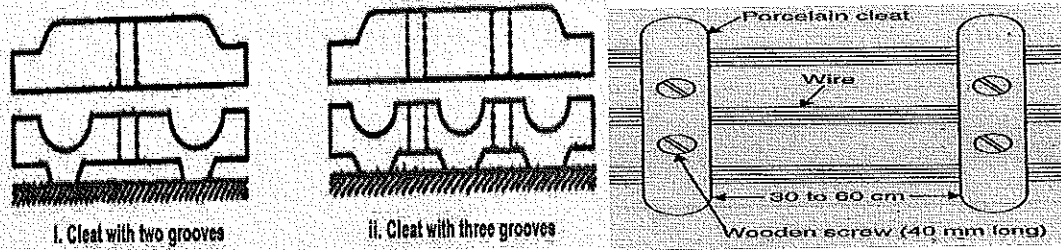
- There is a high risk of fire in casing & capping wiring system.
- Not suitable in the acidic and humidity conditions.
- Costly repairing and need more material.

**BHARTIYA SKILL DEVELOPMENT UNIVERSITY**

**2. Write note on different types of house wiring in brief?**

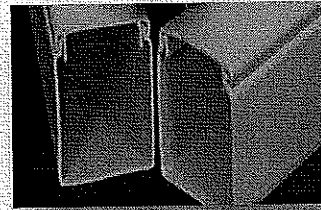
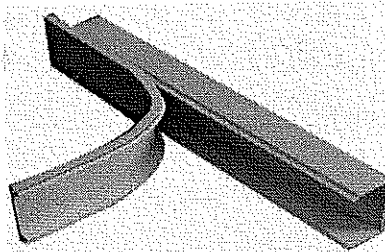
**Ans.** Cleat wiring:

Cleats is generally made up of porcelain, Plastic or wood. Cleat wiring system is a temporary wiring system therefore it is not suitable for domestic Purpose. The use of cleat wiring system is over nowadays.



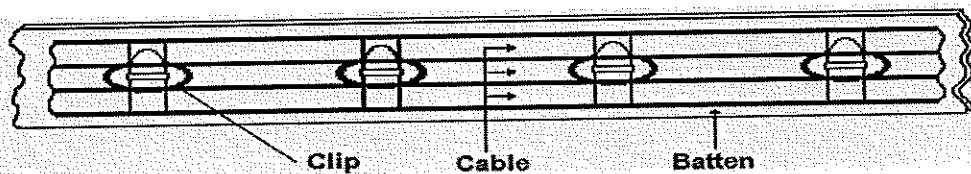
**2.2 Casing and capping wiring**

The cables are covered in the casing. The casing is made up of PVC with parallel grooves so as to install cables. the capping used to cover the wires and cables installed and fitted in the casing.



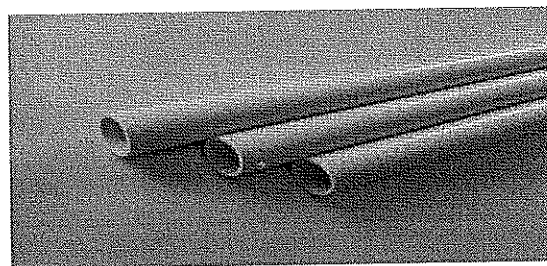
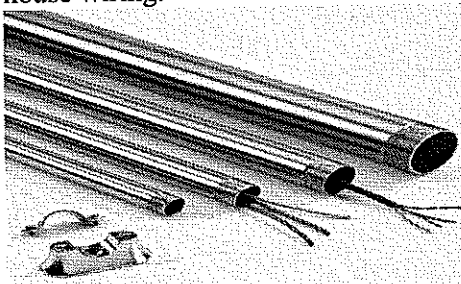
**2.3 Batten Wiring (CTS or TRS)**

The full form of TRS is Tough rubber-sheath and CTS is cab tyre sheath. Single core or double core or three core TRS cables with a circular shape cables are used in this kind of wiring. Mostly, single core cables are preferred. TRS cables are chemical proof, water proof, steam proof. The TRS and CTS cables are install on wood batten. The cables are held on the wooden batten by brass link clips (buckle clip) already fixed on the batten with brass pins and spaced at an interval of 10cm for horizontal runs and 15cm for vertical runs.



**2.4 Conduit Wiring**

There are two types of conduit wiring according to pipe installation. In Conduit wiring system, the conduits should be connected to earth at some suitable points in case of steel conduit. Conduit wiring is a professional way of wiring a building. Mostly PVC conduits are used in house wiring.



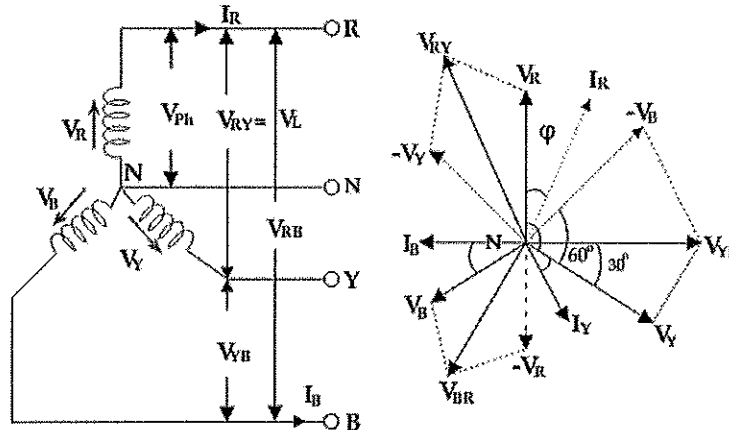
**BHARTIYA SKILL DEVELOPMENT UNIVERSITY**

**Section – C**

03X03 = 09 marks

**1. Derive the expression for the relationship between line current and phase current, line voltage and phase voltage in a star connected system.**

**Ans.** To derive the relations between line and phase currents and voltages of a star connected system, we have first to draw a balanced star connected system.



Suppose due to load impedance the current lags the applied voltage in each phase of the system by an angle  $\phi$ . As we have considered that the system is perfectly balanced, the magnitude of current and voltage of each phase is the same. Let us say, the magnitude of the voltage across the red phase i.e. magnitude of the voltage between neutral point (N) and red phase terminal (R) is  $V_R$ . Similarly, the magnitude of the voltage across yellow phase is  $V_Y$  and the magnitude of the voltage across blue phase is  $V_B$ . In the balanced star system, magnitude of phase voltage in each phase is  $V_{ph}$ .

$$V_R = V_Y = V_B = V_{ph}$$

We know in the star connection, line current is same as phase current. The magnitude of this current is same in all three phases and say it is  $I_L$ .

$\therefore I_R = I_Y = I_B = I_L$ , Where,  $I_R$  is line current of R phase,  $I_Y$  is line current of Y phase and  $I_B$  is line current of B phase. Again, phase current,  $I_{ph}$  of each phase is same as line current  $I_L$  in star connected system.

$$\therefore I_R = I_Y = I_B = I_L = I_{ph}$$

Now, let us say, the voltage across R and Y terminal of the star connected circuit is  $V_{RY}$ . The voltage across Y and B terminal of the star connected circuit is  $V_{YB}$  The voltage across B and R terminal of the star connected circuit is  $V_{BR}$ .

From the diagram, it is found that

$$V_{RY} = V_R + (-V_Y)$$

$$\text{Similarly, } V_{YB} = V_Y + (-V_B)$$

$$\text{And, } V_{BR} = V_B + (-V_R)$$

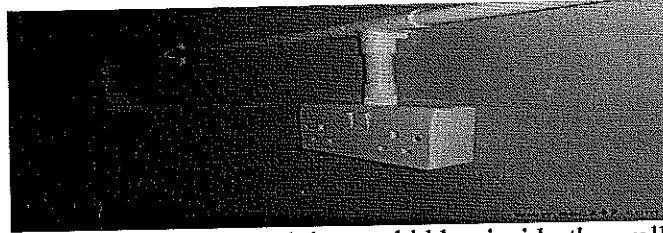
Now, as angle between  $V_R$  and  $V_Y$  is  $120^\circ$ (electrical), the angle between  $V_R$  and  $-V_Y$  is  $180^\circ - 120^\circ = 60^\circ$ (electrical).

$$\begin{aligned} V_L &= |V_{RY}| = \sqrt{V_R^2 + V_Y^2 + 2V_R V_Y \cos 60^\circ} \\ &= \sqrt{V_{ph}^2 + V_{ph}^2 + 2V_{ph} V_{ph} \times \frac{1}{2}} \\ &= \sqrt{3}V_{ph} \\ \therefore V_L &= \sqrt{3}V_{ph} \end{aligned}$$

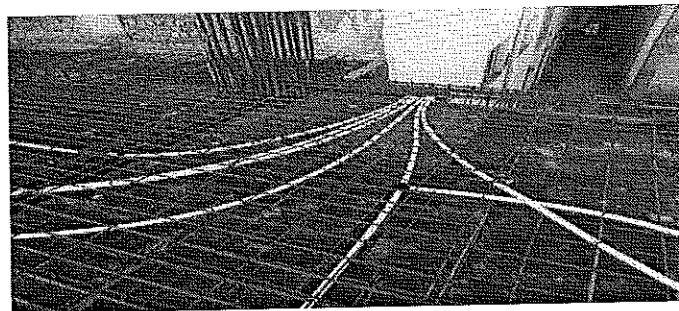
**BHARTIYA SKILL DEVELOPMENT UNIVERSITY**

**2.4.1 Types of Conduit wiring**

(i) **Surface Conduit Wiring:** If conduits installed on surface of wall, it is known as surface conduit wiring. in this wiring method, they make holes on the surface of wall and then conduit is installed.

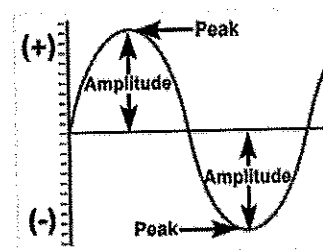
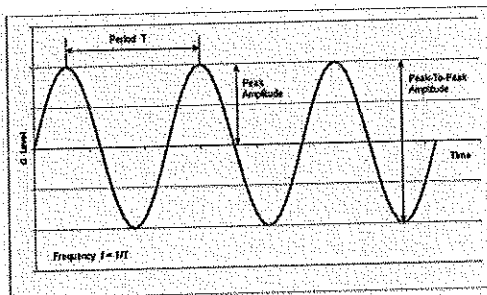


(ii) **Concealed Conduit wiring:** If the conduits are hidden inside the wall slots with the help of plastering, it is called concealed conduit wiring. In other words, the electrical wiring system inside wall, roof or floor with the help of plastic or metallic piping is called concealed conduit wiring. obviously, it is most popular, beautiful, stronger and common electrical wiring system nowadays.



**3. Draw a sine wave and explain following**

- a. Cycle
- b. Time period
- c. Frequency
- d. Amplitude.



**Cycle:** One complete wave of alternating current or voltage.

**Time Period (T):** The time required to produce one complete cycle of a waveform

**Frequency (f):** is equal to number of cycles per second.

$$f = 1/T$$

**Amplitude:** is the magnitude or intensity of the signal waveform measured in volts or amps.

( )

( )

**BHARTIYA SKILL DEVELOPMENT UNIVERSITY**

School of HVAC Skill

2<sup>nd</sup> insem examination

B. Voc. Program, Winter (2018-19)

HVA1106 Basic Electronics for HVAC

Time: 1 Hour

Max. Marks: 20

Answer all the questions

**Section – A****05 objective type questions, each question carries 01 mark. 05X01 = 05 Marks**

1. Which one of the following is correct for Forward bias PN junction diode?  
i) Depletion layer increases ii) Depletion layer decreases iii) Depletion layer remains constant iv) None of the above
2. Which one of the following is abbreviated for LED?  
i) Light Emitting Diode ii) Light Emission Diode iii) Light Effecting Diode iv) None of the above
3. There are two components diode and resistor. Which one of the following is correct for them?  
i) Both are active devices ii) Both are passive devices iii) Diode active and resistor passive device iv) None of the above
4. Which one of the following is correct for n-type semiconductor?  
i) Electrons are majority ii) Holes are majority iii) Both electrons and holes are majority iv) None of them
5. Which one of the following is required for intrinsic semiconductor?  
i) Doping ii) Thermal and light energy iii) Chemical energy iv) none of the above

**Section – B****03 short answer type questions, each question carries 02 marks. 06 Marks**

1. What is Diode? What's the difference between diode and resistor?
2. What's the difference between intrinsic and extrinsic semiconductor?
3. When does semiconductor behave as an insulator? Discuss it.

**Section – C****03 essay type questions, each question carries 03 marks. 03X03 = 09 Marks**

1. Draw and explain the operation of Forward biased PN junction diode.
2. How is color of LED defined? Discuss the working principle of a LED
3. What is Full wave rectifier? Explain the operation principle of it.

( )

( )

**BHARTIYA SKILL DEVELOPMENT UNIVERSITY****School of HVAC Skill****2<sup>nd</sup> insem examination****B. Voc. Program, Winter (2018-19)****HVA1106 Basic Electronics for HVAC****Time: 1 Hour****Max. Marks: 20****Answer all the questions****Section – A****05 objective type questions, each question carries 01 mark.****05X01 = 05 Marks**

1. Which one of the following is correct for Forward bias PN junction diode?  
i) Depletion layer increases ii) Depletion layer decreases iii) Depletion layer remains constant iv) None of the above
2. Which one of the following is abbreviated for LED?  
i) Light Emitting Diode ii) Light Emission Diode iii) Light Effecting Diode iv) None of the above
3. There are two components diode and resistor. Which one of the following is correct for them?  
i) Both are active devices ii) Both are passive devices iii) Diode active and resistor passive device iv) None of the above
4. Which one of the following is correct for n-type semiconductor?  
i) Electrons are majority ii) Holes are majority iii) Both electrons and holes are majority iv) None of them
5. Which one of the following is required for intrinsic semiconductor?  
i) Doping ii) Thermal and light energy iii) Chemical energy iv) none of the above

**Section – B****03 short answer type questions, each question carries 02 marks.****06 Marks**

1. What is Diode? What's the difference between diode and resistor?  
**Ans:** Diode is two terminal passive component which is usually used for rectifying the AC signal.  
Diode is semiconductor device but resistor is not like that. Diode can rectify the AC signal but resistor can't do this.
2. What's the difference between intrinsic and extrinsic semiconductor?  
**Ans:** Intrinsic semiconductor is pure but extrinsic semiconductor is not pure. All semiconductors are normally intrinsic and could be extrinsic after doping. Doping is necessary for extrinsic but intrinsic semiconductors do not require this.
3. When does semiconductor behave as insulator? Discuss it  
**Ans:** At absolute 0 K, semiconductor behaves as insulator as no electron can move from valance band to conduction band at this temp. Band gap is large enough and unable to move electrons from Valance to conduction band.

# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

## Section – C

03 essay type questions, each question carries 03 marks.

03X03 = 09 Marks

1. Draw and explain the operation of Forward biased PN junction diode.

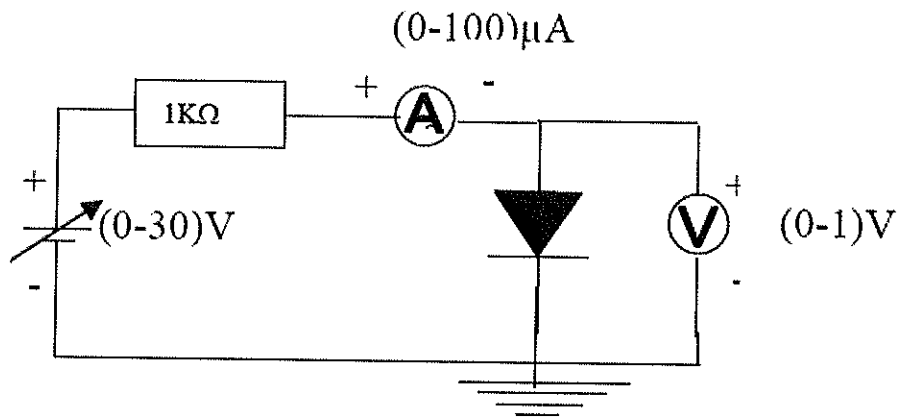


Fig.1: Forward biased PN junction

A p-n junction diode is two-terminal or two-electrode semiconductor device, which allows the electric current in only one direction while blocks the electric current in reverse direction. If the diode is forward biased, it allows the electric current flow. On the other hand, if the diode is reverse biased, it blocks the electric current flow. P-N junction semiconductor diode is also called as p-n junction semiconductor device.

If the p-n junction diode is forward biased, it allows the electric current flow. Under forward biased condition, the p-type semiconductor is connected to the positive terminal of battery whereas; the n-type semiconductor is connected to the negative terminal of battery.

2. How is color of LED defined? Discuss the working principle of a LED

The colours of the LED depend on materials used to fabricate the devices.

Light Emitting Diode (LED) works only in forward bias condition. When Light Emitting Diode (LED) is forward biased, the free electrons from n-side and the holes from p-side are pushed towards the junction.

When free electrons reach the junction or depletion region, some of the free electrons recombine with the holes in the positive ions. We know that positive ions have less number of electrons than protons. Therefore, they are ready to accept electrons. Thus, free electrons recombine with holes in the depletion region. In the similar way, holes from p-side recombine with electrons in the depletion region.

# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

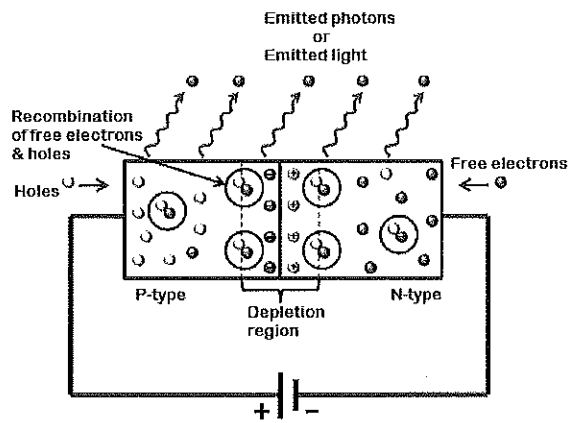


Fig2: LED schematic for operation

3. What is Full wave rectifier? Explain the operation principal of it.

**Ans:** This type of rectifier uses two diodes and a transformer with center tapped secondary winding. During the positive half cycle of the input AC diode D1 is forward biased and the current starts flowing to the load through it. During the negative half of the input diode D2 forward biased and D1 becomes reverse biased. Load current start flowing through D2 during this negative peak. Note that the current flow through load has not changed even when the voltage polarity changed.

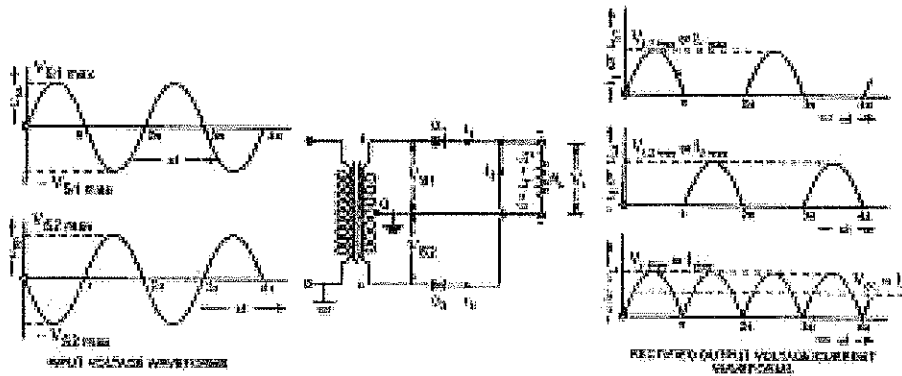


Fig 3: Full Wave Center-tapped Rectifier

Advantages of this rectifier are lower ripple factor and higher efficiency, but the necessity of transformer with center tapping secondary is the main disadvantage and makes a circuit as costlier.

