Registration No.: .....

# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

**School of RAC Skills**

**1st Semester, 2nd In-Sem. Examination**

**B. Voc. Program, Summer Semester (2019-20)**

**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 kinematic viscosity of a fluid of specific gravity = 0.9 and viscosity of 0.05 poise is:
   a) 0.056Stoke
   b) $5.56\times10-4m^2/s$
   c) $5.56\times10-5m^2/s$
   d) $5.56\times10-7m^2/s$
2. The internal pressure of a 25 mm diameter soap bubble ($\sigma$ = 0.5 N/m) is:
   a) 80 $N/m^2$
   b) 160 $N/m^2$
   c) 40 $N/m^2$
   d) 320 $N/m^2$
3. The viscosity of Newtonian fluids relates the variation of shear stress with :
   a) Strain
   b) Shear strain
   c) Rate of shear strain
   d) None of these
4. Bulk modulus is the ratio of:
   a) shear stress to volumetric strain
   b) volumetric strain to shear stress
   c) compressive stress to volumetric strain
   d) volumetric strain to compressive stress
5. The fluid will rise in capillary when the capillary is placed in fluid, if?
   a) the adhesion force between molecules of fluid and tube is less than the cohesion between liquid molecules
   b) the adhesion force between molecules of fluid and tube is more than the cohesion between liquid molecules
   c) the adhesion force between molecules of fluid and tube is equal to the cohesion between liquid molecules
   d) All of the above

## Section – B

03X02 = 06 Marks

1. Write down the definition of fluid.
2. Derive expression for newton's law of viscosity.
3. Explain surface tension and vapour pressure.

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## Section – C

03X03 = 09 Marks

1. Derive Bernoulli's equation in terms of energy and head.
2. Write down the different types of fluid flow.
3. A fluid having mass of 2000Kg occupying a volume of 20 $m^3$ respectively, calculate density, specific volume, specific gravity and specific weight of that fluid?

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**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) b
4) c
5) b

**Short answer: Section B**

1) Fluid it is a substance that deform countinousely under the action of shear stress no matter how small it is
2) Miu = tio/du/dy
3) the tension of the surface film of a liquid caused by the attraction of the particles in the surface layer by the bulk of the liquid, which tends to minimize surface area.
   the pressure of a vapour in contact with its liquid or solid form.

**Long answer question Section C**

1) $P + \frac{1}{2} \rho v^2 + \rho g h = \text{constant}$
2) Laminar flow, turbulent flow, steady flow, uniform flow, compressible or incompressible flow, one, two and three dimensional flow. Viscid or inviscid flow

3). Density= 2000/20 = 100 kg/m3
Specific volume 20/2000= 0.01
Specific gravity = 100/1000 =0.1
Specific weight = 100*10 =1000

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**School of RAC Skills**

**Session: 2019-20 (Summer Semester)**

**B. Voc. Program, 1st Semester,**

**2st In-Sem. Examination**

**Course Code: HVA1102** **Time: 1 Hour**

**Course Name: Installation and Assembly of Refrigerator** **Max. Marks: 20**

## Section – A

05X01 = 05 Marks

1. Which grade/type of copper can't be used in a pressurized system application?

a) K type
b) L type
c) M type
d) DWG type

2. Who did first study about the refrigeration?

a) William Cullen
b) Oliver Evans
c) Jacob Perkins
d) James Harrison

3. What is the melting temperature of copper?

a) 1285 °C
b) 1685 °C
c) 1085 °C
d) 1585 °C

4. What is main purpose of vacuuming?

a) Decreases of system
b) Lowers the temperature
c) Remove air and moisture from system
d) Collect refrigerant in ODU

5. Which of the following refrigerant is not being used in refrigerators ?

a) R134a
b) R600
c)R290
d) R32

## Section – B

03X02 = 06 Marks

1. Explain all safety procedures during brazing.
2. Explain cooling by salt and ice mixture.

3. Calculate heat absorbed by 10Kg of water to raise its temperature by 20° C?

## Section – C

03X03 = 09 Marks

1. Explain the working and functioning of refrigerator.
2. How refrigerant transfer heat in VCR system, explain with suitable sketch?
3. Explain bending process of making "L" bend with sketch.

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**School of RAC Skills**

**Session: 2019-20 (Summer Semester)**

**B. Voc. Program, 1st Semester,**

**2st In-Sem. Examination**

**Course Code: HVA1102** **Time: 1 Hour**

**Course Name: Installation and Assembly of Refrigerator** **Max. Marks: 20**

## Section – A

05X01 = 05 Marks

1. (d)DWG type

2. (a) William Cullen

3. (c) 1085 °C

4.(c) Remove air and moisture from system

5. (d) R32

## Section – B

03X02 = 06 Marks

**Answer 1**

Proper outer clothing, preferably woolen, and eye protection should be worn.
Protective gloves should be worn when handling the chemicals used for brazing.
Chemicals such as acids and alkalines are sometimes used to clean parts before brazing and can produce chemical burns if allowed to come in contact with the skin.
The caution notices on the packages should be followed when using brazing fluxes. Fumes generated during brazing can be a serious hazard. Brazing fluxes generate fluoride fumes when heated. Cadmium in silver brazing alloys vaporizes when overheated and produces cadmium oxide, a highly toxic substance. If cadmium oxide fumes are inhaled into the respiratory tract, they can cause pulmonary distress, shortness of breath and in cases of severe exposure, may cause death.

**Answer 2**

Cooling by Ice and salt solution

Certain substances such as common salt, when added to water dissolve in water and absorb its heat of solution from water (endothermic process). This reduces the temperature of the solution (water+salt). Sodium Chloride salt (NaCl) can yield temperatures up to -20° C and Calcium Chloride (Cecil2) up to - 50° C in properly insulated containers. However, as it is this process has limited application, as the dissolved salt has to be recovered from its solution by heating.

**Answer 3**

$m = 10\ Kg = 10000\ g$

$c_p = 4.18\ J/g{\cdot}K$

$\Delta T = 20^\circ C = 20\ K$

$Q = m \times C_p \times \Delta T$

$Q = 10000g \times 4.18\ J/g{\cdot}K \times 20^\circ K$

$= 836{,}000J$

$= 836KJ = 13.34\ KW$

## Section – C

03X03 = 09 Marks

**Answer 1**

refrigerator a common device used in all scopes of refrigeration to preserve and store perishable food items. It works on VCR cycle. It consists of a heat pump, insulated body and container on which insulation has been applied. VCR cycle work as follows:-

Compressor compresses refrigerant having low temperature and pressure, after compression refrigerant vapour has a stage of high pressure and pressure (superheated vapour). This high temperature is not required so we need to reject it, in condenser this temperature(heat) has been rejected into atmosphere. This heat is gained from the evaporator.

Condenser converts superheated vapour from compressor into subcooled liquid. At the outlet of condenser refrigerant normally has temperature range close to 35-40 degree centigrade. After condenser liquid refrigerant enters into expansion valve, here refrigerant loses its pressure because pipe friction. Pressure and temperature are proportional so sudden large drop in refrigerant creates sudden temperature. Expansion valve almost work opposite of compressor.

After expansion valve liquid refrigerant having low temperature and pressure enters into a heat exchanger named as evaporator. Here low temperature refrigerant exchanges heat with surrounding (say room), this heat cause evaporation (not boiling) in refrigerant, in this heat exchange process we get cooling on our fridge or cold air through AC.

At the outlet of evaporator, refrigerant is a mixture of liquid and vapour. It enter into compressor through accumulator and repeat cycle.

**Answer 2**

Refrigerant transfer heat in VCR cycle, during this process its temperature and pressure increase and decrease.

Compressor compresses refrigerant having low temperature and pressure,, after compression refrigerant vapour has a stage of high pressure and pressure (superheated vapour). This high temperature is not required so we need to reject it, in condenser this temperature(heat) has been rejected into atmosphere. This heat is gained from the evaporator.

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After expansion valve liquid refrigerant having low temperature and pressure enters into a heat exchanger named as evaporator. Here low temperature refrigerant exchanges heat with surrounding (say room), this heat cause evaporation in refrigerant,, in this heat exchange process we get cooling on our fridge or cold air through AC.

At the outlet of evaporator, refrigerant is a mixture of liquid and vapor. It enter into compressor through accumulator and repeat cycle.

**Answer 3**

**Procedure**

a) Take a pipe of 200mm length.
b) Mark reference point "A" at the mid of pipe,, i.e. 100mm
c) Mark bending point "B",, taking distance C from point A towards end of pipe. Where

C = (distance between 0-45 degree) – diameter of pipe

d) Set point C at 0-0 position and bend pipe.

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## School of **RAC Skills**

**I Semester, 2nd In-Sem. Examination**

**B. Voc. Program, Summer Semester (2019-20)**

**Course Code: HVA1103** **Time: 1 Hour**

**Course Name: Assembly & Installation of AC** **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. At which rate additional refrigerant to be added in a room AC? If piping length is going longer then the company nominal length.
   a. 20 g/m
   b. 30 g/m
   c. 25 g/m
   d. 35 g/m

2. The efficiency of air cooled heat exchanger over water cooled heat exchanger is-

   a. More
   b. Less
   c. Equal
   d. None

3. Fins are used in an AC system for-

   a. Reduces the heat transfer
   b. Increases the heat transfer
   c. Both a & b
   d. None of the above

4. By increasing the number of rows in a cooling coil. The efficiency of system will be-

   a. Increase
   b. Reduce
   c. Equal
   d. None of the above

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5. The capacity of AC unit is measured in-

   A. Ampere

   B. Volt

   C. Watt

   D. Joule

## Section – B

03X02 = 06 Marks

1. Define the term TR.
2. Write down the steps in pumping down of an Air conditioning system.
3. Enlist the name of tools required during the installation of an Air Conditioner .

## Section – C

03X03 = 09 Marks

1. Explain the installation steps in short.
2. Explain the following terms: -

   a) Latent Heat

   b) Sensible Heat

   c) Watt
3. Explain the different types of heat exchanger.

Md. Nayimul Haque

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## School of **RAC Skills**

## ANSWER KEY

**I Semester, 2nd In-Sem. Examination**

**B. Voc. Program, Summer Semester (2019-20)**

**Course Code: HVA1103** **Time: 1 Hour**

**Course Name: Assembly & Installation of AC** **Max. Marks: 20**

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4. Each question of Section – C carries 03 mark.

### Section – A

05X01 = 05 Marks

1. At which rate additional refrigerant to be added in a room AC? If piping length is going longer then the company nominal length.
   a. 20 g/m

2. The efficiency of air cooled heat exchanger over water cooled heat exchanger is-

   b. Less

3. Fins are used in an AC system for-

   b. Increases the heat transfer

4. By increasing the number of rows in a cooling coil. The efficiency of system will be-

   a. Increase

5. The capacity of AC unit is measured in-

   c. Watt

### Section – B

03X02 = 06 Marks

1. Define the term TR.

One ton of refrigeration is the heat transfer rate required to melt 1 ton (2000 lbf) of ice at 32°F in 1 day (24 hr).

2. Write down the steps in pumping down of an Air conditioning system.

Ans:- Turn on AC

Run for 10-15 minutes on high speed

Add the compound gauge to system

Close discharge valve

Wait for gauge pressure until reaching to 0.

Close the suction valve and Turn off AC from main switch as gauge shows 0 pressure

3. Enlist the name of tools required during the installation of an Air Conditioner.

Ladder

Sprit level

Bender

Wire cutter

Hammer

Screw driver

Vacuum pump

Etc.

## Section – C

03X03 = 09 Marks

1. Explain the installation steps in short.

Ans:-

Selection of proper location

Opening the unit box

Marking on the wall

Making holes on the wall of required no. as per manual

Place the IDU & ODU

Making proper connection with tubes and drain pipe

Making electrical connection

Nitrogen gas holding

Leak testing

Vacuuming

Opening the refrigerant valve

Check all parameters

2. Explain the following terms: -

a) Latent Heat

The amount of heat required for changing the phase of a substance.

b) Sensible Heat

The amount of heat required for changing the temperature of a substance.

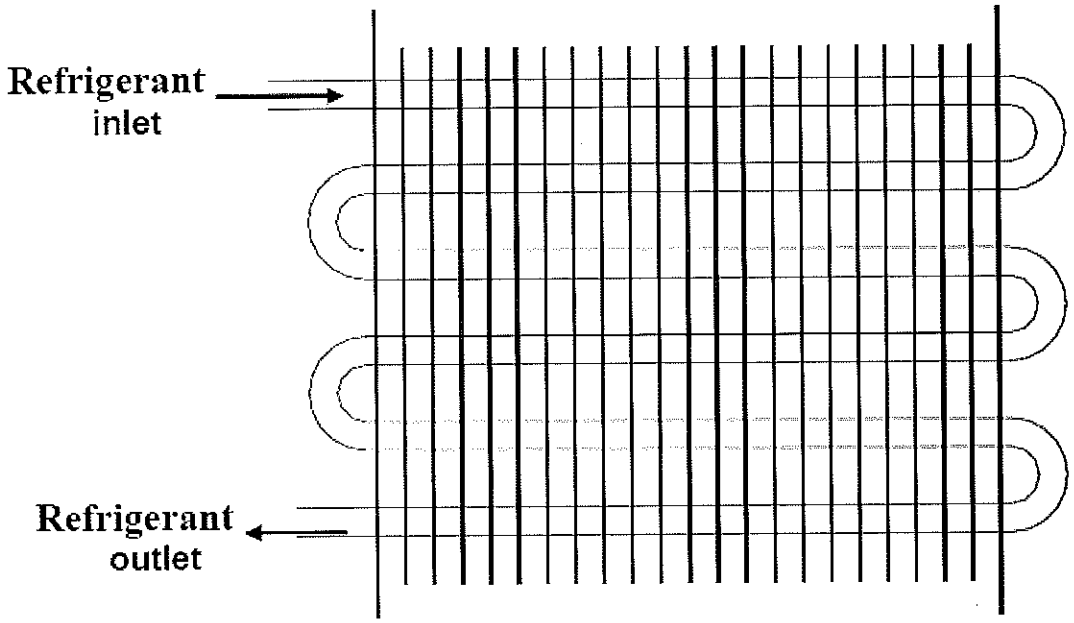
c) Watt

The rate of doing work.

3. Explain the different types of heat exchanger.

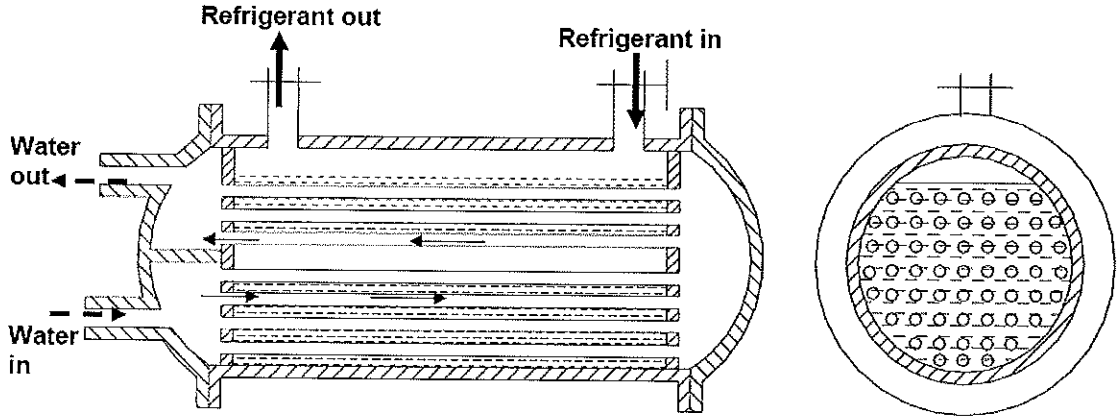
**Ans:-**

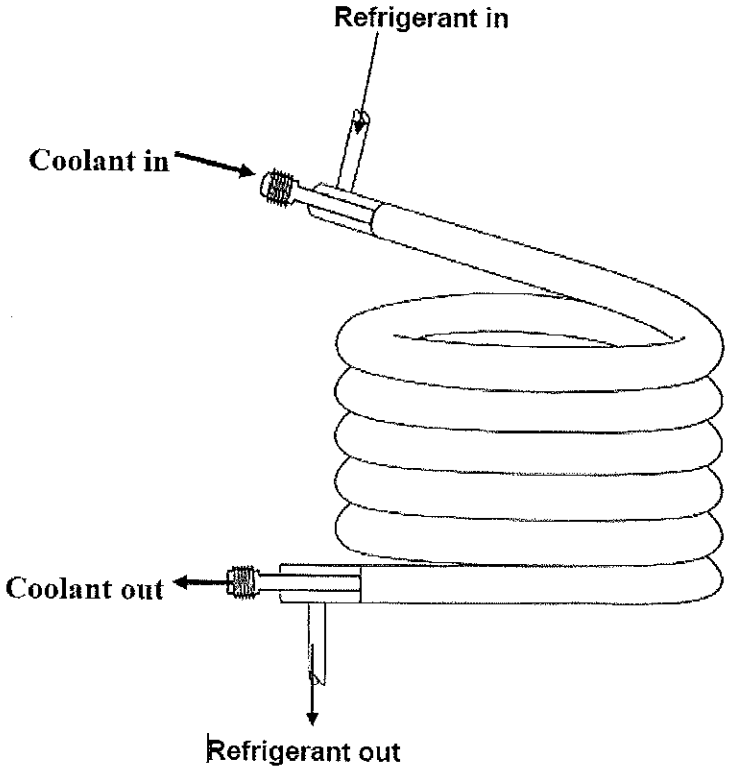
Fin and tube heat exchanger




Shell and tube heat exchanger

Tube and tube heat exchanger



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## School of RAC Skills

**I Semester, 2nd In-Sem. Examination**

**B. Voc. Program, Summer Semester (2019-20)**

**Course Code: HVA1104** **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. Types of Joining Process according to primary classification are:

   a. Welding and brazing
   b. Nut & bold
   c. Temporary & Permanent
   d. Adhesive

2.In OXY-FUEL Process which one of the following gases has high pressure:

   a. Butane
   b. Acetylene
   c. Oxygen
   d. Argon

3.Oxygen cylinder Line pressure & cylinder pressure are:

   a. 0.25 bar & 200 bar
   b. 0.5psi & 200 psi
   c. 0.5bar & 200 psi
   d. 0.25Psi &19bar

4. Color coding for Oxygen & Acetylene is :

   a. Red &Blue
   b. Black & white
   c. Blue & Red
   d. maroon & Ruby Red

5.Welding Electrode code 6013 means:

   a. Cellulose Electrode
   b. Rutile Electrode
   c. Basic Electrode
   d. Special Purpose Electrode

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## Section – B

03X02 = 06 Marks

1. Define Brazing and the temperature range for Brazing?
2. Explain Welding and its types.
3. What is the role of nitrogen during brazing?

## Section – C

03X03 = 09 Marks

1. Name and draw three different Flames of Oxy Acetylene setup.
2. What are the Safety procedure for brazing?
3. Name and explain the function of Sheet metal tools.

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## School of **RAC Skills**

**III Semester, 2nd In-Sem. Examination**

**B. Voc. Program, Summer Semester (2019-20)**

**Course Code: HVA1104** **Time: 1 Hour**

**Course Name: SHEET METAL & 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.C

2.C

3.A

4. C

5.C

### Section – B

03X02 = 06 Marks

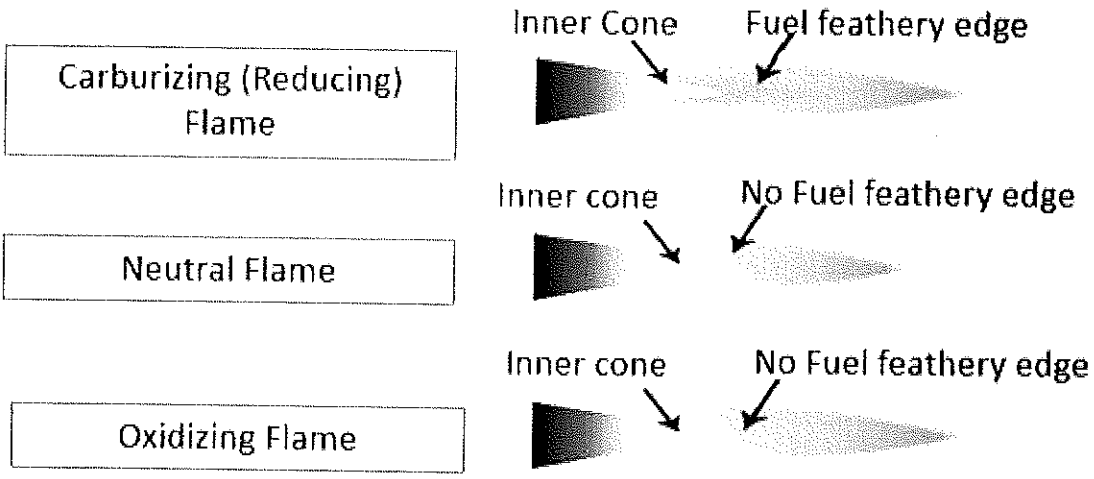
1. Brazing is non detachable joining process most common in AIR-CONDITIONING or pipe lines for producing tough, strong and leak proof joint .Temperature range for brazing is between 450c- 873\900 c
2. Electric arc welding is defined as Electric arc generated to fuse the molten metal on the base plate is Known as electric arc welding.
3. Flushing nitrogen during brazing will not allow oxide formation inside the copper tube which in turn will not react with refrigerant.

### Section – C

03X03 = 09 Marks

1. Three oxy acetylene Flames are

   Oxidizing, Carburising and neutral flame




2. The safety procedures for brazing are:

- Using the tool and equipment with care.
- Not using the fingers when applying flux
- Protect the valves with rags and sink material
- Use only recommended fillers for joints.
- Never let the temperature reach beyond limits.

3. Steel Rule: It is useful in measuring and laying out small work. It can be measure with accuracy of 0.5 mm.

Vernier Calipers: This is used for measuring dimensions up to 0.02 mm.

Micrometer Caliper: This is used to measure the thickness of metal sheets accurately up to 0.01 mm.

Straight Edge: This is a flat graduated bar of steel with one longitudinal edge beveled. This bar comes in variety of lengths ranging from 1 to 3 meters. It is useful for scribing long straight lines.

Scriber: This is sometimes called the metal workers pencil. It is a long wire of steel I with its one end sharply pointed and hardened to scratch lines on sheet metal I in laying out patterns.

1.

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# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

**School of Electrical Skills**
**Session: 2019-20 (Summer Semester)**
**B. Voc. Program, 1st Semester,**
**2nd In-Sem. Examination**

**Course Code: HVA1105** **Time: 1 Hour**
**Course Name: RAC Electricals** **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 unit of magnetic flux is:
   (a) Henry (b) Weber (c) ampere turn/ weber (d) ampere/metre
2. Permeability in magnetic circuit corresponds to _____ in electrical circuit.
   (a) Resistance (b) resistivity (c) conductivity (d) conductance
3. 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
4. Two resisters of resistance R1 and R2 are connected in series the equivalent resistance (R) is:
   (a) R= R1+R2 (b) R=(R1R2)/(R1+R2)
   (c) R=(R1+R2)/(R1R2) (d) none of these
5. Current is said to be alternating when it changes in:
   (a) Magnitude only (b) Direction only
   (c) Both Magnitude and direction (d) None of these

## Section – B

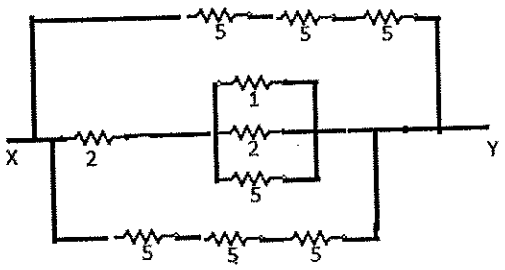
03X02 = 06 Marks

1. Define (i) permanent magnets (ii) Electromagnets.
2. Explain Faraday's laws of electromagnetic induction.
3. Briefly explain following.
   (i) Reluctance (ii) Permeability

## Section – C

03X03 = 09 marks

1. Three resistance of 50 ohms, 100 ohms and 200 ohms are connected in parallel to a 250V supply. Determine the current flowing through each resistor.
2. Draw a sine wave and explain following
   (i) Cycle (ii) Time period (iii) Frequency (iv) Amplitude.
3. Find the equivalent resistance between X and Y (Given all the resistances are in ohms).



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Set - B (A)

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**School of Electrical Skills**
**Session: 2019-20 (Summer Semester)**
**B. Voc. Program, 1st Semester,**
**2nd In-Sem. Examination**

**Course Code: HVA1105**
**Course Name: RAC Electricals**

**Time: 1 Hour**
**Max. Marks: 20**

## Section – A

05X01 = 05 Marks

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

## Section – B

03X02 = 06 Marks

**Ans. 1**

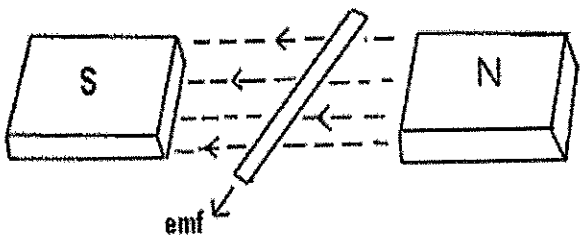
Permanent Magnets

These magnets are permanent in the sense that once they have been magnetized they retain a certain degree of magnetism. Permanent magnets are generally made of ferromagnetic material. Such material consists of atoms and molecules that each have a magnetic field and are positioned to reinforce each other

Electromagnets

Electromagnets are extremely strong magnets. They are produced by placing a metal core (usually an iron alloy) inside a coil of wire carrying an electric current. The electricity in the current produces a magnetic field. The strength of the magnet is directly proportional to the strength of the current and the number of coils of wire. Its polarity depends on the direction of flow of current. While the current flows, the core behaves like a magnet. However, as soon as the current stops, the core is demagnetized.

**Ans. 2.**




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.

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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.

**Ans. 3.**

**(i) 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.

**(ii) 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

**Section – C**

03X03 = 09 marks

**Ans. 1.** Three resistance 50 ohms, 100 ohms and 200 ohms are connected in parallel to a 250V supply. Determine the current flowing through each resistor.

R1=50
R2=100
R3=200
Since it is a parallel circuit the voltage across all the resistor is same.
Thus,
250=50*I1
I1=5 A
Current through 50 ohm resistor is 5A
250=100*I2

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I2=2.5

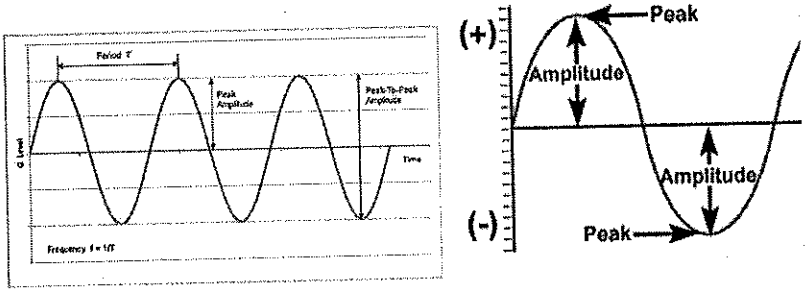
Current through 100 ohm resistor is 2.5A

250=200*I3

I3=1.25

Current through 200 ohm resistor is 1.25A

**Ans. 2.**




Cycle: One complete wave of alternating current or voltage.

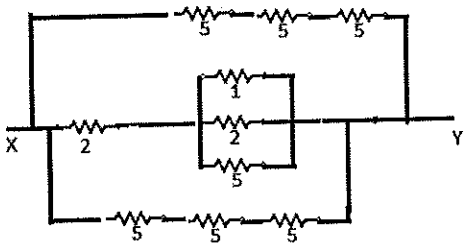
Time Period (T): The time required to produce one complete cycle of a waveform

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.

**Ans. 3.** Find the equivalent resistance between X and Y (Given all the resistances are in ohms).




RT1= 5+5+5

=15

RT2=5+5+5

=15

1/RT3=1/1+1/2+1/5

1/RT3=1+.5+.2

1/RT3=1.7

RT3=0.588

RT4=2+0.588

RT4=2.588

1/Rtotal =[1/15+1/15+1/2.588]

1/Rtotal=0.519732

Rtotal=1.924068

Set-A

# BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

**School of HVAC Skills**
**Session: 2019-20 (Summer Semester)**
**B. Voc. Program, 1st Semester,**
**2nd In-Sem. Examination**

**Course Code: 1106** HVA
**Course Name: Electronics and Instrumentation**

**Time: 1 Hour**
**Max. Marks: 20**

## Section – A

05X01 = 05 Marks

1 Which one of the following is the possible range of current limiting resistor essential for lightening the LED in certain applications after pressing the push-button?
a. 25- 55 Ω
b. 55-110 Ω
c. 110-220 Ω
d. 220- 330 Ω

2 Which one of the following is responsible for the color of emitted light from LED?
a. Construction of LED, that is physical dimensions
b. Number of available carriers
c. Type of semiconductor material used
d. Number of recombinations taking place

Q. 3 Which one of the following is use photovoltaic solar energy conversion system?
a. Fuel cell
b. Solar cell
c. Solar pond
d. None of the above.

Q. 4 In a full wave rectifier, the current in each diode flows for
a. Whole cycle of the input signal
b. Half cycle of the input signal
c. More than half cycle of the input signal
d. None of these

Q. 5 Which one of the following material is generally use for ICs?
a. Silicon
b. Germanium
c. Copper
d. None of the above

## Section – B

03X02 = 06 Marks

1. What is LED and where it is used?
2. What is the difference between half wave and full wave rectifier?
3. What are the advantages of ICs?

## Section – C

03X03 = 09 Marks

1. What is a p-n junction diode? Explain its working.
2. How a Bipolar Junction Transistor works? Explain.
3. What is a full-wave rectifier? Explain its working.

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**c.Type of semiconductor material used**

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a. silicon
b. germanium
c. copper
d. none of the above
**a. Silicon**

## Section – B

03X02 = 06 Marks

**1. What is LED and where it is used?**

Ans. A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The major uses of LEDs are to illuminate objects and even places. Its application is everywhere due to its compact size, low consumption of energy, extended lifetime and flexibility in terms of use in various applications.

Applications and Uses of LEDs can be seen in:

- TV Backlighting
- Smartphone Backlighting
- LED displays

- Automotive Lighting
- Dimming of lights

**2. What is the difference between half wave and full wave rectifier?**

| Parameters | Half Wave Rectifier | Full Wave Rectifier |
|---|---|---|
| Number of diodes used in circuit | 1 | 2 or 4<br>(It varies with the type of circuit) |
| Maximum efficiency for rectification | 40.6% | 81.2% |
| Basic ripple frequency | f (i.e., supply frequency provided) | 2f |
| Ripple factor | More | Less |
| Voltage regulation | Good | Better as compared to half wave rectifier |
| Transformer utilization factor | 0.287 | 0.693 |
| Peak inverse voltage (PIV) | Maximum value of supplied input | Twice the maximum value of supplied input |
| Peak factor | 2 | 1.414 |
| Form factor | 1.57 | 1.11 |
| Average current value | $I_{mav}/\pi$ | $2I_{mav}/\pi$ |
| Transformer core saturation | Possible | Not posiible |

**3. What are the advantages of ICs?**

The Integrated circuits (ICs) have many more following advantages:

- The entire physical size of IC is extremely small than that of discrete circuit.
- The weight of an IC is very less as compared entire discrete circuits.
- It's more reliable.
- Because of their smaller size it has lower power consumption.
- It can easily replace but it can hardly repair, in case of failure.
- Because of an absence of parasitic and capacitance effect it has increased operating speed.
- Temperature differences between components of a circuit are small.
- It has suitable for small signal operation.
- The reduction in power consumption is achieved due to extremely small size of IC.

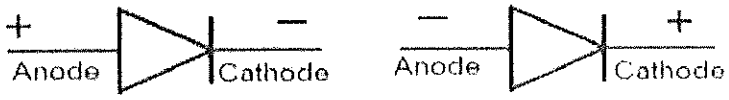
**Section – C**

03X03 = 09 Marks

**1. What is a p-n junction diode? Explain its working.**

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 opposite or 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.

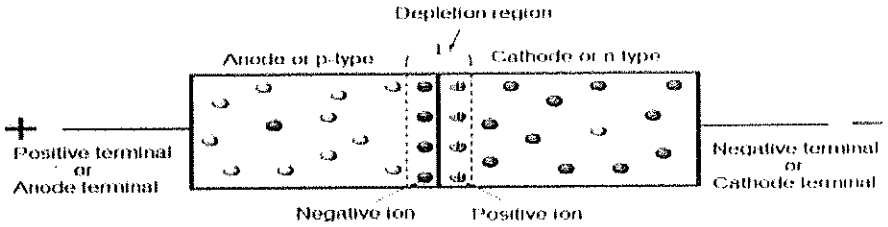



Forward biased Reverse biased

In the above figure, arrowhead of a diode indicates the conventional direction of electric current when the diode is forward biased (from positive terminal to the negative terminal). The holes which moves from positive terminal (anode) to the negative terminal (cathode) is the conventional direction of current.

**Forward Biased Diode**

In forward biased p-n junction diode (p-type connected to positive terminal and n-type connected to negative terminal), anode terminal is a positive terminal whereas cathode terminal is negative terminal. Anode terminal is a positively charged electrode or conductor, which supplies holes to the p-n junction. In other words, anode terminal or positive terminal is the source of positive charge carriers (holes), the positive charge carriers (holes) begins their journey at anode terminal and travel through the diode and ends at cathode terminal.

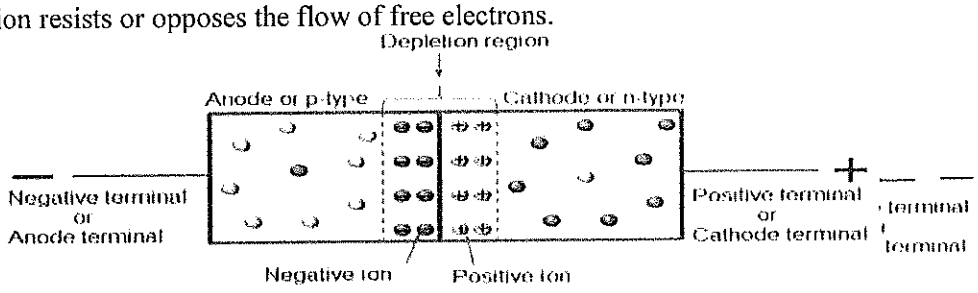



Forward biased

Cathode is the negatively charged electrode or conductor, which supplies free electrons to the p-n junction. In other words, cathode terminal or negative terminal is the source of free electrons, the negative charge carriers (free electrons) begins their journey at cathode terminal and travel through the diode and ends at anode terminal. The free electrons are attracted towards the anode terminal or positive terminal whereas the holes are attracted towards the cathode terminal or negative terminal.

**Reverse Biased Diode**

If the diode is reverse biased (p-type connected to negative terminal and n-type connected to positive terminal), the anode terminal becomes a negative terminal whereas the cathode terminal becomes a positive terminal. Anode terminal or negative terminal supplies free electrons to the p-n junction. In other words, anode terminal is the source of free electrons, the free electrons begin their journey at negative or anode terminal and fills the large number of holes in the p-type semiconductor. The holes in the p-type semiconductor get attracted towards the negative terminal. The free electrons from the negative terminal cannot move towards the positive terminal because the wide depletion region at the p-n junction resists or opposes the flow of free electrons.



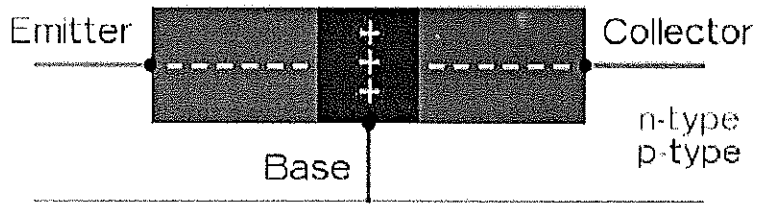

Reverse biased

Cathode terminal or positive terminal supplies holes to the p-n junction. In other words, cathode terminal is the source of holes, the holes begin their journey at positive or cathode terminal and occupies the electrons position in the n-type semiconductor.

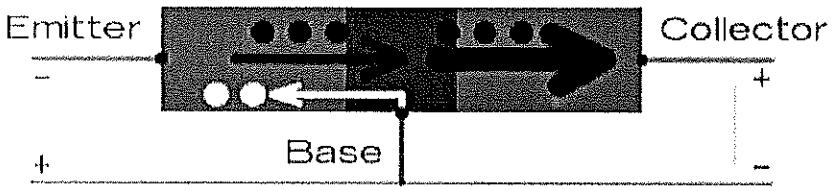
The free electrons in the n-type semiconductor gets attracted towards the positive terminal. The holes from the positive terminal cannot move towards the negative terminal because the wide depletion region at the p-n junction opposes the flow of holes.

**2. How a Bipolar Junction Transistor works? Explain.**

A **bipolar junction transistor** (**bipolar transistor** or **BJT**) is a type of transistor that uses both electrons and holes as charge carriers. Unipolar transistors, such as field-effect transistors, only use one kind of charge carrier. BJTs use two junctions between two semiconductor types, n-type and p-type. BJTs are manufactured in two types: NPN and PNP, and are available as individual components, or fabricated in integrated circuits, often in large numbers. A transistor will either amplify a current or switch it on or off. Let's see how it works in the case of an n-p-n transistor.
Transistor has three terminals **emitter**, **collector**, and **base**. When no current is flowing in the transistor, we know the p-type silicon is short of electrons (shown here by the little plus signs, representing positive charges) and the two pieces of n-type silicon have extra electrons (shown by the little minus signs, representing negative charges).




Another way of looking at this is to say that while the n-type has a surplus of electrons, the p-type has **holes** where electrons should be. Normally, the holes in the base act like a barrier, preventing any significant current flow from the emitter to the collector while the transistor is in its "off" state. A transistor works when the electrons and the holes start moving across the two junctions between the n-type and p-type silicon. Let's connect the transistor up to some power. Suppose we attach a small positive voltage to the base, make the emitter negatively charged, and make the collector positively charged. Electrons are pulled from the emitter into the base—and then from the base into the collector. And the transistor switches to its "on" state:



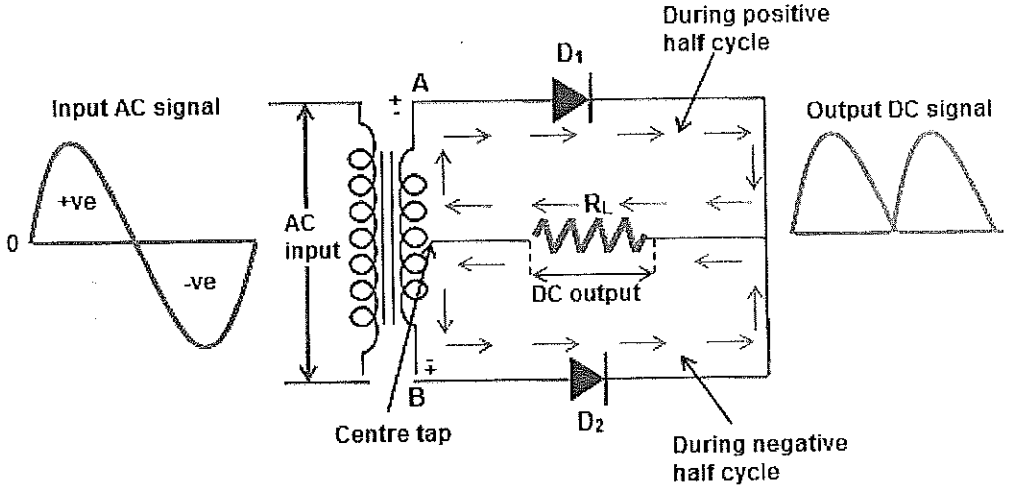

The small current that we turn on at the base makes a big current flow between the emitter and the collector. By turning a small input current into a large output current, the transistor acts like an amplifier. But it also acts like a switch at the same time. When there is no current to the base, little or no current flows between the collector and the emitter. Turn on the base current and a big current flows. So the base current switches the whole transistor on and off. Technically, this type of transistor is called **bipolar** because two different kinds (or "polarities") of electrical charge (negative electrons and positive holes) are involved in making the current flow. We can also understand a transistor by thinking of it like a pair of diodes. With the base positive and the emitter negative, the base-emitter junction is like a forward-biased diode, with electrons moving in one direction across the junction (from left to right in the diagram) and holes going the opposite way (from right to left). The base-collector junction is like a reverse-biased diode. The positive voltage of the collector pulls most of the electrons through and into the outside circuit (though some electrons do recombine with holes in the base).

**3. What is a full-wave rectifier? Explain its working.**

The process of converting the AC current into DC current is called rectification. Rectification can be achieved by using a single diode or group of diodes. These diodes which convert the AC current into DC current are called rectifiers. Rectifiers are generally classified into two types: half wave rectifier and full wave rectifier. A half wave rectifier uses only a single diode to convert AC to DC. So it is very easy to construct the half wave rectifier. However, a single diode in half wave rectifier only allows either a positive half cycle or a negative half cycle of the input AC signal and the remaining half cycle of the

input AC signal is blocked. As a result, a large amount of power is wasted. Furthermore, the half wave rectifiers are not suitable in the applications which need a steady and smooth DC voltage. So the half wave rectifiers are not efficient AC to DC converters.

We can easily overcome this drawback by using another type of rectifier known as a full wave rectifier. The full wave rectifier has some basic advantages over the half wave rectifier. The average DC output voltage produced by the full wave rectifier is higher than the half wave rectifier. Furthermore, the DC output signal of the full wave rectifier has fewer ripples than the half wave rectifier. As a result, we get a smoother output DC voltage. A full wave rectifier is a type of rectifier which converts both half cycles of the AC signal into pulsating DC signal.




As shown in the above figure, the full wave rectifier converts both positive and negative half cycles of the input AC signal into output pulsating DC signal.