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. Which one of the following is the unit of density?
   a) Kg/m^3
   b) Kg/m^2
   c) Kg/m
   d) Kg/ms
2. The specific gravity of a liquid is:
   a) the same unit as that of density
   b) the same unit as that of weight
   c) the same unit as that of specific volume
   d) no unit
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. The specific volume of a liquid is the reciprocal of?
   a) Weight
   b) Density
   c) Specific weight
   d) Specific volume
5. Which one of the following is the unit of specific weight?
   a) N/m^3
   b) N/m^2
   c) N/m
   d) N/ms

Section – B

03X02 = 06 Marks

1. Write down the definition of viscosity.
2. Derive expression of continuity equation.
3. Explain surface tension and vapour pressure.

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Section – C

03X03 = 09 Marks

1. Water is flowing in a fire hose with a velocity of 2.0 m/s and a pressure of 300000 Pa. At the nozzle the pressure decreases to atmospheric pressure (101300 Pa), there is no change in height. Use the Bernoulli's equation to calculate the velocity of the water exiting the nozzle.
2. Write down the classification of fluid on the basis of viscosity.
3. A fluid having mass of 1500Kg occupying a volume of 0.05 m^3 respectively, calculate density, specific volume, specific gravity and specific weight of that fluid?

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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

1) a
2) a
3) b
4) c
5) b

Short answer: Section B

1) it is the property of fluid by virtue of which if offer resistance to movement of one layer of fluid to another layer
2) $A_1V_1 = A_2V_2$
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) $P + \frac{1}{2} \rho v^2 + \rho g h = \text{constant}$
   $1/2\ \rho v1/2 + \rho g h1 + P1 = 1/2\ \rho v2\ 2 + \rho g h2 + P2$
   $1/2\ \rho v1\ 2 + P1 = 1/2\ \rho v2\ 2 + P2$
   $2\ \rho\ 1\ 2\ \rho v1\ 2 + P1 - P2 = v2 = 14\ m/s$
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= 1500/0.05 = 300 kg/m3
   Specific volume 0.05/1500= 0.000033
   Specific gravity = 300/1000 =0.3
   Specific weight = 300*10 =3000

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Registration No.: .....

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. Refrigerator with display-glass window is an example of?

   a) Domestic Refrigerator
   b) Commercial refrigerator
   c) Industrial Refrigerator
   d) Refrigerated vehicle

2. Who did first study about the refrigeration?

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

3. Which copper type have highest hardness?

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

4. What is the cooling temperature range of domestic refrigerator?

   a) 100 – 400 litre
   b) 35- 500 watt
   c) 1 KW to 2 KW
   d) 15- 5 ◦C

5. Which is main function of condenser?

   a) Converts refrigerant into vapors
   b) Rejects heat of refrigerant
   c) Rejects Heat inside the Room
   d) Exchange heat between refrigerant and room

Section – B

03X02 = 06 Marks

1. Calculate heat absorbed by 2.5Kg of water to raise its temperature by 55° C?
2. Explain the importance of vacuuming?

3. What are scope and applications of refrigeration?

Section – C

03X03 = 09 Marks

1. Write a note on history of refrigerator.
2. Write a note on natural cooling methods.
3. Explain bending process of making U bend with suitable sketch.

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Registration No.: .....

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. (b) Commercial refrigerator
2. (a) William Cullen
3. (a) Type K
4. (d) 15-5 °C
5. (b) rejects heat of refrigerant

Section – B

03X02 = 06 Marks

Answer 1

m = 2.5 Kg = 2500 g

c_p = 4.18 J/g·K

ΔT = 55° C

Q= m x C_p x ΔT

Q = 2500g x 4.18 J/g·K x 55° C

= 574,750J

= 574.750 KJ = 9.57 KW

Answer 2

In this process we remove moisture, air and dust from system circuit up to a required level as per application. Removal of moisture, air and dust is necessary because it can choke system and also can react with refrigerant. It also helps to keep refrigerant pure and long life of compressor with good efficiency.

Answer 3

Scope and Application of refrigeration

Domestic

Domestic refrigeration is for the home and kitchen. These units are small in size but has maximum number of units in refrigeration sector. Power input of these units is between 35 to 500W, and use hermetically sealed compressor.

Commercial

These types of units are used by retail stores, restaurants, hotels, and for the storing, displaying, processing, and dispensing of perishable items of all types. These units are bigger in size and power consumption.

Industrial

As a general rule, industrial applications are larger in size than commercial applications and have the distinguishing feature of requiring an attendant on duty, usually a licensed operating engineer. Typical industrial applications are ice plants, large food- packing plants, and industrial plants, such as oil refineries, chemical plants, rubber plants, etc.

Section – C

03X03 = 09 Marks

Answer 1

Domestic refrigeration systems:

The domestic refrigerator using natural ice (domestic ice box) was invented in 1803. before it ice box was used, because of limited temperature and replenishment of ice after a time, ice box was not reliable.

General Electric Company introduced the first domestic refrigerator in 1911, followed by Frigidaire in 1915. Kelvinator launched the domestic mechanical refrigerator in 1918. domestic refrigerators used mainly sulphur dioxide as refrigerant. Some units used methyl chloride and methylene chloride. These refrigerants were replaced by Freon-12 in 1930s.

General Electric Company introduced the first refrigerator with a hermetic compressor in 1926. Soon the open type compressors were completely replaced by the hermetic compressors.

The domestic refrigerator based on absorption principles, was first made by Electrolux Company in 1931 in Sweden. In Japan the first mechanical domestic refrigerator was made in 1924. The first dual temperature (freezer-refrigerator) domestic refrigerator was introduced in 1939.

Most of domestic refrigerators are mechanical refrigerators that use a hermetic compressor and an air cooled condenser. The modern refrigerators use either HFC-134a (hydro-fluoro-carbon) or iso-butane as refrigerant.

Answer 2

Ice by nocturnal cooling

Ice by nocturnal cooling was perfected in India. In this method ice was made by keeping a thin layer of water in a shallow earthen tray, and then exposing the tray to the night sky.

Compacted hay of about 0.3 m thickness was used as insulation. The water loses heat by radiation to the stratosphere, and by early morning hours the water in the trays freezes to ice. This method of ice production was very popular in India.

Evaporative Cooling:

As the name indicates, evaporative cooling is the process of reducing the temperature of a system by evaporation of water. Human beings dissipate their metabolic heat by evaporative cooling if the ambient temperature is more than skin temperature.

Cooling by earthen vessel

Evaporative cooling has been used in India for centuries to obtain cold water in summer by storing the water in earthen pots. The water permeates through the pores of earthen vessel to its outer surface where it evaporates to the surrounding, absorbing its latent heat in part from the vessel, which cools the water.

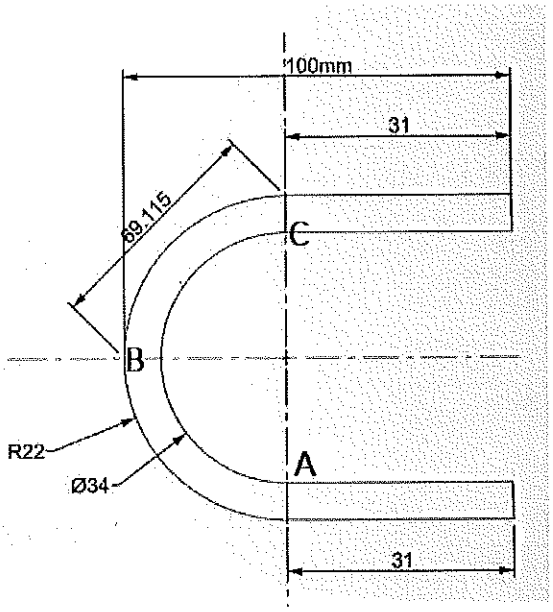
Cooling by Ice and salt solution

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 ($Cecil_2$) 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

Procedure

a) Cut a pipe of any length, say 200mm.
b) Using steel scale mark a point at the mid of pipe i.e. 100mm. this is our reference point **B**.
c) Measure perimeter of pipe bender "P", by using flexible measuring tape. Here **ABC=P**
d) Mark a point **A** towards the end of pipe from reference point, **at the distance half of the P + Radius of pipe**
e) Place point **B** at the 0-0 position in pipe bender, now bend it on 180 degrees.
Here point **A** and point **C** are same, but in opposite side of reference point, bending can also be done from point **C** also.



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BHARTIYA SKILL DEVELOPMENT UNIVERSITY

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. The cooling and dehumidification process is done by a room AC in-
   a. Winter
   b. Summer
   c. All around year
   d. None of the above

2. Installation tool beg need not to carry -, for a new AC installation.

   a. Screw driver
   b. Sprit level
   c. Capacitor
   d. Measuring tape

3. In a split room AC capillary tube is placed-

   a. Inside the room
   b. Outside the room
   c. Both a & b
   d. None of the above

4. What is the measuring unit of electric current?

   a. Ampere
   b. Volt
   c. Watt
   d. None of the above

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5. Which of the following is not controlled by a room AC?

   A. Air temperature

   B. Humidity

   C. Both a & b

   D. None of the above

Section – B

03X02 = 06 Marks

1. Write down the name of different types of expansion device.
2. Why compressor is known as the heart of VCR system?
3. Define latent heat and Sensible heat.

Section – C

03X03 = 09 Marks

1. Explain thermostatic expansion valve.
2. Explain different types of compressor.
3. Explain the different air conditioning processes done by an Air Conditioner.

Md. Najmul Haque

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ANSWER SHEET

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. The cooling and dehumidification process is done by a room AC in-

   b. Summer

2. Installation tool beg need not to carry -, for a new AC installation.

   c. Capacitor

3. In a split room AC capillary tube is placed-

   b. Outside the room

4. What is the measuring unit of electric current?

   a. Ampere

5. Which of the following is not controlled by a room AC?

   b.Humidity

Section – B

03X02 = 06 Marks

1. Write down the name of different types of expansion device.

   Ans:- a. Capillary tube

   b. Thermostatic expansion valve

   c. Electronic expansion valve

   d. Automatic expansion valve

2. Why compressor is known as the heart of VCR system?

   Ans:- Like heart compressor also pumps the refrigerant throughout the cycle.

3. Define latent heat and Sensible heat.

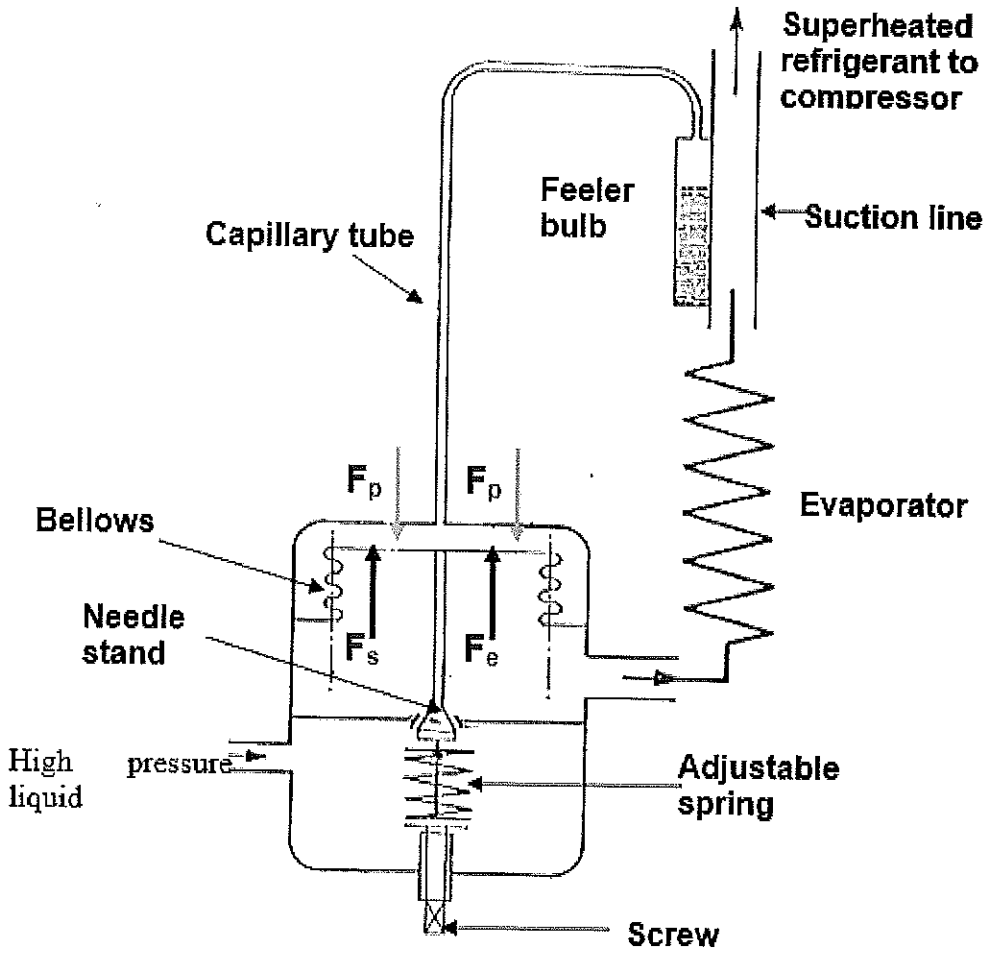
   Ans:- **Latent heat-** Responsible for phase change of a substance.

   Sensible heat- Responsible for temperature change of a substance.

Section – C

03X03 = 09 Marks

1. Explain thermostatic expansion valve.



A thermostatic expansion valve maintains a constant degree of superheat at the exit of evaporator.

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2. Explain different types of compressor.

Based on the working principle:

i. Positive displacement type
ii. Roto-dynamic type

Based on arrangement of compressor motor or external drive:

i. Open type
ii. Hermetic (or sealed) type
iii. Semi-hermetic (or semi-sealed) type

3. Explain the different air conditioning processes done by an Air Conditioner.

Ans:- Cooling and dehumidification
Cooling and humidification
Heating and humidification
Heating and humidification

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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 & 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.Which among the following electrode works on D.C+?

a. Basic
b. Rutile
c. Cellulose
d. Special purpose

2. In OXY-FUEL Process which of the following has high pressure ?

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

3. Acetylene 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. Valve on cylinder is also known as ?

a. Bull nose key
b. square Peg Valve Black & white
c. Non return valve
d. butterfly Valve

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5.Welding Electrode code 7018 means ?

a.Cellulose Electrode

b.Rutile Electrode

c.Basic Electrode

d. Special Purpose Electrode

Section – B

03X02 = 06 Marks

1. Define Brazing & Temperature Range for Brazing?
2. What are the safety procedure taken in consideration for Brazing?
3. How can we classify metal joining process?

Section – C

03X03 = 09 Marks

1. What are the components used in Brazing?
2. Name and define Function of sheet metals tools (Any 5)?
3. What are the steps involved in brazing?

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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.A

2.C

3.D

4. B

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. Temprature range for brazing is between 450c- 873\900 c.
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.
    - Explain Electric ARC Welding and its type?.

3.

Temporary Joint	Permanent Joint
Temporary joints allow easy dismantling of assembled components without breaking them.	Permanent joints don't allow dismantling of assembled components without rupturing them.

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Temporary joints are not necessarily leak-proof.	Permanent joints are usually leak-proof.
Strength of temporary joint is comparatively less.	Strength of permanent joint is high. Usually joint strength is same with that of the components.
It facilitates fast, easy and cost efficient inspection. No destructive testing is required for inspection of joints.	As permanent joints cannot be disassembled easily, so inspection is difficult and costly. Often destructive testing is carried out, which damages the assembled structures.
Repair and replacement are also easy.	Repair and replacement are difficult and costly.

Section – C

03X03 = 09 Marks

1. Brazing tool kit

   Brazing Nozzle

   Filler Material

   Heat Deflector

   Acetylene Cylinder

   Oxygen Cylinder

2. 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.

3.

- Assembly
- Torch /Flame Adjustment
- Applying Heat
- Apply Filter
- Complete Joint
- Remove the heat

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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 **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

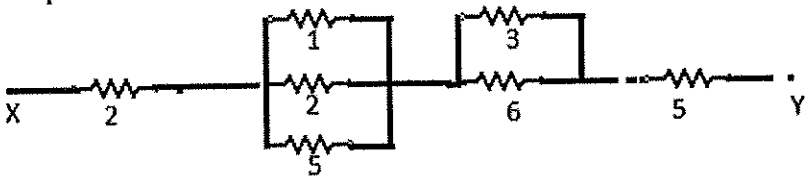
05X01 = 05 Marks

1. Two resisters of resistance R1 and R2 are connected in parallel the equivalent resistance (R) is:
   (a) R= R1+R2 (b) R=(R1R2)/(R1+R2)
   (c) R=(R1+R2)/(R1R2) (d) none of these
2. Given, V=10sin100 π t find the frequency f:
   (a) 50Hz (b) 100Hz (c) 60 Hz (d) None of these
3. The unit of magnetic flux is:
   (a) Henry (b) Weber (c) ampere turn/ weber (d) ampere/metre
4. A current is said to be direct current when its
   (a) Magnitude remains constant with time (b) Magnitude changes with time
   (c) Direction changes with time (d) Magnitude and direction changes with time
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

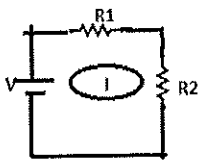
Section – B

03X02 = 06 Marks

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



2. Explain the properties of magnetic lines of force.
3. Find the current in circuit given below when applied voltage V=100 V and R1=R2= 10 ohms.



Section – C

03X03 = 09 marks

1. Draw a sine wave and explain following.
   (i) Cycle (ii) Time period (iii) Frequency (iv) Amplitude.
2. Explain color coding of resistor and represent 20k Ω with 10% tolerance resistance using color codes.
3. Distinguish between Magnetic and Electrical circuits.

6/11/19

Set - B

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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

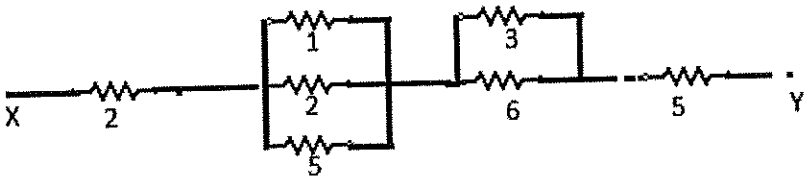
05X01 = 05 Marks

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

Section – B

03X02 = 06 Marks

Ans. 1



REq= [1||2||5]+[3||6]+5+2
REq=({[10/17]+[2]+5+2
REq=10/17+9
REq=9.58

Ans. 2. Magnetic flux of a filed is considered as the total number of magnetic lines of force in the field. These are also called magnetic flux lines.

- Each magnetic flux line is closed loop.
- Each magnetic flux line starts from north pole of a magnet and comes to the south pole through the field and continues from south pole to north pole in the body of the magnet.
- No two flux lines cross each other.
- Two similar lines of force travel side by side but repeal each other.
- The lines of force are stretched like elastic cord.

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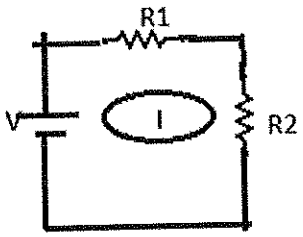
Ans. 3.



V-I*R1-I*R2=0 or V= I*R1+I*R2

V=I(R1+R2)

100=I(10+10)

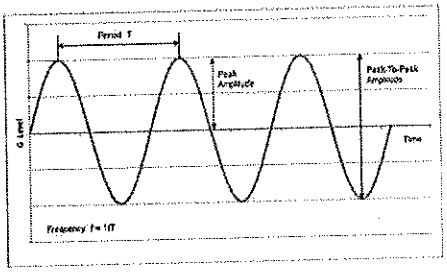
I= 100/20

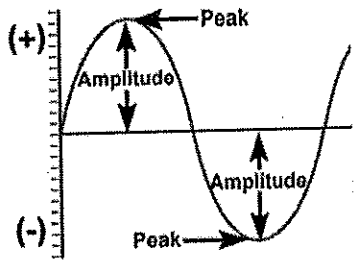
I=5A

Section – C

03X03 = 09 marks

Ans. 1.





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.

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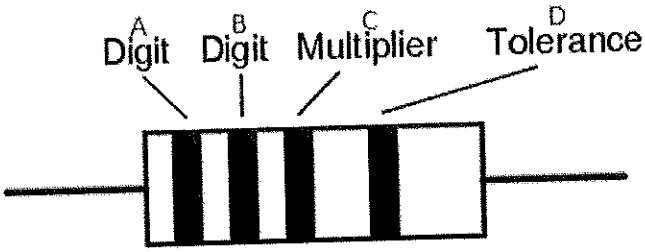
Ans. 2.

Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9
Gold	5%
Silver	10%
(none)	20%



The value of resistance can be calculated by

$R = AB * 10^{C} \pm D$

Hence the 20kΩ resistance with 10% tolerance can be represented as

Red, Black, Orange, Silver.

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

Electric Circuit	*Magnetic Circuit*
1. E.M.F. in volts	1. M.M.F. in Ampere Turns
2. Current in Amperes	2. Flux in Webers
3. Resistance in Ohms $R = \frac{\rho l}{a}$	3. Reluctance in AT/Wb $S = \frac{l}{a\mu}$
4. Conductivity $= \left(\frac{1}{\text{resistivity}}\right)$	4. Permeability $= \left(\frac{1}{\text{reluctivity}}\right)$
5. Conductance $= \left(\frac{1}{\text{resistance}}\right)$	5. Permeance $= \left(\frac{1}{\text{reluctance}}\right)$
6. Current $= \left(\frac{\text{e.m.f.}}{\text{resistance}}\right)$	6. Flux $= \left(\frac{\text{M.M.F.}}{\text{reluctance}}\right)$
7. Resistivity	7. Reluctivity

Set-B

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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 material is used in solar cells?
   a. Silicon
   b. Germanium
   c. Silver
   d. Aluminium.

2. Which one of the following is active component in an IC?
   a. Resistors
   b. Capacitors
   b. Transistors and diodes
   d. None of the above

3. When forward biased, LED emits light because of
   a. Recombination of carriers
   b. Light generated in breaking the covalent bonds
   c. Light produced by collisions
   d. All of the above reasons

4. Purpose of capacitor filter in a rectifier is to
   a. Convert dc to ac
   b. Convert ac to dc
   c. Filter the output
   d. Retain frequency

5. One that is a pentavalent impurity atom is
   a. Boron
   b. Indium
   c. Gallium
   d. Antimony

Section – B

03X02 = 06 Marks

1. What does a transistor actually do?
2. What is the role of a capacitor in a half wave rectifier?
3. What are the advantages of LED lights?

Section – C

03X03 = 09 Marks

1. What is rectifier and how it works? Explain.
2. What is the common base configuration of a transistor? Explain.
3. What is a PN diode? Explain its applications.

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: HVAC1106 **Time: 1 Hour**
Course Name: Electronics and Instrumentation **Max. Marks: 20**

Section – A

05X01 = 05 Marks

1. Which one of the following material is used in solar cells?
a. silicon b. germanium
c. silver d. aluminium.
a. silicon

2. Which one of the following is active component in an IC?
a. resistors b. capacitors
b. transistors and diodes d. none of the above
b. transistors and diodes

3. When forward biased, LED emits light because of
a. recombination of carriers
b. light generated in breaking the covalent bonds
c. light produced by collisions
d. all of the above reasons
a. recombination of carriers

4. Purpose of capacitor filter in a rectifier is to
a. convert dc to ac b. convert ac to dc
c. filter the output d. retain frequency
c. filter the output

5. One that is a pentavalent impurity atom is
a. boron b. indium
c. gallium d. antimony
d. antimony

Section – B

03X02 = 06 Marks

1. What does a transistor actually do?

A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals controls the current through another pair of terminals. A transistor is a miniature electronic component that can do two different jobs. It can work either as an amplifier or a switch:

- When it works as an **amplifier**, it takes in a tiny electric current at one end (an input current) and produces a much bigger electric current (an output current) at the other end. In other words, it's a kind of current booster. That comes in really useful in things like hearing aids, a hearing aid has a tiny microphone in it that picks up sounds from the world around you and turns them into fluctuating electric currents. These are fed into a transistor that boosts them and powers a tiny loudspeaker, so you hear a much louder version of the sounds around you.
- Transistors can also work as **switches**. A tiny electric current flowing through one part of a transistor can make a much bigger current flow through another part of it. In other words, the small current switches on the larger one. This is essentially how all computer chips work. For example, a memory chip contains hundreds of millions or even billions of transistors, each of which can be switched on or off individually. Since each transistor can be in two distinct states, it can store two different numbers, zero and one. With billions of transistors, a chip can store billions of zeros and ones, and almost as many ordinary numbers and letters (or characters, as we call them).

2. What is the role of a capacitor in a half wave rectifier?

A half-wave rectifier outputs only 1/2 of the applied sine wave. For example, the rectifier will pass current as the voltage tracks a sine curve over the interval of zero degrees to 180 degrees. Then, as the applied voltage reverses polarity, the rectifier will block current during the 180 to 360 degrees' portion of the cycle. The resultant output is a sine curve for half the cycle and no output for the second half of the cycle. This could also be called a very high ripple content. The capacitor is placed across the output of the half-wave rectifier so that it accepts current (charges up) during that portion of the sine wave that the rectifier passes. It retains this charge until the rectifier begins to supply current again.
If there was no load applied to the rectifier, the capacitor would eventually charge up to the peak of the rectifier's output voltage. If there is a load, then the capacitor will charge during the half-cycle of rectifier output, and then will attempt to supply current to the load during the half-cycle of rectifier shut-down. This smooths the power to the load. More capacitance will result in a smoother DC applied to the load. The net effect of the capacitor is to reduce the ripple voltage presented to the load.

3. What are the advantages of LED lights?

LED (Light Emitting Diodes) lights are the latest and most fascinating technological advancement in the lighting industry. LEDs are small, solid light bulbs that are powerful, energy-efficient, and long lasting. LEDs operate in different ways than traditional incandescent bulbs. This makes LEDs far more durable than traditional incandescent light bulbs. LED technology also provides many additional advantages over incandescent, fluorescents, and compact fluorescent lamps and lighting devices. This includes an exceptionally longer lifespan (60,000 hours), significantly lower energy consumption (90% more efficient), reduced maintenance costs, and higher safety. LEDs are made of non-toxic materials, unlike neon lighting that use mercury that may pose a danger to the environment. LED is recyclable and also considered "green", or earth-friendly.
LEDs are currently used for a wide variety of different applications, such as in residential lighting, the military, as well as the architectural, automotive, transmissions, electronic instrumentation, the entertainment and gaming, the military, and the traffic and transportation industry. Since LEDs are focused lights, they are great at performing some specific lighting tasks, such as desk lamps, reading lights, night lights, security signals, spotlights, accent lamps, and lighting for signs. LED lighting is growing in popularity within the industry, with proponents proclaiming that it is a more sustainable source. However, this cost is said to be regained over its lifetime and the fixtures are said to have sufficient benefits.

Section – C

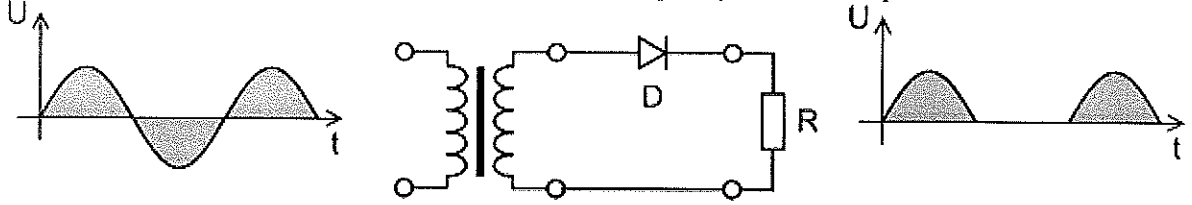
03X03 = 09 Marks

1. What is rectifier and how it works? Explain.

A **rectifier** is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. Rectifier circuits may be single-phase or multi-phase. Most low power rectifiers for domestic equipment are single-phase, but three-phase rectification is very important for industrial applications and for the transmission of energy as DC.

Half-wave rectifier

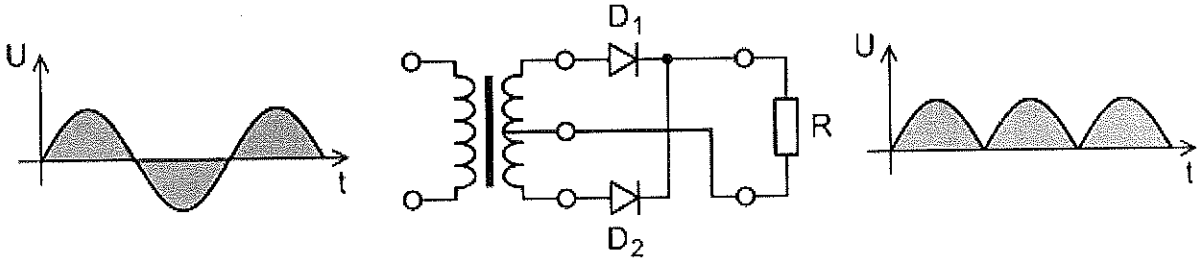
In half-wave rectification of a single-phase supply, either the positive or negative half of the AC wave is passed, while the other half is blocked. Mathematically, it is a step function (for positive pass, negative block): passing positive corresponds to the ramp function being the identity on positive inputs, blocking negative corresponds to being zero on negative inputs. Because only one half of the input waveform reaches the output, mean voltage is lower. Half-wave rectification requires a single diode in a single-phase supply, or three in a three-phase supply. Rectifiers yield a unidirectional but pulsating direct current; half-wave rectifiers produce far more ripple than full-wave rectifiers, and much more filtering is needed to eliminate harmonics of the AC frequency from the output.



Full-wave rectifier

A full-wave rectifier converts the whole of the input waveform to one of constant polarity (positive or negative) at its output. Mathematically, this corresponds to the absolute value function. Full-wave rectification converts both polarities of the input waveform to pulsating DC (direct current), and yields a higher average output voltage. Two diodes and a center tapped transformer, or four diodes in a bridge configuration and any AC source (including a transformer without center tap), are needed. Single semiconductor diodes, double diodes with common cathode or common anode, and four-diode bridges, are manufactured as single components.

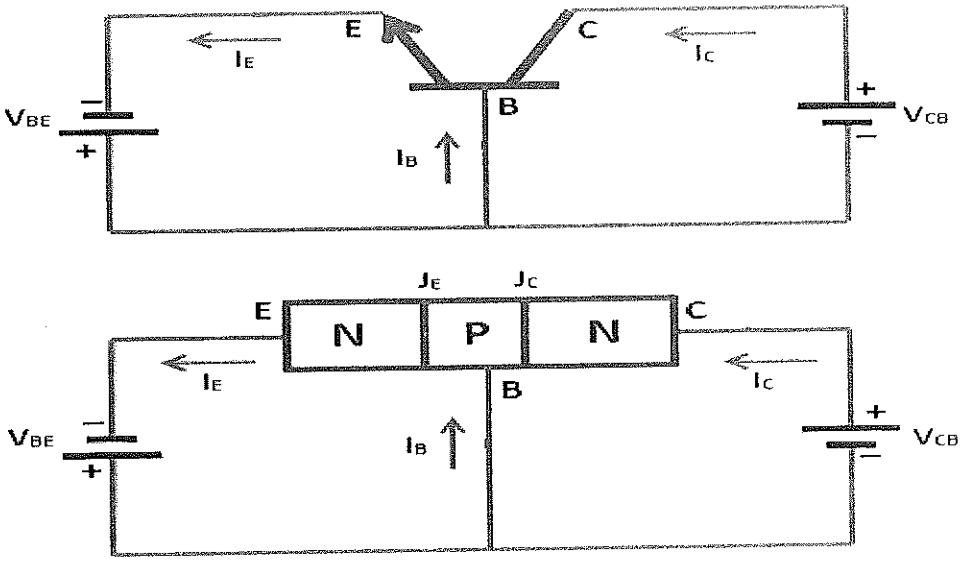
For single-phase AC, if the transformer is center-tapped, then two diodes back-to-back (cathode-to-cathode or anode-to-anode, depending upon output polarity required) can form a full-wave rectifier. Twice as many turns are required on the transformer secondary to obtain the same output voltage than for a bridge rectifier, but the power rating is unchanged.



2. What is the common base configuration of a transistor? Explain.

A **transistor** is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit. The naming of the three basic transistor configurations indicates the transistor terminal that is common to both input and output circuits. This gives rise to the three terms: common base, common collector and common emitter.

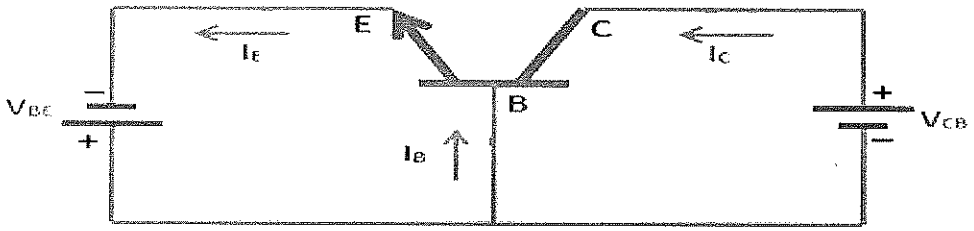
Common Base Configuration: In common base configuration, emitter is the input terminal, collector is the output terminal and base terminal is connected as a common terminal for both input and output. That means the emitter terminal and common base terminal are known as input terminals whereas the collector terminal and common base terminal are known as output terminals. In common base configuration, the base terminal is grounded so the common base configuration is also known as grounded base configuration. Sometimes common base configuration is referred to as common base amplifier, CB amplifier, or CB configuration.



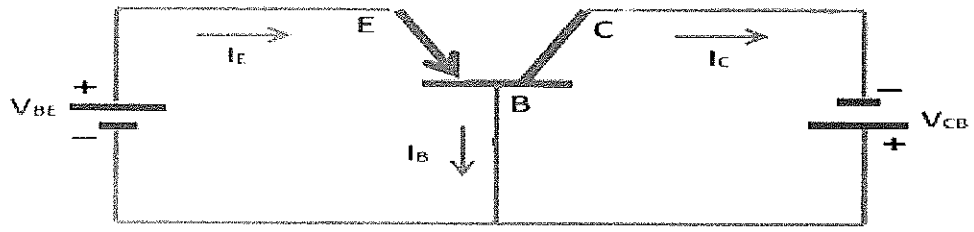
Common base configuration

The input signal is applied between the emitter and base terminals while the corresponding output signal is taken across the collector and base terminals. Thus the base terminal of a transistor is common for both input and output terminals and hence it is named as common base configuration.

The supply voltage between base and emitter is denoted by V_{BE} while the supply voltage between collector and base is denoted by V_{CB}. In every configuration, the base-emitter junction J_E is always forward biased and collector-base junction J_C is always reverse biased. Therefore, in common base configuration, the base-emitter junction J_E is forward biased and collector-base junction J_C is reverse biased. The common base configuration for both NPN and PNP transistors is shown in the below figure.



NPN Transistor



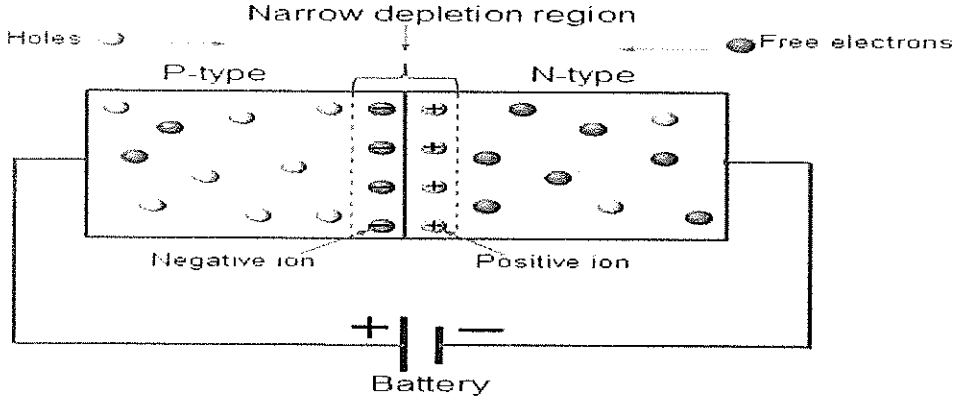
PNP transistor

Common base configuration

From the above circuit diagrams of NPN and PNP transistors, it can be seen that for both NPN and PNP transistors, the input is applied to the emitter and the output is taken from the collector. The common terminal for both the circuits is the base.

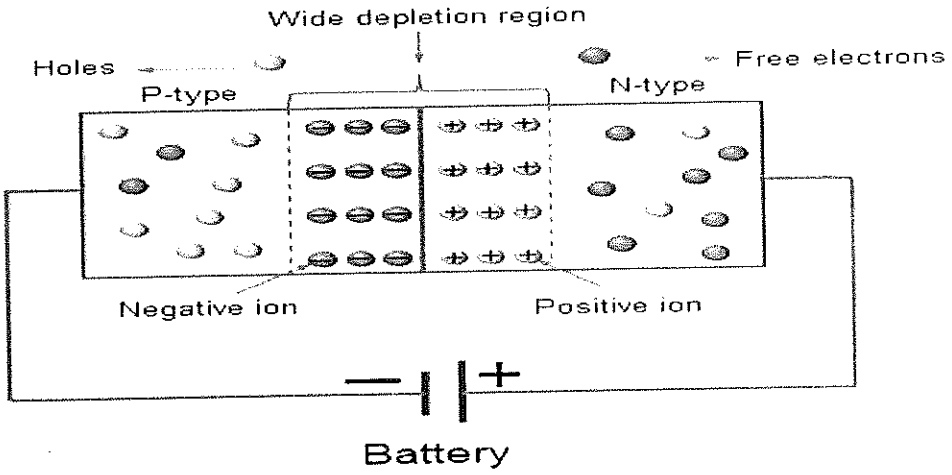
3. What is a PN diode? Explain its applications.

A **p–n diode** is a type of semiconductor diode based upon the p–n junction. The diode conducts current in only one direction, and it is made by joining a *p*-type semiconducting layer to an *n*-type semiconducting layer. Semiconductor diodes have multiple uses including rectification of alternating current to direct current, detection of radio signals, emitting light and detecting light. There are three possible biasing conditions and two operating regions for the typical PN-Junction Diode, they are zero bias, forward bias and reverse bias. A p-n junction diode is a two terminal device that allows electric current in one direction and blocks electric current in another direction.



Forward bias

A p-n junction diode allows electric current when it is forward biased and blocks electric current when it is reverse biased. This action of p-n junction diode enables us to use it as a rectifier.



Reverse bias

The diode finds number of applications as given below:

- Rectification
- Diodes are used in clamping circuits for DC restoration.
- Diodes are used in clipping circuits for wave shaping.
- Diodes are used in voltage multipliers.
- Diodes are used as switch in digital logic circuits used in computers.
- Diodes are used in demodulation circuits.
- Laser diodes are used in optical communications.
- Light Emitting Diodes (LEDs) are used in digital displays.
- Diodes are used in voltage regulators.