



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of HVAC&R Skills

1st Semester, End-Sem. Examination

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

Course Code: HVA-1101

Time: 3 Hour

Course Name: Basic of Refrigeration and Air-Conditioning

Max. Marks: 100

Instruction: Attempt all questions of section A.

Attempt any six question of section B

Attempt all questions of section C

Section – A

10X02 = 20 Marks

1. I. The specific volume of a liquid is the reciprocal of:

- a) Weight density
- b) Mass density
- c) Specific weight
- d) Specific volume

II. in which direction does heat flow?

- a) From cold substance to hot substance
- b) Up
- c) Down
- d) From warm substance to cold substance

2. I. Which of the following is a unit of kinematic viscosity?

- a) Stokes
- b) Pa-s
- c) m^2/s
- d) Poise

II. is the time rate of doing work

- a) Power
- b) Work
- c) Heat
- d) Temperature

3. I. Which of the following is a shear-thinning fluid?

- a) Bingham plastic
- b) Rheopectic
- c) Dilatant
- d) Pseudoplastic

II. in closed stationary system the total energy is:

- a) Kinetic energy
- b) Potential energy
- c) Internal energy
- d) Sensible energy

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

4. I. Which of the following is the condition for the boiling of a liquid?
- The Absolute pressure of a liquid must be greater than or equal to its vapor pressure
 - The Absolute pressure of a liquid must be less than or equal to its vapor pressure
 - The Absolute pressure of a liquid must be equal to its vapor pressure
 - The Absolute pressure of a liquid must be greater than its vapor pressure
- II. the condenser in a refrigeration system is used to:
- Decrease pressure
 - Increase Pressure
 - Heat transfer
 - None of these
5. I. Which of the following assumption is incorrect in the derivation of Bernoulli's equation?
- The fluid is ideal
 - The flow is steady
 - The flow is incompressible
 - The flow is rotational
- II. Finned tube heat exchanger:
- Give a large area per tube
 - Use metal fins of low thermal conductivity
 - Facilitate very large temperature drop through a tube wall
 - Are used for a smaller heat load
6. I. In vapor compression refrigeration system, heat is rejected by the refrigerant in:
- Compressor
 - Condenser
 - Throttle valve
 - Evaporator
- II. one ton of refrigeration is equivalent to:
- 1KW
 - 2.5 KW
 - 3.5 KW
 - 5 KW
7. I. Multipass heat exchanger is used:
- Because of simplicity of fabrication
 - For low heat Load
 - To obtain a high heat transfer coefficient and a shorter tube
 - To reduce the pressure drop
- II Heat transfer coefficient for a liquid increase with:
- Increasing temperature
 - Decreasing temperature
 - Decreasing Reynolds number
 - None of these
8. I. Viscosity of gases..... With an increase in temperature:
- Increase very rapidly
 - Increase slowly
 - Decrease slowly
 - Remain unaffected

**BHARTIYA SKILL DEVELOPMENT UNIVERSITY**

II Fourier law applies to heat transfer by:

- a) Convection
- b) Radiation
- c) Conduction
- d) All of the above

9. I. Which of the following has highest thermal conductivity?

- a) Brick
- b) Air
- c) Silver
- d) Water

II Heat flux is the time rate of heat transfer per unit:

- a) Length
- b) Area
- c) Volume
- d) None of these

10. I. The ratio of heat extracted in the refrigerator to the work done in refrigerant is called:

- a) COP of heat pump
- b) COP of refrigerator
- c) Efficiency
- d) Relative COP

II The efficiency of Carnot heat engine is 80%. The COP of refrigeration operating on reversed Carnot cycle is equal to:

- a) 0.25
- b) 0.40
- c) 0.60
- d) 0.80

Section – B

06X05 = 30 Marks

1. What are density and specific gravity of fluid?
2. Under what condition fluid is called as Newtonian fluid or Non-Newtonian fluid.
3. Differentiate between the evaporation and boiling.
4. Write down the definition of 1st law and 2nd law of thermodynamics.
5. Differentiate between open, closed and isolated system with example.
6. Write down different pressure units used in RAC system.
7. What is pressure and what is viscosity?
8. What is heat exchanger? Explain types of heat exchanger.

Section – C

05X10 = 50 Marks

1. Write down different types of fluid flow with an example.
2. What is pure substance? Differentiate between saturation pressure and saturation temperature for pure substance. Explain P-H chart with neat sketch.



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

3. Explain different types of fluid on the basis of Viscosity?
4. Differentiate between heat engine, heat pump and refrigeration with help of neat sketch.
5. Explain Bernoulli theorem in terms of head, pressure and energy, also write various limitations of Bernoulli theorem. In which RAC area, this equation has importance?



School of HVAC&R Skills

Session: 2018-19 (Winter Semester)

B. Voc. Program, I Semester,

End-Sem. Examination (Answers)

Course Code: HVA1101

Time: 3 Hours

Course Name: BASIC RAC

Max. Marks: 100

Instruction:

Attempt all questions of Section A.

Attempt any six questions of Section B.

Attempt all questions of Section C.

Section – A

Objective type questions

20X01 = 20 Marks

1. Sensory inspection is a type of:
 - a) Subjective measurement
2. Convert:
 - a) $1 \text{ mm} = \underline{\hspace{1cm}} 1000 \mu\text{m}$
 - b) $20 \text{ cm} = 200 \text{ mm}$
 - c) $10 \text{ inches} = 254 \text{ mm}$
 - d) $1 \text{ mtr.} = 1000 \text{ mm}$
3. In what type of measuring process, we get the numerical value...
 - a) Objective.
4. Material of a measuring tool should be—
 - b) Harder than the work piece
5. What is the use of Ratchet
 - c) Both fine movement and two limit the measuring force
6. Vernier Caliper is used for measuring
 - c) Both a and b
7. Parallax error occurs in measurement is due to
 - c) Poor visual alignment



8. Which type of measuring instrument the Micrometer is
- b) End measurement type
9. Clearance between two part is checked by
- a) Feeler gauge
10. Surface flatness is checked by
- a) Edge ruler
11. Objects that are symmetric can be shown effectively using this type of section
- a) Half section
12. An _____ section allows the drafter to create a Cutting Plane line which is not in a straight line across the part.
- a) Offset
13. A circle will appear on an isometric drawing as
- a) Ellipse
14. The heat transfer takes place according to which law
- c) Second law
15. Conduction is a process of heat transfer
- a) From one particle of the body to another without the actual motion of the particles
16. In case of liquid and gases, the heat transfer takes place according to
- b) Convection
17. The capillary tube, as an expansion device is used in
- d) All of the above
18. The capillary tube is not used in large capacity refrigeration system because
- b) Capacity control is not possible
19. An evaporator is known as
- d) All of the above
20. Moisture should be removed from refrigerants to avoid
- d) All of the above



Section – B

06X05 = 30 Marks

Long answer type questions

21. Define the following terms

a) Least count

The smallest value that can be measured by the measuring instrument is called its **least count**.

$$L.C. = (\text{Minimum value on main scale}) / (\text{Total no. of divisions on secondary scale})$$

b) measuring

The process of getting numerical value by comparing the object with standard measuring instrument. e.g. steel rule

c) Gauging

A process that measures and gives a visual display of the amount, level, or contents of something. It just confirms whether the object is OK or NOT OK.

e.g. feeler gauge, radius gauge etc.

22. Write down the three application of Vernier calipers.

Line measurement

End measurement

Depth measurement

23. Give the name of five measuring instruments and their use.

Vernier caliper

Micrometer

Dial indicator

Bevel protractor

Vernier height gauge

24. Define engineering drawing and how it is different from ordinary drawing?

engineering drawing

It is an engineer's language

To convey all necessary & relevant information to get things manufactured, modified or assembled.

To ensure all engineering specifications and requirements are met.

To help us visualize things (final product).

ordinary drawing

No specifications.

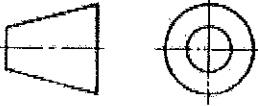
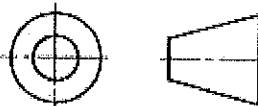
Not necessary to contain all the information.

Only for aesthetic purpose.

Not need to be understood by other person exactly.

25. Give the difference between first angle and third angle projection with symbol.

First angle projection	Third-angle projection
Object is kept in the first quadrant.	Object is assumed to be kept in the third quadrant.
Object lies between observer and the plane of projection.	Plane of projection lies between the observer and the object.
The plane of projection is assumed to be non-transparent.	The plane of projection is assumed to be transparent.
Front (elevation) view is drawn above the XY line	Front (elevation) view is drawn below the XY line
Top (plan) view is drawn below the XY line	Top (plan) view is drawn above the XY line
Left view is projected on the right plane and vice versa	Left view is projected on the left plane itself.
Followed in India, European countries	Followed in USA

Projection	Symbol
First angle	
Third angle	

26. Write down the difference between hermetic and open type compressor.

In hermetic compressors, the motor and the compressor are enclosed in the same housing to prevent refrigerant leakage. The housing has welded connections for refrigerant inlet and outlet and for power input socket. As a result of this, there is virtually no possibility of refrigerant leakage from the compressor. All motors reject a part of the power supplied to it due to eddy currents and friction, that is, inefficiencies. Similarly the compressor also gets heated-up due to friction and also due to temperature rise of the vapor during compression. In Open type, both the compressor and the motor normally reject heat to the surrounding air for efficient operation. In hermetic compressors heat cannot be rejected to the surrounding air since both are enclosed in a shell. Hence, the cold suction gas is made to flow over the motor and the



compressor before entering the compressor. This keeps the motor cool. The motor winding is in direct contact with the refrigerant hence only those refrigerants, which have high dielectric strength, can be used in hermetic compressors. The cooling rate depends upon the flow rate of the refrigerant, its temperature and the thermal properties of the refrigerant. If flow rate is not sufficient and/or if the temperature is not low enough the insulation on the winding of the motor can burn out and short-circuiting may occur. Hence, hermetically sealed compressors give satisfactory and safe performance over a very narrow range of design temperature and should not be used for off-design conditions.

In open type compressors the rotating shaft of the compressor extends through a seal in the crankcase for an external drive. The external drive may be an electrical motor or an engine (e.g. diesel engine). The compressor may be belt driven or gear driven. Open type compressors are normally used in medium to large capacity refrigeration system for all refrigerants and for ammonia (due to its incompatibility with hermetic motor materials). Open type compressors are characterized by high efficiency, flexibility, better compressor cooling and serviceability. However, since the shaft has to extend through the seal, refrigerant leakage from the system cannot be eliminated completely. Hence refrigeration systems using open type compressors require a refrigerant reservoir to take care of the refrigerant leakage for some time, and then regular maintenance for charging the system with refrigerant, changing of seals, gaskets etc.

27. Why the size of evaporator is always smaller than condenser?

Heat rejection by the condenser = Heat extracted by evaporator + Heat of compressor

28. How the automatic and manual defrosting take place in a refrigerator?

Auto-defrost, automatic defrost or self-defrosting is a technique which regularly defrosts the evaporator in a refrigerator or freezer. Appliances using this technique are often called frost free, frostless or no-frost. Defrost timer is used for this operation and it activates after every eight hours for its preset operation time. A heating coil is also used.

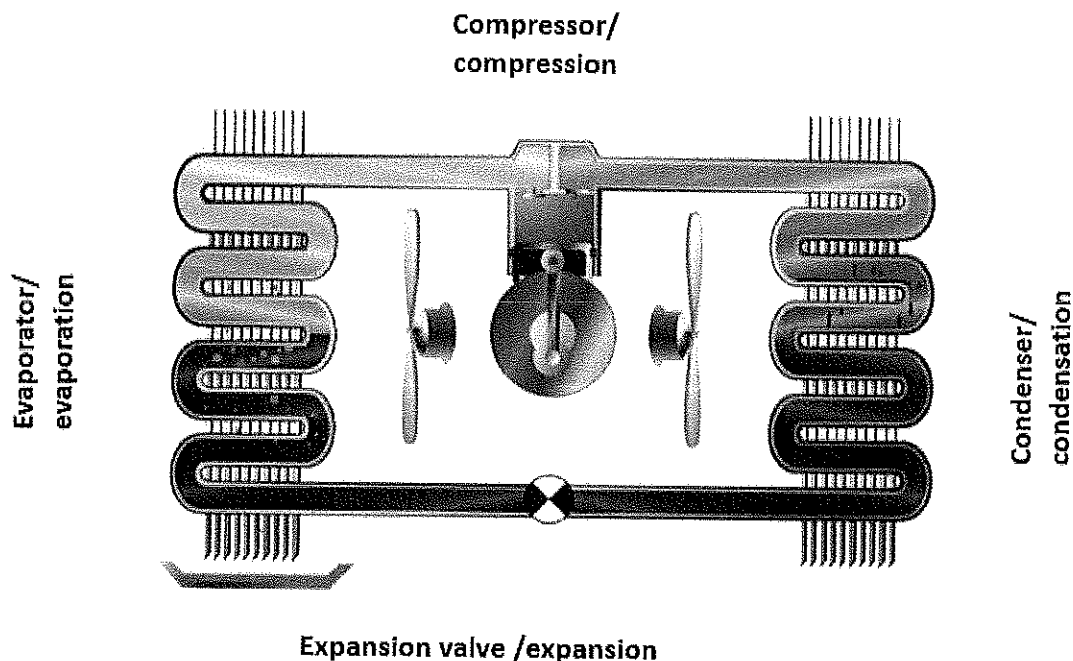
Manual defrosting is done manually by turning off the machine for some time and refrigerator door opened.

Section – C

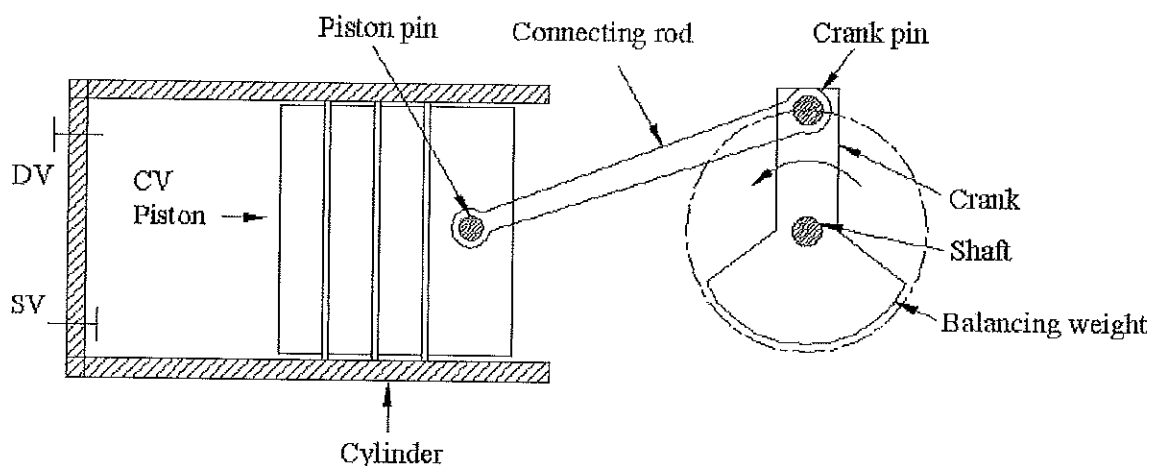
05X10 = 50 Marks

Essay type questions.

29. Explain the basic refrigeration cycle in detail with neat sketch.



30. Explain reciprocating compressor in detail with neat sketch.



31. Explain the following

a) Thermometer

A device used for measuring temperature, especially of the air, surface or in a person's body

b) Ohm meter (Megger)

An **ohmmeter** is an electrical instrument that measures electrical resistance, the opposition to an electric current. **Micro-ohmmeters** (microhmmeter or microohmmeter) make low resistance measurements. **Megohmmeters** (also a trademarked device Megger) measure large values of resistance. Used for compressor winding shortage.

c) Vacuum pump

A vacuum pump is a device that removes gas molecules from a sealed volume in order to leave behind a partial vacuum. A pump used for creating a vacuum.

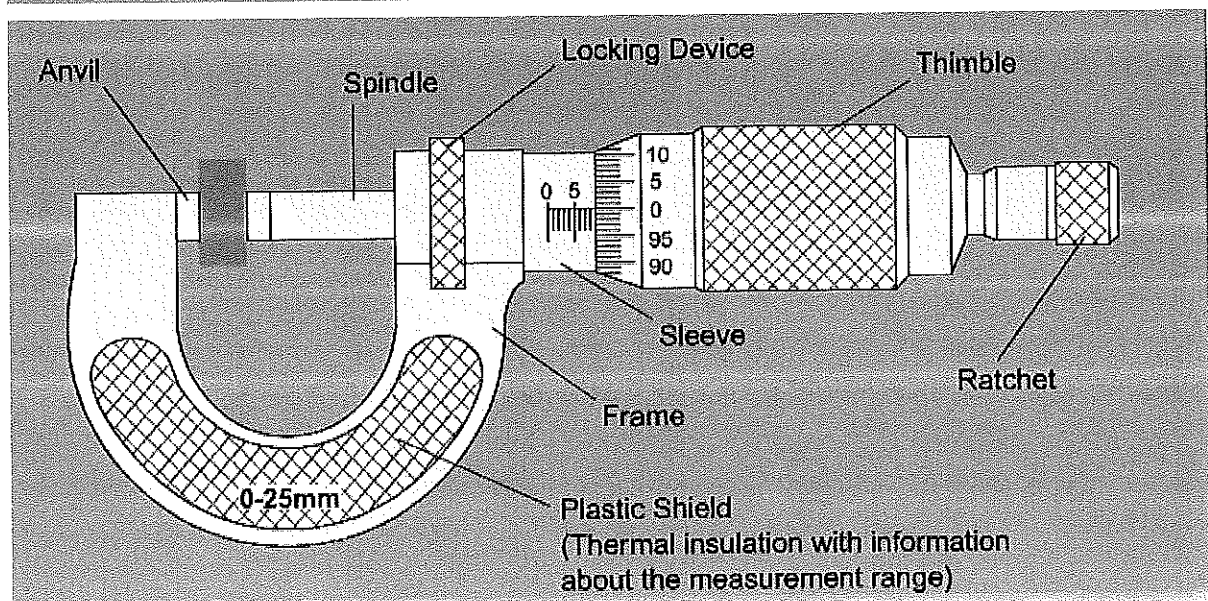
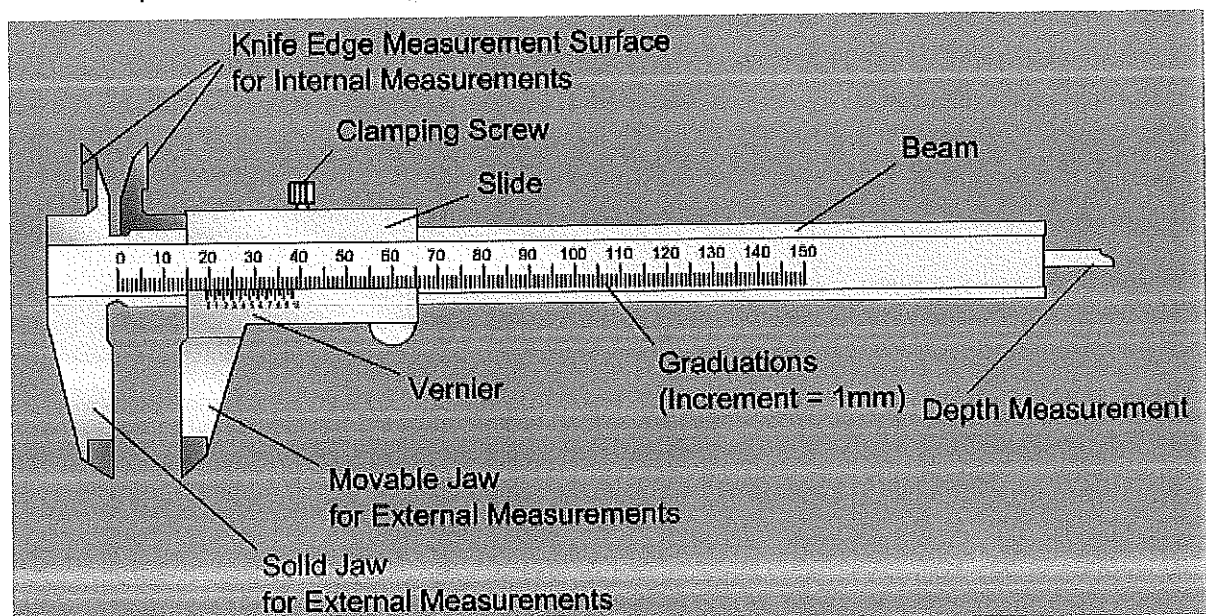
d) Pressure gauge

A pressure gauge is a device which measures the pressure in a gas or liquid.

e) Refrigerant with five names

A refrigerant is a substance or mixture, usually a fluid, used in a heat pump and refrigeration cycle. In most cycles it undergoes phase transitions from a liquid to a gas and back again and works as a heat transfer agent.

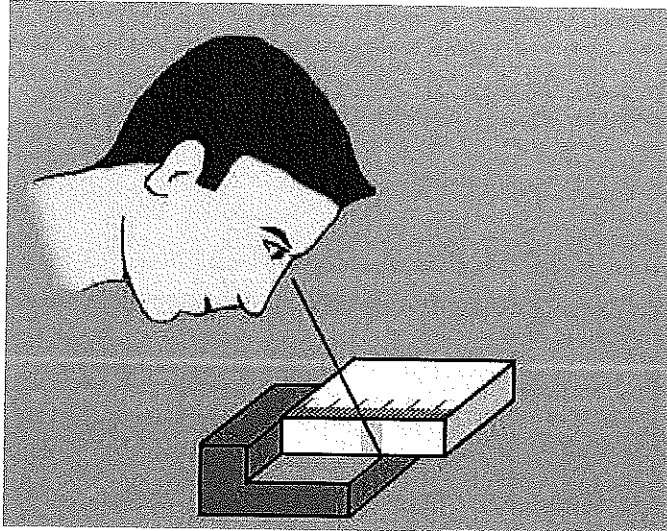
32. Explain the use and all parts of Vernier caliper and micrometer in detail.



33. Explain the types of measurement and errors in measurement in detail.

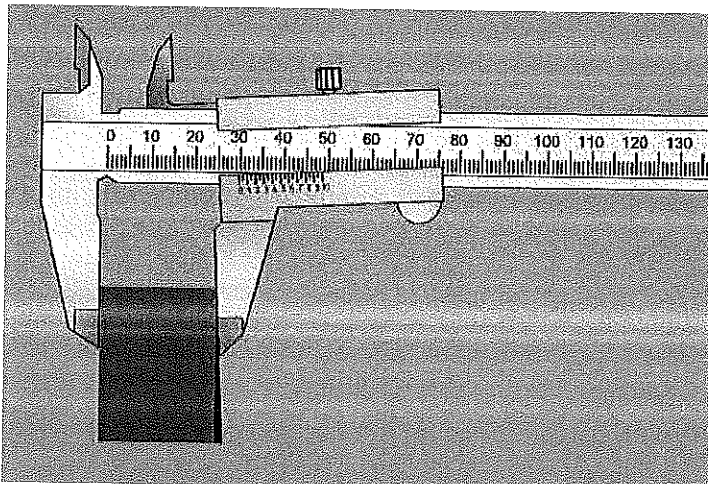
Type

- a. Line measurement : steel rule
- b. End measurement : micrometer



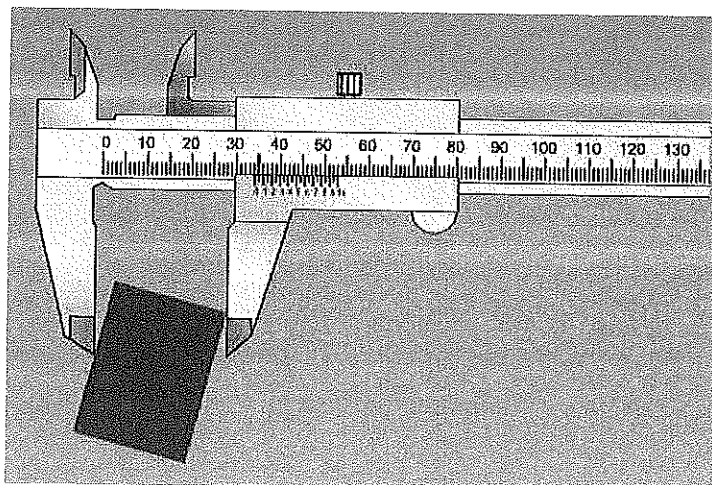
Parallax Errors

The person reading the measurement is not looking at the scale and vernier from directly above the measurement point.



Tilt Error

The movable jaw has too much play in the guide and tilts down when brought in contact with the work piece.



Cocking

Either the work piece or the measurement tool is cocked during the measurement process.



School of HVAC&R Skills
Session: 2018-19 (Winter Semester)
B. Voc. Program, I Semester,
End-Sem. Examination

Course Code: HVA-1102

Time: 3 Hours

Course Name: Assembly and Installation of refrigerator

Max. Marks: 100

Instruction:

Attempt all questions of Section A.

Attempt any six questions of Section B.

Attempt all questions of Section C.

Section – A

Objective type questions

20X01 = 20 Marks

1. Sensory inspection is a type of:
 - a) Subjective measurement
 - b) Objective measurement
 - c) Both a and b
 - d) None of the above
2. Convert:
 - a) 1 mm = ____ μ m
 - b) 20 cm = ____ mm
 - c) 10 inches = ____ mm
 - d) 1 mtr. = ____ mm
3. In what type of measuring process, we get the numerical value...
 - a) Objective
 - b) Gauging
 - c) Subjective
 - d) All of the above
4. Material of a measuring tool should be—
 - a) Softer than the work piece
 - b) Harder than the work piece
 - c) Same hardness as of work piece
 - d) None of the above
5. What is the use of Ratchet?
 - a) Fine movement
 - b) To limit the measuring force
 - c) Both fine movement and two limit the measuring force
 - d) None of these
6. Vernier Caliper is used for measuring:
 - a) Internal dimension
 - b) External dimension
 - c) Both a and b
 - d) None of the above
7. Parallax error occurs in measurement is due to:
 - a) Poor positioning of object
 - b) Poor instrument handling
 - c) Poor visual alignment
 - d) All of the above



8. Which type of measuring instrument the Micrometer is:
 - a) Line measurement type
 - b) End measurement type
 - c) Both a and b
 - d) None of the above
9. Clearance between two part is checked by:
 - a) Feeler gauge
 - b) Slip gauge
 - c) Snap gauge
 - d) Ring gauge
10. Surface flatness is checked by:
 - a) Edge ruler
 - b) Try square
 - c) Bevel protractor
 - d) All of the above
11. Objects that are symmetric can be shown effectively using this type of section:
 - a) Half section
 - b) Full section
 - c) Symmetric section
 - d) All of the above
12. An _____ section allows the drafter to create a Cutting Plane line which is not in a straight line across the part.
 - a) Offset
 - b) Half
 - c) Whole
 - d) Broken out
13. A circle will appear on an isometric drawing as:
 - a) Ellipse
 - b) cycloid
 - c) circle
 - d) Parabola
14. The heat transfer takes place according to which law:
 - a) Zeroth law
 - b) First law
 - c) Second law
 - d) Kirchhoff's law
15. Conduction is a process of heat transfer:
 - a) From one particle of the body to another without the actual motion of the particles
 - b) From one particle of the body to another by the actual motion of the particles
 - c) From a hot body to a cold body, in a straight line, without affecting the intervening medium
 - d) None of the above
16. In case of liquid and gases, the heat transfer takes place according to:
 - a) Conduction
 - b) Convection
 - c) Radiation
 - d) All of the above
17. The capillary tube, as an expansion device is used in:
 - a) Domestic refrigerator
 - b) Water coolers
 - c) Room air conditioners
 - d) All of the above
18. The capillary tube is not used in large capacity refrigeration system because:
 - a) Cost is too high
 - b) Capacity control is not possible
 - c) It is made of copper
 - d) Require pressure drop cannot be achieved
19. An evaporator is known as:
 - a) Freezing coil
 - b) Cooling coil
 - c) Chilling coil
 - d) All of the above



20. Moisture should be removed from refrigerants to avoid:

- a) Freezing at the expansion valve b) Restriction to refrigerant flow
- c) Corrosion of steel plates d) All of the above

Section – B

06X05 = 30 Marks

Long answer type questions

1. Write down different pressure units used in RAC system.
2. What is condensation? Explain different types of convection heat transfer used in RAC system.
3. What is pressure? Write down different pressure units used in RAC. Explain with a neat sketch absolute pressure, gauge pressure and vacuum pressure
4. Write down the reason for not cooling and improper cooling of any refrigeration system.
5. Write down the steps to be followed while replacing any dysfunctional part.
6. Write down the steps of assembly and disassembly of refrigeration system.
7. Why the size of evaporator is always smaller than condenser?
8. How the automatic and manual defrosting take place in a refrigerator?

Section – C

05X10 = 50 Marks

Essay type questions.

1. Explain the basic refrigeration cycle in detail with neat sketch.
2. Explain water cooler in detail with neat sketch.
3. Explain the following
 - a) Thermometer
 - b) Ohm meter (Megger)
 - c) Vacuum pump
 - d) Pressure gauge
 - e) Refrigerant with five names
4. Explain the use and all parts of Vernier caliper and micrometer in detail.
5. Explain different types of refrigerator used in refrigeration industries and its applications.



School of HVAC&R Skills
Session: 2018-19 (Winter Semester)
B. Voc. Program, I Semester,
End-Sem. Examination (Answers)

Course Code: HVA1102

Time: 3 Hours

Course Name: Assembly and Installation of refrigerator

Max. Marks: 100

Instruction:

- Attempt all questions of Section A.
- Attempt any six questions of Section B.
- Attempt all questions of Section C.

Section – A

Objective type questions

20X01 = 20 Marks

1. Sensory inspection is a type of:
 - a) Subjective measurement
2. Convert:
 - a) 1 mm = _1000 μ m
 - b) 20 cm = 200 mm
 - c) 10 inches = 254 mm
 - d) 1 mtr. = 1000 mm
3. In what type of measuring process, we get the numerical value...
 - a) Objective.
4. Material of a measuring tool should be—
 - b) Harder than the work piece
5. What is the use of Ratchet
 - c) Both fine movement and two limit the measuring force
6. Vernier Caliper is used for measuring
 - c) Both a and b
7. Parallax error occurs in measurement is due to
 - c) Poor visual alignment



8. Which type of measuring instrument the Micrometer is
- b) End measurement type
9. Clearance between two part is checked by
- a) Feeler gauge
10. Surface flatness is checked by
- a) Edge ruler
11. Objects that are symmetric can be shown effectively using this type of section
- a) Half section
12. An _____ section allows the drafter to create a Cutting Plane line which is not in a straight line across the part.
- a) Offset
13. A circle will appear on an isometric drawing as
- a) Ellipse
14. The heat transfer takes place according to which law
- c) Second law
15. Conduction is a process of heat transfer
- a) From one particle of the body to another without the actual motion of the particles
16. In case of liquid and gases, the heat transfer takes place according to
- b) Convection
17. The capillary tube, as an expansion device is used in
- d) All of the above
18. The capillary tube is not used in large capacity refrigeration system because
- b) Capacity control is not possible
19. An evaporator is known as
- d) All of the above
20. Moisture should be removed from refrigerants to avoid
- d) All of the above



Section – B

06X05 = 30 Marks

Long answer type questions

21. Define the following terms

a) Least count

The smallest value that can be measured by the measuring instrument is called its **least count**.

$$\text{L.C.} = (\text{Minimum value on main scale}) / (\text{Total no. of divisions on secondary scale})$$

b) measuring

The process of getting numerical value by comparing the object with standard measuring instrument. e.g. steel rule

c) Gauging

A process that measures and gives a visual display of the amount, level, or contents of something. It just confirms whether the object is OK or NOT OK.

e.g. feeler gauge, radius gauge etc.

22. Write down the three application of Vernier calipers.

Line measurement

End measurement

Depth measurement

23. Give the name of five measuring instruments and their use.

Vernier caliper

Micrometer

Dial indicator

Bevel protractor

Vernier height gauge

24. Define engineering drawing and how it is different from ordinary drawing?

engineering drawing

It is an engineer's language

To convey all necessary & relevant information to get things manufactured, modified or assembled.

To ensure all engineering specifications and requirements are met.

To help us visualize things (final product).

ordinary drawing

No specifications.

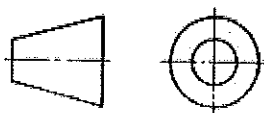
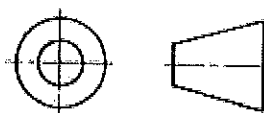
Not necessary to contain all the information.

Only for aesthetic purpose.

Not need to be understood by other person exactly.

25. Give the difference between first angle and third angle projection with symbol.

First angle projection	Third-angle projection
Object is kept in the first quadrant.	Object is assumed to be kept in the third quadrant.
Object lies between observer and the plane of projection.	Plane of projection lies between the observer and the object.
The plane of projection is assumed to be non-transparent.	The plane of projection is assumed to be transparent.
Front (elevation) view is drawn above the XY line	Front (elevation) view is drawn below the XY line
Top (plan) view is drawn below the XY line	Top (plan) view is drawn above the XY line
Left view is projected on the right plane and vice versa	Left view is projected on the left plane itself.
Followed in India, European countries	Followed in USA

Projection	Symbol
First angle	
Third angle	

26. Write down the difference between hermetic and open type compressor.

In hermetic compressors, the motor and the compressor are enclosed in the same housing to prevent refrigerant leakage. The housing has welded connections for refrigerant inlet and outlet and for power input socket. As a result of this, there is virtually no possibility of refrigerant leakage from the compressor. All motors reject a part of the power supplied to it due to eddy currents and friction, that is, inefficiencies. Similarly the compressor also gets heated-up due to friction and also due to temperature rise of the vapor during compression. In Open type, both the compressor and the motor normally reject heat to the surrounding air for efficient operation. In hermetic compressors heat cannot be rejected to the surrounding air since both are enclosed in a shell. Hence, the cold suction gas is made to flow over the motor and the



compressor before entering the compressor. This keeps the motor cool. The motor winding is in direct contact with the refrigerant hence only those refrigerants, which have high dielectric strength, can be used in hermetic compressors. The cooling rate depends upon the flow rate of the refrigerant, its temperature and the thermal properties of the refrigerant. If flow rate is not sufficient and/or if the temperature is not low enough the insulation on the winding of the motor can burn out and short-circuiting may occur. Hence, hermetically sealed compressors give satisfactory and safe performance over a very narrow range of design temperature and should not be used for off-design conditions.

In open type compressors the rotating shaft of the compressor extends through a seal in the crankcase for an external drive. The external drive may be an electrical motor or an engine (e.g. diesel engine). The compressor may be belt driven or gear driven. Open type compressors are normally used in medium to large capacity refrigeration system for all refrigerants and for ammonia (due to its incompatibility with hermetic motor materials). Open type compressors are characterized by high efficiency, flexibility, better compressor cooling and serviceability. However, since the shaft has to extend through the seal, refrigerant leakage from the system cannot be eliminated completely. Hence refrigeration systems using open type compressors require a refrigerant reservoir to take care of the refrigerant leakage for some time, and then regular maintenance for charging the system with refrigerant, changing of seals, gaskets etc.

27. Why the size of evaporator is always smaller than condenser?

Heat rejection by the condenser = Heat extracted by evaporator + Heat of compressor

28. How the automatic and manual defrosting take place in a refrigerator?

Auto-defrost, automatic defrost or self-defrosting is a technique which regularly defrosts the evaporator in a refrigerator or freezer. Appliances using this technique are often called frost free, frostless or no-frost. Defrost timer is used for this operation and it activates after every eight hours for its preset operation time. A heating coil is also used.

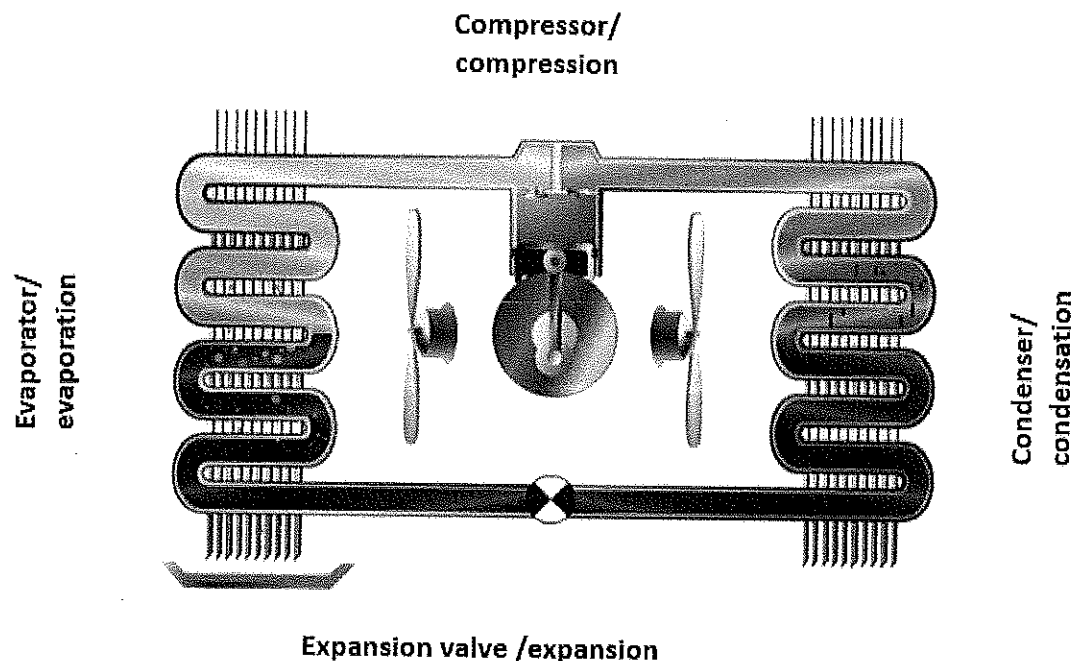
Manual defrosting is done manually by turning off the machine for some time and refrigerator door opened.

Section – C

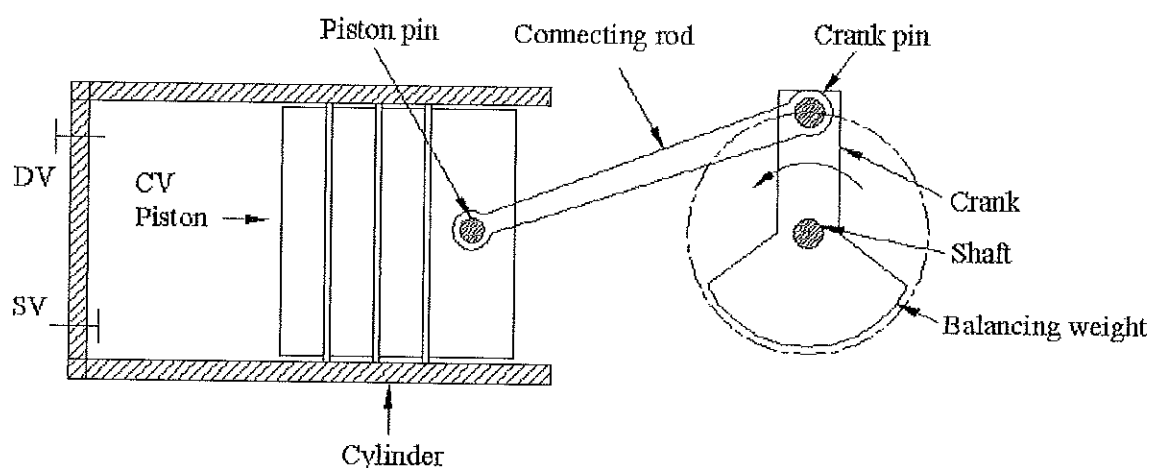
05X10 = 50 Marks

Essay type questions.

29. Explain the basic refrigeration cycle in detail with neat sketch.



30. Explain reciprocating compressor in detail with neat sketch.



31. Explain the following

a) Thermometer

A device used for measuring temperature, especially of the air, surface or in a person's body

b) Ohm meter (Megger)

An **ohmmeter** is an electrical instrument that measures electrical resistance, the opposition to an electric current. **Micro-ohmmeters** (microohmmeter or microohmmeter) make low resistance measurements. Megohmmeters (also a trademarked device Megger) measure large values of resistance. Used for compressor winding shortage.

c) Vacuum pump

A vacuum pump is a device that removes gas molecules from a sealed volume in order to leave behind a partial vacuum. A pump used for creating a vacuum.

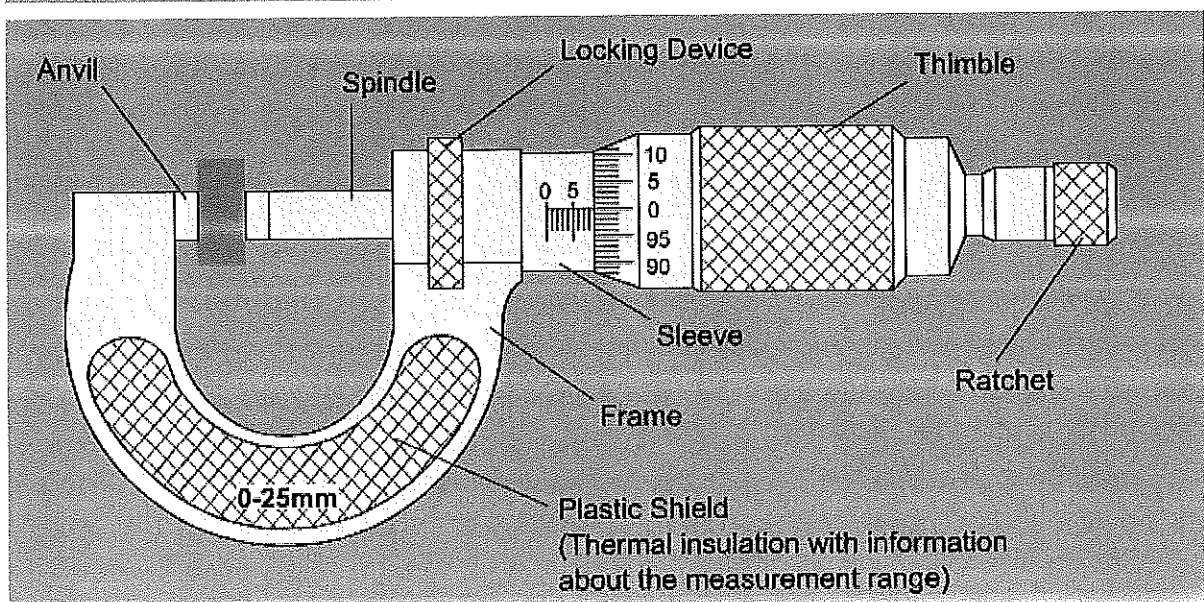
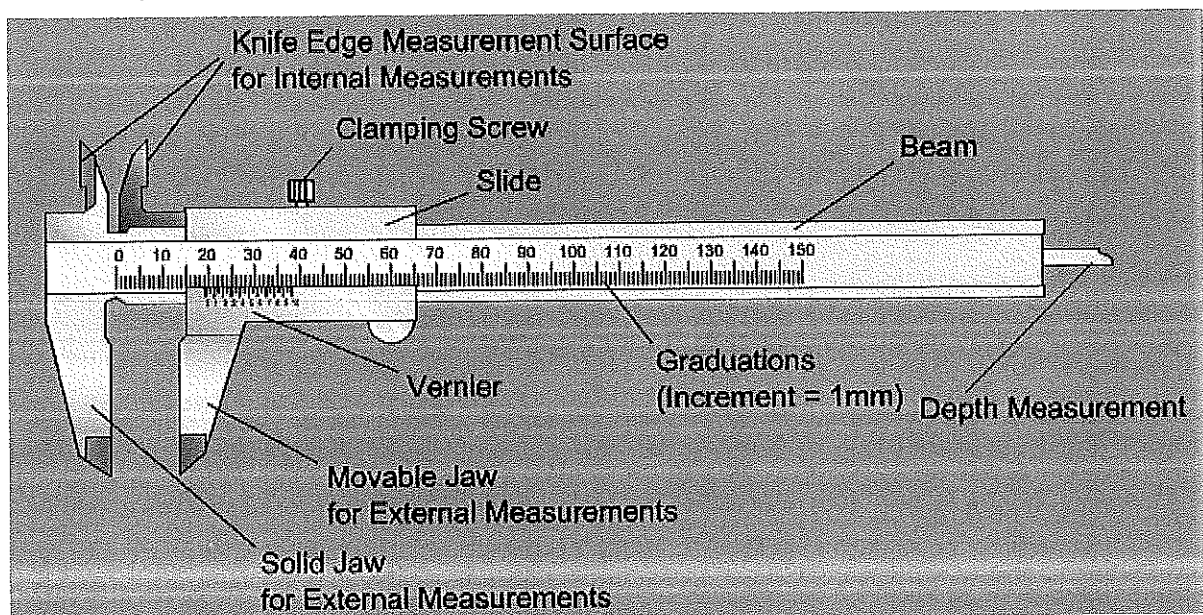
d) Pressure gauge

A pressure gauge is a device which measures the pressure in a gas or liquid.

e) Refrigerant with five names

A refrigerant is a substance or mixture, usually a fluid, used in a heat pump and refrigeration cycle. In most cycles it undergoes phase transitions from a liquid to a gas and back again and works as a heat transfer agent.

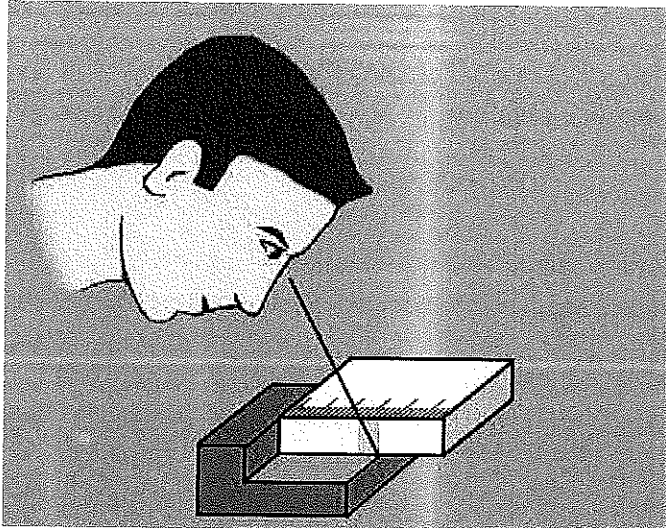
32. Explain the use and all parts of Vernier caliper and micrometer in detail.



33. Explain the types of measurement and errors in measurement in detail.

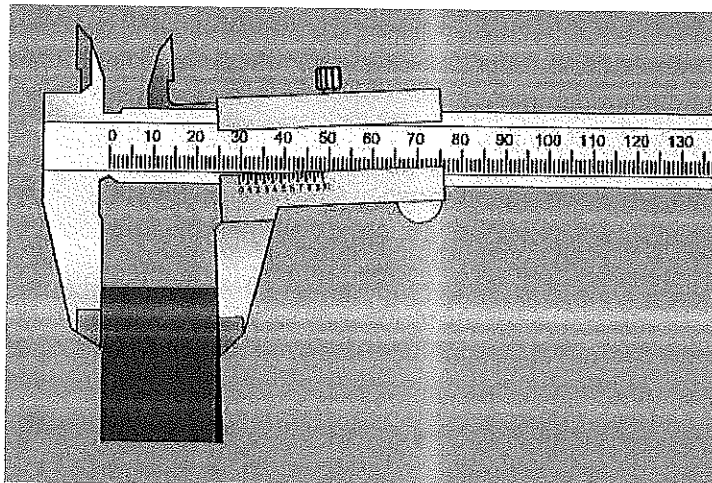
Type

- a. Line measurement : steel rule
- b. End measurement : micrometer



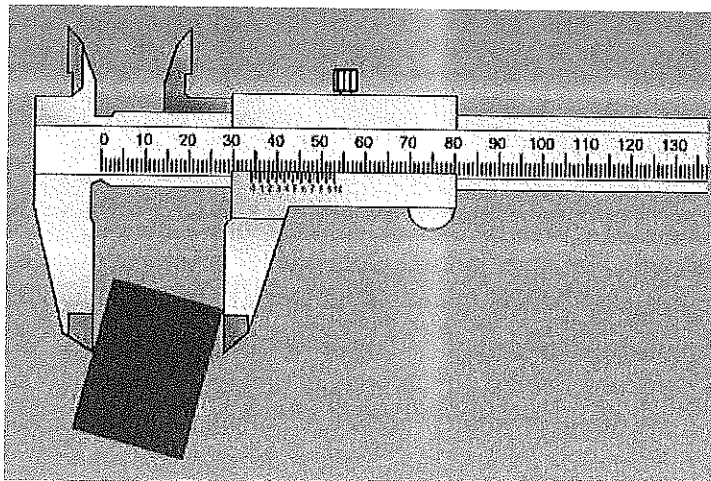
Parallax Errors

The person reading the measurement is not looking at the scale and vernier from directly above the measurement point.



Tilt Error

The movable jaw has too much play in the guide and tilts down when brought in contact with the work piece.



Cocking

Either the work piece or the measurement tool is cocked during the measurement process.



Registration No.:

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of HVAC Skill

Session: 2018-19 (Winter Semester)

B. Voc. Program, 1stSemester (2018-19)

End-Sem. Examination

Course Code: HVA-1103

Time: 3 Hours

Course Name: Assembly and Installation of AC

Max. Marks: 100

Section – A

Attempt all the following questions

20×01 = 20 Marks

Q1. A Refrigerator removes heat from its content by:

- (A) Evaporating the liquid refrigerant in the evaporator
- (B) Changing the refrigerant in the evaporator in to a liquid
- (C) Allowing the refrigerant to evaporate into the air
- (D) All of the above.

Q2. Most substances change their physical state by

- (A) Becoming invisible
- (B) The addition or removal of heat
- (C) Becoming molecules
- (D) The addition of heat only

Q3. How many centimetres arc equal to one inch?

- (A) 25.4 cm.
- (B) 0.254 cm.
- (C) 2.54 cm.
- (D) 1.5 cm.

Q4. A substance has a temperature of 20°C. What is the temperature in °F?

- (A) 52 °F.
- (B) 68 °F.
- (C) 64 °F.
- (D) None of the above

Q5. Micrometres are used to measure:

- (A) Hundredths of an inch
- (B) Thousandths of an inch or hundredths of a millimetre
- (C) Ten-thousandths of an inch or hundredths of a millimetre
- (D) Any of the above

Q6. What type of lubricant does R-134a use?

- (A) Mineral oil.
- (B) Polyol ester-based.
- (C) Both A and B.
- (D) Neither A nor B.

Q7. Never fill refrigerant cylinders over % of capacity:

- (A) 80
- (B) 90
- (C) 50
- (D) 100

Q8. The condition of refrigerant after passing through the condenser in a vapour compression system is

- (A) Saturated liquid
- (B) Wet vapour
- (C) Dry saturated vapour
- (D) Superheated vapour

Q9. In the capillary tube system of refrigerant control, when does the needle valve open?

- (A) This system has no needle valve.
- (B) When the liquid level in the evaporator falls.
- (C) when the compressor reduces pressure in the evaporator.
- (D) When the evaporator pressure is low and the temperature is above normal

Q10. In a Vapour compression system, the _____ is usually found in the low-pressure side.

- (A) condenser
- (B) liquid line
- (C) liquid receiver
- (D) motor

Q11. One ton of refrigeration is equal to the refrigeration effect corresponding to melting of 1000 kg of ice:

- (A) In 1 hour
- (B) In 1 minute
- (C) In 24 hours
- (D) In 12 hours

Q12. The moisture in a refrigerant is removed by

- (A) Evaporator
- (B) Safety relief valve
- (C) Dehumidifier
- (D) Driers

Q13. In a vapour compression system, the lowest temperature during the cycle occurs after:

- (A) Compression
- (B) Condensation
- (C) Expansion
- (D) Evaporation

Q14. In vapour compression refrigeration cycle, the condition of refrigerant is saturated liquid.

- (A) Before entering the expansion valve
- (B) Before entering the compressor
- (C) After passing through the condenser
- (D) Before passing through the condenser

Q15. The vapour pressure of the refrigerant should be:

- (A) Lower than atmospheric pressure
- (B) Higher than atmospheric pressure
- (C) Equal than atmospheric pressure
- (D) None of the above

- Q16. In refrigeration cycle, the flow of refrigerant is controlled by:**
(A) Condenser
(B) Compressor
(C) Evaporator
(D) Expansion valve
- Q17. During a refrigeration cycle, heat is rejected by the refrigerant in:**
(A) Condenser
(B) Compressor
(C) Evaporator
(D) Expansion valve
- Q18. The process of removing air from the air conditioning system is called:**
(A) Pump down
(B) Vacuuming
(C) Charging
(D) None of the above
- Q19. Which of the following device is used to measure the pressure?**
(A) Thermometer
(B) Barometer
(C) Hygrometer
(D) None of the above
- Q20. Which one of the following is Controller?**
(A) Thermistor
(B) Thermal Expansion Valve
(C) Thermostat
(D) None of the above

Section – B

06 × 05 = 30 Marks

Attempt any 06 questions:

- Q21.** What are the basic components of Refrigeration systems? Which part produces Cooling Effect in the refrigeration system?
- Q22.** Which device is used for refrigerant flow control? Explain with neat diagram.
- Q23.** What are differences between Condenser and Evaporator? Explain with diagram.
- Q24.** How does an Air Conditioner rejects heat?
- Q25.** What do you mean by pump down process? Explain the process.
- Q26.** What is the manifold block? What are the pressures can be measured using it?
- Q27.** What is Vacuuming? Explain.
- Q28.** What is TEV? Explain its role in VCRS.

Section – C Attempt all the following questions

05×10 = 50 Marks

Q29. Explain controller in Air conditioning system with example?

Q30. Explain state of R32 refrigerant in Condenser and Evaporator with temperature and pressure?

Q31. Write the steps in selecting location for a split AC installation.

Q32. What are various safety devices and protection equipment for a AC field technician?

Q33. What are various controlling devices in Air conditioning system? Explain any two devices.

A handwritten signature in black ink, consisting of a stylized 'S' followed by a horizontal line and a small flourish.



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of HVAC Skill

Session: 2018-19 (Winter Semester)

B. Voc. Program, 1st Semester (2018-19)

End-Sem. Examination (Answersheet)

Course Code: HVA-1103

Time: 3 Hours

Course Name: Assembly and Installation of AC

Max. Marks: 100

Section – A

Attempt all the following questions

20×01 = 20 Marks

Q1. A Refrigerator removes heat from its content by:

- (A) **Evaporating the liquid refrigerant in the evaporator.** ✓
- (B) Changing the refrigerant in the evaporator in to a liquid
- (C) Allowing the refrigerant to evaporate into the air
- (D) All of the above.

Q2. Most substances change their physical state by

- (A) Becoming invisible
- (B) **The addition or removal of heat** ✓
- (C) Becoming molecules
- (D) The addition of heat only

Q3. How many centimetres are equal to one inch?

- (A) 25.4 cm.
- (B) 0.254 cm.
- (C) **2.54 cm.** ✓
- (D) 1.5 cm.

Q4. A substance has a temperature of 20°C. What is the temperature in °F?

- (A) 52 °F.
- (B) **68 °F.** ✓
- (C) 64 °F.
- (D) None of the above

Q5. Micrometres are used to measure:

- (A) Hundredths of an inch
- (B) Thousandths of an inch or hundredths of a millimetre
- (C) **Ten-thousandths of an inch or hundredths of a millimetre** ✓
- (D) Any of the above

Q6. What type of lubricant does R-134a use?

- (A) Mineral oil.
- (B) **Polyol ester-based.** ✓
- (C) Both A and B.
- (D) Neither A nor B.

Q7. Never fill refrigerant cylinders over % of capacity:

- (A) **80** ✓
- (B) 90
- (C) 50
- (D) 100

Q8. The condition of refrigerant after passing through the condenser in a vapour compression system is

- (A) Saturated liquid✓
- (B) Wet vapour
- (C) Dry saturated vapour
- (D) Superheated vapour

Q9. In the capillary tube system of refrigerant control, when does the needle valve open?

- (A) This system has no needle valve.✓
- (B) When the liquid level in the evaporator falls.
- (C) when the compressor reduces pressure in the evaporator.
- (D) When the evaporator pressure is low and the temperature is above normal

Q10. In a Vapour compression system, the _____ is usually found in the low-pressure side.

- (A) condenser
- (B) liquid line
- (C) liquid receiver
- (D) motor✓

Q11. One ton of refrigeration is equal to the refrigeration effect corresponding to melting of 1000 kg of ice:

- (A) In 1 hour
- (B) In 1 minute
- (C) In 24 hours✓
- (D) In 12 hours

Q12. The moisture in a refrigerant is removed by

- (A) Evaporator
- (B) Safety relief valve
- (C) Dehumidifier
- (D) Driers✓

Q13. In a vapour compression system, the lowest temperature during the cycle occurs after:

- (A) Compression
- (B) Condensation
- (C) Expansion✓
- (D) Evaporation

Q14. In vapour compression refrigeration cycle, the condition of refrigerant is saturated liquid.

- (A) Before entering the expansion valve
- (B) Before entering the compressor
- (C) After passing through the condenser✓
- (D) Before passing through the condenser

Q15. The vapour pressure of the refrigerant should be:

- (A) Lower than atmospheric pressure
- (B) Higher than atmospheric pressure✓
- (C) Equal than atmospheric pressure
- (D) None of the above

- Q16. In refrigeration cycle, the flow of refrigerant is controlled by:**
 (A) Condenser
 (B) Compressor
 (C) Evaporator
 (D) **Expansion valve✓**
- Q17. During a refrigeration cycle, heat is rejected by the refrigerant in:**
 (A) **Condenser✓**
 (B) Compressor
 (C) Evaporator
 (D) Expansion valve
- Q18. The process of removing air from the air conditioning system is called:**
 (A) Pump down
 (B) **Vacuuming✓**
 (C) Charging
 (D) None of the above
- Q19. Which of the following device is used to measure the pressure?**
 (A) Thermometer
 (B) **Barometer✓**
 (C) Hygrometer
 (D) None of the above
- Q20. Which one of the following is Controller?**
 (A) Thermistor
 (B) Thermal Expansion Valve
 (C) **Thermostat✓**
 (D) None of the above

Section – B

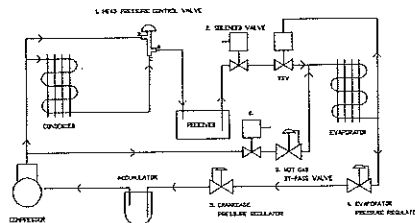
06×05 = 30 Marks

Attempt any 06 questions:

Q21. What are the basic components of Refrigeration systems? Which part produces Cooling Effect in the refrigeration system?

Ans: Compressor, condenser, expansion valve, Evaporator. Evaporator

Q22. Which device is used for refrigerant flow control? Explain with neat diagram.



Ans: Expansion device

Q23. What are differences between Condenser and Evaporator? Explain with diagram.

Ans: The difference between A/C evaporator and condenser coils is there locations in the system. Evaporator work is extracting indoor heat from the air and adding it to. Installed inside the indoor Unit, the evaporator is continuously exposed to the flow of warm air drawn by the return air.

The condenser coil is of similar design to the indoor evaporator coil. However, the difference between is exactly reversed. While the evaporator coil picks up heat from indoor air, the condenser coil releases heat into outdoor air.

Q24. How does an Air Conditioner rejects heat?

Ans: The condenser coil releases heat into outdoor air. The load of heat energy extracted from indoor and compressed in hot refrigerant vapor is rapidly released when refrigerant circulates into the coil and condenses to liquid. As the refrigerant releases its heat load, a fan incorporated in the unit blows air through the condenser coil passages and heat is dispersed into outdoor air.

Q25. What do you mean by pump down process? Explain the process.

Ans: The pumpdown process is a remedy for refrigerant migration to a compressor during the off cycle. The process will also prevent slugging of liquid refrigerant or oil caused from a severe migration problem.

The pumpdown system consists of a normally closed liquid-line valve installed in the liquid line of a refrigeration system.

The compressor will continue to run and will evacuate any refrigerant from the liquid line valve's outlet, up to and including the compressor. This includes part of the liquid line, evaporator, suction line, and crankcase.

This refrigerant will be stored in the condenser and receiver on the high side of the refrigeration system. Most of the refrigerant will be stored in the receiver.

Q26. What is the manifold block? What are the pressures can be measured using it?

Ans: A manifold gauge set consists of a manifold block, two hand valves, three refrigerant hoses, and two pressure gauges. The hose on the left is blue and is connected to the low pressure/suction side of the air conditioning system. Because the gauge reads in two different ranges of pressure, it is usually called a compound gauge. The high-pressure side is red coloured.

Q27. What is Vacuuming? Explain.

Ans: Vacuuming is a process of evacuation after initial installation or after service where the system has been opened to atmosphere is critical to proper operation of an air conditioning system. Evacuation is a two step process of degassing and dehydration. Degassing removes non condensibles which cause increased head pressures. Where high temperatures are frequent, non condensibles combined with moisture will also cause oil failure, decreased capacity and increased compressor wear and potential failure.

Q28. What is TEV? Explain its role in VCRS.

Ans: Reduce the pressure of the refrigerant: The first and the foremost function of the thermostatic expansion valve is to reduce the pressure of the refrigerant from the condenser pressure to the evaporator pressure

Section – C Attempt all the following questions

05×10 = 50 Marks

Q29. Explain controller in Air conditioning system with example?

Ans: A controller used in AC system to regulate the operation of a heating and/or air conditioning system. Usually a sensing device is used to compare the actual state (e.g. temperature) with a target state. Example :Thermostat is a controller temperature control devices maintain the proper temperature inside the room as per our comfort requirements. When the desired temperature is reached these devices switch off the compressor of the air-conditioning system and when temperature goes away to certain extent from the desired levels the compressor is restarted. The setting of the temperature is done by the user manually or automatically using the remote control devise of the air-conditioning system.

Q30. Explain state of R32 refrigerant in Condenser and Evaporator with temperature and pressure?

Ans: Refrigerant state of R32 in a split AC in cooling,

Evaporator:

Suction Temp : 2°C / 35.6°F

Suction Pressure: 105–110psi / 724–758kPa

Condenser:

Discharge Temp: 51°C / 123.5°F

Discharge Pressure: 451psi / 3,110kPa

Q31. Write the steps in selecting location for a split AC installation.

Ans: The first step in the installation of split AC is deciding the location of the indoor and the outdoor units, only then the next important steps of the installation can be initiated. Let us see the factors to be considered when deciding the location of these unit.

1) Indoor Unit:

a) The indoor unit is located inside the room at the location from where the air can be distributed evenly throughout the room.

b) As far as possible the indoor should be installed above the bed so that the maximum cooling effect can be obtained. It should be located directly above the bed. If one has to avoid the direct flow of chilled air on the body, one can always change the direction of the louvers. The indoor unit can also be installed on wall towards your feet though it can be installed on other side walls also.

c) The wall mounted indoor unit should be located at the height of about 8 to 10 feet from the floor so that that most of the chilled air is used for cooling the room and not merely for cooling the hot roof.

d) The indoor unit should be accessible easily so that one can conveniently clean the filter every fortnight and the whole unit and also that one can manually change the position of the louvers easily.

e) If the indoor unit is installed above certain window, make sure that it is in symmetry with the window, else the unit will look shabby. The indoor unit is meant to add to the aesthetics of the room and not destroy it.

2) Outdoor Unit:

Here are some points to consider when deciding the location of the outdoor unit:

a) The outdoor unit should be located in the open space preferably on the terrace so that the air can flow freely over the compressor and the condenser. If the terrace is not available it can be kept on the awning above the wall or it can be hanged on the external wall supported by the angles.

b) The location of outdoor unit should be such that it is easily accessible for carrying out the maintenance works of the compressor, condenser, and other devices. The installation and gas charging also should be convenient.

c) There should not be any hindrances in front of the outdoor that would block the passage of fan air from passing to the open space. Any blockages will seriously affect the performance of the AC and can also lead to the burning of hermetically sealed compressor coil.

d) The surface on which the outdoor unit is to be installed should be rigid enough to avoid its vibration. The vibration of the outdoor unit will raise excessive noise and also lead to the breaking of the copper tubing and leakage of the refrigerant.

Q32. What are various safety devices and protection equipment for a AC field technician?

Tasks, Job Classification or Workstation	Potential Hazard	Type of PPE Required	PPE Required (Yes / No)
Mixing/application of chemicals, solvents	Splash to face, dermal hazards, respiratory hazards	Safety goggles, chemical resistant apron, gloves, boots	Yes
Heating/Air Conditioning/Refrigeration work	Water treatment chemicals, hot/cold exposures, excess noise	Chemical resistant gloves, thermal insulated gloves, safety glasses, hearing protection. When using large quantities of chemicals, a face shield and goggles	Yes
General Maintenance Work	Rough surfaced materials, lifting/carrying	Cut/puncture resistant gloves, safety glasses, safety shoes	Yes
Moving work	Lifting/Carrying	Safety shoes, gloves	Yes
Machine Tools (drills, grinders and saws)	Flying particles	Safety glasses	Yes
Roofing Work	Falling, hot surfaces, heat and cold stress, sealing chemicals, solvents, lifting/carrying	Safety glasses, safety shoes, fall protection, heat resistant gloves, chemical resistant gloves. Temperature stress protective clothing, depending on weather conditions	Yes
Confined Space work	Hazardous atmosphere, restricted exit, other hazards as determined by type of space	Determine appropriate PPE in accordance with the Confined Space Entry Program	Yes

Q33. What are various controlling devices in Air conditioning system? Explain any two devices.

Ans: Thermostat, Humidstate.



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of HVAC Skill

Session: 2018-19 (Winter Semester)

B. Voc. Program, 1st Semester (2018-19)

End-Sem. Examination

Course Code: HVA-1104

Time: 3 Hours

Course Name: Sheet metal and Welding Processes

Max. Marks: 100

Section – A

Attempt all the following questions

20×02 = 20 Marks

Q1. Specify the code for MMA welding.

- (A) 111
- (B) 135
- (C) 136
- (D) 141

Q2. What type of current does a welding transformer supply?

- (A) DC
- (B) AC
- (C) Both
- (D) None

Q3. Wire feeding system is used for:

- (A) Control the gas supply
- (B) Adjust the voltage
- (C) control the wire speed
- (D) control the welding speed

Q4. For GMAW process, we use following current and polarity:

- (A) DCEN
- (B) DCEP
- (C) PULSED DC
- (D) Square wave AC

Q5. Which of the following is not a PPE?

- (A) Apron
- (B) Hand gloves
- (C) Wire brush
- (D) Welding Helmet

Q6. Which of the following components are manufactured by the sheet metal forming process?

- (A) Connecting rods
- (B) Electric wires
- (C) Car bodies
- (D) Engine blocks

Q7. Stakes are usually used as _____,

- (A) supporting and forming tools
- (B) Shearing
- (C) Punching
- (D) Riveting

Q8. Shearing is a process of _____,

- (A) Sheet metal cutting operation along a straight line
- (B) Sheet metal bending operation along a straight line
- (C) Notching
- (D) Embossing

Q9. The process of increase in angle of bent part after forming tool removed is:

- (A) Embossing
- (B) Spring back
- (C) Hem
- (D) Blanking

Q10. Sheet metal forming process of shock wave whose energy is transmitted to force part into cavity is known as:

- (A) Explosive forming
- (B) Drawing
- (C) Electromagnetic forming
- (D) Piercing

Section – B

06×05 = 30 Marks

Attempt any 06 questions:

Q11. Write any three characteristics of electrode covering.

Q12. List the advantages of Welding Inverter over other welding power sources.

Q13. What are differences between sheet and plate? Explain applications of both.

Q14. Write the name and operations of sheet metal forming hand tools?

Q15. Write the various processes of sheet metal joining.

Q16. Write the name of all components brazing with oxyacetylene gas? Explain with neat diagram

Q17. Write the process of brazing of a copper tube? Explain all parameters to be controlled.

Q18. Draw various types of stacks used in sheet metal forming.

Section – C Attempt all the following questions

05×10 = 50 Marks

Q19. What Are Commonly Used Sheet-metal Assembly Process?

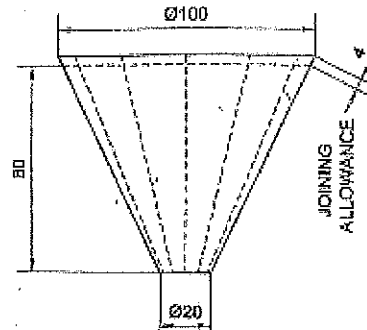
Q20. Describe representation of welding seam in drawing?

Q21. Write the name of sheet metal thickness measuring tool. What are common unit and sizes to measure sheet metal thickness?

Q21. Write the name of sheet metal thickness measuring tool. What are common unit and sizes to measure sheet metal thickness?

Q22. What are various safety devices and PPE for Welding and sheet metal workshop?

Q23. Calculate size of sheet to fabricate component shown in figure below.



[Handwritten signature]



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of HVAC Skill

Session: 2018-19 (Winter Semester)

B. Voc. Program, 1st Semester (2018-19)

End-Sem. Examination (Answers)

Course Code: HVA-1104

Time: 3 Hours

Course Name: Sheet metal and Welding Processes

Max. Marks: 100

Section – A

Attempt all the following questions

20×02 = 20 Marks

Section- A

1. Specify the code for MMA welding.

Ans. (a) 111

2. What type of current does a welding transformer supply?

Ans. (b) AC

3. Wire feeding system is used for

Ans. (c) control the wire speed

4. For GMAW process, we use following current and polarity:

Ans.(b) DCEP

5. Which of the following is not a PPE?

Ans. (c) wire brush

Q6. Which of the following components are manufactured by the sheet metal forming process?

(C) Car bodies

Q7. Stakes are usually used as _____,

(A) supporting and forming tools

Q8. Shearing is a process of _____,

(A) Sheet metal cutting operation along a straight line

Q9. The process of increase in angle of bent part after forming tool removed is:

(B) Spring back

Q10. Sheet metal forming process of shock wave whose energy is transmitted to force part into cavity is known as:

(A) Explosive forming

Section – B

06×05 = 30 Marks

Attempt any 06 questions:

Q11. Write any three characteristics of electrode covering.

Ans. Characteristics of electrode covering:

1. Provide a protective atmosphere.
2. Stabilize the arc.
3. Provide a protective slag coating to accumulate impurities, prevent oxidation, and slow the cooling of the weld metal.
4. Reduce spatter.
5. Add alloying elements.
6. Affect arc penetration
7. Influence the shape of the weld bead.
8. Add additional filler metal. (any 3)

Q12. List the advantages of Welding Inverter over other welding power sources.

Ans. Small setup, more portable and light weight and multi process welding capability

Q13. What are differences between sheet and plate? Explain applications of both.

Main difference of Sheet and plate is thickness. Sheet is below 3 mm, and plate is above 3 mm thickness. Sheets are used in forming, plates are used in structures.

Q14. Write the name and operations of sheet metal forming hand tools?

Stacks, mallet,

Q15. Write the various processes of sheet metal joining.

Hemming, welding, rebitting

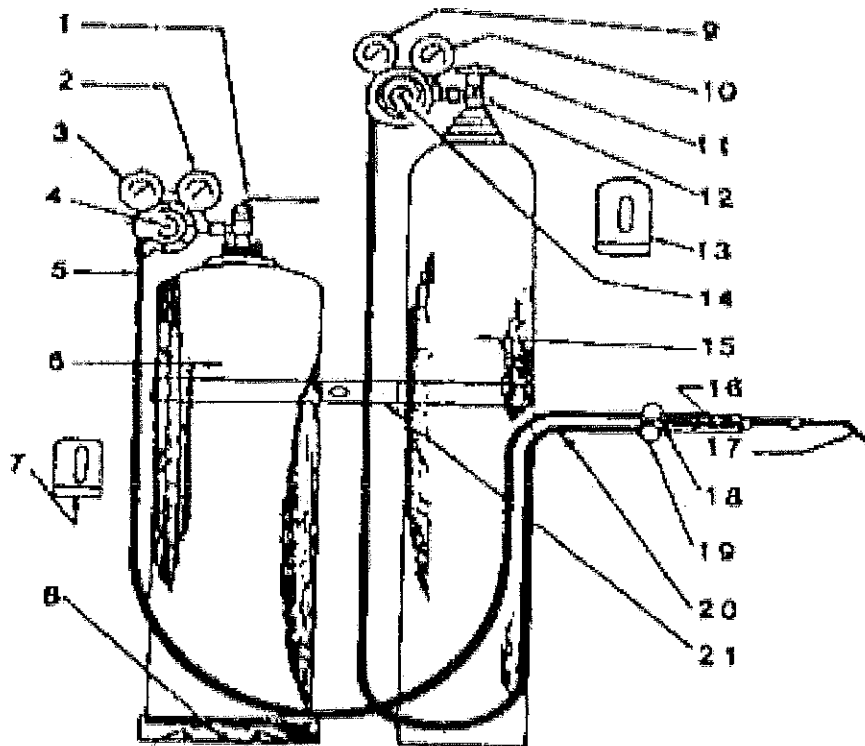
Q16. Write the name of all components brazing with oxyacetylene gas? Explain with neat diagram

1. Acetylene cylinder
2. Safety valve
3. Oxygen cylinder cap
4. Cylinder pressure gauge
5. Line pressure (acetylene) adjusting screw
6. Line pressure gauge
7. Oxygen cylinder
8. Line pressure adjusting
9. Torch body
10. Welding tip
11. Acetylene hose
12. Acetylene torch
13. Acetylene cylinder valve
14. Acetylene cylinder cap
15. Oxygen torch valve
16. Fusible plugs
17. Oxygen hose
18. Line pressure gauge
19. Cylinder

support

20. Cylinder pressure gauge

21. Oxygen cylinder valve.



Q17. Write the process of brazing of a copper tube? Explain all parameters to be controlled.

The most common method of joining copper tube is with the use of a socket-type, copper or copper alloy fitting into which the tube sections are inserted and fastened by means of a filler metal, using brazing process. This type of joint is known as a capillary or lap joint because the socket of the fitting overlaps the tube end and a space is formed between the tube and the fitting. This space is called the capillary space. The surfaces of fitting and tube that overlap to form the joint are known as the faying surfaces. Tube and fitting are then solidly joined using a filler metal that is melted into the capillary space and adheres to these surfaces.

The filler metal is a metal alloy that has a melting temperature below that of either the tube or fitting. The melting point of copper (Cu) alloy is 1,981°F/1082°C. As such, the filler metals for brazing copper and copper alloy tube and fittings must have melting temperatures below this temperature.

Q18. Draw various types of stakes used in sheet metal forming.

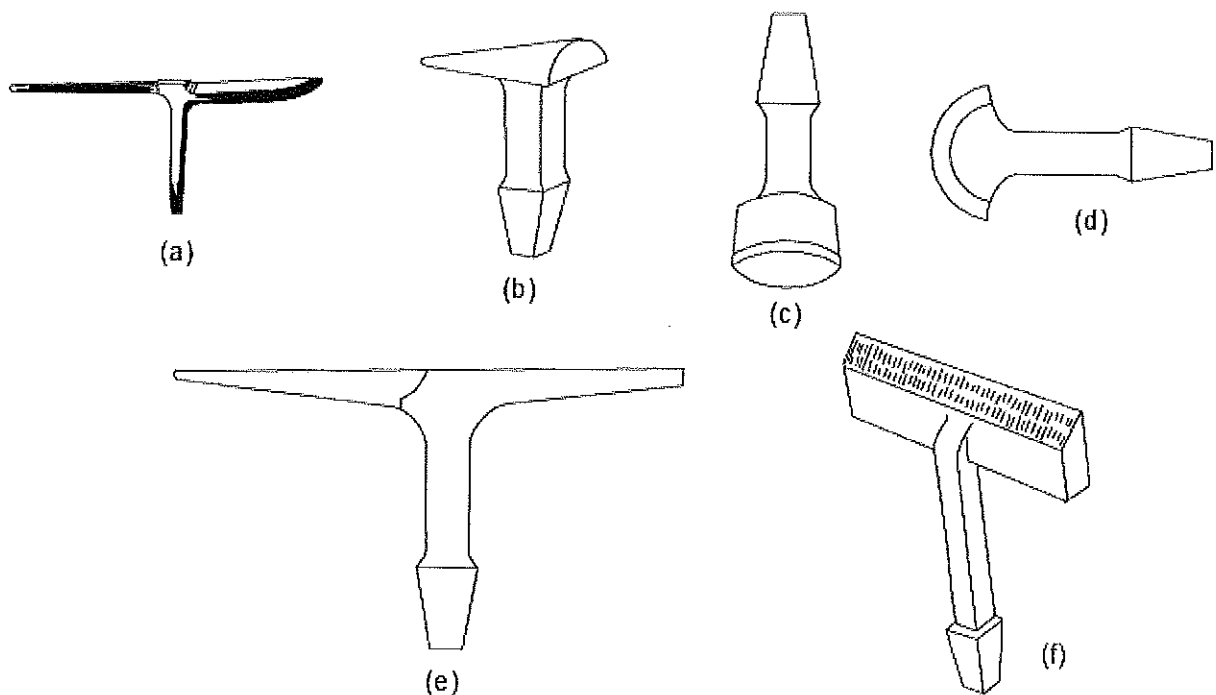
Various types of stakes are used to form the metal sheets into different types of shapes. The stake is a sort of anvil, which supports the sheet for sheet metal work. Stakes consist of a shank and a head or horn. The shank of the stake is designed to fit into a tapered bench socket. The head or horn of stake is available in a number of varieties of sizes and shapes. Working faces of stakes are machined to required shape. With the use of tools like hammer, operations such as bending, seaming or forming can be performed easily with stakes. Few stakes are made of forged mild steel faced with cast steel material. Whereas the better class stakes are made either of cast iron or cast steel material. Below images shows us the different types of stakes:

(a) Beak horn stake: Beak horn stake (shown in Fig. (a)) is basically used for forming, riveting and seaming articles made of sheet metal part. It is not much suitable like blowhorn stake. Beak horn stake has a thick tapered horn at one end and a rectangularly shaped horn at the other end.

(b) Funnel stake: Funnel stake (shown in Fig. (b)) is commonly used for planishing tapered work and hand forming of funnels and similar conical shapes of sheet metal.

(c) Half moon stake: Half moon stake (shown in Fig. (c)) is basically used for throwing up edges of curved sheet metal work and for preliminary stages of wiring curved edges.

(d) Round bottom stake: Round bottom stake (shown in Fig. (d)) is commonly used for squaring up edges and setting up the bottom of cylindrical jobs made up of sheets.



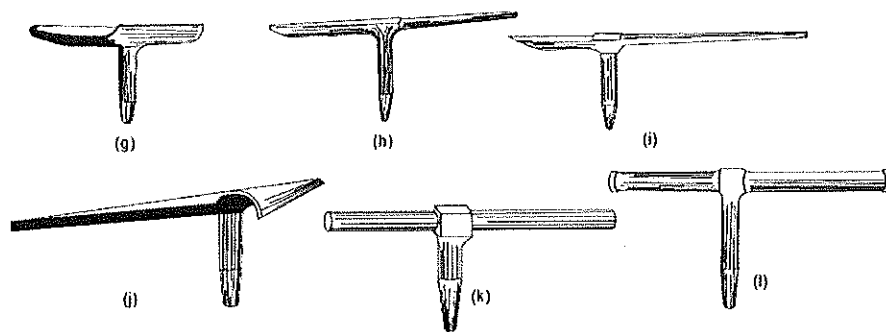
(e) Bick iron: Bick iron stake (shown in Fig. (e)) is mainly used for forming taper handles, spouts and tubular work in general. The narrow flat anvil end of brick iron is very useful on rectangular work.

(f) Hatchet stake. Hatchet stake (shown in Fig. (f)) is generally used for making sharp bends, bending edges and forming boxes and pans of sheet metal by hand. Hatchet stake has a sharp straight edge beveled along one side.

(g) Creasing with horn stake: Creasing horn stake (shown in Fig. (g)) has a round horn used for forming conically shaped pieces in sheets. The other end has a tapering square horn with grooved slots for wiring and beading.

(h) Needle case stake: Needle case stake (shown in Fig. (h)) is commonly used for bending of sheets. Needle case stake has a round slender horn for forming wire rings and tubes.

(i) Candle mold stake: Candle mold stake (shown in Fig. (i)) has two horns for different tapers when forming, seaming and riveting long flaring articles made up of sheet metal.



(j) Blow horn stake: Blow horn stake (shown in Fig. (j)) is generally used in forming, riveting and seaming tapered articles such as funnels.

(k) Conductor stake: Conductor stake (shown in Fig. (k)) has two cylindrical horns of different diameters. Conductor stake is used for forming, riveting, seaming tubes and small sized pipes.

(l) Double seaming stake: Double seaming stake (shown in Fig. (l)) consists of two cylindrical horns of different diameters. It is commonly used for riveting, forming, seaming tubes and small sized pipes.

Section – C Attempt all the following questions

05×10 = 50 Marks

Q19. What Are Commonly Used Sheet-metal Assembly Process?

Mechanical (hardware) Assembly: Uses various different types of hardware or fasteners (bolts, nuts, screws, etc.) to assemble multiple parts together. This method is great for an assembly that is not permanent, needs maintenance, adjustments, and replaceable parts because it allows the flexibility to remove and reinstall hardware. This is great for chassis, box assemblies, and water tight assemblies.

Weld Assembly: Fuses two or more pieces of metal together to essentially become one. This method is great for an assembly that is permanent, structural, and needs strength. This assembly method is great for structural and robust assemblies.

Spot Weld Assembly: Joins and bonds two pieces of sheet metal together. This method is less permanent than regular welding and less expensive, but more permanent than hardware assembly. This assembly method is great for cabinets, brackets, and other sheet metal components.

Rivet Assembly: Has similar but less strength than a weld, and also cheaper. This method is great for assemblies that need shear strength and for assemblies that use different types of material. This assembly method is preferred for structural and robust assemblies that encounter fluctuating temperature and pressure.

Brazing / Soldering Assembly: Uses a filler metal that is melted to a certain temperature which will bond the two components together. This is a great way to bond two different types of metals together while still keeping the strength, like a weld. This type of assembly method is used for pipes for plumbing, flashing, gutters, electronic parts, and jewelry.

Q20. Describe representation of welding seam in drawing?

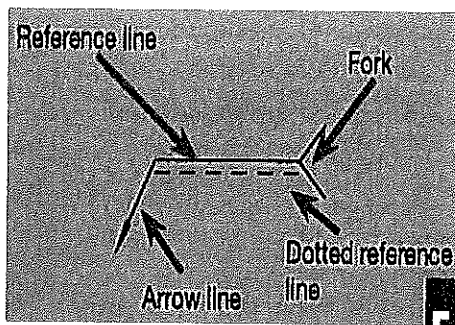
Arrow Line- Shows the welding Position

Reference Line (Solid)

Dotted Reference Line

} Their Intersection shows
 the plane of welding

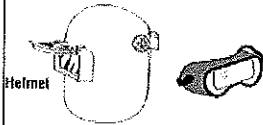
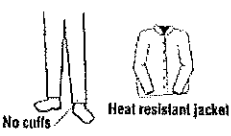
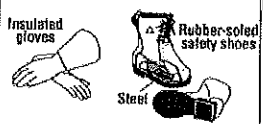
Fork- Contain the supplementary Information of the welding



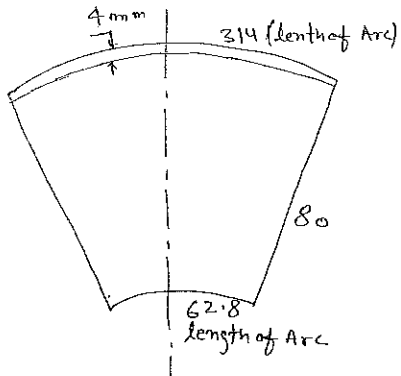
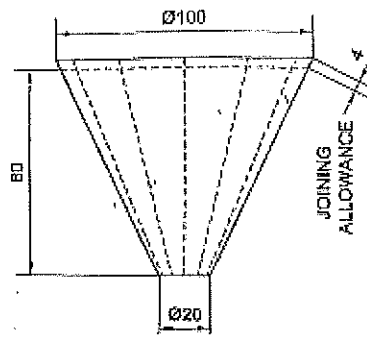
Q21. Write the name of sheet metal thickness measuring tool. What are common unit and sizes to measure sheet metal thickness?

Ans: sheet metal thickness is measured in gauges: the higher the number, the thinner the sheet metal. A gauge is a traditional, non-linear measurement. The most commonly used sheet metal sizes range from 30 gauge (thinner) to 7 gauge (thicker).

Q22. What are various safety devices and PPE for Welding and sheet metal workshop?

Body Part	Equipment	Illustration	Reason
Eyes and face	Welding helmet, hand shield, or goggles		Protects from: • radiation • flying particles, debris • hot slag, sparks • intense light • irritation and chemical burns Wear fire resistant head coverings under the helmet where appropriate
Lungs (breathing)	Respirators		Protects against: • fumes and oxides
Exposed skin (other than feet, hands, and head)	Fire/Flame resistant clothing and aprons		Protects against: • heat, fires • burns • radiation Notes: pants should not have cuffs, shirts should have flaps over pockets or be taped closed
Ears - hearing	Ear muffs, ear plugs		Protects against: • noise Use fire resistant ear muffs where sparks or splatter may enter the ear, rather than plugs.
Feet and hands	Boots, gloves		Protects against: • electric shock • heat • burns • fires

Q23. Calculate size of sheet to fabricate component shown in figure below.



**BHARTIYA SKILL DEVELOPMENT UNIVERSITY**

School of HVAC & R Skills

First Semester, End-Semester Examination

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

Course Code: HVA 1105

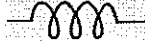
Time: 3 Hours

Course Name: RAC Electrical

Max. Marks: 100

Instructions: Answer all questions from section A, each question carries two marks. Answer any six questions from section B, each question carries five marks. Answer all questions from section C, each question carries ten marks. Scientific calculator can be used.

Section – A**10x2=20 Marks**

- Q.1. (A) farad (F) is the unit of:
(a) Capacitance (b) inductance (c) Resistance (d) none of these
- (B) Unit of charge is:
(a) coulomb (b) Ampere (c) volt (d) none of these
- Q.2. (A) Two resistors of resistance R_1 and R_2 are connected in series the equivalent resistance (R) is:
(a) $R = R_1 + R_2$ (b) $R = (R_1 R_2) / (R_1 + R_2)$
(c) $R = (R_1 + R_2) / (R_1 R_2)$ (d) none of these
- (B) The property of a material which opposes the production of magnetic flux is known as:
(a) Reluctance (b) mmf (c) Permittivity (d) None of these
- Q.3. (A) Identify the symbol of inductor:
(a)  (b)  (c)  (d) None of these
- (B) Watt is the unit of:
(a) Power (b) Energy (c) current (d) None of these
- Q.4. (A) What are the types of conduits available?
(a) PVC conduit (b) Flexible conduit
(c) Heavy gauge steel screwed conduit (d) All of these
- (B) Given, $V = 10 \sin 100 \pi t$ find the frequency f:
(a) 50Hz (b) 100Hz (c) 60 Hz (d) None of these
- Q.5. (A) The unsafe act or unsafe condition can lead to an:
(a) Accident (b) safety (c) both a and b (d) None of these
- (B) In an atom particles having positive charge is called:
(a) Proton (b) Neutron (c) Electron (d) None of these
- Q.6. (A) In a star connected system which of the following is correct:
(a) Line current = Phase current (b) Line voltage = Phase voltage
(c) Line voltage = $\sqrt{3}$ * Phase voltage (d) Both a and c
- (B) Digital multi-meter 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
- Q.7. (A) A 200-ohm resistor is directly connected to 10V battery, Calculate the current through the resistor:
(a) 20 A (b) 0.05 A (c) 5A (d) 1 A
- (B) Units for magnetic flux density is:
(a) Wb /m² (b) Wb/A.m (c) A / m (d) Tesla/m
- Q.8. (A) The elements which are not capable of delivering energy by its own are known as:
(a) Unilateral elements (b) Nonlinear elements (c) Passive elements (d) Active elements
- (B) A current is said to be alternating when it changes in:
(a) Magnitude only (b) Direction only
(c) Both Magnitude and direction (d) None of above
- Q.9. (A) Which of the following is an active element in a circuit?
(a) Current source (b) Resistance (c) Inductance (d) Capacitance
- (B) The resistance of voltmeter is:
(a) Very low (b) Very high (c) Variable (d) None of above

Q.10. (A) A current is said to be direct current when its:

- (a) Magnitude remains constant with time
- (c) Direction changes with time

(b) Magnitude changes with time

(d) Magnitude and direction changes with time

(B) A certain transformer has 400 turns in the primary winding and 2,000 turns in the secondary winding. The turns ratio is:

(a) 0.2

(b) 0.4

(c) 5

(d) 25

Section – B

6x5=30 Marks

Answer any six questions.

Q. 1. State and explain ohms law.

Q. 2. State and explain KCL.

Q. 3. Explain the properties of magnetic lines of force.

Q. 4. Three resistance 50 ohms, 100 ohms and 200 ohms are connected in parallel to a 250V supply. Determine the current flowing through each resistor.

Q. 5. Explain the basic working principle of a transformer.

Q. 6. On what principle induction motor works. What are the main parts of the motor?

Q. 7. Draw a sine wave and define:

(a) Time Period (T) (b) Frequency (c) Amplitude

Q. 8. Write down some common electrical wiring problems.

Section – C

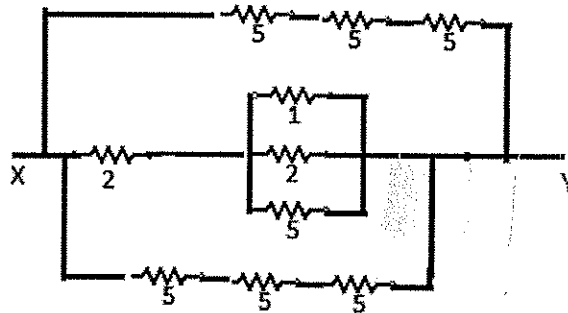
5x10=50 Marks

Q. 1. Write down the process to troubleshoot the Electrical Surges problem.

Q. 2. Explain colour coding of resistor and represent $20k\ \Omega$ with 10% tolerance resistance using colour codes.

Q. 3. Distinguish between Magnetic and Electrical circuits.

Q. 4. Find the equivalent resistance between X and Y (Given all the resistances are in ohms).



Q. 5. Explain the followings:

(A) Faraday's law of electromagnetic induction

(B) KVL

(C) Reluctance

(D) Permeability

Handwritten signature and initials

**BHARTIYA SKILL DEVELOPMENT UNIVERSITY**

School of HVAC & R Skills

First Semester, End-Semester Examination

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

Course Code: HVA 1105

Course Name: RAC Electrical

Max. Marks: 100

10x2=20 Marks

Section – A

Q.1. (A) farad (F) is the unit of:

- (a) Capacitance (b) inductance (c) Resistance (d) none of these

Ans. (a)

(B) Unit of charge is:

- (a) coulomb (b) Ampere (c) volt (d) none of these

Ans. (a)

Q.2. (A) Two resistors 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

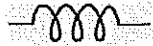
Ans. (a)

(B) The property of a material which opposes the production of magnetic flux is known as:

- (a) Reluctance (b) mmf (c) Permittivity (d) None of these

Ans. (a)

Q.3. (A) Identify the symbol of inductor:

- (a)  (b)  (c)  (d) None of these

Ans. (c)

(B) Watt is the unit of:

- (a) Power (b) Energy (c) current (d) None of these

Ans. (a)

Q.4. (A) 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)(B) Given, $V = 10 \sin 100 \pi t$ find the frequency f:

- (a) 50Hz (b) 100Hz (c) 60 Hz (d) None of these

Ans. (a)

Q.5. (A) The unsafe act or unsafe condition can lead to an:

- (a) Accident (b) safety (c) both a and b (d) None of these

Ans. (a)

(B) In an atom particles having positive charge is called:

- (a) Proton (b) Neutron (c) Electron (d) None of these

Ans. (a)

Q.6. (A) In a star connected system which of the following is correct:

- (a) Line current = Phase current (b) Line voltage = Phase voltage
(c) Line voltage = $\sqrt{3}$ * Phase voltage (d) Both a and c

Ans. (d)

(B) Digital multi-meter 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)

Answer Key

Q.7. (A) A 200-ohm resistor is directly connected to 10V battery, Calculate the current through the resistor:

- (a) 20 A (b) 0.05 A (c) 5A (d) 1 A

Ans. (b)

(B) Units for magnetic flux density is:

- (a) Wb /m² (b) Wb/A.m (c) A / m (d) Tesla/m

Ans. (a)

Q.8. (A) The elements which are not capable of delivering energy by its own are known as:

- (a) Unilateral elements (b) Nonlinear elements (c) Passive elements (d) Active elements

Ans. (c)

(B) A current is said to be alternating when it changes in:

- (a) Magnitude only (b) Direction only
(c) Both Magnitude and direction (d) None of above

Ans. (c)

Q.9. (A) Which of the following is an active element in a circuit?

- (a) Current source (b) Resistance (c) Inductance (d) Capacitance

Ans. (a)

(B) The resistance of voltmeter is:

- (a) Very low (b) Very high (c) Variable (d) None of above

Ans. (b)

Q.10. (A) 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

Ans. (a)

(B) A certain transformer has 400 turns in the primary winding and 2,000 turns in the secondary winding. The turns ratio is:

- (a) 0.2 (b) 0.4 (c) 5 (d) 25

Ans. (c)

Section – B

6x5=30 Marks

Answer any six questions.

Q. 1. State and explain ohms law.

Ans. Ohm's law states that in any closed circuit the current is directly proportional to the voltages applied and inversely proportional to the resistance of the circuit, keeping the physical conditions are constant.

$$I \propto V,$$

$$I \propto 1/R$$

$$I = V/R$$

$$V = IR$$

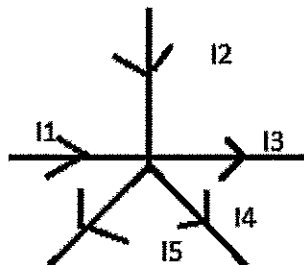
Where, V=applied voltage in volt

I is the current flowing through the circuit in A

R is the resistance of the circuit in Ω

Q. 2. State and explain KCL.

Ans. The algebraic sum of the currents at any junction of a network is zero. In other words, the sum of current entering in to a junction is equal to the sum of current leaving from the junction.



$$I1+I2-I3-I4-I5=0$$

Or

$$I1+I2=I3+I4+I5$$

Q. 3. Explain the properties of magnetic lines of force.

Ans.

- Magnetic flux of a field 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 repel each other.
- The lines of force are stretched like elastic cord.

Q. 4. Three resistance 50 ohms, 100 ohms and 200 ohms are connected in parallel to a 250V supply. Determine the current flowing through each resistor.

Ans. $R_1=50$

$R_2=100$

$R_3=200$

Since it is a parallel circuit the voltage across all the resistor is same.

Thus,

$$250=50 \times I_1$$

$$I_1=5 \text{ A}$$

Current through 50 ohm resistor is 5A

$$250=100 \times I_2$$

$$I_2=2.5$$

Current through 100 ohm resistor is 2.5A

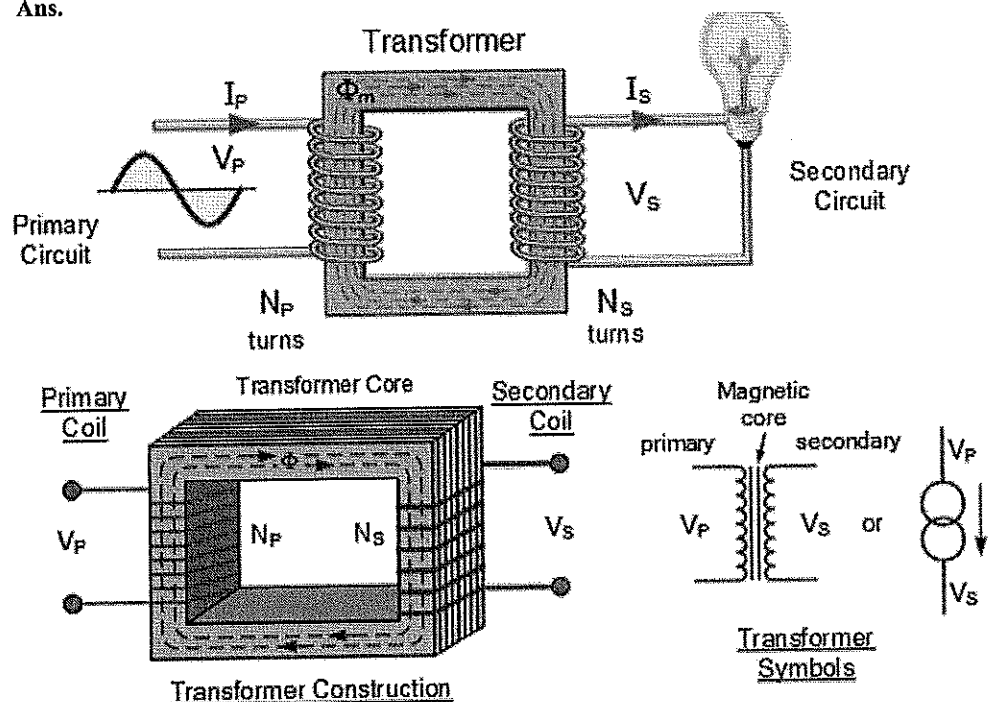
$$250=200 \times I_3$$

$$I_3=1.25$$

Current through 200 ohm resistor is 1.25A

Q. 5. Explain the basic working principle of a transformer.

Ans.



Transformer there is no direct electrical connection between the two coil windings, thereby giving it the name also of an Isolation Transformer. Generally, the primary winding of a transformer is connected to the input voltage supply and converts or transforms the electrical power into a magnetic field. While the job of the secondary winding is to convert this alternating magnetic field into electrical power producing the required output voltage as shown.

When an alternating voltage (V_P) is applied to the primary coil, current flows through the coil which in turn sets up a magnetic field around itself, called *mutual inductance*, by this current flow according to Faraday's Law of electromagnetic induction. The strength of the magnetic field builds up as the current flow rises from zero to its maximum value which is given as $d\Phi/dt$. As the magnetic lines of force setup by this electromagnet expand outward from the coil the soft iron core forms a path for and concentrates the magnetic flux. This magnetic flux links the turns of both windings as it increases and decreases in opposite directions under the influence of the

Answer Key

AC supply. However, the strength of the magnetic field induced into the soft iron core depends upon the amount of current and the number of turns in the winding. When current is reduced, the magnetic field strength reduces. When the magnetic lines of flux flow around the core, they pass through the turns of the secondary winding, causing a voltage to be induced into the secondary coil. The amount of voltage induced will be determined by: $N \cdot d\Phi/dt$ (Faraday's Law), where N is the number of coil turns. Also this induced voltage has the same frequency as the primary winding voltage.

Q. 6. On what principle induction motor works. What are the main parts of the motor?

Ans. The induction motor does not have any direct power supplied into the rotor; instead, a secondary current is induced in the rotor. To achieve this, stator windings are arranged around the rotor so that when energised with a polyphase supply they create a rotating magnetic field pattern which sweeps past the rotor. This changing magnetic field pattern induces current in the rotor conductors. These currents interact with the rotating magnetic field created by the stator and in effect cause a rotational motion on the rotor. However for these currents to be induced the speed of the rotor must be less than the speed of the rotating magnetic field in the stator or else the magnetic field will not be moving relative to the rotor conductors and no currents will be induced. If by some chance this happens, the rotor typically slows slightly until a current is re-induced and then the rotor continues as before. This difference between the speed of the rotor and speed of the rotating magnetic field in the stator is called slip. It is unitless and is the ratio between the relative speed of the magnetic field as seen by the rotor (the slip speed) to the speed of the rotating stator field. Due to this, an induction motor is sometimes referred to as an asynchronous machine

Q. 7. Draw a sine wave and define:

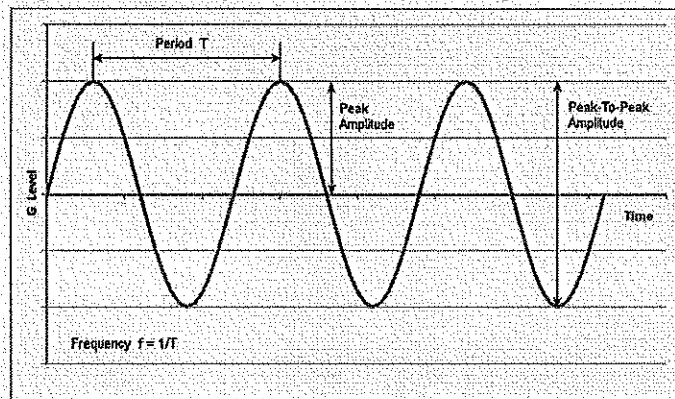
(a) Time Period (T) (b) Frequency (c) Amplitude

Ans.

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



Q. 8. Write down some common electrical wiring problems.

- Ans.**
1. Overloading
 2. Electrical surges
 3. Power sags and dips
 4. Junction box that is uncovered
 5. Switches of light not working
 6. flickering
 7. tripping circuit breaker
 8. Less outlets
 9. electrical shocks
 10. No RCCB (Residual current circuit breaker)
 11. Frequent burning out of light bulbs
 12. Over Circuited panel
 13. High electricity bill

Section – C

Q. 1. Write down the process to troubleshoot the Electrical Surges problem.

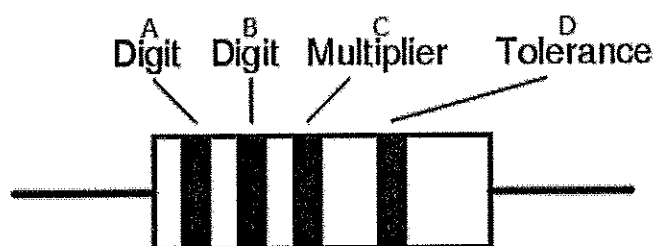
Ans. Identify the power coming cable and don't work with the power on. Flag the circuit with a label to make others aware that you are working on it.

- Check all equipment served by each cable and don't forget to disconnect device with any associated cable. Isolate the equipment to avoid a failing component.
- Check the switch with an OHM Meter.
- Securely test the fixture with an extra cord to check whether it works. If it doesn't – check the installation wiring, bulbs and so on.
- In some cases a hot wire will test alright way to ground ordinarily a ground wire, however won't test ok to the White Neutral Wire. This can be caused by a couple of things, a free or burnt association that has burnt clear of the association point, for example, a receptacle screw or the point of insertion at the back of a receptacle. A device won't work if there is no neutral. Make sure to check all the Neutral Connections at the source and at any intersection prompting the issue zone.
- The space heaters with high wattage used for a long time make the receptacle to get heated more. This occurs especially on the heater side.
- If a receptacle became stained where the cord is connected then the possibilities are the wiring appended to the receptacle inside the box will have encountered overheating and could be burnt.
- Ensure your connections are well made. A free connection will likewise cause shorts and make burnt wires which could bring about a potential fire danger.
- Don't over fix wire nuts, however ensure they are on tight. As the circuit and all the components are checked you must be able to find the issue and fix it. Always keep in mind safety is paramount, so if you are unsure about the issue don't consider it for fixing alone. A professional electrician can easily diagnose and resolve it. Be safe!!

Q. 2. Explain color coding of resistor and represent 20k Ω with 10% tolerance resistance using color codes.

Ans.

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

$$R = AB \times 10^C \pm D$$

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

Red, Black, Orange, Silver.

Answer Key

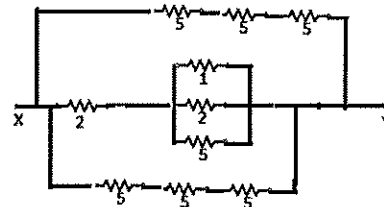
Q. 3. Distinguish between Magnetic and Electrical circuits.

Ans.

<i>Electric Circuit</i>	<i>Magnetic Circuit</i>
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

Q. 4. Find the equivalent resistance between X and Y (Given all the resistances are in ohms).

Ans.



$$RT1 = 5+5+5 = 15$$

$$RT2 = 5+5+5 = 15$$

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

$$1/RT3 = 1 + .5 + .2$$

$$1/RT3 = 1.7$$

$$RT3 = 0.588$$

$$RT4 = 2 + 0.588$$

$$RT4 = 2.588$$

$$1/R_{total} = [1/15 + 1/15 + 1/2.588]$$

$$1/R_{total} = 0.519732$$

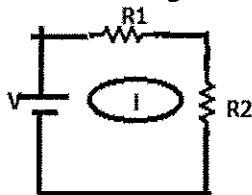
$$R_{total} = 1.924068$$

Q. 5. Explain the followings:

(A) Faraday's law of electromagnetic induction (B) KVL (C) Reluctance (D) Permeability

Ans. Kirchhoff's Voltage Law (KVL)

It states that the algebraic sum of all the voltages in any closed electrical circuit is equal to the zero.



$$V - I \cdot R1 - I \cdot R2 = 0 \text{ or } V = I \cdot R1 + I \cdot R2$$

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



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of HVAC Skill

Session: 2018-19 (Winter Semester)

B. Voc. Program, 1st Semester (2018-19)

End-Sem. Examination

Course Code: HVA1106

Time: 3 Hours

Course Name: RAC Electronics and instrumentation

Max. Marks: 100

Section – A

Attempt all the following questions

20 × 01 = 20 Marks

Q1. Which one of the following can amplify the signal?

- (A) Resistor
- (B) Capacitance
- (C) Transistor
- (D) None of the above

Q2. Which one of the following is correct for output current in LR circuit?

- (A) Lagging behind Voltage
- (B) Leading the voltage
- (C) Either Lagging or Leading
- (D) None of the above

Q3. Which one of the following can store energy?

- (A) Resistor
- (B) Inductor
- (C) Capacitor
- (D) Both Capacitor and Inductor

Q4. Which one is true from the following?

- (A) Electron charge is positive
- (B) Electron charge is negative
- (C) Electron is either positive or negative
- (D) None of them

Q5. Which of the following is true to keep your electronic equipment safely?

- (A) Circuit
- (B) Fuse
- (C) Resistor
- (D) Cell

Q6. Which one of the following is true when current decays through a conductor?

- (A) Heat
- (B) Energy
- (C) Resistance
- (D) None of the above

Q7. Which one of the following is true if two or more active/passive elements are connected along with an energy source?

- (A) Battery
- (B) Circuit
- (C) Terminal
- (D) Resistor

Q8. Which one of the following is true if the current through the diode is large?

- (A) Reverse bias
- (B) Forward bias
- (C) No bias
- (D) Either reverse or forward

Q9. Which one of the following is true for wider depletion layer in a PN junction?

- (A) Forward bias
- (B) Reverse bias
- (C) Both forward and reverse bias
- (D) None of the above

Q10. Which one of the following is used to measure Voltage?

- (A) Ammeter
- (B) Voltmeter
- (C) Barometer
- (D) Thermometer

Q11. Which one of the following is true for the current flowing through metal?

- (A) Movement of Electrons only
- (B) Movement Holes only
- (C) Movement of Electrons and Holes
- (D) None of the above

Q12. Which one from the following conditions LED can emit light?

- (A) Reverse bias
- (B) Forward bias
- (C) No bias
- (D) None of the above

Q13. Which of the following semiconductors are used in LED?

- (A) Indirect bandgap
- (B) Direct bandgap
- (C) Both direct and indirect
- (D) None of the above

Q14. Which one of the following semiconductors is used for most of electronic components?

- (A) Si
- (B) Ge
- (C) Both Si and Ge
- (D) GaAs

Q15. Which one of the following regions is needed for BJT as switch?

- (A) Cutoff
- (B) Saturation
- (C) Active
- (D) None of the above

Q16. Which of the following terminals is grounded for Common Emitter configuration?

- (A) Emitter
- (B) Collector
- (C) Base
- (D) None of them

Q17. Which of the following is the bandgap for Si?

- (A) 0.3 eV
- (B) 1.12 eV
- (C) 0.7 eV
- (D) 0.25 eV

Q18. Which of the following resistors is used to measure the temperature change?

- (A) Thermistor
- (B) Chemoresistor
- (C) Varistor
- (D) None of the above

Q19. Which of the following device is used to measure the Temperature?

- (A) Thermometer
- (B) Barometer
- (C) Hygrometer
- (D) None of the above

Q20. Which one of the following is true for sensing in capacitive sensor?

- (A) Change of color
- (B) Change of capacitance
- (C) Change of resistance
- (D) None of the above

Section – B**06 × 05 = 30 Marks****Attempt any 06 questions:**

Q21. What is resistor? There are several resistors such as $R_1, R_2, R_3, \dots, R_N$ are connected in series and parallel. What will be the value of resultant resistance when these are in series and parallel?

Q22. What is function of Capacitor in a ckt? How does capacitance of a ckt get effected? 5.0 nF, 20.5 nF, and 10 nF Capacitors are connected in a series of a circuit. Find out resultant Capacitance of this circuit?

Q23. What are differences between LED and PN Junction diode? How does solar cell work? Explain it.

Q24. How does solar energy is effective in your home appliances? How is the solar cell environment friendly?

Q25. What do you mean by forward biased PN junction diode? Explain the working principle of forward biased PN junction.

Q26. Why does Capacitor block DC? What is the unit of a capacitor? How much energy is stored in Capacitor?

Q27. What do you mean by an amplifier? Explain CE Transistor amplifier with proper circuit diagram.

Q28. What is common based current gain (α)? Find out the relation between α and β ? A Transistor $\alpha = 0.98$, $I_B = 100 \mu A$. Calculate I_C and I_E respectively neglecting leakage current.

Section – C Attempt all the following questions**05 × 10 = 50 Marks**

Q29. What are difference between Inductor and Capacitor? In a circuit, one Capacitor (C) and a resistor with resistance (R) are connected in a series combination with a DC Electric Field (E) then draw the circuit diagram and find out the value of current (I) flowing through this circuit. What is time constant of this circuit?

Q30. What is direct and indirect band gap semiconductor? There are two diodes one is made from Si and other from GaAs. Which one is direct bandgap between these semiconductors? State and explain how does GaAs diode emit light?

Q31. Can you make a Transistor connecting two diodes back to back? Discuss it. How many transistors are available depending on doping densities? Why are NPN Transistors widely used in various electronic applications? A Common Emitter (CE) Transistor has current gain (β) = 100 and base current (I_B) = 10 μA . Find the value of Collector current respectively.

Q32. What is rectifier? How many rectifiers are there? What are the differences between rectifier and amplifier? Write the application of rectifiers. Draw and explain properly the working principle of Full Wave rectifier.

Q33. What is sensor? Why are sensors useful for our lives? Define sensitivity, response time and selectivity of a sensor. What is thermistor? How many types of thermistors are available in the market? Indicate the applications of Thermistors.

checked By

(Sign)




Registration No.:

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of HVAC Skill

Session: 2018-19 (Winter Semester)

B. Voc. Program, 1st Semester (2018-19)

End-Sem. Examination (Answers)

Course Code: HVA1106

Time: 3 Hours

Course Name: RAC Electronics and instrumentation

Max. Marks: 100

Section – A

Attempt all the following questions

20 × 01 = 20 Marks

Q1. Which one of the following can amplify the signal?

- (A) Resistor
- (B) Capacitance
- (C) Transistor
- (D) None of the above

Q2. Which one of the following is correct for output current in LR circuit?

- (A) Lagging behind Voltage
- (B) Leading the voltage
- (C) Either Lagging or Leading
- (D) None of the above

Q3. Which one of the following can store energy?

- (A) Resistor
- (B) Inductor
- (C) Capacitor
- (D) Both Capacitor and Inductor

Q4. Which one is true from the following?

- (A) Electron charge is positive
- (B) Electron charge is negative
- (C) Electron is either positive or negative
- (D) None of them

Q5. Which of the following keeps your electronic equipment safely?

- (A) Circuit
- (B) Fuse
- (C) Resistor
- (D) Cell

Q6. Which one of the following results if current decays through a conductor?

- (A) Heat
- (B) Energy
- (C) Resistance
- (D) None of the above

Q7. Which one of the following is true if two or more active/passive elements are connected along with an energy source?

- (A) Battery
- (B) Circuit
- (C) Terminal
- (D) Resistor

Q8. Which one of the following is true if the current through the diode is large?

- (A) Reverse bias
- (B) Forward bias
- (C) No bias
- (D) Either reverse or forward

Q9. Which one of the following is true for wider depletion layer in a PN junction?

- (A) Forward bias
- (B) Reverse bias
- (C) Both forward and reverse bias
- (D) None of the above

Q10. Which one of the following is used to measure Voltage?

- (A) Ammeter
- (B) Voltmeter
- (C) Barometer
- (D) Thermometer

Q11. Which one of the following is true for the current flowing through metal?

- (A) Movement of Electrons only
- (B) Movement Holes only
- (C) Movement of Electrons and Holes
- (D) None of the above

Q12. Which one from the following conditions LED can emit light?

- (A) Reverse bias
- (B) Forward bias
- (C) No bias
- (D) None of the above

Q13. Which of the following semiconductors are used in LED?

- (A) Indirect bandgap
- (B) Direct bandgap
- (C) Both direct and indirect
- (D) None of the above

Q14. Which one of the following semiconductors is used for most of electronic components?

- (A) Si
- (B) Ge
- (C) Both Si and Ge
- (D) GaAs

Q15. Which one of the following regions is needed for BJT as ON switch?

- (A) Cutoff
- (B) Saturation
- (C) Active
- (D) None of the above

Q16. Which of the following terminals is grounded for Common Emitter configuration?

- (A) Emitter
- (B) Collector
- (C) Base
- (D) None of them

Q17. Which of the following is true for Si bandgap?

- (A) 0.3 eV
- (B) 1.12 eV
- (C) 0.7 eV
- (D) 0.25 eV

Q18. Which of the following resistors is used to measure the temperature change?

- (A) Thermistor
- (B) Chemoresistor
- (C) Varistor
- (D) None of the above

Q19. Which of the following device is used to measure the Temperature?

- (A) Thermometer
- (B) Barometer
- (C) Hygrometer
- (D) None of the above

Q20. Which one of the following is true for sensing in capacitive sensor?

- (A) Change of color
- (B) Change of capacitance
- (C) Change of resistance
- (D) None of the above

Section – B**Attempt any questions****06×05 = 30 Marks****Attempt any 06 questions:**

Q21. What is resistor? There are several resistors such as $R_1, R_2, R_3, \dots, R_N$ are connected in series and parallel. There are two wires one is thin and another is thick. What will be the value of resultant resistance when these are in series and parallel? Which of the above two wires resistance will be high during the current passing through it? Discuss it.

Ans: Resistor is a device having resistance to the passage of an electric current.

Series: $R_T = R_1 + R_2 + R_3 + \dots + R_N$

Parallel: $R_T = 1 / (1/R_1 + 1/R_2 + 1/R_3 + \dots + 1/R_N)$

Resistance of the thin wire will be higher than other.

Q22. What is function of Capacitor in a ckt? How does capacitance of ckt get effected? 5.0 nF, 20.5 nF, and 10 nF Capacitors are connected in a series of a circuit. Find out resultant Capacitance of this circuit?

Ans: The function of Capacitor is to store the electrical energy and give this energy again to the circuit when necessary. In other words, it charges and discharges the electric charge stored in it. Besides this, the functions of a capacitor are as follows: It blocks the flow of DC and permits the flow of AC.

Resultant Capacitance value $(1/C_T) = 1/C_1 + 1/C_2 + 1/C_3$

Q23. What are differences between LED and PN Junction diode? How does solar cell work? Explain it.

Ans: LED can emit light but PN junction can't do that. LED only works in forward direction but PN junction works both forward and reverse bias respectively. Direct band gap semiconductor can be used for LED but indirect band gap semiconductors are mostly used for PN junction diode.

A simple solar cell is a pn junction diode. The schematic of the device is shown in figure 4. The n region is heavily doped and thin so that the light can penetrate through it easily. The p region is lightly doped so that most of the depletion region lies in the p side. The penetration depends on the wavelength and the absorption coefficient increases as the wavelength decreases. Electron hole pairs (EHPs) are mainly created in the depletion region and due to the built-in potential and electric field, electrons move to the n region and the holes to the p region. When an external load is applied, the excess electrons travel through the load to recombine with the excess holes

Q24. How does solar energy is effective in your home appliances? How is the solar cell environment friendly?

Ans: Applications:

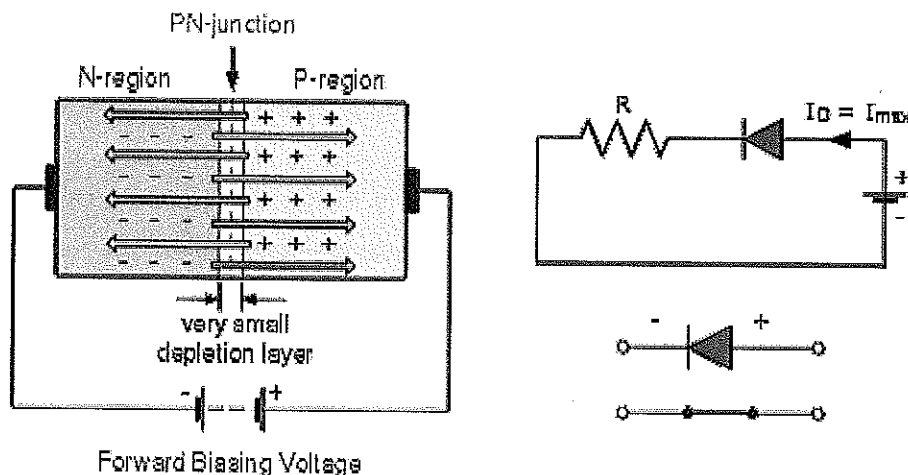
- Solar energy can be converted to electricity that can be used to power the appliances in our home. This is known as photovoltaic (PV).
- Solar energy can also be used in geo thermal applications, where the sun warms or cools a liquid (like the water in your home). This is known as solar heating and cooling (SHC).
- The third application for solar is called concentrating solar power or CSP—used to heat a steam turbine or in another large-scale application

Energy from the sun is clean and helps the environment by decreasing our reliance on traditional methods of powering our world: natural gas, coal and oil – collectively known as fossil fuels. The resources that we have depended on for so long have caused harm to the environment through oils spills, damage to pristine natural landscapes, and our water supplies. They have also contributed to global warming and have led to numerous conditions that are harmful to our health

Q25. What do you mean by forward biased PN junction diode? Explain the working principle of forward biased PN junction.

Ans: Forward biased PN junction is a diode when p type is connected to positive and n type is negative.

A PN Junction Diode is one of the simplest semiconductor devices around, and which has the characteristic of passing current in only one direction only. However, unlike a resistor, a diode does not behave linearly with respect to the applied voltage as the diode has an exponential current-voltage (I-V) relationship and therefore we can not described its operation by simply using an equation such as Ohm's law.



If a suitable positive voltage (forward bias) is applied between the two ends of the PN junction, it can supply free electrons and holes with the extra energy they require to cross the junction as the width of the depletion layer around the PN junction is decreased.

Q26. Why does Capacitor block DC? What is the unit of a capacitor? How much energy is stored in Capacitor?

Ans: AC has some frequency, due to which capacitor can flow through it. A capacitor blocks DC as it has zero frequency. Once the Capacitor gets charged up to the input voltage with the same polarity then no further transfer of electrons can happen except to replenish the slow discharge due to leakage.

$$\text{Stored Energy} = \frac{1}{2} CV^2$$

Q27. What do you mean by an amplifier? Explain CE Transistor amplifier with proper circuit diagram.

Ans: Amplifier is a circuit that is used for amplifying a signal. The input signal to an amplifier will be a current or voltage and the output will be an amplified version of the input signal. An amplifier circuit which is purely based on a transistor or transistors is called a transistor amplifier.

Q28. What is common based current gain (α)? Find out the relation between α and β ? A Transistor $\alpha = 0.98$, $I_B = 100 \mu A$. Calculate I_C and I_E respectively neglecting leakage current

Common base current gain (α) = and Common emitter current gain (β) =

$$= , \text{ now } I_B = I_E - I_C$$

$$\text{Now, } (\beta) = = =$$

$$I_C = I_B +$$

$$= (0.98 \times 100) / (1 - 0.98) + 6 / (1 - 0.98)$$

$$= 4900 + 300 = 5.2 \text{ mA}$$

$$I_E = I_C + I_B = 5200 + 100 = 5.3 \text{ mA}$$

Section – C Attempt all the following questions

05 × 10 = 50 Marks

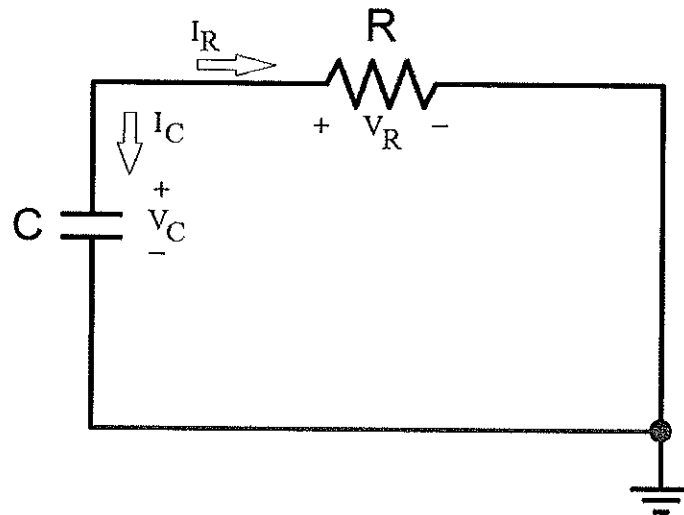
Q29. What are difference between Inductor and Capacitor? In a circuit, one Capacitor (C) and a resistor with resistance (R) are connected in a series combination with a DC Electric Field (E) then draw the circuit diagram and find out the value of current (I) flowing through this circuit. What is time constant of this circuit?

Ans: The main difference between a capacitor & inductor is that an inductor is used to store the energy in the form of magnetic field, whereas a capacitor stores the energy in the form of an electric field.

When the switch is in position 1 as shown in Fig. 1(a), charge on the conductors builds to a maximum value after some time. When the switch is thrown to position 2 as in Fig. 1(b), the battery is no longer part of the circuit and, therefore, the charge on the capacitor cannot be replenished. As a result the capacitor discharges through the resistor. If we wish to examine the charging and discharging of the capacitor, we are interested in what happens immediately after the switch is moved to position 1 or position 2, not the later behavior of the circuit in its steady state.

For the circuit shown in Fig. 1(a), Kirchhoff's loop equation can be written as

$$\Delta V - Q/C - R \, dQ/dt = 0 \quad (1)$$



The solution to is Eq. (2) is $Q_f = Q_0(1 - e^{-t/RC})$ (2)

where Q_f represents the final charge on the capacitor that accumulates after an infinite length of time, R is the circuit resistance, and C is the capacitance of the capacitor. From this expression you can see that charge builds up exponentially during the charging process. See Fig. 2(a). When the switch is moved to position 2, for the circuit shown in Fig. 1(b), Kirchhoff's loop equation is now given by

$$Q/C - R \, dQ/dt = 0 \quad (3)$$

solution to Eq. (4) is $Q_c = Q_0 e^{-t/RC}$ (5) where Q_0 represents the initial charge on the capacitor at the beginning of the discharge.

RC is the time constant for CR circuit.

Q30. What is direct and indirect band gap semiconductor? There are two diodes one is made from Si and other from GaAs. Which one is direct bandgap between these semiconductors? State and explain how does GaAs diode emit light?

Ans: Indirect-band-gap are defined by the fact that the minimum energy in the conduction band and the maximum energy in the valence band occur at different values of the crystal momentum. This means that an indirect transition occurs from the valence (V.B.) to the conduction band (C.B.) But, in direct bandgap the minima of the CB and maxima of the VB lies at same k value so the electrons directly move from valance band (VB) to conduction band (CB)

In direct semiconductor photons are generated but in indirect photon are generated.

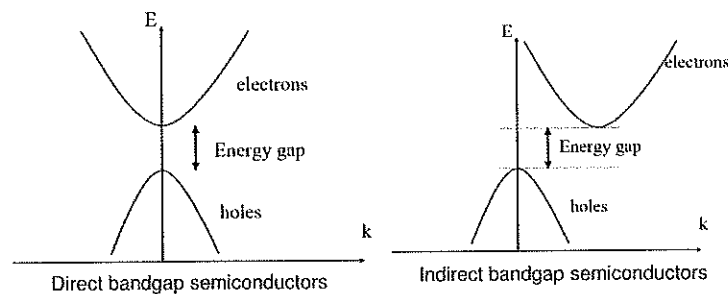


Fig: Direct and indirect band gap semiconductor

Q31. Can you make a Transistor connecting two diodes back to back? Discuss it. How many transistors are available depending on doping densities? Why are NPN Transistors widely used in various electronic applications? A Common Emitter (CE) Transistor has current gain (β)=100 and base current (I_b)=10 μ A. Find the value of Collector current respectively.

Ans: No.

Minority carrier diffusion length must be greater than base width so all the carriers recombine in base so no carrier move to collector region and Transistor action ceases.

NPN and PNP Transistors

Electrons are the majority carriers in NPN Transistor. Mobility of electron is larger than hole. So, the speed of NPN Transistor is higher than PNP Transistor

$$I_C = \beta I_b = 100 \times 10 = 1 \text{ mA}$$

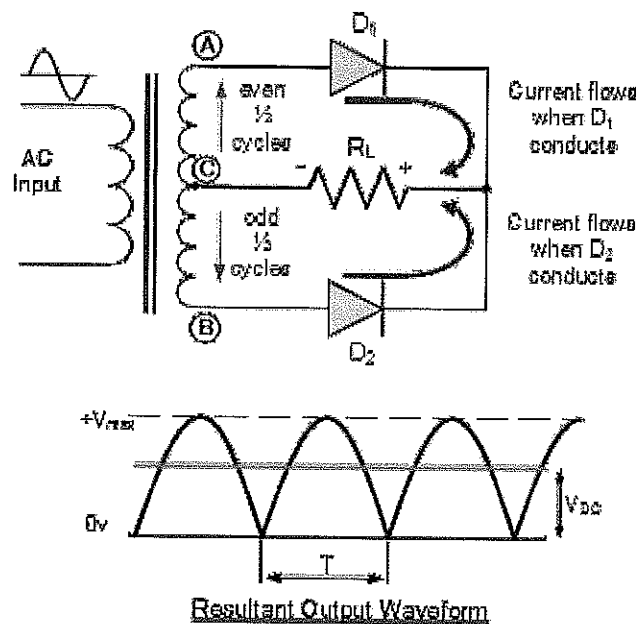
Q32. What is rectifier? How many rectifiers are there? What are the differences between rectifier and amplifier? Write the application of rectifiers. Draw and explain properly the working principle of Full Wave rectifier.

Ans: An electrical device which converts an alternating current into a direct one by allowing a current to flow through it in one direction only.

- a. Half wave
- b. Full wave
- c. Bridge rectifier

Rectifier is used to convert AC to DC but amplifier is used to amplify signal. Rectifier can't amplify the signal but amplifier can do this. Rectifier is a simple circuit but amplifier is complex.

As we are aware that all electrical appliances use DC power supply to function. Using a rectifier in the power supply helps in converting AC to DC power supply. Bridge rectifiers are widely used for large appliances, where they are capable of converting high AC voltage to low DC voltage.



Q33. What is sensor? Why are sensors useful for our lives? Define sensitivity, response time and selectivity of a sensor. What is thermistor? How many types of thermistors are available in the market? Indicate the applications of Thermistors.

Ans: A sensor is a device which can detect events or changes in its environment and send the information to other electronics.

Need of sensors

- Sensors Seismic monitors provide an early warning system for earthquakes.

- Sensors were developed to detect and quantify structures and functions of human body

Sensitivity: The sensitivity of an instrument is the change of output divided by the change of the measurand (the quantity being measured). As an example, consider a pressure sensor that has a measurement range of 0–100PSI and an output range of 0–5V. Its sensitivity is .05 Volt/PSI.

Response: Response time is defined as the time required to the output signal of a sensor to display a change with respect to input.

Thermistor: A thermistor is a type of resistor used to measure temperature changes, relying on the change in its resistance with changing temperature. Thermistor is a combination of the words thermal and resistor

A simple linear relationship between resistance and temperature for the following discussion:

$$\Delta R = k \Delta T$$

where

ΔR = change in resistance

ΔT = change in temperature

k = first-order temperature coefficient of resistance

Thermistors can be classified into two types depending on the sign of k .

If k is positive, the resistance increases with increasing temperature, and the device is called a positive temperature coefficient (PTC) thermistor, Posistor.

If k is negative, the resistance decreases with increasing temperature, and the device is called a negative temperature coefficient (NTC) thermistor.

Applications: Thermistor Sensor Applications for Temperature Measurement, Compensation, and Control. NTC thermistor temperature sensors are used in a variety of thermistor sensor applications to help regulate, monitor, control, and compensate temperature

