Registration No:.....

Bhartiya Skill Development University

SCHOOL OF HVAC&R SKILLS

END-SEMESTER EXAMINATION – 2018

SUMMER SEMESTER, B. VOC. PROGRAM

Course Code: HVA-1101

Course Name: BASIC RAC

Time: 3 Hour

Max. Marks: 100

Instructions:

1. Attempt all Questions from section A and C and any 06 out of 08 questions from section B.
2. Each question of Section – A carries 02 marks.
3. Each question of Section – B carries 05 marks.
4. Each question of Section – C carries 10 marks.

Section-A

Select the one correct option from the given options in the Following questions : - (10x2) = 20 Marks

Q1. (I) The ratio of heat extracted in the refrigerator to the work done on the refrigerant is called:

a) The coefficient of performance of refrigeration
b) The coefficient of performance of the heat pump
c) Relative coefficient of performance
d) Refrigerating efficiency

(II) The efficiency of the Carnot heat engine is 80%. The COP of refrigerator operating on the reversed Carnot cycle is equal to:

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

Q2. (I) In which direction does heat flow?

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

(II) ------ is the time rate of doing work.

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

BHARTIYA SKILL DEVELOPMENT UNIVERSITY, JAIPUR

[illegible]

[illegible] December [illegible]

EXAMINATION AND EVALUATION SYSTEM

Amendments in the rules for promotion to higher semesters

[illegible]

For B.Voc (3 year Degree program)

Semester	Credits per Semester	Minimum Credits required for promotion
I to II Semester	30	[illegible]
II to III Semester	60	[illegible]
III to IV Semester	90	78
IV to V Semester	120	105
V to VI Semester	150	132
B.Voc Degree	180	180

For M.Voc (2 year Degree program)

Semester	Credits per Semester	Minimum Credits required for promotion
I to II Semester	25	20
II to III Semester	50	40
III to IV Semester	75	[illegible]
M.Voc Degree	100	[illegible]

Prof. GMJ Bhat
Registrar
BSDU

Q3. (I) In the closed stationary system, the total energy is:

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

(II) The specific volume of a liquid is the reciprocal of:

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

Q4. (I) Which of the following is a unit of kinematic viscosity?

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

(II) Which of the following is a shear-thinning fluid?

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

Q5. (I) Which of the following is the condition for the boiling of a liquid?

a) The absolute pressure of a liquid must be greater than or equal to its vapor pressure
b) The absolute pressure of a liquid must be less than or equal to its vapor pressure
c) The absolute pressure of a liquid must be equal to its vapor pressure
d) The absolute pressure of a liquid must be greater than its vapor pressure

(II) Which of the following assumption is incorrect in the derivation of Bernoulli's equation?

a) The fluid is ideal
b) The fluid is steady
c) The flow is incompressible
d) The flow is rotational

Q6. (I) The Condenser in a refrigeration system is used to:

a) decrease pressure
b) increase pressure
c) heat transfer
(d) none of these

(II) The Finned tube heat exchanger:

a) Give a larger area per tube
b) Use metal fins of low thermal conductivity
c) Facilitate very large temperature drop through a tube wall
d) Are used for a smaller heat load

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School of Carpenter Skills

Job request

Date:

Requested by Department:
Recommended due date:

Name: Dr. Book
Designation:

Project description with purpose:

Drawing available: ☐ Yes ☐ No

Material: ☐ From SCS ☐ Supplied from requester ☐ Other: _____

Partlist:

Nr.	Part name	Material	NOS	Dimensions in mm			Remarks
				Length	Width	Thikness	
1							
2							
3							
4							
5							
6							

To be filled by SCS ☐ Approved ☐ Rejected

Estimated completion date:

Material cost: _____ Working hours cost: _____ **Total cost:** _____

Remarks: _____

Head of req. Dept: SCS PM: SCS Principal I/C:

Q7. (I) In vapor Compression refrigeration system, heat is rejected by the refrigerant in:

a) compressor
b) condenser
c) throttle valve
d) evaporator

(II) One Ton refrigeration is equivalent to:

a) 1 kW
b) 2.5 kW
c) 3.5 kW
d) 5 kW

Q8. (I) Multipass heat exchanger is used:

a) Because of simplicity of fabrication
b) For low heat load
c) To obtain a higher heat transfer coefficient and a shorter tube
d) To reduce the pressure drop

(II) Heat transfer coefficient for a liquid increase with:

a) Increasing temperature
b) Decreasing temperature
c) Decreasing Reynolds number
d) None of these

Q9. (I) Viscosities of gases…….. with an increase in temperature:

a) Increases very rapidly
b) Increases slowly
c) Decreases slowly
d) Remain unaffected

(II) Fourier law applies to heat transfer by:

a) Convection
b) radiation
c) Conduction
d) All of the above

Q10. (I) Which one of the following has the 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

ARAI, Pune

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Section-B

(6x5) = 30 Marks

Q11. Write down different pressure units used in RAC system.

Q12. What is condensation? Explain different types of convection heat transfer used in RAC System.

Q13. What is pressure? Write down different pressure units used in RAC. Explain with a neat sketch absolute pressure, gauge pressure, and vacuum pressure.

Q14. What is viscosity? Explain types of fluid on the basis of viscosity.

Q15. Explain Ph chart with a neat sketch used in RAC system.

Q16. Differentiate between open, close and isolated thermodynamic system with examples.

Q17 What is heat-exchanger? Explain types of heat exchanger.

Q18. Write the definition of 1st law and 2nd law of thermodynamics.

Section-C

(5x10) = 50 Marks

Q19. Differentiate between heat engine, heat pump and refrigeration with help of a neat sketch.

Q20. What is heat transfer? Explain different modes of heat transfer.

Q21. Explain with a neat sketch vapor compression refrigeration cycle, also write down Functions of components involved in it.

Q22. What is fluid flow? Explain different types of fluid flow with a neat sketch.

Q23. Explain Bernoulli theorem in terms of head, pressure and energy form, also write various limitations of Bernoulli theorem. In which RAC area, this equation has importance?

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Ans Key

School of HVAC&R Skills

1st Semester, 1st In-Sem. Examination

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

Course Code: HVA-1101 **Time: 1 Hour**

Course Name: Basic of Refrigeration and Air-Conditioning **Max. Marks: 20**

Instruction: (Attempt all questions.)

Section A

1. (I) a
   (II) a
2. (I) d
   (II) a
3. (I) c
   (II) b
4. (I) b
   (II) D
5. (I) a
   (II) d
6. (I) a
   (II) a
7. (I) b
   (II) c
8. (I) c
   (II) a
9. (I) b
   (II) c
10. (I) c
    (II) b

Short answer: Section B

11. Different pressure units are: N/m2, Pascal, Bar, atmospheric pressure, torr, PSI, mm of Hg.
12. Cooling or extracting heat from substance is called condensation. Free convection and forced convection.
13. Pressure: it is a normal force/unit area
    Different pressure units are: N/m2, Pascal, Bar, atmospheric pressure, torr, PSI, mm of Hg.
    Absolute pressure = atmospheric pressure+ gauge pressure (pressure above atmospheric)
    Absolute pressure = atmospheric pressure- gauge pressure (pressure below atmospheric)
14. Viscosity it is the property of fluid by virtue of which it offers resistance to one layer of fluid to another layer. Types of fluid are: Newtonian fluid, non-Newtonian fluid, pseudoplastic fluid and dilatant fluid

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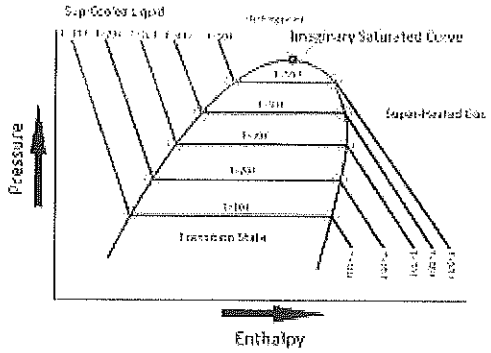

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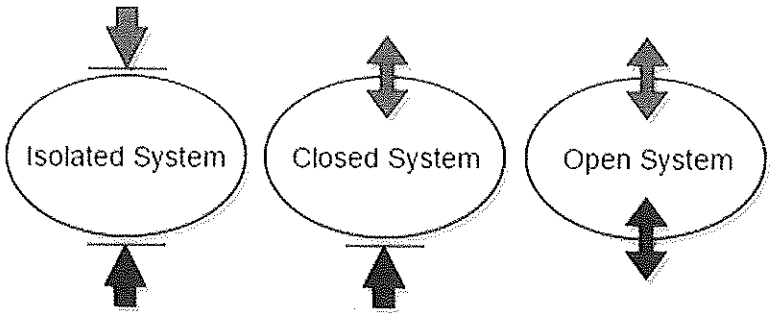

Exchange of energy

Exchange of matter

16.

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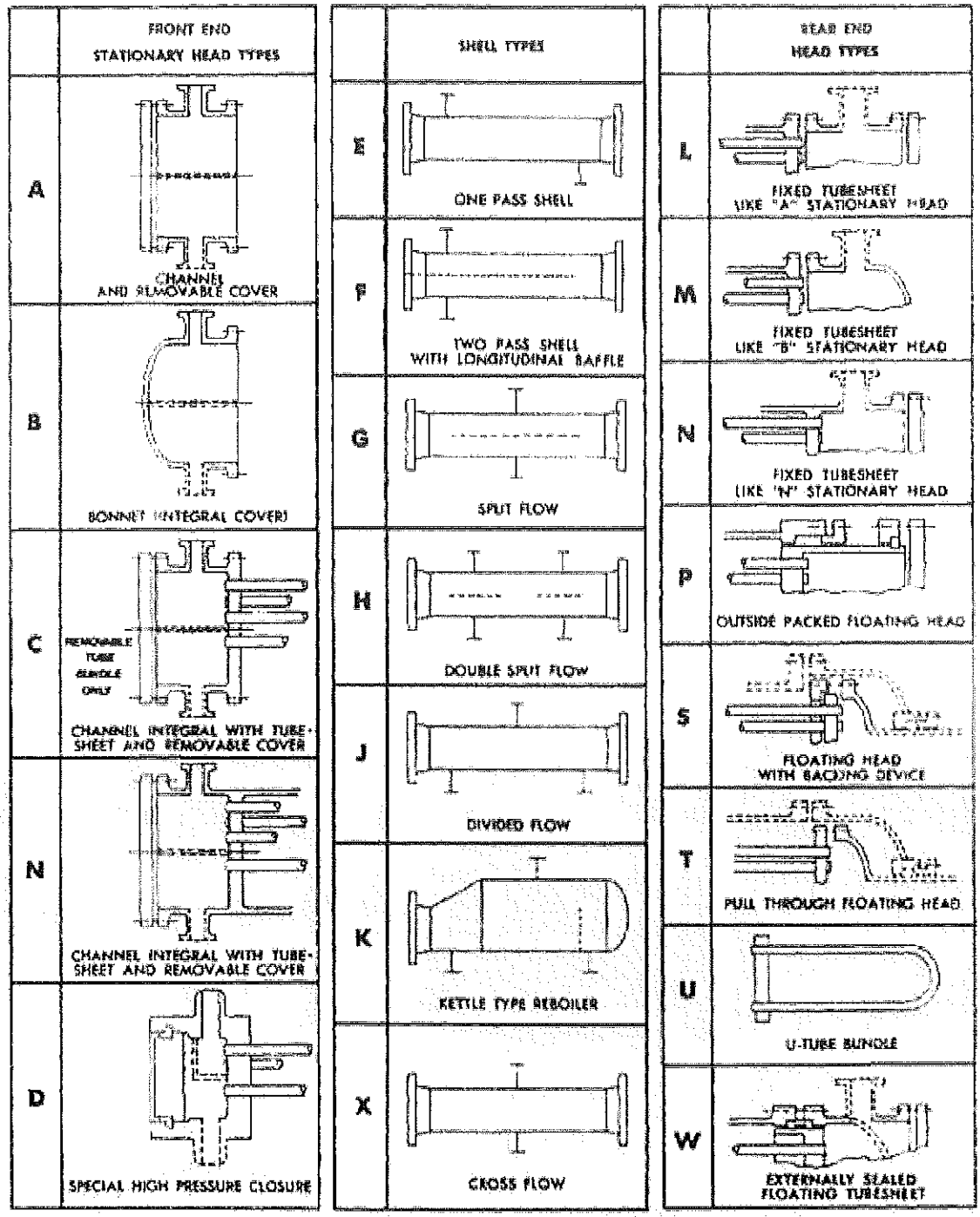

Figure 3-6. Heat exchanger nomenclature. (From Tubular Exchanger Manufacturers Association, © 1978.)

17. The first law of thermodynamics is a version of the law of conservation of energy, adapted for thermodynamic systems. The law of conservation of energy states that the total energy of an isolated system is constant; energy can be transformed from one form to another, but can be neither created nor destroyed. The first law is often formulated

18. Kelvin statement: It is impossible, by means of inanimate material agency, to derive mechanical effect from any portion of matter by cooling it below the temperature of the coldest of the surrounding objects.

Clausius statement: Heat can never pass from a colder to a warmer body without some other change, connected therewith, occurring at the same time.

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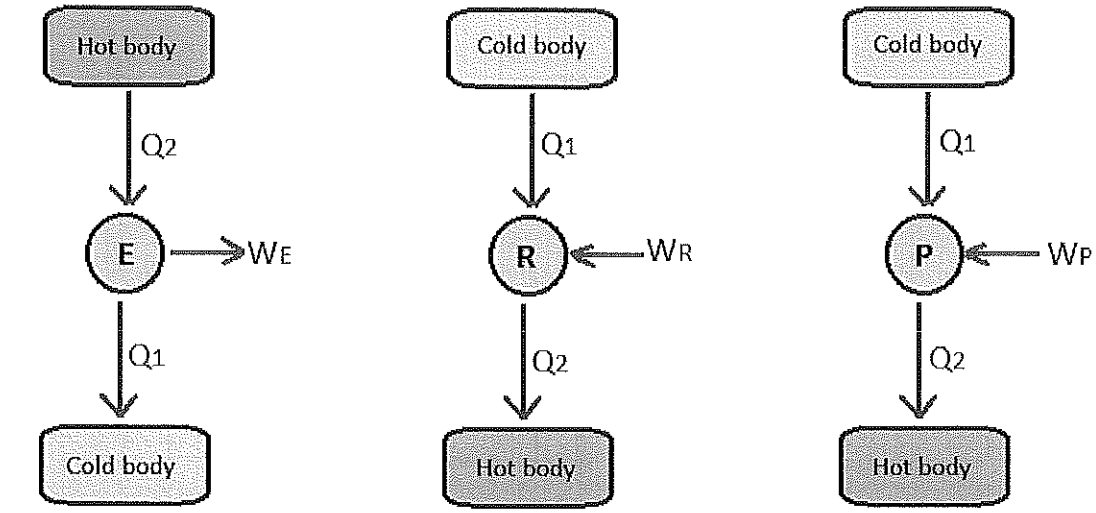
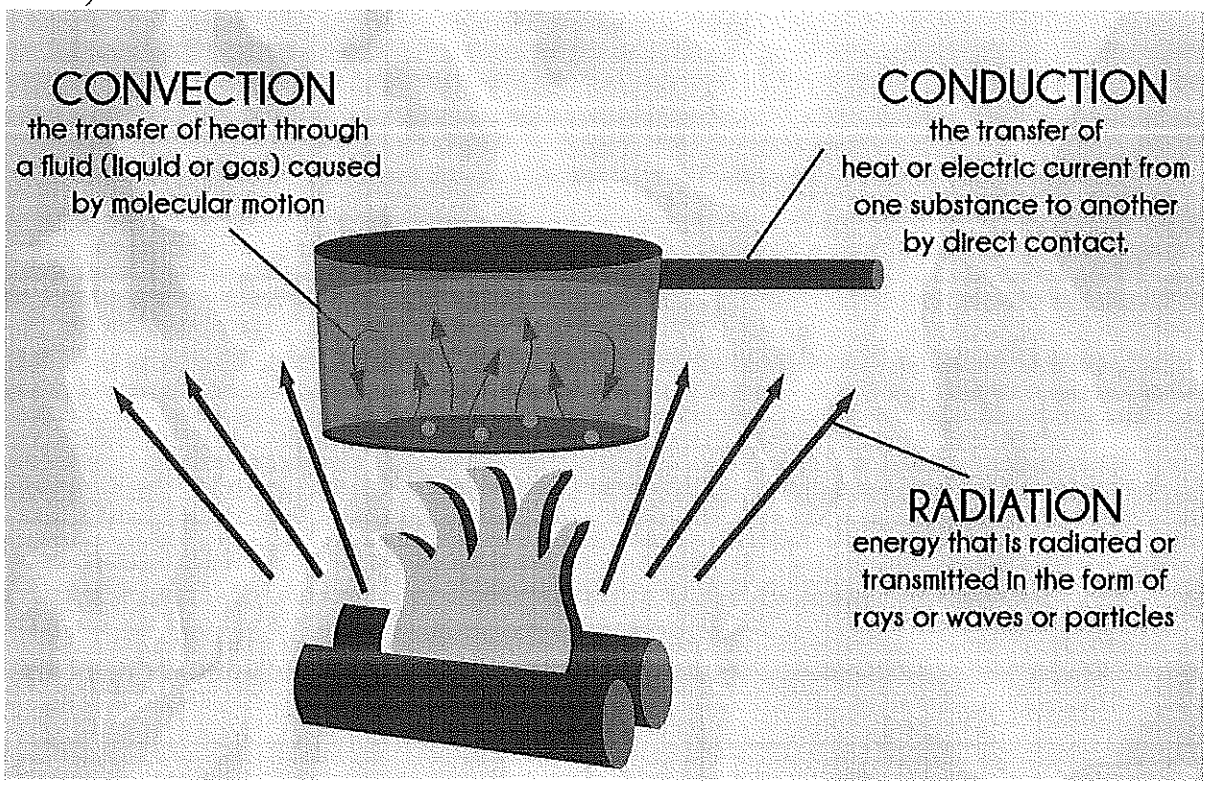
Long answer question Section C

19)



a) Heat engine b) Refrigerator c) Heat pump

20).



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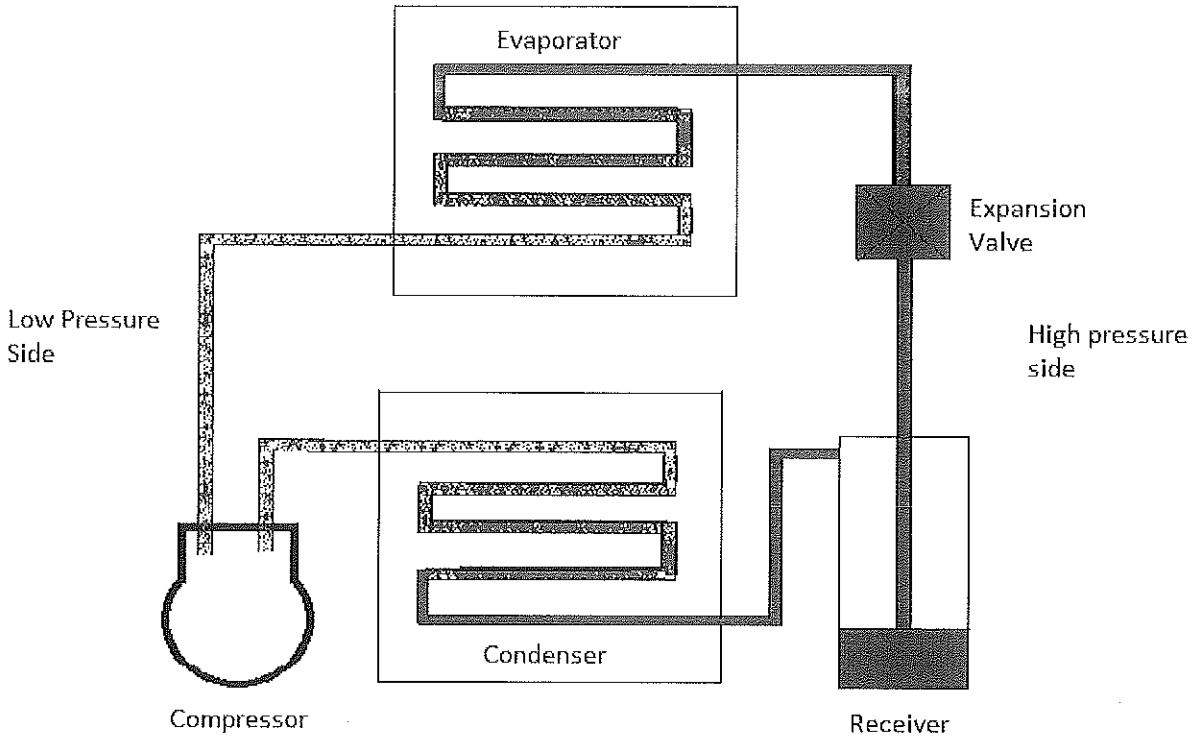

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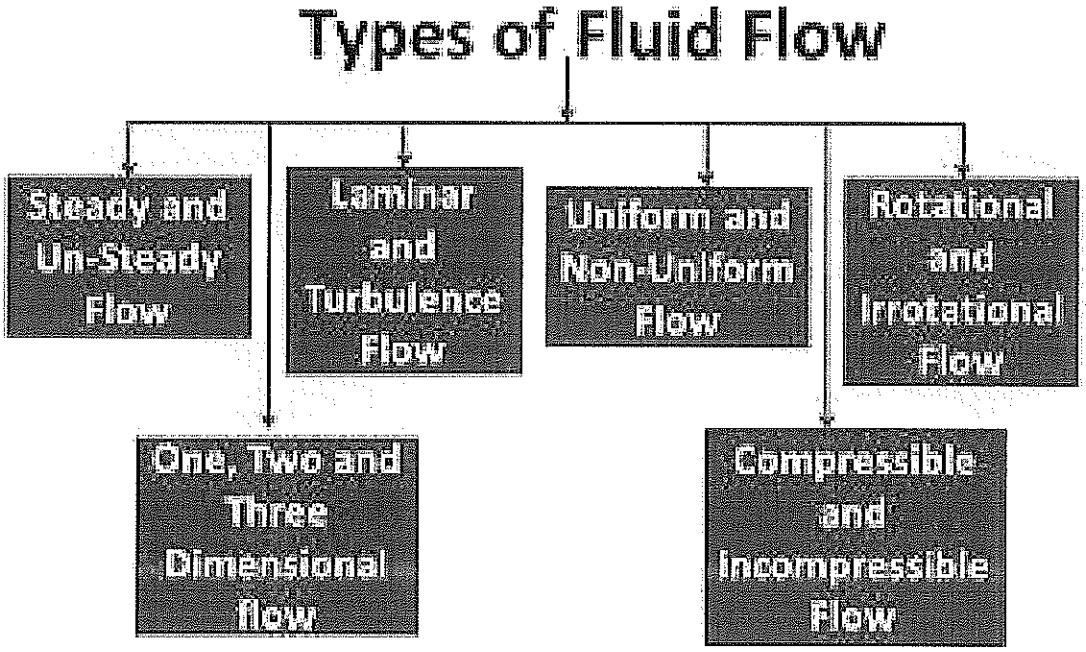

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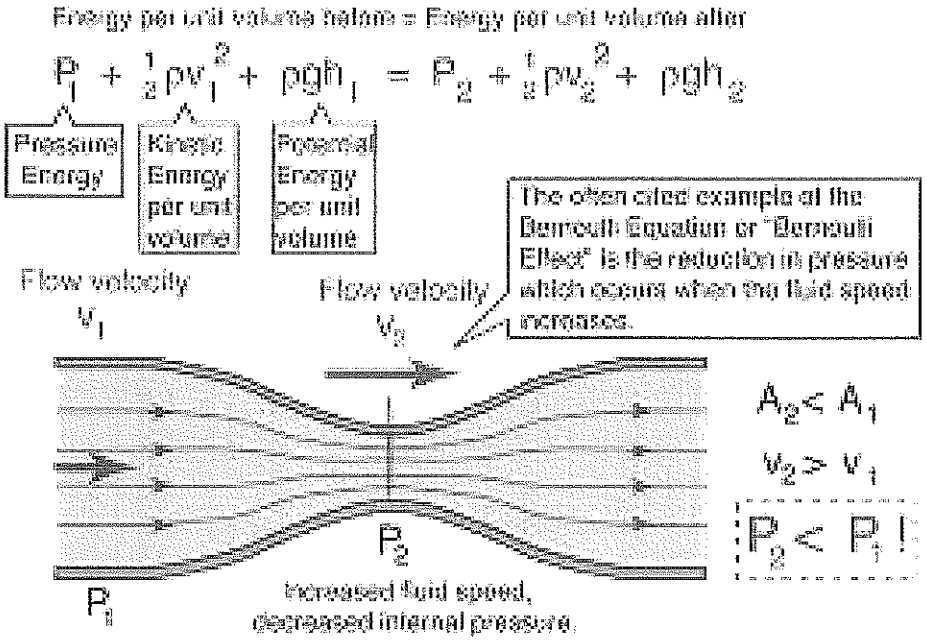

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Registration No.: .....

School of HVAC&R Skills

Session: 2018-19 (Summer Semester)

B. Voc. Program, I Semester

End-Sem. Examination

Course Code: HVA1102 **Time: 3 Hours**

Course Name: Assembly and Installation of Refrigerator **Max. Marks: 100**

Instructions:

1. Attempt all questions from Section A.
2. Attempt any six questions from Section B.
3. Attempt all questions from Section C.

Section – A

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 the following:
   a) 1 mm = ___ µm
   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

1. Define the following terms
   a) Least count.
   b) Measuring.
   c) Gauging.
2. Write down the three applications of Vernier calipers.
3. Give the name of five measuring instruments and their uses.
4. Define Engineering Drawing and how it is different from ordinary drawing?
5. Give the difference between first angle and third angle projection with symbols.
6. Write down the difference between hermetic and open type compressor.
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

1. Explain the Basic refrigeration cycle in detail with a neat sketch.
2. Explain reciprocating compressor in detail with a 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 uses and all parts of Vernier caliper and micrometer in detail.
5. Explain the types of measurement and errors in measurement in detail.

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Registration No.: .....

Answers Key

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

Course Code: HVA1102 **Time: 3 Hours**
Course Name: Assembly and Installation of refrigerator **Max. Marks: 100**

Section – A

20X01 = 20 Marks

1. Sensory inspection is a type of
   a) Subjective measurement.
2. Convert the following:
   a) 1 mm= 1000 µm.
   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

c) 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

1. Define the following terms

Solution:

a) Least count

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

L.C. = (Minimum value on main scale)/ (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.

2. Write down the three application of Vernier calipers.

Solution:

1. Line measurement
2. End measurement
3. Depth measurement

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

Solution:

1. Vernier caliper
2. Micrometer
3. Dial indicator
4. Bevel protractor
5. Vernier height gauge

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

Solution:

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.

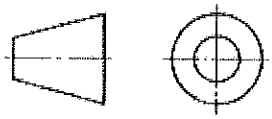
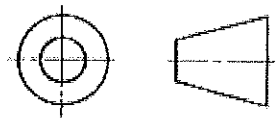
Only for aesthetic purpose.

Not need to be understood by other person exactly.

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

Solution:

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	

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

Solution:

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.

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

Solution:

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

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

Solution:

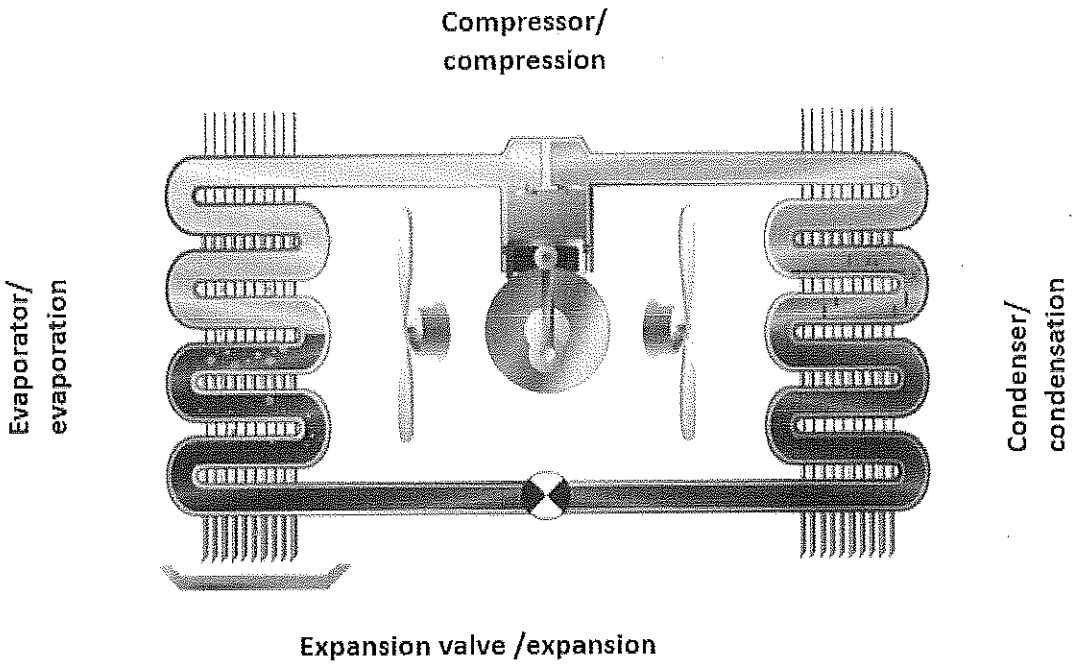
Auto-defrost, **automatic defrost** or **self-defrosting** is a technique which regularly defrosts the evaporator in a refrigerator or freezer. Appliances using this technique are often called frost free, frostless or no-frost. Defrost timer is used for this operation and it activates after every eight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

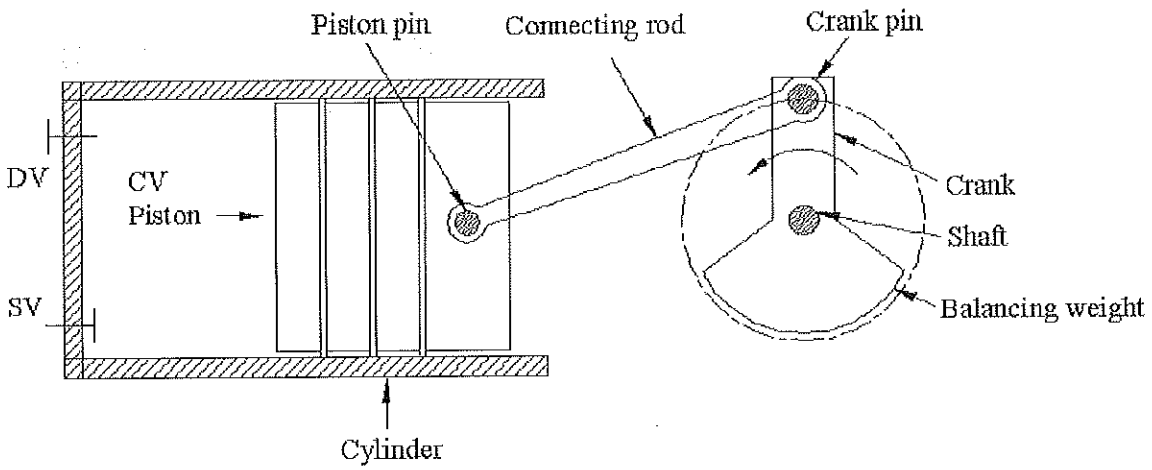
Section – C

05X10 = 50 Marks

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



2. Explain reciprocating compressor in detail with neat sketch.



3. 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 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

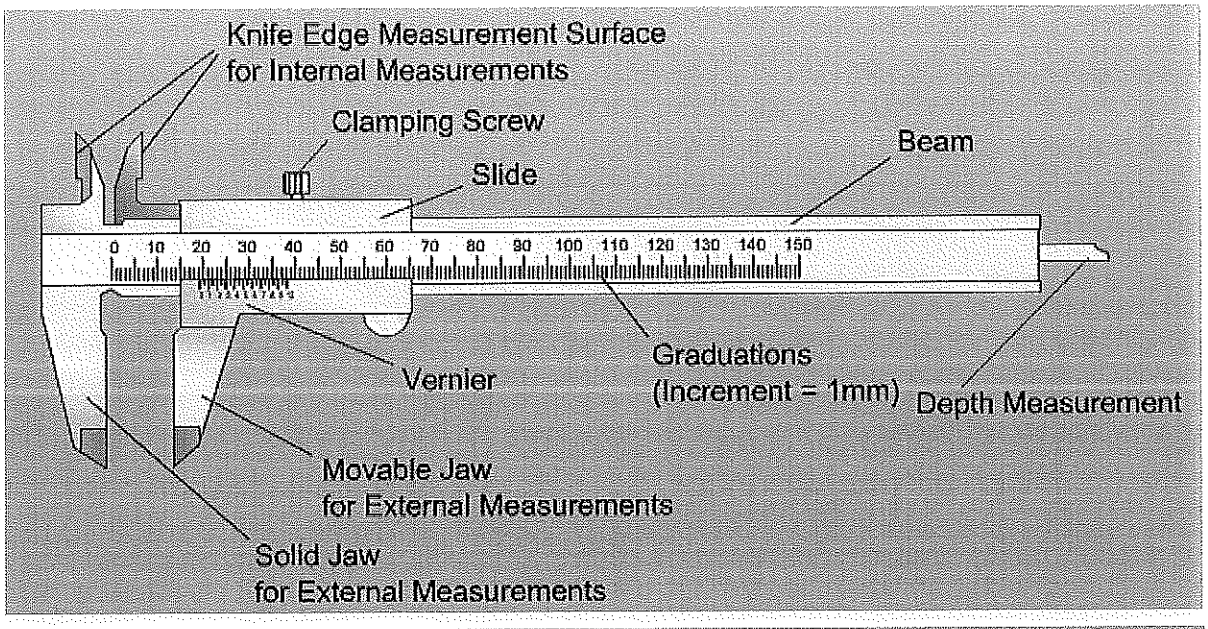
A pressure gauge is a device which measures the pressure in a gas or liquid.

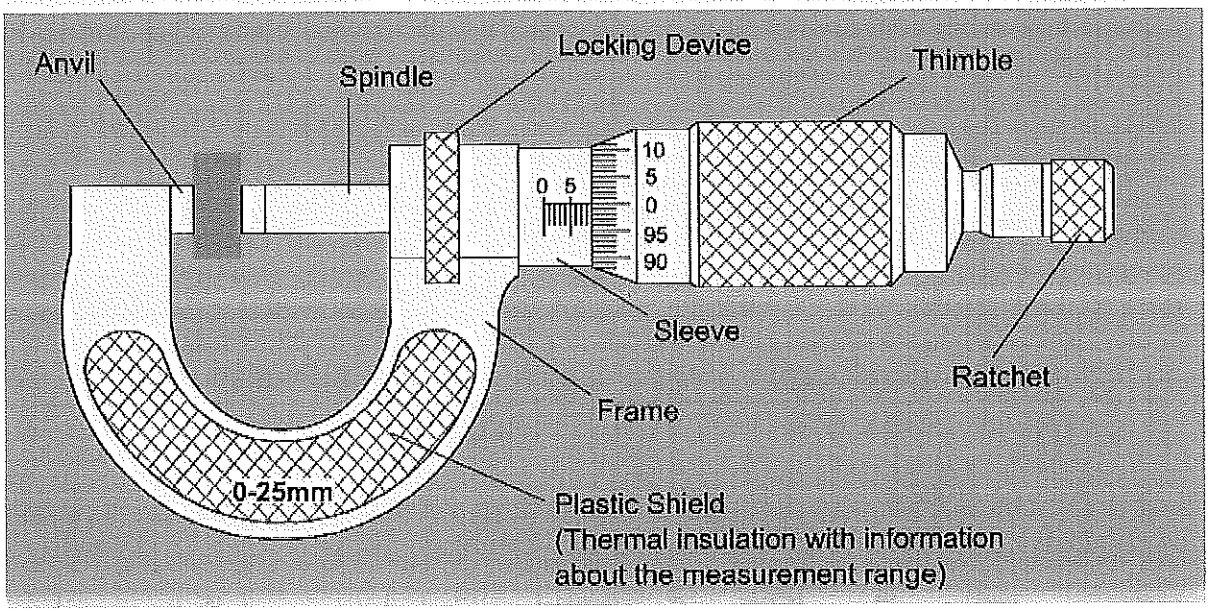
e) Refrigerant with five names

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.

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

Solution:





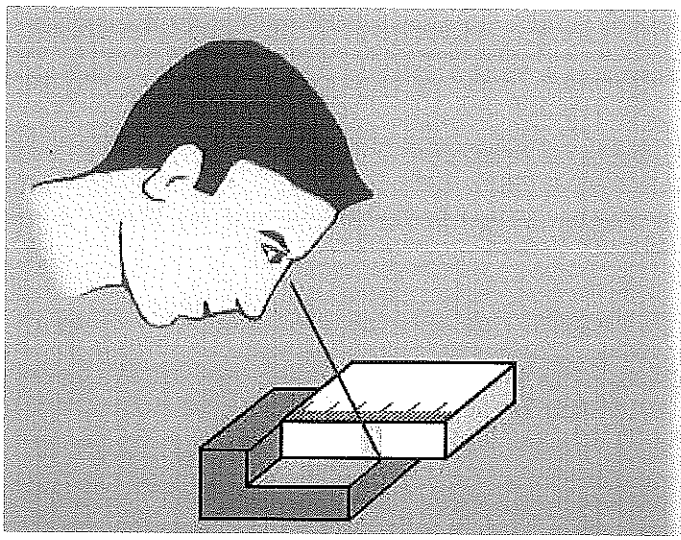
5. Explain the types of measurement and errors in measurement in detail.

Solution:

Type of measurement and errors are follows:

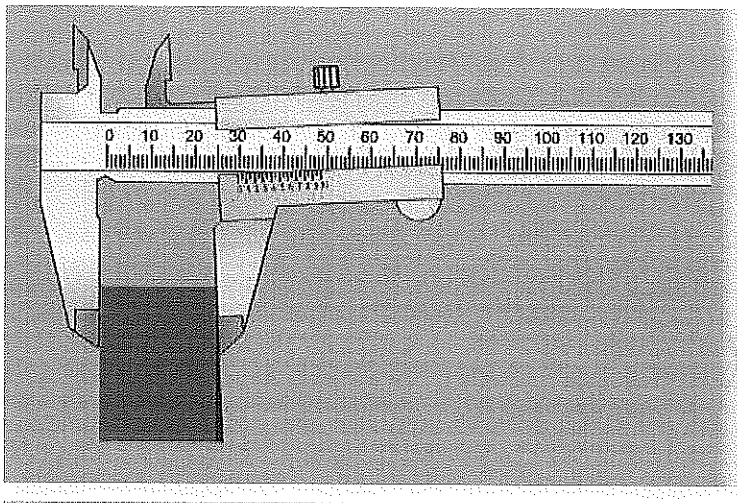
a. Line measurement : Steel Rule.

b. End measurement : Micrometer.



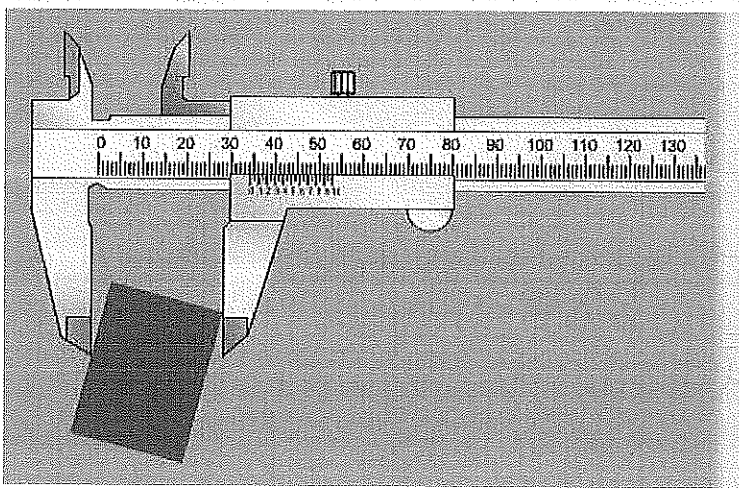
Parallax Errors

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.

Bhartiya Skill Development University
School of General Education
B. Voc. Program, IV-Semester
Summer Semester (2018-19)

AWARD SHEET -ASSIGNMENTS

S. No.	Registration No.	Student Name	School	Assignments										
				Business Communication (GEN-1401)				Organizational Behaviour (GEN-1402)				Current Af (GEN-14		
				I	II	III	Total	I	II	III	Total	I	II	III
1	170111W002	Madhusudan Singh Rathore	Manufacturing Skills	8.5	9	8.5	26	8	8	7	23	9	9	9
2	170111W003	Mukesh Kumar Khakhal	Manufacturing Skills	8	8.5	8	24.5	8	8	7	23	8	8	8
3	170111W004	Parmeshver Choudhary	Manufacturing Skills	8	8	8	24	8	7	8	23	10	5	8
4	170111W005	Pradeep Sangwan	Manufacturing Skills	8	8	9	25	8	7	8	23	10	10	9
5	170111W006	Shankar Lal Choudhary	Manufacturing Skills	8.5	8.5	8.5	25.5	8	8	8	24	9	8	9
6	170111W007	Shiv Shankar Sharma	Manufacturing Skills	8.5	8.5	8.5	25.5	8	7	7	22	9	9	9
7	170111W008	Sooraj Ram Choudhary	Manufacturing Skills	8	7	8	23	4	5	7	16	9	8	8
8	170111W009	Sumit Bhukar	Manufacturing Skills	8	8	8	24	8	6	8	22	9	7	9

fairs 03)

Total
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fairs 03)

Total
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BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of HVAC&R Skills

Session: 2018-19 (Summer / Winter Semester)

B. Voc. Program, 1st Semester,

End-Sem. Examination

Course Code: HVA1103 **Time: 3 Hours**

Course Name: Assembly and Installation of Air-conditioning **Max. Marks: 100**

Instruction:

1. Attempt all Questions from section A and C and any 06 out of 08 questions from section B.
2. Each question of Section – A carries 01 mark.
3. Each question of Section – B carries 05 marks.
4. Each question of Section – C carries 10 marks.

Section – A

20X01 = 20 Marks

1. 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.

2. In SI units the joule is unit of ;

A. Temperature

B. Heat

C. Work

D. Both heat and work.

3. _____ has the largest specific heat capacity.

A. Water

B. Iron

C. Glass

D. Brick

4. What is dry ice?

A. A liquid form of ice.

B. Solid carbon dioxide.

C. Sulfur dioxide.

D. A vapor.

5. Given two objects of the same size one chrome plated and one painted black-which one will absorb more radiant heat?

A. Chrome-painted object.

B. Black-painted object.

C. Both absorb equally.

D. Neither absorb.

6. Which of the following illustrates the Principle of convection;

A. Movement of heat by fluid or air.

B. Heat waves from the sun.

C. Heat traveling through a solid object from end to end

D. Radiation from the sun

7. Which one glass or copper will conduct heat most rapidly?

A. Glass.

B. Both conduct heat at an equal rate.

C. Both are not conductor of heat.

D. Copper

8. Should refrigerants be operated at temperatures above or below their critical temperature?

A. Above

B. Below.

C. Neither above or below- They should be at their critical temperature.

D. Either above or below.

9. Liquid can boil only _____ temperature;

A. at its evaporation

B. below its evaporation

C, at or above its evaporation

D. at or below its freezing

10. What is a very important precaution one must take when filling refrigerant cylinders?

A. Obey refrigerant color code.

B. Never fill cylinders over 80% of capacity

C. Both A and B.

D. Never reuse refrigerant cylinders.

11. When a system is left connected to a vacuum pump for a time to clean it, this procedure is referred to as;

A. Evacuating

B. Flushing

C. Purging

D. vapor degreasing

12. Purging is a term which describes_____.

A. -leakage of refrigerant into the atmosphere

B. removing unwanted air, vapors. dirt or moisture from a system

C. removing excess dirt from the atmosphere

D. adding refrigerant to a system

13. In the AEV system, 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.

14. A _____system has two compressors with an intercooler between them.

A. cascade refrigerating

B. compound refrigerating

C. modulating refrigerating

D. multiple evaporator

15. In a compression refrigerator, the _____ is usually found in the low-pressure side.

A. condenser

B. liquid line

C. liquid receiver

D. motor

16. Does an AEV system have a dry or a flooded evaporator?

A. Dry.

B. Flooded.

C. Dry during refrigeration cycle; flooded during Off cycle.

D. Flooded during refrigeration cycle; dry during Off cycle.

17. What is the most common expansion valve body material?

A. Aluminum alloys.

B. Brass.

C. Phosphor bronze.

D. Stainless steel.

18.What may be the trouble if a capillary tube unit frosts down the suction tube?

A. Not enough refrigerant in the system.

B. Too much refrigerant in the system.

C. Wrong size capillary tube.

D. Either A or B.

19. What force causes a solenoid valve to open?

A. Vapor pressure.

B. Gravity

C. An electromagnet

D. A bimetal -strip bends when heated by a resistor.

20. Thermistors are used in refrigeration work;

A, to measure temperatures

B. to protect an overheated motor from burn-out

C. as a temperature-operated electric circuit control

D. All of the above.

Section – B

06X05 = 30 Marks

Q.21 What is the difference between a distributor and a capillary?

Q.22 What are the benefits of a VRV/VRF system over chiller system?

Q.23 What will happen if we overcharge a VRV/VRF system?

Q.24 Why can't we charge R-32 in a R-22 machine

Q.25 Write a short note on charging and discharging of refrigerant.

Q.26 Why is there a pump available in cassette ac but not in split ac?

Q.27 Why are expansion valves adjustable?

Q.28 What basic conditions are necessary to produce refrigeration?

Section – C

05X10 = 50 Marks

Q.29 Explain the working of a four-way valve with the help of a neat diagram.

Q.30 What is the selection criteria for VRV/VRF indoor and outdoor unit.

Q.31 Write down the classification of refrigerants with examples.

Q.32 If 0.2 kg of air at a Pressure of 1000 N/m^2 is contained in a volume of 50 m^3, what is the temperature in Degree Centigrade? (R = 288.68 J/kg)

Q.33 What is Enthalpy? Calculate the total enthalpy of 5 kg of water at 80°C. (Specific heat of water (sp. ht.) = 4.19 kJ/kg.K)

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of HVAC&R Skills Ans. Key

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B. Voc. Program, 1st Semester,

End-Sem. Examination

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C. Heat traveling through a solid object from end to end

D. Heat transfer in metals.

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B. to protect an overheated motor from burn-out

C. as a temperature-operated electric circuit control

D. All of the above.

Section – B

06X05 = 30 Marks

Q.21 What is the difference between a distributor and a capillary?

Distributer is used to distribute refrigerant flow at various sections of evaporator DX coil while capillary id expansion device.

Q.22 What are the benefits of a VRV/VRF system over chiller system?

Compact, can work as cooling and heating simultaneously, low power consumption.

Q.23 What will happen if we overcharge a VRV/VRF system?

Effective Cooling will not be achieved and frosting on accumulator will be formed.

Q.24 Why can't we charge R-32 in a R-22 machine?

Boiling temperature and pressure of both refrigerant is different.

Q.25 Write a short note on charging and discharging of refrigerant?

Refrigerant charging in a system can be done using manifold. It is coonected at suction line and start pump till achieve desire pressure and rated weigh of refrigerant.

Q.26 Why is there a pump available in cassette ac but not in split ac?

Pump is provided to drain condensate water to drain pipe.

Q.27 Why are expansion valves adjustable?

To set the temperature according to requirement/load.

Q.28 What basic conditions are necessary to produce refrigeration?

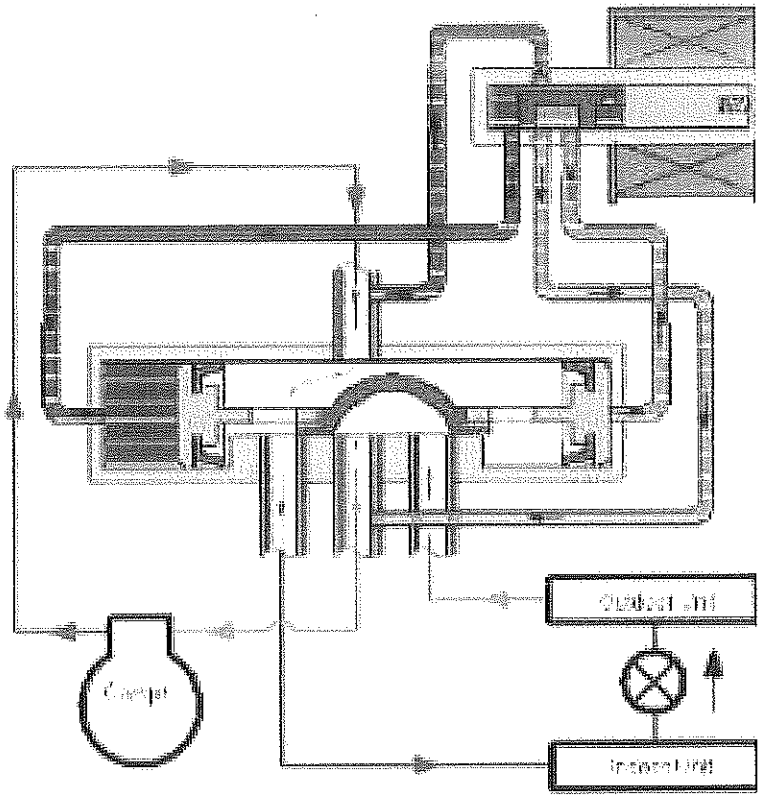
Evaporation of refrigerant and Temperature & pressure deference

Section – C

05X10 = 50 Marks

Q.29 Explain the working of a four-way valve with the help of a neat diagram?

A 4-way reversing valve has four ports for tube connections. Three of these ports are on one side, and the fourth is on the opposite side. The three copper tube ports have a larger diameter than the single port on the opposite side. The middle of the three large ports is permanently connected to the suction line, and the single small port is permanently connected to the pressure line. As the two remaining ports can be connected to the suction line or the pressure line depending on the valve position, because of pressure drops they have the same dimensions as the permanent suction line port. A 4-way valve also has a solenoid pilot valve with a coil, which changes the direction of refrigerant flow when it is energised. There are also small pilot lines running from the small valve port to the solenoid pilot valve and back to the middle large port.



Q.30 What is the selection criteria for VRV/VRF indoor and outdoor unit?

According to load requirement and building layout

Q.31 Write down the classification of refrigerants with examples?

Classification of refrigerants

Halocarbon compounds :

(a) invented and developed by Mr. Charles. Kettering and Dr. Thomas Migley in the year 1928.

(b) Sold in the market under the trade name as "Freon" and contain one or more of three halogens chlorine, fluorine and bromine.

Number	Chemical Name	Chemical Formula
R-11	Trichloro Monofluoro Methane	CCl_3F
R-12	Dichloro Difluoro Methane	CCl_2F_2
R-13	Monochloro Trifluoro Methane	$CClF_3$
R-22	Monochloro Difluoro Methane	$CHClF_2$
R-113	Trichloro Difluoro Ethane	$C_2Cl_3F_3$

Azeotropes :

Consits of mixtures of different refrigerants which don't separate into their compounds with the change in pressure or temperature or both. They have fixed thermodynamic properties.

Name	Mixture by weight

R-500	73.8% of R-12 & 26.2% of R-152a
R-502	48.8% of R-22 & 51.2% of R-115
R-503	40.1% of R-23 & 59.9% of R-13

Azeotropic mixture is a mixture of two or more liquids which, when mixed in precise proportion, form a compound having a boiling temperature which is independent of the boiling temperature of the individual liquids.

Hydrocarbons:

Most of the organic compounds are considered as refrigerant under this group. Most of them possess satisfactory thermodynamic-properties but are highly flammable.

Number	Chemical Name	Chemical Formula
R-50	Methane	CH_4
R-100	Ethane	CH_3CH_3
R-290	Propane	$CH_3\ CH_2\ CH_3$

Inorganic compuounds:

The refrigerants under this group were universally used for all purposes before the introduction of halo-carbon. refrigerants. Earlier they were used for different purposes due to their inherent thermo-dynamic and physical properties, for example:

Number	Chemical Name	Chemical Formula	Specific use
R-717	Ammonia	NH_3	Ice plants
R-118	Water	H_2O	In steam production system
R-729	Air	–	For aeroplanes
R-744	Carbon Dioxide	CO_2	For ship refrigeration

Unsaturated Organic Compounds :

Comprising of mainly hydrocarbon group with ethylene and propylene bases, for example:

Number	Chemical Name	Chemical Formula
R-1120	Trichloro Ethylene	$C_2H_1Cl_3$
R-1130	Dichloro Ethylene	$C_2H_2Cl_2$
R-1150	Ethylene	C_2H_4

R-1270 Propylene C_3H_6

Q.32 If 0.2 kg of air at a Pressure of 1000 N/m^2 is contained in a volume of 50 m^3, what is the temperature in Degree Centigrade? (R = 288.68 J/kg)

$$T = \frac{PV}{MR}$$

$P = 1.00 \text{ kPa} = 1000 \text{ newtons/m}^2$

$V = 50 \text{ m}^3$

$R = 288.68 \text{ J/kg} \cdot \text{K}$ (from Figure 1-27)

$M = 0.2 \text{ kg}$

$$T = \frac{1000 \times 50}{0.2 \times 288.68}$$

$T = 866 \text{ K}$

$T\,^\circ\text{C} = T \text{ K} - 273$

$T\,^\circ\text{C} = 866 - 273$

$T\,^\circ\text{C} = 593^\circ\text{C}$

Q.33 What is Enthalpy? Calculate the total enthalpy of 5 kg of water at 80°C. (Specific heat of water (sp. ht.) = 4.19 kJ/kg.K)

Enthalpy at 0°C = 0

Specific heat of water (sp. ht.) = 4.19 kJ/kg · K

Heat needed to raise temperature of 1 kg of water from 0°C to 80°C: 80 – 0 = 80°C

$H = M \times \text{sp. ht.} \times \Delta T$

$H = 5 \times 4.19 \times (80 - 0)$

$H = 5 \times 4.19 \times 80$

$H = 1676 \text{ kJ}$ (total enthalpy at 80°C)

Registration No.....

School of HVAC & R Skills
First Semester, End Semester Examination
Summer Semester, B. Voc. Program, Session: 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) The minimum requirements for causing flow of current are:
(a) A voltage source, a resistor and a switch
(b) A voltage source and a conductor
(c) A power source and a bulb
(d) A voltage source, a conductor, and ammeter and a switch

(B) Correct form of Ohm's law
(a) $I = VR$ (b) $I \propto V$ (c) $V = IR$ (d) both (b) and (c)

Q. 2. (A) Which of the following quantities consists SI unit as Coulomb: -
(a) Force (b) Charge (c) Power (d) Current

(B) Which of the following quantities consists SI unit as kWh: -
(a) Energy (b) Resistance (c) Voltage (d) Current

Q. 3. (A) Flaming's right hand rule is used for: -
(a) Motor (b) Transformer (c) Induction machine (d) Generator

(B) An electric current flows into the page. What is the direction of the magnetic field?
(a) To the bottom of the page (b) To the top of the page
(c) Clockwise (d) Counter-clockwise.

Q. 4. (A) Basic source of magnetism is: -
(a) Charged particles alone (b) Movement of charged particles
(c) Magnetic dipoles (d) Magnetic domains

(B) Units for magnetic flux density is:
(a) Wb /m^2 (b) Wb/A.m (c) A/m (d) Tesla/m

Q. 5. (A) Pole which points towards north are:
(a) N-pole (b) S-pole (c) W-pole (d) E-pole

(B) Pole which points towards south is called:
(a) N-pole (b) S-pole (c) W-pole (d) E-pole

Q. 6. (A) The path of a magnetic flux in a transformer should have:
(a) High resistance (b) High reluctance (c) Low resistance (d) Low reluctance

(B) The resistance of voltmeter is:
(a) Very low (b) Very high (c) Variable (d) None of these

Q. 7. (A) Unit for magnetic flux is:
(a) Wb (b) Wb/A.m (c) A / m (d) Tesla/m

(B) The unit of resistivity is:
(a) Ω (b) Ω – metre (c) Ω / metre (d) Ω / m^2

Q.8. (A) Which of the following are the passive elements?

(a) Resistor (b) Bulb (c) Both (a) and (b) (d) None of these.

(B) Which of the following are active element?

(a) Voltage source (b) Current source (c) Both (a) and (b) (d) None of these

Q.9. (A) Inductor does not allow the sudden change of:

(a) current (b) voltage (c) power (d) None of these

(B) Capacitor does not allow the sudden change of:

(a) current (b) voltage (c) power (d) None of these

Q.10. (A) The basic function of a transformer is to change_____.

(a) The power level (b) The power factor

(c) The level of the voltage (d) The frequency

(B) The transformers are rated in:

(a) kVA (b) kW

(c) kV (d) None of these

Section – B **6x5=30 Marks**

Answer any six questions.

Q. 1. Define Ohm's law. What are the limitations of ohms law?

Q. 2. State and explain Kirchhoff's law for electric circuit.

Q. 3. Distinguish between conductor, insulator and semi-conductor.

Q. 4. Define the following terms:

(i) Time Period (ii) Form Factor

(iii) Magnetic Flux Density (iv) Magnetic Reluctance

Q. 5. Define magnet. What do you understand by magnetic lines of force?

Q. 6. Describe Faraday's Laws of electromagnetic induction.

Q. 7. Explain Fleming's left hand & right hand rule.

Q. 8. Three resistance 50 ohm, 100 ohm and 200 ohm are connected in series to a 200V supply. Determine the current in the circuit and power dissipates in each resistor.

Section – C **5x10=50 Marks**

Q. 1. Define series and parallel circuit? Explain the characteristics of both the circuits.

Q. 2. With a diagram explain the working principle of a single phase transformer. State the relationship between voltages and currents on primary side and secondary side of a transformer.

Q. 3. Derive e.m.f. equation of transformer.

Q. 4. The primary winding of a 50 Hz single phase transformer has 480 turns and is fed from 5400 V supply. The secondary winding has 20 turns. Find the peak value of the flux in the core and the secondary voltage.

Q. 5. A wire of length 50 cms moves at right angles to its length at 50m/sec in a uniform magnetic field of density 1 Wb/m^2. Determine the e.m.f induced in the conductor when the direction of motion is:

(a) Perpendicular to the field (b) inclined at 30 degree to the direction of the field (c) Parallel to the field

Solution of End Semester Examination

Course code :— HVA 1105

Course Name :— RAC Electrical

1. (A) → (b)
   (B) → (d)

2. (A) → (b)
   (B) → (a)

3. (A) → (d)
   (B) → (c)

4. (A) → (b)
   (B) → (a)

5. (A) → (a)
   (B) → (b)

6. (A) → (d)
   (B) → (b)

7. (A) → (a)
   (B) → (b)

8. (A) → (c)
   (B) → (c)

9. (A) → (a)

(B) → (b)

10. (A) → (C)

(B) → (A)

Section-B

1 Ans:-

According to ohm's law, at constant temperature, the current flowing through a conductor is directly proportional to the applied voltage across it.

$I \propto V$

$I = kV$

$I = V/R$ where $k = 1/R$

k is constant of proportionality

So, $\boxed{I = V/R}$

where I = current in amps
V = voltage in volts
R = Resistance in ohms.

Limitations:

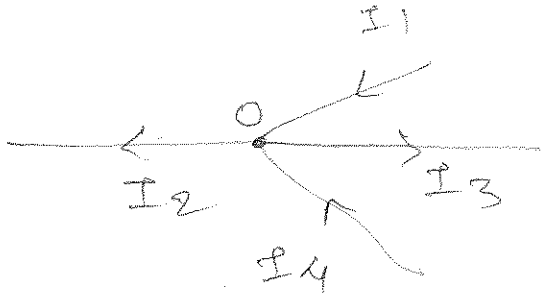
1) ohm's law applicable only for linear circuit.
2) It is valid for constant temperature only.

2. Ans:

Kirchhoff gave two laws to solve complex circuits, namely,

1) Kirchhoff's current law (KCL)
(11) Kirchhoff's voltage law (KVL)

1) KCL :— The algebric sum of currents meeting at a junction in an electrical circuit is zero.



here

$I_1 + I_4 - I_2 - I_3 = 0$

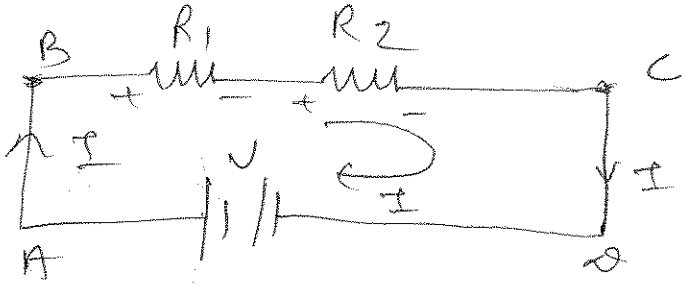
or, $I_1 + I_4 = I_2 + I_3$

Sum of incomming current = Sum of outgoing current.

(11) KVL :—

In any closed electrical circuit or mesh, the algebric sum of all the electromotive forces and voltage drops in resistors is equal to zero.

i.e.



$V - IR_1 - IR_2 = 0$

$\boxed{V = IR_1 + IR_2}$

Algebric sum of e.m.f.s + Algebric sum of voltage drops = 0.

3. Ans:

The major difference between conductor, insulator and semiconductor is defined by the flow of charge particles under the influence of electric field. when any voltage is applied to the conductor, electric charge particles easily flow from valence band to conduction band. Thus conductor is a good conductor of electricity.

Ex:- Cu, Al, Au, etc.

A semiconductor allows very low charge particles to move from valence band to conduction band. In insulators, there is no flow of charge particles under the influence of electric field, hence insulators are the bad conductor of electricity

Plastic, wood, etc. are examples of insulator.

Si, Ge etc are example of semiconductor.

4. Ans:

(A) Time period :- It is the time required to complete one cycle.

(B) Form factor :- Form factor of AC waveform is the ratio of RMS value to average value.

(C) magnetic flux density :- the number of magnetic lines of flux that pass through a certain point or a surface. the SI unit of it is T (tesla).

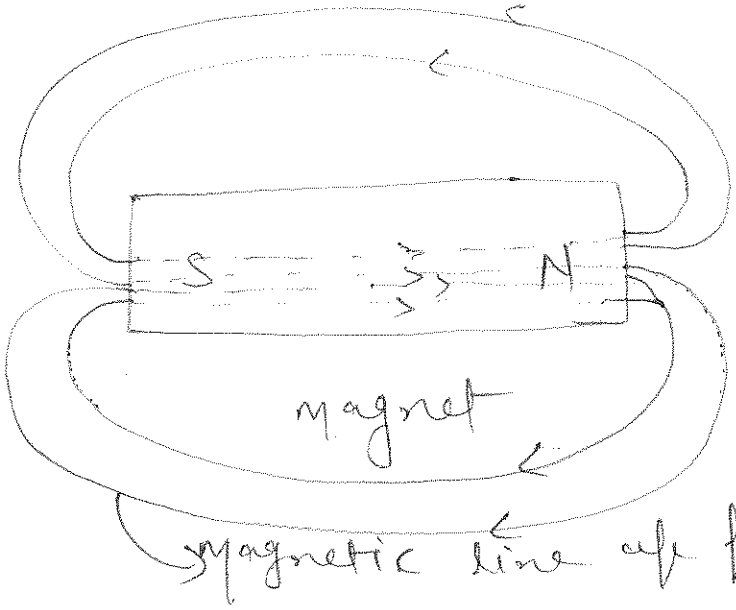
(D) magnetic reluctance :- It is the ~~opposition~~ opposition offer to magnetic flux in magnetic circuit.

$$S = \frac{l}{\mu A}$$

5. Ans:

Magnet is an object that attracts irons and some other materials. every magnet has two poles, - called north and south poles. Magnetic poles exert forces on each other in such a way

that like poles exert forces on each other in such a way that like poles repel and unlike pole attract each other.



the magnetic lines of force always originated from N-pole and terminated on S-pole. these lines of force never intersect each other. these lines of forces always prefer a path of least opposition.

Q.6 Ans:

According to Faraday law:-

Law first:

whenever a conductor cuts the magnetic flux lines an e.m.f. will be induced in that conductor.

Law second :-

The magnitude of induced e.m.f. is equal to rate of change of flux linkages

$$e = N \cdot \frac{d\phi}{dt} \quad \text{volts.}$$

where e = induced e.m.f.
N = number of turns in coil
$\frac{d\phi}{dt}$ = rate of change of flux

Ans 7:

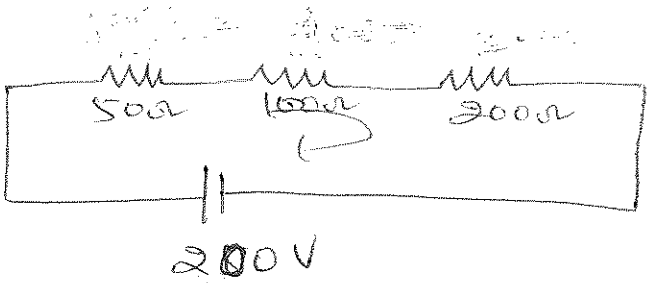
Fleming's left hand rule is applicable for motor and right hand rule is applicable for generator.

According to Fleming's left hand rule, hold the thumb, fore finger and middle finger of left hand at right angle to each other, just like X, Y and Z-axis of 3-D, then thumb points in direction of motion of conductor, fore finger in the direction of magnetic field and

middle finger gives the direction of the induced e.m.f.

Fore flemings right hand rule ~~only~~ all the above mentioned statement is same except in place of left hand we use right hand.

Ans: 8 :—



Total resistance

$$R_T = 50 + 100 + 200 = 350\ \Omega$$

$$I = \frac{V}{R_T} = \frac{200}{350} = 0.571 \text{ amp.}$$

Power loss in 50Ω resistor $= I^2 R$,

$$= (0.571)^2 \times 50$$

$$= 16.3 \text{ watt}$$

Power loss in 100Ω resistor

$$= (0.571)^2 \times 100$$

$$= 32.60 \text{ watt}$$

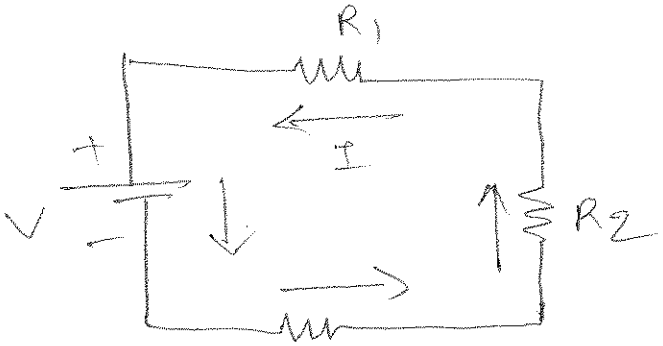
Power loss in 200 Ω resistor

$= (0.571)^2 \times 200$

$= 65.2082$ watt.

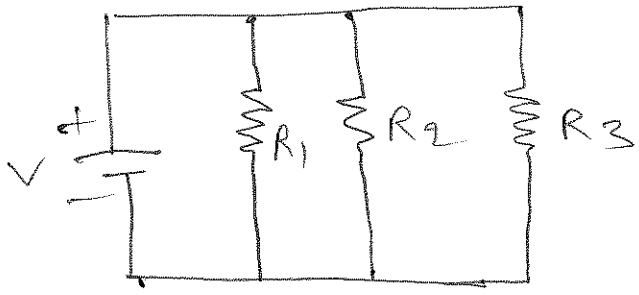
Section - C

1. Ans: In series circuit all components are connected end-to-end to form only one path for electrons to flow through the circuit.



(Series circuit)

In parallel circuit all components are connected between the same two sets of electrically common point creating multiple paths for electrons to flow from one end of battery to the other.



(Parallel circuit)

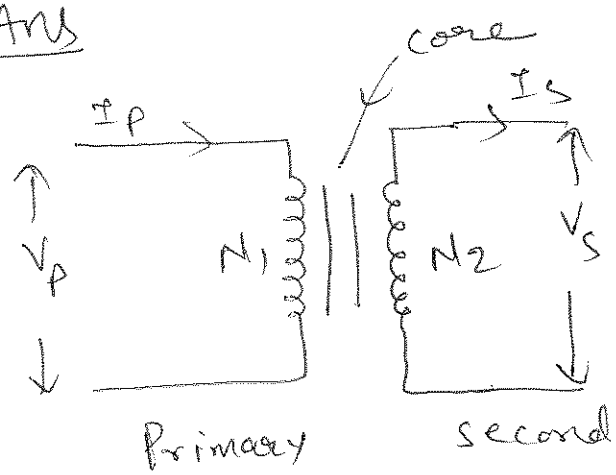
characteristics of series circuit:-

1) same current flows through all parts of the circuit.
2) Different resistor have their individual voltage drops.
3) Applied voltage is equal to the sum of different voltage drops.

characteristics of parallel circuit:-

1) same voltage across all branches of the circuit.
2) Different resistors have their individual currents.
3) Branch currents are additive.

2. Ans



(Single phase transformer)

Transformer works on the principle of mutual induction.

Transformer consists of two or more stationary electric circuits linked by a common magnetic ckt for the purpose of transfering electrical energy between them. In transformer primary and secondary coils are inductively coupled and if current in one coil changes then an e.m.f. gets induced in the other coil.

If we supply voltage to primary winding of transformer, the magnetic flux is created and it is linked with both primary and secondary windings, due to which an emf is induced in both the windings.

em.f induced in primary winding:

$$e_1(t) = N_1 \cdot \frac{d\phi}{dt} \quad \text{---(I)}$$

e.m.f. induced in secondary winding

$$e_2(t) = N_2 \cdot \frac{d\phi}{dt} \quad \text{---(II)}$$

for an ideal transformer no losses are taking place

from equⁿ-(1) and (11)

$$\frac{e_1}{e_2} = \frac{N_1}{N_2}$$

for ideal transformar input power is equal to o/p power

so,

$$e_1 i_1(t) = e_2 i_2(t)$$

so,

$$\boxed{\frac{e_1}{e_2} = \frac{i_2(t)}{i_1(t)}}$$

and

$$\boxed{\frac{e_1}{e_2} = \frac{i_2(t)}{i_1(t)} = \frac{N_1}{N_2}}$$

~~End term 3~~

or, $e = N\omega\phi_m \left[\sin\left(\omega t - \pi/2\right)\right]$ — (3)

equⁿ. — (3) written as

$e = e_m \sin\left(\omega t - \pi/2\right)$

where $e_m = N\omega\phi_m$ i.e. maxᵐ value of e

for sine wave r.m.s. value of e.m.f. is given by

$$e_{rms} = \frac{e_m}{\sqrt{2}}$$

or, $$e_{rms} = \frac{N_1\omega\phi_m}{\sqrt{2}} = \frac{N(2\pi f)\cdot\phi_m}{\sqrt{2}}$$

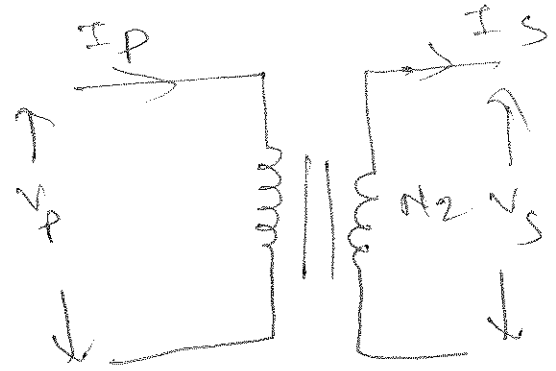
$$= \sqrt{2}\,\pi N_1 f \phi_m$$

or, $$\boxed{e_{rms} = 4.44\, f N \phi_m}$$

The e.m.f induced in each winding of the transformer can be calculated from this emf.

$$\boxed{e_{rms_{primary}} = e_1 = 4.44\, f N_1 \phi_m}$$

3. Ans: —



Since

$$V = V_m \sin \omega t \quad \text{——(I)}$$

$$I = I_m \sin \omega t \quad \text{——(II)}$$

$$\phi = \phi_m \sin \omega t \quad \text{——(III)}$$

Let here flux at any instant is

$$\phi = \phi_m \sin \omega t$$

The instantaneous e.m.f induced in a coil of N turns, linked by this flux is given by Faraday's law as: —

$$e = -N \cdot \frac{d\phi}{dt} = -N \cdot \frac{d(\phi_m \sin \omega t)}{dt}$$

$$= -N\omega \phi_m \cos \omega t$$

$$= -N\omega \phi_m \left[\sin\left(\pi/2 - \omega t\right)\right]$$

$$e_{rms\ secondary} = e_2 = 4.44\, \phi_m f N_2$$

where ϕ_m is max^m. value of flux in wb, f is frequency in Hz and e_1 and e_2 are in volts.

4. Ans:

Sol^n:

$f = 50Hz$, $N_1 = 480$, $N_2 = 20$, $E_1 = 5400V$

$E_1 = 4.44 f \phi_m N_1$

i.e. $5400 = 4.44 \times 50 \times \phi_m \times 480$

$\phi_m = 0.0506$ wb $\longrightarrow$ Peak value of flux

since, $\frac{E_1}{E_2} = \frac{N_1}{N_2}$

i.e $E_2 = \frac{N_2 \times E_1}{N_1} = \frac{20}{480} \times 5400$

$\therefore E_2 = 225V$ $\longrightarrow$ secondary val

5. Ans: —

Voltage induced in a conductor is given by

$$e = Blv \sin\theta$$

(i) Here $B = 1\ Wb/m^2$, $l = 0.5\ m$,
$v = 50\ m/sec$
and $\theta = 90^\circ$

Hence, $e = Blv \sin 90^\circ$

$e = 1 \times 0.5 \times 50 \times 1 = 25$ volts.

(ii) Here $\theta = 30^\circ$

hence $e = Blv \sin\theta$

$= 1 \times 0.5 \times 50 \sin 30^\circ$

$= 0.5 \times 50 \times \frac{1}{2} = 12.5$ volt

(iii) Here $\theta = 0^\circ$

since $\sin 0^\circ = 0$

so, $e = Blv \sin 0^\circ$

$= 0$ Ans.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of HVAC&R Skills

Session: 2018-19 (Summer Semester)

B. Voc. Program, I Semester,

End-Sem. Examination

Course Code: HVA1104 **Time: 3 Hours**

Course Name: Sheet metal & Welding Process **Max. Marks: 100**

Instructions:

1. Attempt all questions from Section A.
2. Attempt any six questions from Section B.
3. Attempt all questions from Section C.

Section – A

20X01 = 20 Marks

1. What is the most required thing in welding?
   A. Current
   B. Pressure
   C. Heat
   D. Electrode
2. Why must welders use a Welding Helmet?
   A. To aid visibility
   B. To protect their eyes when removing slag
   C. To protect their eyes from flashes
   D. To offer protection from radiation
3. Which of the following is not a PPE?
   A. Apron
   B. Hand gloves
   C. Wire brush
   D. Welding Helmet
4. In TIG welding, the time of gas flow after pressing the stop button is known as.....?
   A. Post flow time
   B. Pre flow time
   C. Down slop time
   D. Up slop time

5. For GMAW process, we use following current and polarity:
   A. DCEN
   B. DCEP
   C. PULSED DC
   D. Square wave AC
6. Snips are usually used for _____,
   A. supporting and forming tools
   B. Shearing
   C. Punching
   D. Riveting
7. Roll bending is a process of _____,
   A. Sheet metal cutting operation along a straight line
   B. Making drum
   C. Notching
   D. Embossing
8. The process of increase in angle of bent part after forming tool removed is:
   A. Embossing
   B. Spring back
   C. Hem
   D. Blanking
9. Sheet metal forming process of deformed by mechanical force of an electromagnetic field:
   A. Explosive forming
   B. Drawing
   C. Electromagnetic forming
   D. Piercing

10. In the process of Continuous bending process in which opposing rolls produce long sections of formed shapes from coil in sheet metal is:

   A. bending
   B. Roll forming
   C. punching
   D. spinning

11. Stretch forming is a Sheet metal process of _____ to achieve shape change.

A. Roll of sheet

B. stretched and simultaneously bent

C. Bending

D. Drawing

12. Process of sheetmetal fabrication with rubber and form block is _____ .

A. Guerin Process

B. Blanking process

C. Coining Process

D. Notching Process

13. Processes to form metals using large amounts of energy over a very short time is _____.

A. Spinning Process

B. Bending Process

C. Piercing Process

D. HERF process

14. Piece of sheet metal used for Duct joining is Called _____.

A. Hem

B. Slip

C. Trim

D. Nail

15. Process of bending of edge in sheet metal is called:

A. V bending

B. U Bending

C. Edge Bending

D. Grooving

16. _____ is the example of forming tool.

A. Snip

B. Scriber

C. Hammer

D. Punch

17. _____ is the example of cutting tool.

A. Die-Punch

B. Scale

C. C-Clamp

D. Tri square

18. Which one of the following measuring instrument is not a layout tool?

A. Scale

B. Tri Square

C. C-Clamp

D. Divider

19. Maximum thickness to define sheet metal is;

A. 4 mm

B. 5 mm

C. 6 mm

D. 7 mm

20. _____ Used to create indentations in sheet.

A. Shearing

B. Embossing

C. Bending

D. Blanking

Section – B

06X05 = 30 Marks

21. Write any three characteristics of electrode covering.
22. What is meant by the term 'Weld seam inspection'? Give their types.
23. Write Sheet Metal Operations, not Performed on Presses.
24. Write advantage of Sheet metal parts.
25. Write the process of sheet metal electromagnetic forming.
26. What is spinning? Explain its process in sheet metal.
27. What is Roll bending?
28. What is clearance? Give the value of clearance.

Section – C

05X10 = 50 marks

29. Explain all type of welding joints in detail with neat diagrams.
30. Explain SMAW in detail with a neat sketch.
31. Explain punch and die in sheetmetal fabrication with a line diagram.
32. Explain Drawing and ironing process in sheet metal.
33. What are the principal operations in pressworking that cut sheet metal?

BSDU

End Sem - 2018

Ans Key

Course Code: HVA1104
Course name: Sheet metal and welding

Section- A

1. What is the most required thing in welding?

   Ans. (c) Heat

2. Why must welders use a Welding Helmet?

   Ans. (d) To offer protection from radiation

3. Which of the following is not a PPE?
   Ans. (c) wire brush
4. In TIG welding, the time of gas flow after pressing the stop button is known as.....?
   a) Post flow time

5. For GMAW process, we use following current and polarity:
   Ans.(b) DCEP
6. Snips are usually used for _____,
   B) Shearing
7. Roll bending is a process of _____,

A. Sheet metal cutting operation along a straight line

B. Making drum

C. Notching

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D. Blanking

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D. Notching Process

13. Processes to form metals using large amounts of energy over a very short time is _____.

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B. Bending Process

C. Piercing Process

D. **HERF process**

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B. 5 mm

C. 6 mm

D. 7 mm

20. _____ Used to create indentations in sheet.

A. Shearing

B. Embossing

C. Bending

D. Blanking

Section- B

6. 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)

7.What is meant by the term 'Weld seam inspection? Give their types.

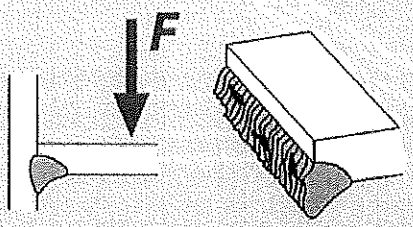
Ans. It is inspection of welding joints.

Weld Seam Inspection Procedures

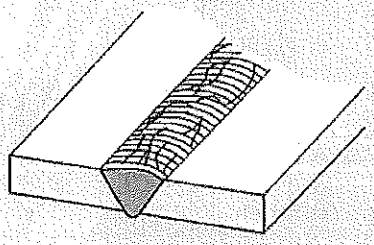
Inspection procedures are divided into two basic types: destructive and non-destructive.

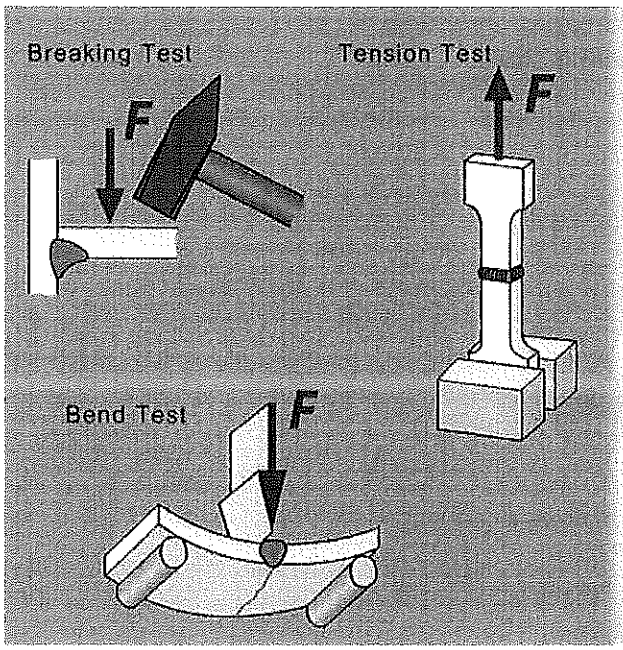
You will be presented with more detail about the various procedures on the following pages.

Destructive Inspection Procedure



Non-Destructive Inspection Procedure





Destructive Weld Seam Inspection Procedures

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

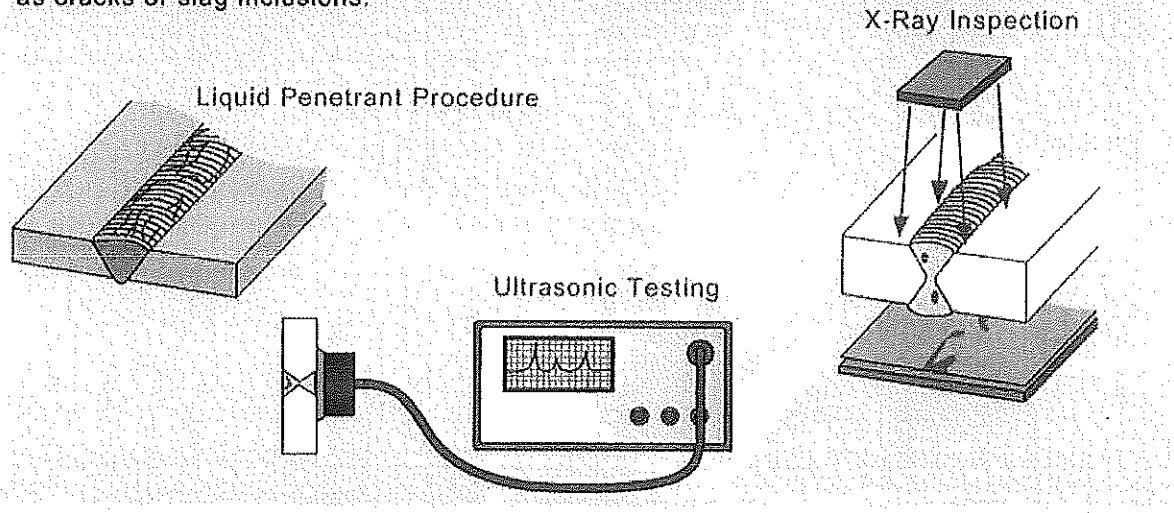
During the breaking test, the weld seam is mechanically broken, for example, in a press or by means of hammer blows.

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

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

Non-Destructive Weld Seam Inspection Procedures

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



21. Write Sheet Metal Operations, not Performed on Presses.

    Stretch forming

    Roll bending and forming

    Spinning

    High-energy-rate forming processes.

22. Write advantage of Sheet metal parts.

    High strength

    Good dimensional accuracy

    Good surface finish

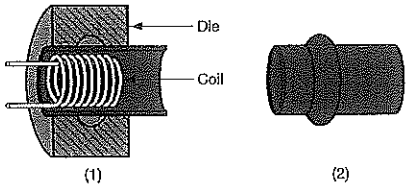
    Relatively low cost

    For large quantities, economical mass production operations are available

23. Write the process of sheet metal electromagnetic forming.

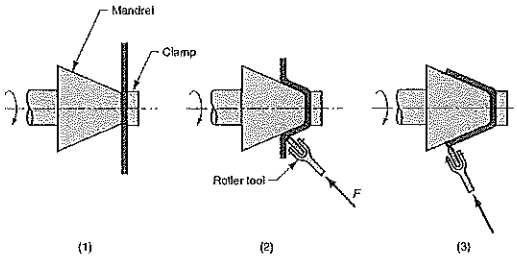
    Sheet metal is deformed by mechanical force of an electromagnetic field induced in workpart by an energized coil

    - Presently the most widely used HERF process
    - Applications: tubular parts



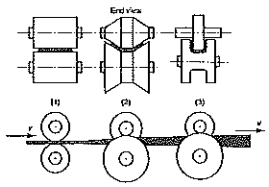
24. What is spinning? Explain its process in sheet metal.

Metal forming process in which an axially symmetric part is gradually shaped over a rotating mandrel using a rounded tool or roller



25. What is Roll bending?

Continuous bending process in which opposing rolls produce long sections of formed shapes from coil or strip stock

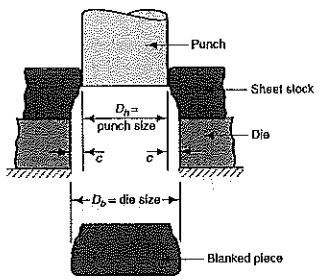


26. What is clearance? Give the value of clearance.

Distance between the punch and die

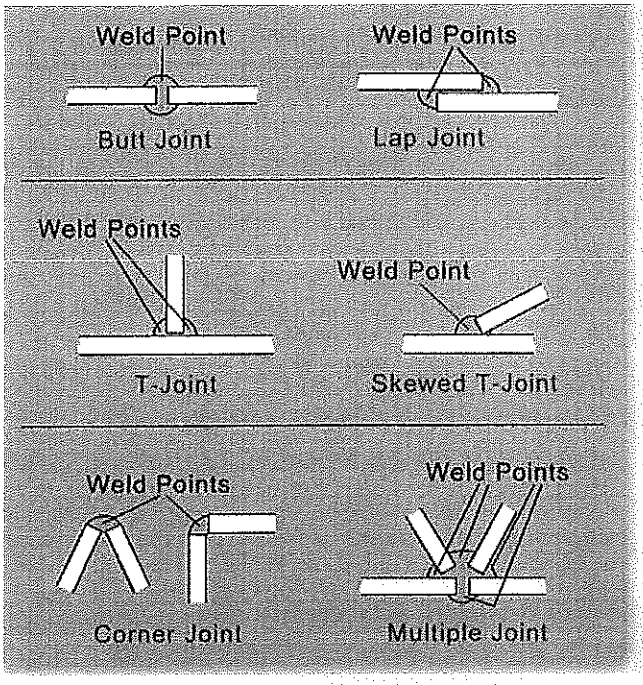
Typical values range between 4% and 8% of stock thickness

- If too small, fracture lines pass each other, causing double burnishing and larger force
- If too large, metal is pinched between cutting edges and excessive burr results



Section C

29. Explain all type of welding joints in detail with neat diagram.



The area in which the work pieces are welded together is referred to as the joint.

Depending on the position of the parts relative to one other, weld joints are identified as:

- Butt joint
- Lap joint
- T-joint
- Skewed T-joint
- Corner joint
- Multiple joint

30. Explain SMAW in detail with neat sketch.

Ans.

Welding Table

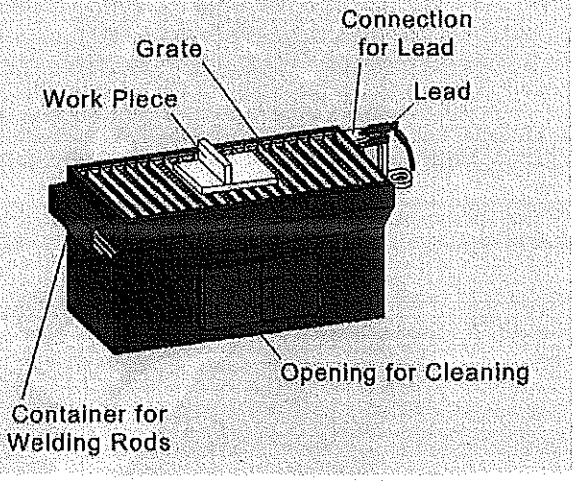
SMAW welding tables have a connection for the work piece lead clamp.

The current flows through the work piece lead clamp back to the power source, thus completing the electrical circuit.

The work piece rests on a grate.

Slag and electrode remains fall through the grate and are collected in a container that is emptied by means of an access door.

Welding tables often have a holder for the welding rod.



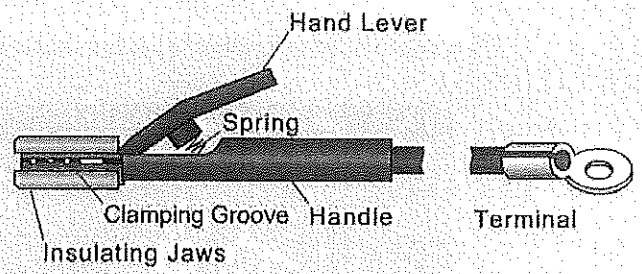
Electrode Holder

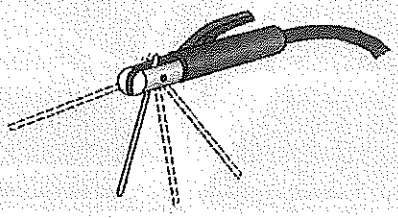
The electrode holder consists of an insulated handle and a clamping device for the welding rod.

To allow the electrode to be positioned in a variety of ways, the jaws are equipped with multi-directional clamping grooves.

The electrode holder is connected to the power source via a cable.

Current flows through the cable, the holder and the electrode to the welding area.

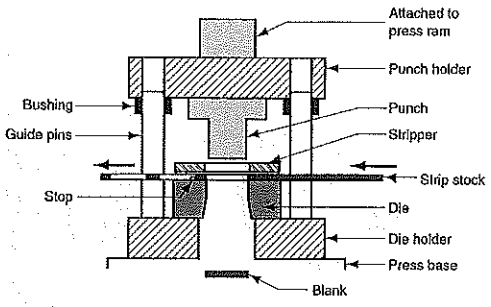




31. Explain punch and die in sheetmetal fabrication with a line diagram.

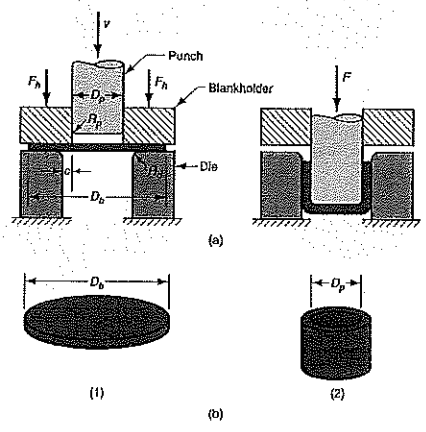
Most pressworking operations performed with conventional *punch-and-die* tooling

- The term *stamping die* sometimes used for high production dies



32. Explain Drawing and ironing process in sheet metal.

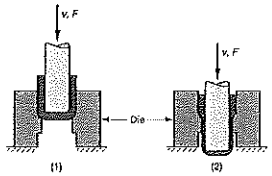
Drawing: Sheet metal forming to make cup-shaped, box-shaped, or other complex-curved, hollow-shaped parts.



Ironing

Makes wall thickness of cylindrical cup more uniform

Examples: beverage cans and artillery shells



33. What are the principal operations in pressworking that cut sheet metal?

Three principal operations in pressworking that cut sheet metal:

- Shearing
- Blanking
- Punching

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of HVAC Skill

Session: 2018-19 (Summer Semester)

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

End-Sem. Examination

Course Code: HVA1106 Time: 3 Hours

Course Name: Basic Electronics for HVAC Max. Marks: 100

Instructions:

1. Calculator is strictly prohibited.
2. Missing data if any can be suitably assumed.
3. In Section A, all questions are compulsory
4. In Section B, attempt any 06 questions
5. In Section C, all questions are compulsory

Section – A

$20 \times 01 = 20$ Marks

Q1. Which one of the following is correct for amplification?

(A) Resistor (B) Capacitance

(C) Transistor (D) None of the above

Q2. Which one of the following is correct for output current in CR 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 is true to store energy?

(A) Resistor (B) Inductor

(C) Capacitor (D) Both Capacitor and Inductor

Q4. Which one of the following is true for the movement of electric charge through conductor?

(A) Electric Current (B) Electric charge

(C) Electric Cell (D) Electric Circuit

Q5. Which one of the following is true when a short thin piece of wire is heated up and melt by flowing of electric current?

(A) Circuit (B) Fuse

(C) Resistor (D) Cell

Q6. Which one of the following is true if a component provides resistance?

(A) Heat (B) Energy

(C) Resistor (D) None of the above

Q7. Which one of the following is true if two or more batteries are connected in series?

(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 current levels is true if the diode is reverse biased?

(A) mAmp (B) μAmp

(C) Amp (D) None of the above

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

(A) Ammeter (B) Voltmeter

(C) Barometer (D) Thermometer

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

(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 cann't 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 called indirect bandgap semiconductor?

(A) Si (B) Ge

(C) Both Si and Ge (D) GaAs

Q15. Which one of the following regions is needed for signal amplification of BJT?

(A) Cutoff (B) Saturation

(C) Active (D) None of the above

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

(A) Emitter (B) Collector

(C) Base (D) None of them

Q17. Which of the following Cut in voltage is true for Si diode?

(A) 0.3 V (B) 1.12 V

(C) 0.7 V (D) 0.25 V

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 humidity?

(A) Thermometer (B) Barometer

(C) Hygrometer (D) None of the above

Q20. Which one of the following is true for sensing in colorimetric 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 Capacitor? There are several capacitors such C1, C2, C3, ...Cn . What will be the value of resultant capacitance when these are in series and parallel?

Q22. How is resistance created in Conductor/Semiconductors? How is resistance of a wire effected by its width? 5.5 K, 10.5 K, 15K, and 20K resistors are connected in a parallel of a circuit. Find out resultant resistance of this circuit?

Q23. What are differences between LED and solar cell? Write and explain with a proper diagram working principle of a photovoltaic cell.

Q24. What is solar energy? How solar energy is effective in your home appliances? How does solar help the environment?

Q25. What do you mean by reverse biased PN junction diode? Does any current flow through reverse biased PN junction diode? Explain the reverse biased PN junction with a proper diagram.

Q26. Which parameters affect the capacitance of the capacitor? What is the unit of a capacitor? Find out the stored energy of a Capacitor.

Q27. Which configuration of the Transistors usually used for signal amplification? How biasing can be made to make Common Emitter Transistor (CE) amplifier? Explain NPN CE transistor configuration for amplifier with a proper circuit diagram.

Q28. What is α and β of a Transistor? Find out the relation between α and β? A Transistor $\alpha = 0.98$, $I_B = 100\ \mu A$ and $I_{CO} = 6\ \mu A$. Calculate I_C and I_E respectively.

Section – C

05×10 = 50 Marks

Q29. What do you mean by an Inductor? What is the unit of an Inductor? An Inductor with inductance (L) 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. Why is Si diode unable to emit light? When does crystalline Si emit light? There are two diodes one is made from Si and other from GaAs. What are the basic differences between them? In respect of energy conversion explain with proper diagrams. How does GaAs diode emit light?

Q31. Is it possible to make a Transistor connecting two diodes back to back? Explain it. What are the uses of Transistors? Classify the transistors depending on doping densities. Why are NPN Transistors widely used in different applications? A Common Base (CB)Transistor has current gain 0.95 and Emitter current (I_E)1mA, find the value Collector and Base current respectively.

Q32. Why are bridge rectifiers usually used for rectification in different circuits? Draw and explain properly the working principle of Full Wave bridge rectifier. What are the functions of Capacitors/ Inductors at the output of a rectifier?

Q33. What do you mean by a 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.

Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

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Section – A

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(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 Capacitor? There are several capacitors such as C_1, C_2, C_3, ... Cn. What will be the value of resultant capacitance when these are in series and parallel?

Ans:

Capacitor is an electronic component that stores electric charge. The capacitor is made of 2 close conductors (usually plates) that are separated by a dielectric material.

Series: C=1/C1+1/C2+1/C3+.....1/Cn

Parallel: C=C1+C2+C3+.....Cn

Q22. How is resistance created in Conductor/Semiconductors? What are the basic difference between a Resistor and Capacitor? 5.5 K, 10.5 K, 15 K, and 20 K resistors are connected in a parallel of a circuit. Find out resultant resistance of this circuit?

Ans: During the movement of carriers through the conductors/semiconductors, collision occur among carriers, carriers with ions, unpaired electrons etc. Due to this collision, resistance is created across conductors/ semiconductors.

- Resistor cannot store energy but Capacitor can store energy

Resultant resistance (R) = (5.5x10.5x15x20)/5(5.5+10.5+15+20)

= 339.7K

Q23. What are differences between LED and solar cell? Write principle of operation of a photovoltaic cell

Ans: Solar cells convert light to electricity and LEDs convert electricity to light

Working principle of solar cell: 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. What is solar energy? How solar energy is effective in your home appliances?

Ans: Energy released from Sun is termed as Solar energy. Solar energy is converted to electrical energy by photovoltaic cell.

Applications:

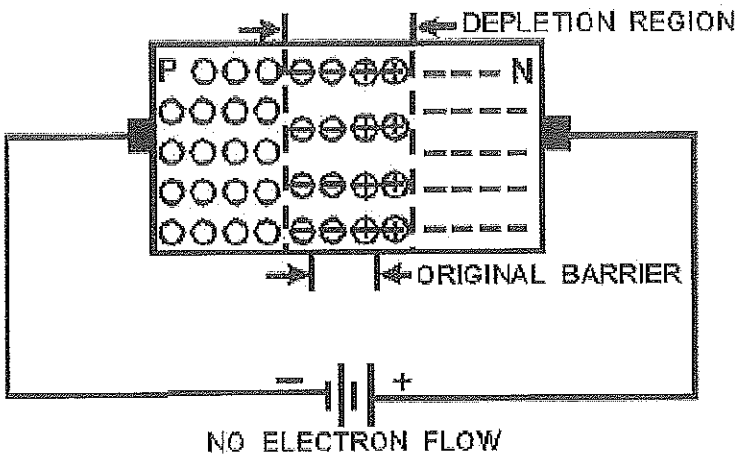
- Solar energy can be converted to electricity that can be used to power the appliances in our home. This is known as photovoltaic (PV).
- Solar energy can also be used in geo thermal applications, where the sun warms or cools a liquid (like the water in your home). This is known as solar heating and 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 reverse biased PN junction diode? Does any current flow through reverse biased PN junction diode? Explain the reverse biased PN junction with a proper diagram.

Ans: When the polarity of the battery is such that P side is connected with negative and N side is connected with positive terminal of the battery then diode blocks current, the diode is said to be reverse-biased.

Usually, very small amount of current (mAmp) due to flow of minority carriers flow through reverse biased PN junction diode



Due to the positive potential of the n-type region the electrons are drifted towards the junction and combine with holes adjacent to the layer of positive impurity ions and create more positive impurity ions in the layer. Hence, the thickness of the layer increases. In this way over all width of the depletion layer increases along with its barrier potential. This increment of the width of depletion layer will continue till the barrier potential reaches to applied reverse biased voltage.

Q26. Which parameters affect the capacitance of the capacitor? What is the unit of a capacitor? Find out the stored energy of a Capacitor.

Ans:

PLATE AREA: All other factors being equal, greater plate area gives greater capacitance; less plate area gives less capacitance.

PLATE SPACING: All other factors being equal, further plate spacing gives less capacitance; closer plate spacing gives greater capacitance.

DIELECTRIC MATERIAL: All other factors being equal, greater permittivity of the dielectric gives greater capacitance; less permittivity of the dielectric gives less capacitance.

Unit= Capacitance

Stored Energy $=(1/2)CV^2$

Q27. Which configuration of the Transistors usually used for signal amplification? How biasing can be made to make Common Emitter Transistor (CE) amplifier? Explain NPN CE transistor configuration for amplifier with a proper circuit diagram.

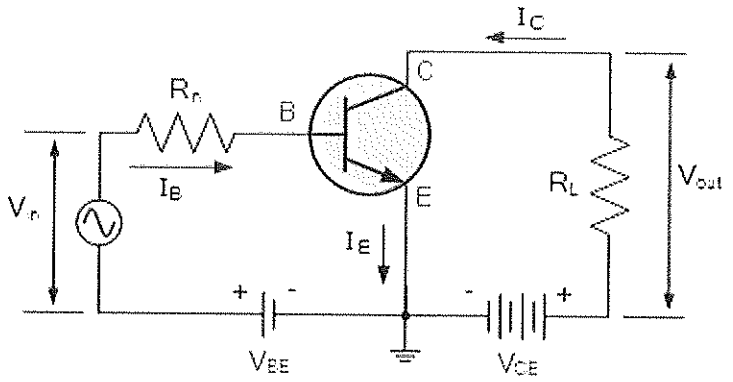
Ans: CE configurations are usually used for signal amplification

To operate Common Emitter Transistor configuration base emitter junction should be forward biased and collector emitter is reverse biased respectively. Common Emitter Amplifier is a

three basic single stage bipolar Transistor and is used as voltage amplifier. The input is applied to the base terminal and output is taken at collector terminal. Emitter is common to both input and output respectively. The common emitter (CE) amplifiers are used when large current gain is needed.

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

The supply voltage between base and emitter is denoted by VBE while the supply voltage between collector and emitter is denoted by VCE. In common emitter (CE) configuration, input current or base current is denoted by I_B and output current or collector current is denoted by I_C.



Q28. What is α and β of a Transistor? Find out the relation between α and β? A Transistor α =0.98, I_B = 100 μA and I_{CO} = 6 μA. Calculate I_C and I_E respectively.

Ans: Common base current gain (α)= $\frac{I_C}{I_E}$ and Common emitter current gain (β)= $\frac{I_C}{I_B}$

$\frac{\beta}{\alpha}=\frac{I_E}{I_B}$, now $I_B = I_E - I_C$

Now, (β)= $\frac{I_C}{I_B}=\frac{Ic/IE}{IE/IE-IC/IE}=\frac{\alpha}{1-\alpha}$

$Ic=\frac{\alpha}{1-\alpha}I_B+\frac{ICO}{1-\alpha}$

= (0.98x100)/(1-0.98) +6/(1-0.98)
=4900+300=5.2 mA
IE=IC+IB=5200+100=5.3 mA

Section – C

05×10 = 50 Marks

What do you mean by an Inductor? What is the unit of an Inductance? An Inductor with inductance (L) 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: An inductor is a passive electronic component that stores energy in the form of a magnetic field. In its simplest form, an inductor consists of a wire loop or coil.

Unit of Inductor is Henry

Kirchhoff's voltage law (KVL) gives us:

$$V_{(t)} - (V_R + V_L) = 0$$

The voltage drop across the resistor, R is I*R (Ohms Law).

$$V_R = I \times R$$

The voltage drop across the inductor, L is by now our familiar expression L(di/dt)

$$V_L = L\frac{di}{dt}$$

Then the final expression for the individual voltage drops around the LR series circuit can be given as:

$$V_{(t)} = I \times R + L\frac{di}{dt}$$

We can see that the voltage drop across the resistor depends upon the current, i, while the voltage drop across the inductor depends upon the rate of change of the current, di/dt. When the current is equal to zero, (i = 0) at time t = 0 the above expression, which is also a first order differential equation, can be rewritten to give the value of the current at any instant of time as:

Expression for the Current in an LR Series Circuit

$$I_{(t)} = \frac{V}{R}\left(1 - e^{-Rt/L}\right) \text{ (A)}$$

Q30. Why is Si diode unable to emit light? When does crystalline Si emit light? There are two diodes one is made from Si and other from GaAs. What are the basic differences between them? In respect of energy conversion explain with proper diagrams. How does GaAs diode emit light?

Ans:

Si is an indirect bandgap semiconductor. All the energy converted to infrared energy rather than light energy in direct bandgap semiconductor.

At nano level Si can emit light.

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.

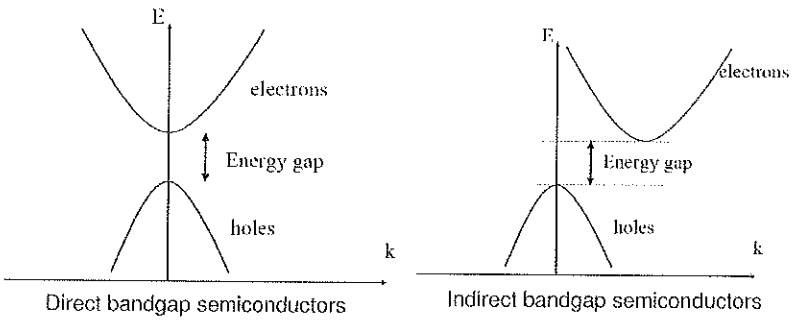


Fig: Direct and indirect band gap semiconductor

Q31. Is it possible to make a Transistor connecting two diodes back to back? Explain it. What are the uses of Transistors? Classify the transistors depending on doping densities. Why are NPN Transistors widely used in different applications? A Common Base (CB)Transistor has current gain 0.95 and Emitter current (I_E)1mA, find the value Collector and Base current respectively.

Ans: No,

Minority career diffusion length must be greater that base width so all the careers recombine in base so no career move to collector region and Transistor action ceases.

NPN and PNP Transistors

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

$I_C=\alpha I_E=0.96x2=1.92mA$

$I_B=I_E-I_C= 2-1.92=80\ \mu A$

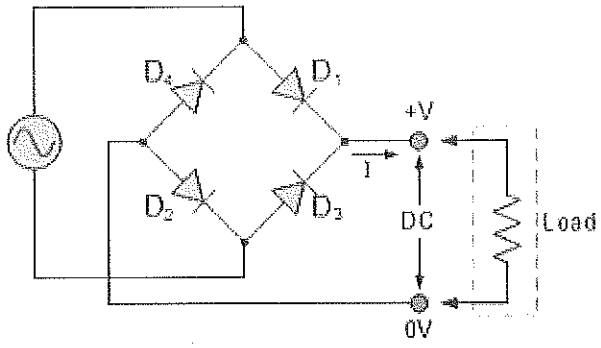
Q32. Why are bridge rectifiers usually used for rectification in different circuits? Draw and explain properly the working principle of Full Wave bridge rectifier. What are the functions of Capacitors/ Inductors at the output of a rectifier?

Ans: Efficiency of bridge rectifier is higher than other rectifiers

A Bridge rectifier is an Alternating Current (AC) to Direct Current (DC) converter that rectifies mains AC input to DC output. Bridge Rectifiers are widely used in power supplies that provide

necessary DC voltage for the electronic components or devices. They can be constructed with four or more diodes or any other controlled solid state switches.

Depending on the load current requirements, a proper bridge rectifier is selected. Components' ratings and specifications, breakdown voltage, temperature ranges, transient current rating, forward current rating, mounting requirements and other considerations are taken into account while selecting a rectifier power supply for an appropriate electronic circuit's application.



The output of rectifier is not perfect DC, AC signal superimposed on DC. Our target is to enhance the percentages of DC with respect to AC. Capacitors/Inductors is used to filter the AC from DC

Q33. What do you mean by a 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 senor applications to help regulate, monitor, control, and compensate temperature