Registration No.: .....

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of RAC Skills

III Semester, 1st In-Sem. Examination

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

Course Code: HVA1301 **Time: 1 Hour**

Course Name: Refrigerant & Psychrometry **Max. Marks: 20**

Instruction:

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

Section – A

05X01 = 05 Marks

1. The refrigerant affects _____.
   a. COP of the system
   b. Heat transfer
   c. Environment
   d. All of the above

2. The ODP value of HFC refrigerant is:

   a. Higher than CFC refrigerant
   b. Lower than CFC refrigerant
   c. Same as CFC refrigerant
   d. None of the above

3. Which UV ray is useful for human health?

   a. UV- A
   b. UV- B
   c. UV- C
   d. All of the above

4. Which refrigerant is most environmentally friendly among the HC, HFC and HCFC refrigerant?

   a. HC
   b. HFC
   c. HCFC
   d. Not comparable

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5. For large commercial installations, NH_3 is used as a refrigerant because of its:
   A. Large latent heat
   B. Relatively cheaper price
   C. Moderate working pressure
   D. All of the above

Section – B

03X02 = 06 Marks

1. Define the term refrigerant.
2. What is the importance of degree of sub- cooling in a VCRS.
3. How water can be used as a refrigerant?

Section – C

03X03 = 09 Marks

1. How does refrigerant affect the COP of the refrigeration system? Explain in detail.
2. Write down a note on stratospheric layer depletion.
3. Describe the classification of refrigerant on the basis of flammability and toxicity.

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School of RAC Skills

III Semester, 1st In-Sem. Examination

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

Course Code: HVA1301 **Time: 1 Hour**

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Instruction:

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

Section – A

05X01 = 05 Marks

1. The refrigerant affects _____.

   d. All of the above

2. The ODP value of HFC refrigerant is:

   b. Lower than CFC refrigerant

3. Which UV ray is useful for human health?

   a. UV- A

4. Which refrigerant is most environmentally friendly among the HC, HFC and HCFC refrigerant?

   a. HC

5. For large commercial installations, NH_3 is used as a refrigerant because of its:

   d. All of the above

Section – B

03X02 = 06 Marks

1. Define the term refrigerant.

   Heat carrying medium.

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2. What is the importance of degree of sub- cooling in a VCRS.

   To ensure low temperature refrigerant after expansion device for high amount of latent heat of vaporization.

3. How water can be used as a refrigerant?

   Secondary refrigerant in chilling system i.e. no phase changes.

Section – C

03X03 = 09 Marks

1. How does refrigerant affect the COP of the refrigeration system? Explain in detail.

   Low boiling and freezing point.

   High critical pressure and temperature.

   High latent heat of vaporization.

   Low specific heat of liquid, and high specific heat of vapor.

   High thermal conductivity.

   Mixes well with oil.

2. Write down a note on stratospheric layer depletion.

   OZONE DEPLETION PHENOMENON:

   Definition:

   Ozone depletion is the phenomena that occur when destruction of the stratospheric ozone is more than the production of the molecule. The scientists have observed reduction in stratospheric ozone since early 1970s. It is found to be more prominent in polar Regions. Following is the set of chemical equations describing Ozone Depletion:

   $CFCl_3 + UV\ Light \rightarrow CFCl_2 + Cl$

   $Cl + O_3 \rightarrow ClO + O_2$

   $ClO + O \rightarrow Cl + O_2$

   The free chlorine atom is then free to attack another ozone molecule:

   $Cl + O_3 \rightarrow ClO + O_2$

   $ClO + O \rightarrow Cl + O_2$

3. Describe the classification of refrigerant on the basis of flammability and toxicity.

   On Toxicity basis- Low toxicity class A

   High toxicity class B

   On Flammability basis- 1 no flammability

   2L Lower flammability (Flame speed < 10 cm/s)

   2 Lower flammability (no flash point)

   3 Higher flammability(with flash point)

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School of RAC Skills

3rd Semester, 1st In-Sem. Examination

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

Course Code: HVA-1302 **Time: 1 Hour**

Course Name: Compressor, Condenser and Evaporator **Max. Marks: 20**

Instruction: Attempt all questions.

Section – A

05X01 = 05 Marks

1. A compressor suction pressure is 21 Psi_g and discharge pressure at 169 Psi_g pressure the compression ratio is equal to:
   a) 5.169
   b) 51.69
   c) 61.69
   d) 6.169
2. Rotary compressor can be classified as:
   a) Positive Displacement compressor
   b) Steady flow compressor
   c) Both of the above mentioned
   d) None of the mentioned
3. In positive displacement compressor occurrence of compression done by:
   a) Transfer of kinetic energy
   b) Transfer of potential energy
   c) Trapping refrigerant
   d) All of the mentioned
4. The function of .....is to convert high kinetic energy of gases into pressure energy?
   a) Impeller
   b) Diffuser
   c) Casing
   d) None of the above
5. Work done on a compressor will be minimum if refrigerant is compressed at:
   a) The atmosphere
   b) A source at 273K
   c) A source of low temperature refrigerant
   d) Reversibly and adiabatic

Section – B

03X02 = 06 Marks

1. Draw different points of leakage in rotary and swing compressor.
2. Write down advantage of hermetic sealed compressor.
3. Which compressor is used in Daikin room air conditioning and VRV machine.

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Section – C

03X03 = 09 Marks

1. Explain with neat sketch principal and working of centrifugal compressor.
2. Explain with neat sketch construction and working of rotary compressor.
3. Explain with neat sketch construction and working of scroll compressor.

Prepared by
Vipin

Registration No.: .....

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Section – C

03X03 = 09 Marks

1. Explain with neat sketch principal and working of centrifugal compressor.
2. Explain with neat sketch construction and working of rotary compressor.
3. Explain with neat sketch construction and working of scroll compressor.

Prepared by
Vipin

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School of RAC Skills

3rd Semester, 1st In-Sem. Examination

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

Course Code: HVA-1302 **Time: 1 Hour**

Course Name: Compressor, Condenser and Evaporator **Max. Marks: 20**

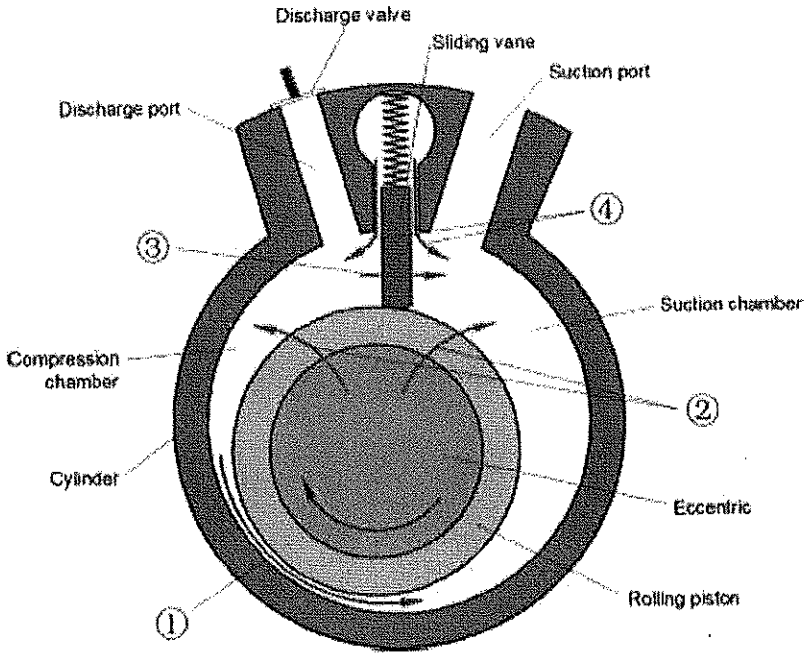
Instruction: (Attempt all questions.)

Section A

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

Short answer: Section B

1) leakage points are



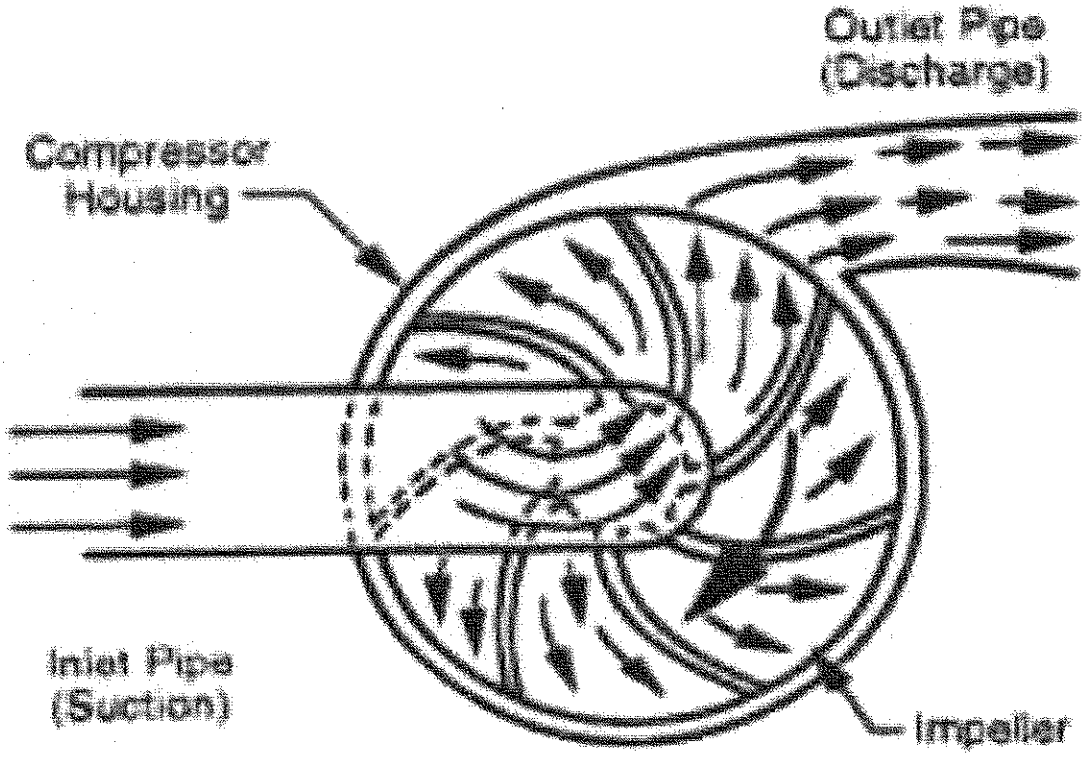
2) Maintenance free and must be replaced in case of any fault. Small size small capacity. used in small systems such as domestic refrigerators, water coolers, air conditioners etc.
Compressor and driving motor coupled to the same shaft, and are enclosed in a common rigid casing made of welded steel

3) Rotray compressor and scroll compressor

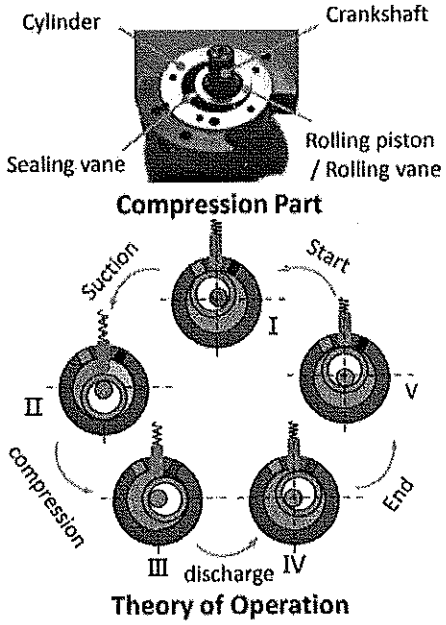
Long answer question Section C

1) Centrifugal compressors use the rotating action of an impeller wheel to exert centrifugal force on refrigerant inside a round chamber (volute). Fluid enter impeller axially but discharged radially. Unlike other designs, centrifugal compressors do not

operate on the positive displacement principle, but have fixed volume chambers. They are well suited to compressing large volumes of refrigerant to relatively low condensing pressures. The compressive force generated by an impeller wheel is small, so systems that use centrifugal compressors usually employ two or more stages (impellers wheels) in series to generate high compressive forces. Centrifugal compressors are desirable for their simple design, few moving parts, and energy efficiency when operating multiple stages.



2) Rotary compressor



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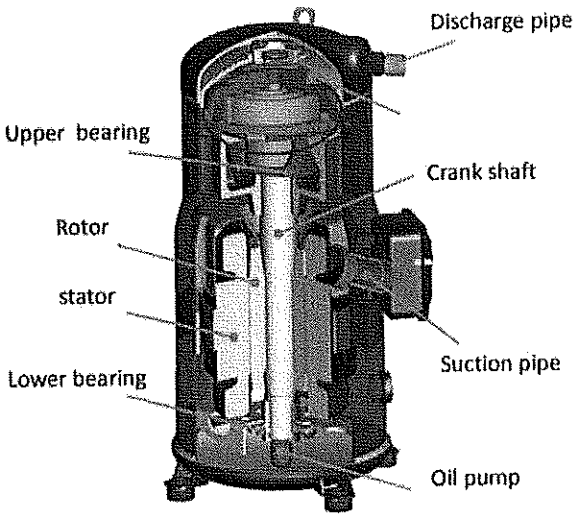
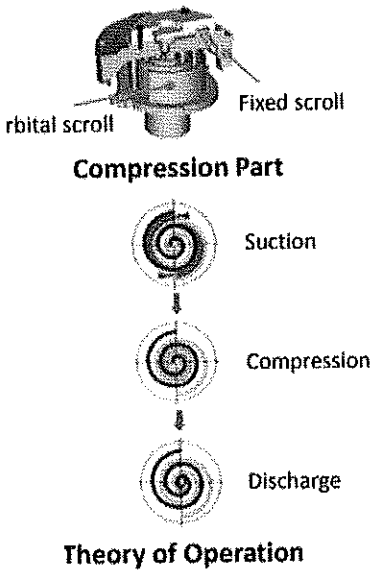
3) Scroll compressor





Prepared by
vipin

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Registration No.: .....

School of HVAC&R Skills

Session: 2019-20 (Summer / Winter Semester)

B. Voc. 3rd Semester,

1st In-Sem. Examination

Course Code: HVA-1303 **Time: 1 Hour**

Course Name: Air Distribution **Max. Marks: 20**

Instruction: Attempt all questions.

Section – A

05X01 = 05 Marks

1. What is the clo value for summer?:
   a) 1.0 b) 0.7 c) 0.5 d) 0.3

2. Each pound of air at standard atm pressure and 70°F can hold:
   a) 110 grains of moisture
   b) 0.01378 pounds of moisture
   c) Both a and c
   d) None of the above

3. Air movement above 40 fpm is called –
   a) High terminal air velocity
   b) Drafts
   c) Stratification
   d) None of the above

4. Which of the following is an air contaminant?
   a) Asbestos Fibers
   b) Pathogens
   c) CO2
   d) All of the above

5. If the RH is high then the space needs to be_____ to provide thermal comfort.
   a) Warmer
   b) Hotter
   c) Cooler
   d) Can't be determined.

Section – B

03X02 = 06 Marks

1. What is thermal comfort?
2. Why is air movement required in thermal comfort?
3. What is "met" and how does it affect thermal comfort?

Section – C

03X03 = 09 Marks

1. What is stratification and how it is caused?
2. What are the factors affecting heat exchange for thermal comfort?
3. What is the importance of exhaust systems in maintaining indoor air quality?

Prepared :- Shyam Anand
by

Anand
S.

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of HVAC&R Skills

Session: 2019-20 (Summer / Winter Semester)

B. Voc. 3rd Semester,

1st In-Sem. Examination

Course Code: HVA-1303 **Time: 1 Hour**

Course Name: Air Distribution **Max. Marks: 20**

Answer key

Section – A

05X01 = 05 Marks

1. c.
2. a.
3. b.
4. d.
5. c.

Section – B

03X02 = 06 Marks

1. The human body must give off some of its generated heat to the surroundings or it will overheat. Therefore, Comfort is a feeling in which a human body is in physical contentment with the environment. For Humans it is approximately at 73°F and 50-55 % RH.

2. Air movement may provide desirable cooling in warm conditions, but it may also increase the risk of unacceptably cool drafts. Standard 55-2004 includes no minimum velocity past the occupant's comfort. In residential environment comfort and negligible air movement is the norm. According to the standard maximum rate of air movement should not be above 40 fpm to avoid drafts. Higher air speed. i.e up to 160 fpm can be used to enhance cooling, only if the speed is under occupant's control.

3. Met is the unit of metabolic activity. A resting adult produces 1 met. Light office work produces 1 to 1.3 met. Walking produces 2 met.

Section – C

03X03 = 09 Marks

1. Stratification in a space is the division of air into series of temperature layers. If conditioned air is introduced at about the 10ft level or below, the space will be conditioned. Conditioning may reduce above 10ft level.
2. Factors affecting the heat exchange:
   Absolute and Relative humidity (RH)
   Dry Bulb Temperature

Thermal Radiation
Air movement (fpm)
Insulation value of clothing (clo)
Activity Level (met)
Direct contact with surfaces not at a body temperature.

3. Exhaust systems should be able to capture aerosols, gases at specific location within a space .Also should be able to transport them where they could be collected, filtered, inactivated or safely discharged in the atmosphere. Exhaust or emitted air should meet air quality standard 62.1-2007.The standard specifies exhaust rates for various places. For eg. 0.5 cfm/ft2 for barber shops, locker rooms and copy/print rooms.

Prepared by :- Shyam Anand

Anand

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School of RAC Skills

Session: 2019-20 (Summer Semester)

B. Voc. Program, 3rd Semester,

1st In-Sem. Examination

Course Code: HVA1304 **Time: 1 Hour**

Course Name: Thermal Insulation **Max. Marks: 20**

Section – A

05X01 = 05 Marks

1. Melting temperature range of perlite is

   a) 800-1200°C b) 230- 570°C

   c) 800- 1700°C d) 900- 1300°C

2. Which is medium temperature range thermal insulating material?

   a) 100-200°C b) 200-500°C

   a) 90- 300 °C d) 15- 350°C

3. Annealing process is used to make

   a) Fibre Glass b) Foam Glass

   c) Glass wool d) Perlite

4. Which insulating material is made of glass fibre?

   a) Glass wool b) foam Glass

   c) Stone wool d) Reed panels

5. Which insulating material have lowest working temperature?

   a) Glass wool b) Aluminium Silicate

   c) Foam Glass d) Ceramic fibre insulation

Section – B

03X02 = 06 Marks

1. What are differences between XPS and EPS?
2. What is need of insulation in human life?
3. What are advantages and disadvantages of ACC?

Section – C

1. Describe different parameters to classify Thermal Insulation materials?
2. Write a note on history of Polystyrene insulation.

Prepared By

Reviewed By

Answer Sheet

Thermal Insulation

Section A

Answer 1 (a

Answer 2 (d

Answer 3 (b

Answer 4 (a

Answer 5 (c

Section B

Answer 1

EPS	XPS
It less effected by moisture	It has high impact of moisture
It has high permeability	It has low permeability
It has high amount of recycle products during manufacturing	Only limited amount of recycle product can be used during manufacturing process
It does not contain CFCs, HCFCs components	XPS contain HCFCs like 134a
It las comparatively low compressive strength	It has high compressive strength
EPS costs 10% to 30% less than XPS per equivalent R-value and compressive strength.	It is comparatively costly

Answer 2

Insulation is a part of our daily life, we use insulation in various forms

1. We use insulation on electric wires.
2. We use insulation on roof to make it water proof for rainy season.
3. We use brick insulation to reduce heating of home form sun radiation.
4. In summer and we use insulation on roofs to make a stable temperature.
5. To reduce surrounding noise (if our home is near to heavy traffic site)
6. It Reduces the amount of energy required for heating or cooling.
7. It Makes a stable temperature inside building.
8. It Reduces the fuel consumption in power plants.
9. It Reduces the emission of harmful gases
10. It Improves the quality of living.

Answer 3

1. Lightweight saves cost and energy in transportation, labour expenses, and increases chances of survival during seismic activity.

2. Environmentally friendly: It produces at least 30% less solid waste than traditional concrete. There is a decrease of 50% of greenhouse gas emissions.

3. Fire resistant: As with regular concrete, AAC is fire resistant. Porous structure gives superior fire resistance.

4. Non-toxic: There are no toxic gases or other toxic substances in autoclaved aerated concrete. It neither attracts rodents or other pests nor can it be damaged by such.

5. Improved thermal efficiency reduces the heating and cooling load in buildings.
Workability allows accurate cutting, which minimizes the generation of solid waste during use.

Section C

Answer 1

According to Shapes

1. Rolls vary in the degree of flexibility and the ability to bend or pressure. They could be fastened by nails like glass wool, rock wool, polyethylene and foil-ceramic rolls

2. Sheets There are specific dimensions and thicknesses such as polyethylene layers, polystyrene, cork and cellulose.

3. Grains a powder or granules are usually placed in the spaces between the walls and it can also be mixed with some other materials. Examples of such materials granulated cork and polymers.

4. Liquid or gaseous form poured or sprayed on to form the desired dielectric layer, such as polyurethane foam and epoxy.

According to Structure

1. Organic such as cotton, wool, cork, rubber and cellulose.

2. Inorganic such as glass, asbestos, Rockwool, perlite, vermiculite and calcium silicate.

3. Metallic: such as aluminium foils and tin reflectors

According to Structure

1. Organic such as cotton, wool, cork, rubber and cellulose.

2. Inorganic such as glass, asbestos, Rockwool, perlite, vermiculite and calcium silicate.

3. Metallic: such as aluminium foils and tin reflectors

Answer 2

Polystyrene had been known long before but it was not in use until the 20th century. Its original monomer was the natural styrene that was named after a genus of tropical and Mediterranean trees called Styrax.

The monomer of polystyrene can be commercially manufactured from petroleum which is a mixture of around 500 various substances. In 1929 in Ludwigshafen (Germany) the researcher of the IG Farbenindustrie AG (today Badishe Anilin und Sodafabrik) Hermann Franz Mark (1895-1992) produced synthetic styrene with the catalytic dehydrogenation of ethyl-benzene at a temperature of 500-600℃.

In 1930 two scientists from the company, Karl Wulff and Eugen Dörrer, carried out a successful polymerisation with styrene creating polystyrene.

Thereafter the industrial production of polystyrene began and the utilization of it as plastic foam followed shortly after.

Polystyrene foam was first made in 1931 in the USA.

A Swedish inventor (1897-1989) patented the method for foaming polystyrene. Applying their technology, the first polystyrene foam was produced in 1941 by Otis Ray McIntire (1918-1996).

an engineer of the Dow Chemical Company. He heated the milkwhite polystyrene granulate up to 200℃ in an extruder using a chlorinated hydrocarbon (chloromethane) as a foaming agent. He led the polystyrene foam through a narrow aperture which resulted in extruded polystyrene (XPS) panels with a 98% closed cellular structure.

The first polystyrene insulating product was put on the market by the company in 1943 under the name of Styrofoam R . Another technology – the expanded polystyrene foam (EPS) – was invented in Germany by the engineers of IG Farbenindustrie AG in 1950. Using pentane as a foaming agent the polystyrene granulate is supplied with water vapour. As the temperature rises the grains of the raw material grow soft and the effects of the pentane results in a 20-50-fold increase in the volume of the pearls. During this action small closed cells arise inside, as a result of which, the expanded polystyrene foam has excellent thermal insulating capacity creating an ideal building insulation material.

To create a useable and saleable product a technology for making blocks was needed. Researchers noticed that after the foaming procedure the surface of the cooled polystyrene pearls becomes solid, the foaming agent contracts, so air is able to infiltrate the cells. When the blocks are rested for a few days the water vapour added during the steaming evaporates. If these pearls are steamed again in a closed mould they form a regular block without a binding material. The first product made with the help of this technology was put on the market in 1951 under the name of Styropor R .

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BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of HVAC & R Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: HVA 1305 **Time: 1 Hour**
Course Name: Electrical and Electronics Safety Testing **Max. Marks: 20**

Instruction: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks. Scientific calculator is allowed.

Section – A

05X01 = 05 Marks

Q.1. Which agents are used for electrical fire quenching?

(a) CO_2 (b) NO_2 (c) SO_2 (d) All of these

Q.2. A person qualified to perform electrical work must possess: -

(a) Skills/techniques to distinguish live parts from other parts of electrical equipment.
(b) Skills and techniques to determine the nominal voltage of exposed live parts.
(c) Knowledge on the use of PPE, insulating and shielding materials, and insulated tools.
(d) All of the above.

Q.3. During the first-aid burns should be treated by: -

(a) By dressing the burns (b) Covering the burns to exclude air
(c) Both a and b (d) None of these

Q.4. Which IS is applicable for the portable CO_2 Extinguishers for their performance and construction specifications?

(a) IS 2878 (b) IS 15683 (c) IS 9001 (d) None of these

Q.5. Where to locate CO_2 Extinguishers?

(a) At the man gate of premises (b) at the reception
(c) Near to the source of the fire risk (d) All of the above

Section – B

03X02 = 06 Marks

Q.1. When to operate C class type fire extinguisher?

Q.2. What is the meaning of an accident?

Q.3. What do you understand by First-Aid?

Section – C

03X03 = 09 Marks

Q.1. What precautions to be taken for avoiding any electrical fire?

Q.2. How to extinct the fire?

Q.3. What are the four classifications of voltage level?

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

School of HVAC & R Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 3rd Semester,
1st In-Sem. Examination

Course Code: HVA 1305 **Time: 1 Hour**
Course Name: Electrical and Electronics Safety Testing **Max. Marks: 20**

Section – A

05X01 = 05 Marks

Q.1. Which agents are used for electrical fire quenching?

(a) CO_2 (b) NO_2 (c) SO_2 (d) All of these

Ans. (a)

Q.2. A person qualified to perform electrical work must possess: -

(a) Skills/techniques to distinguish live parts from other parts of electrical equipment.
(b) Skills and techniques to determine the nominal voltage of exposed live parts.
(c) Knowledge on the use of PPE, insulating and shielding materials, and insulated tools.
(d) All of the above.

Ans. (d)

Q.3. During the first-aid burns should be treated by: -

(a) By dressing the burns (b) Covering the burns to exclude air
(c) Both a and b (d) None of these

Ans. (c)

Q.4. Which IS is applicable for the portable CO_2 Extinguishers for their performance and construction specifications?

(a) IS 2878 (b) IS 15683 (c) IS 9001 (d) None of these

Ans. (a)

Q.5. Where to locate CO_2 Extinguishers?

(a) at the man gate of premises (b) at the reception
(c) near to the source of the fire risk (d) All of the above

Ans. (c)

Section – B

03X02 = 06 Marks

Q.1. When to operate C class type fire extinguisher?

Ans. The C class type fire extinguishers to be used when there is fire in the live electrical equipment.

Q.2. What is the meaning of an accident?

Ans. An unpleasant, unexpected, unforeseen or unintended happening sometimes resulting from negligence that results in injury, loss, damage etc. and is caused by mistake or machine failure or natural disaster or sabotage.

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Q.3. What do you understand by First-Aid?

Ans. First aid is the first and immediate assistance given to any person suffering from either a minor or serious illness or injury, with care provided to preserve life, prevent the condition from worsening, or to promote recovery. First aid is generally performed by someone with basic medical training.

Or

First aid is emergency care given immediately to an injured person. The purpose of first aid is to minimize injury and future disability.

Section – C

03X03 = 09 Marks

Q.1. What precautions to be taken for avoiding any electrical fire?

Ans. Any fire causes immense loss of property and life. Hence, due care should be taken to minimize the risk of fire so that fire does not start. Same is true in case of electrical fire.

If due care is taken while selecting equipment and installation methods, the possibility of electrical fire can be reduced to a very large extent.

Proper Material

Selection of Good Quality and proper material is essential as cheap and low quality material may not have good electrical & mechanical properties.

These can lead to faults. Also, new fire retardant, fire retardant low smoke or Halogen free fire resistant cables, wires are available. These can be used in high density areas. These materials emit lower smoke and also resist the propagation of fire.

Proper Installation Method

All openings in walls, beams, slabs used for carrying electrical systems/ cables/ wires etc. form one area to another must be sealed by fire retardant/ fire resistant material.

This can stop propagation of fire from one area to another. Vertical shafts in buildings must also be sealed at every level.

This stops the smoke from moving up as smoke is a major reason for fatalities in any fire.

Electrical Protection

Restrict electrical faults in the form of over load, short circuit protection, gas operated relays, over voltage protection, proper earthing and surge arrestors, earth leakage relays.

Necessary protections as demanded by IS standards need to be employed at every level right from substation.

Proper selection of switch gear, EF and OC relays, relay settings, proper rating in terms of current carrying capacities & breaking capacities of MCCB's & MCB's exact OC relay ranges for motor feeders, Earth leakage detection devises where ever required should be employed.

All these protections either preempt the tripping before actual disastrous faults or restrict the electrical faults there by restricting damage to equipment and avoid fire.

Elaborate Pre-Commissioning testes of Pre-commissioning testing of entire electrical installation including continuity, insulation resistance.

Insulation strength, physical and functional checks, earthing resistance need to be done properly and as recommended.

Faulty material and installation can be detected prior to commissioning in most cases if proper testing is done. This avoids accidents both electrical & fire.

Q.2. How to extinct the fire?

Ans. By the removal of (i) combustible materials (ii) air (iii) heat and (iv) breaking chain reactions

Q.3. What are the four classifications of voltage level?

Ans. The classifications of voltages is as follows:

i. Low voltage ≤ 250 V
ii. Medium Voltage > 250 V and ≤ 650 V
iii. High Voltage >650 V and ≤ 33000 V
iv. Extra high voltage >33 kV