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# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2024**

**Subject Code:3161910 Date:20-11-2024**

**Subject Name:Applied Thermodynamics**

**Time:02:30 PM TO 05:00 PM Total Marks:70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | Marks |
|---|---|---|---|
| **Q.1** | **(a)** | State and explain Avogadro's law. | **03** |
| | **(b)** | What is the Vander Waal's equation of state? What is the significance of the various constants involved in this equation? What are the limitations? | **04** |
| | **(c)** | Explain the following terms briefly: (i) Dew point temperature (ii) Cooling and Dehumidification (iii) Comfort Air conditioning (iv) Wet bulb temperature (v) Psychrometry (vi) Relative humidity (vii) Dry bulb temperature. | **07** |
| **Q.2** | **(a)** | What is the effect of sub-cooling on the performance of vapour compression refrigeration system? | **03** |
| | **(b)** | Explain with neat sketch about working and construction of the sling psychrometer. | **04** |
| | **(c)** | Define following terms related with engine: (1) Indicated power (2) Brake power (3) Friction power (4) Mechanical efficiency (5) Thermal efficiency (6) Volumetric efficiency (7) Brake specific fuel consumption. | **07** |
| | | **OR** | |
| | **(c)** | Explain with neat sketch, two stage compression system with flash intercooler. | **07** |
| **Q.3** | **(a)** | Explain why the specific heats of gases increase with increases in temperature? | **03** |
| | **(b)** | Explain adiabatic saturation process with neat sketch. | **04** |
| | **(c)** | Mention the limitations of simple vapour compression refrigeration cycle. Briefly explain the working of two stage compression with water intercooler and liquid sub-cooler employed for vapour compression system. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | State the important uses of compressed air for engineering purpose. | **03** |
| | **(b)** | How will you assign number to the refrigerants: dichloro difluoro methane and dichloro tetra fluoro ethane? | **04** |
| | **(c)** | Explain various methods of obtaining friction power and explain any one of them in detail. | **07** |
| **Q.4** | **(a)** | Differentiate compressible and incompressible flow. | **03** |
| | **(b)** | Prove that velocity of a sound wave in a compressible fluid is given by $C = \sqrt{\gamma RT}$. | **04** |
| | **(c)** | Explain with neat sketch the working of a simple ammonia water absorption refrigeration system. | **07** |

**OR**

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| **Q.4** | **(a)** | Give advantages and disadvantages of multistage reciprocating air compressor over Single stage air compressor. | **03** |
| | **(b)** | Explain with a neat sketch the construction and working of a single stage single acting reciprocating air compressor. | **04** |
| | **(c)** | A refrigerating machine working on reversed Carnot cycle consumes 5.5 kW for producing refrigerating effect of 940 kJ/min for maintaining a region at -38°C. Determine:<br>(i)COP of refrigerating machine;<br>(ii)Highest temperature of cycle;<br>(iii)Amount of heat delivered in kJ/min, when this device is used as a heat pump. | **07** |
| **Q.5** | **(a)** | What is the effect of clearance volume on the performance of air compressor? | **03** |
| | **(b)** | How are air compressor classified? | **04** |
| | **(c)** | A two stroke diesel engine was motored when the meter reading was 1.5 kW. Then the test on the engine was carried out for one hour and the following observations were recorded:<br>Brake torque = 120 Nm;<br>Speed = 600 rpm;<br>Fuel used = 2.5 kg;<br>calorific value of fuel = 40.3 MJ/kg;<br>Cooling water used = 818 kg;<br>Rise in temperature of cooling water = 10°C.<br>Exhaust gas temperature = 345°C.<br>Room temperature = 25°C;<br>A/F = 32:1;<br>Determine: (i) bp, (ii) ip, (iii) mechanical efficiency, (iv) indicated thermal efficiency, and (v) Draw heat balance sheet on *minute basis* and also on *percentage basis*. | **07** |

**OR**

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| **Q.5** | **(a)** | What are the major pollutants comes out from the IC engine? | **03** |
| | **(b)** | State the advantages and disadvantages of vapour absorption refrigeration system over vapor compression refrigeration system. | **04** |
| | **(c)** | Explain with schematic diagram of simple vapor compression cycle. Draw the p-h and T-S diagram simple vapor compression cycle. | **07** |

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