P P SAVANI UNIVERSITY

Third Semester of B. Tech. Examination

May 2019

SEME2011 Engineering Thermodynamics

21/05/2019, Tuesday **Time: 09:00 a.m. To 11:30 a.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.
5. Use of Steam stable is allowed.

SECTION – I

Q - 1 **Attempt (Any Five)** **[05]**

(i) Absolute Zero temperature is taken as

a) -273°C b) 273°C c) 237°C d) -373°C

(ii) A gas which obeys kinetic theory perfectly is known as

a) Monoatomic gas b) real gas c) ideal gas d) Perfect gas

(iii) In reversible cycle, the entropy of the system

a) Increases b) decreases c) does not change d) increases and then decreases

(iv) The change of entropy, when heat is absorbed by the gas is

a) Positive b) negative c) cannot say

(v) Bomb calorimeter is used to find the calorific value of_____ fuel.

a) Solid b) Gaseous c) Solid and Gaseous d) none of the above

(vi) What is kelvin plank statement?

(vii) What is Avogadro's law?

Q - 2 (a) What are the similarities and dissimilarities between heat and work? **[05]**

Q - 2 (b) In a steam power plant, 1 kg of water per second is supplied to the boiler. The enthalpy and velocity of water entering the boiler are 800 kj/kg and 5 m/s. The water receives 2200 kj/kg of heat in the boiler at constant pressure. The steam after passing through the turbine comes out with a velocity of 50m/s, and its enthalpy is 2520 kj/kg. The inlet is 4m above the turbine exit. Assuming the heat losses from the boiler and the turbine to the surroundings are 20kj/s, calculate the power developed by the turbine. Consider the boiler and turbine as single system. **[05]**

OR

Q - 2 (a) A Carnot cycle operates between source and sink temperatures of 250°C and -15°C. If the system receives 90 kj from the source, find: 1) Efficiency of the system 2) The network transfers 3) Heat rejected to sink. **[05]**

Q - 2 (b) Reduce the steady flow energy equation for nozzle and steam turbine. **[05]**

Q - 3 (a) Explain concept of PMM and explain the PMM1, PMM2. **[05]**

Q - 3 (b) An iron cube at a temperature of 400°C is dropped into an insulated bath containing 10 kg water at 25°C. The water finally reaches a temperature of 50°C at steady state. Given that the specific heat of water is equal to 4186 j/kg K. Find the entropy changes for the iron cube and the water. Is the process reversible? If so why? **[05]**

OR

Q - 3 (a) Explain the violation of kelvin plank statement by Clausius statement and violation of Clausius statement by kelvin plank statement. **[05]**

Q - 3 (b) Describe Carnot's theorem in detail. **[05]**

Q - 4	**Attempt any one.**	**[05]**
(i)	Obtain the steady flow energy equation for Water turbine and boiler.	
(ii)	Explain the entropy principle with example.	

SECTION – II

Q - 1	**Attempt (Any Five)**	**[05]**
(i)	Rankine cycle efficiency of a good steam power plant may be in the range of a) 15 to 20% b) 35 to 45% c) 70 to 80% d) 90 to 95%	
(ii)	Rankine efficiency of a steam power plant a) Improves in summer as compared to winter b) Improves in winter as compared to summer c) Remain unaffected by climatic condition d) None of above	
(iii)	For a gas turbine the pressure ratio may be in the range a) 2 to 3 b) 3 to 5 c) 16 to 18 d) 18 to 22	
(iv)	Thermal efficiency of closed cycle gas turbine plant increases by a) Reheating b) Regeneration c) Intercooling d) All of the above	
(v)	Define the Cut off ratio.	
(vi)	Define the Compression ratio.	
(vii)	Difference between Universal gas constant and characteristic gas constant.	
Q - 2 (a)	Explain the Rankine cycle with regeneration.	**[05]**
Q - 2 (b)	The minimum pressure and temperature in an Otto cycle are 100kpa and 27°C. The amount of heat added to the air per cycle is 1500 kj/kg. 1) Determine the pressure and temperatures at all points of the air standard Otto cycle. 2) Calculate the efficiency considering compression ratio of 8:1	**[05]**

OR

Q - 2 (a)	Explain Rankine cycle with reheating.	**[05]**
Q - 2 (b)	Explain Vander wall's equation.	**[05]**
Q - 3 (a)	Derive the equation of air standard efficiency of Otto cycle.	**[05]**
Q - 3 (b)	In a steam turbine steam at 20 bars, 360°C is expanded to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assume ideal processes, find per kg of steam the net work and the cycle efficiency.	**[05]**

OR

Q - 3 (a)	Explain the Comparison of the Otto, Diesel and Dual cycle for Same compression ratio.	**[05]**
Q - 3 (b)	A simple Rankine cycle works between pressure 28 bar and 0.06 bar, the initial condition of steam being dry saturated. Calculate the cycle efficiency, work ratio.	**[05]**
Q - 4	**Attempt any one.**	**[05]**
(i)	Differentiate the VCR and VAR refrigeration system.	
(ii)	Explain the important properties of refrigerants.	

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