

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2017

Subject Code: 2140907

Date: 09/11/2017

Subject Name: Applied Thermal and Hydraulic Engineering

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.

- Q.1**
- (a) Give comparison between Impulse and Reaction Turbine. **03**
 - (b) Explain the working of Centrifugal pump with neat diagram. **04**
 - (c) Air enters the compressor of a gas turbine plant operating on Brayton cycle at 101.325 kPa, 27°C. The pressure ratio in the cycle is 6. Calculate the maximum temperature in the cycle and the cycle efficiency. Assume $W_T = 2.5 W_C$, where W_T and W_C are the turbine and compressor work respectively. Take $\gamma = 1.4$. **07**

- Q.2**
- (a) Describe the absolute pressure, atmospheric pressure and gauge pressure. **03**
 - (b) What the advantages and disadvantages of Gas turbine over Steam Turbine? **04**
 - (c) In a steam turbine steam at 20 bar, 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. Find the net work per kg of steam and cycle efficiency. **07**

OR

- (c) A pipe is having diameters 40 cm and 20 cm at the cross sections 1 and 2 respectively through which water is flowing. The velocity of water at section 1 is 5 m/s. determine the velocity head at section 1 and 2. Also find the mass flow rate of water in pipe. **07**
- Q.3**
- (a) Define: (i) Thermal conductivity (ii) Ton of refrigeration (iii) Emissive power **03**
 - (b) What is draft tube? List the functions of draft tube. **04**
 - (c) A thick walled tube of stainless steel with 20 mm inner diameter and 40mm outer diameter is covered with a 30-mm layer of asbestos insulation ($k = 0.2 \text{ W/m}^\circ\text{C}$). If the inside wall temperature of the pipe is maintained at 600°C and the outside insulation at 1000°C, calculate the heat loss per meter of length. **07**

OR

- Q.3**
- (a) Write the applications of Gas Turbines. **03**
 - (b) Explain Bell Coleman Cycle. **04**
 - (c) A jet strikes the buckets of a Pelton wheel, which is having shaft power as 7000 KW. The diameter of jet is 200 mm. If the net head on the turbine is 400 m, find the overall efficiency of the turbine. Take $C_v = 1.0$ **07**

- Q.4**
- (a) Compare natural and forced convection. **03**
 - (b) Write a short note on “Bourdon Tube Pressure Gauge”. **04**
 - (c) Derive LMTD for parallel flow heat exchanger. **07**

OR

Q.4	(a) List the applications of fins.	03
	(b) Define: (i) specific weight (ii) Viscosity (iii) Surface tension (iv) Capillary rise.	04
	(c) In a counter flow double pipe heat exchanger, water is heated from 25°C to 65°C by an oil with a specific heat of 1.45 KJ/kg K and mass flow rate of 0.9 kg/s. The oil is cooled from 230°C to 160°C. If the overall heat transfer coefficient is 420 W/m ² , calculate the following, (i) the rate of heat transfer (ii) mass flow rate of water (iii) surface area of heat exchanger.	07
Q.5	(a) Explain Kirchhoff's law.	03
	(b) Plot T-S and h-S diagram for a reheat cycle.	04
	(c) State different heads and efficiencies of the turbine.	07
OR		
Q.5	(a) Classify Heat Exchangers.	03
	(b) Differentiate between notches and weirs. List the types of notches.	04
	(c) A centrifugal pump delivers oil at the rate of 120 litres/sec against a pressure of 0.6MPa. Calculate the power required to drive the pump when the overall efficiency of the pump is 70%. Assume specific gravity of oil is 0.85.	07
