

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2018

Subject Code:2140907

Date:22/11/2018

Subject Name:Applied Thermal and Hydraulic Engineering

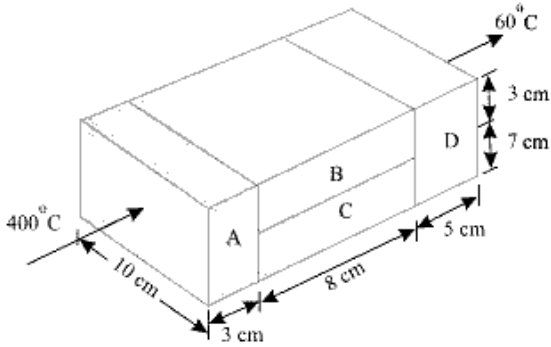
Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- 4. Use of steam tables is permitted.

		MARKS
Q.1	(a) Name and explain briefly the various modes of Heat Transfer.	03
	(b) Enlist various devices used to measure pressure of the fluid. With neat sketch explain working and construction of Bourdon tube pressure gauge.	04
	(c) With neat sketch explain Rankine cycle for thermal power plant. Plot the same cycle on T-s and h-s diagram also.	07
Q.2	(a) Enlist the different methods of improving efficiency of Brayton cycle and explain any one in detail.	03
	(b) What is Draft Tube? Why it is used in Reaction Turbine?	04
	(c) Find the heat flow rate through the composite wall as shown in figure. (assume one dimensional flow)	07
	$k_A = 150 \text{ W/m}^\circ\text{C}$	
	$k_B = 30 \text{ W/m}^\circ\text{C}$	
	$k_C = 65 \text{ W/m}^\circ\text{C}$	
	$k_D = 50 \text{ W/m}^\circ\text{C}$	



OR

(c)	A steam Pipe of outer diameter 120 mm is covered with two layers of lagging, inside layer 45 mm thick ($k = 0.08 \text{ W/m}^\circ\text{C}$) and outside layer 30 mm thick ($k = 0.12 \text{ W/m}^\circ\text{C}$). The pipe conveys steam at temperature 262.4°C . The outside temperature of lagging is 25°C . if the steam pipe length is 30 m long, determine	07
	(i) Heat loss per hour	
	(ii) Interface temperature of lagging.	
	The thermal resistance of steam pipe can be neglected.	
Q.3	(a) Explain Fins and their application.	03
	(b) With neat sketch, explain working of venturimeter for flow measurement.	04

	(c)	What are the factors decide whether Kaplan, Francis or Pelton type turbine would be used in a hydroelectric project?	07
		OR	
Q.3	(a)	Define Heat, Heat Transfer and Thermodynamics.	03
	(b)	Define the Specific Speed of Turbine and derive an expression for the same.	04
	(c)	A steam power plant working on Rankine Cycle has range of operation from 40 bar dry saturated to 0.05 bar. Determine:	07
		(i) Cycle efficiency	
		(ii) Work ratio	
		(iii) Specific Steam Consumption.	
Q.4	(a)	What is Cavitation?	03
	(b)	What is the Concept of Black Body? Define Emissivity& Kirchhoff's Law for radiation.	04
	(c)	In a constant pressure open cycle gas turbine air enters the compressor at 1 bar and 18°C where it is compressed to a pressure ratio of 6. The gases enters the gas turbine at 730 °C and expands to original pressure. Calculate the work ratio and the thermal efficiency when a gas turbine plant operates on a Brayton cycle. Assume, $\gamma = 1.4$, $C_p = 1.0 \text{ kJ/kg K}$ for air and $\gamma = 1.3$, $C_p = 1.1 \text{ kJ/kg K}$ for gases. Neglect the mass of fuel.	07
		OR	
Q.4	(a)	Draw inlet and outlet Velocity triangles for any Reaction turbine. Indicates various velocities with its direction.	03
	(b)	Calculate the critical radius of insulation for asbestos ($k = 0.172 \text{ W/mK}$) surrounding a pipe and exposed to room air at 3300 K with $h = 2.8 \text{ W/m}^2\text{K}$. Calculate the heat loss from a 475 K, 60 mm diameter pipe covered with the critical radius of insulation and without insulation.	04
	(c)	Explain the working of a simple air cooling system used for aircraft.	07
Q.5	(a)	Explain Multistage Centrifugal Pumps.	03
	(b)	Give comparison between open cycle and closed cycle gas turbines	04
	(c)	Derive expression for LMTD for Counter flow heat Exchanger.	07
		OR	
Q.5	(a)	State and prove Bernoulli's equation.	03
	(b)	Explain simple vapour compression refrigeration system with neat sketch.	04
	(c)	The flow rates of hot and cold water streams running through a parallel flow heat exchanger are 0.2 kg/s and 0.5 kg/s respectively. The inlet temperatures on the hot and cold side are 75°C and 20°C. the exit temperature of hot water is 45°C. If the individual heat transfer coefficient on both sides are 650 $\text{W/m}^2\text{°C}$, calculate the area of the heat exchanger.	07
