

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV(New) • EXAMINATION – WINTER 2016

Subject Code:2140907

Date:18/11/2016

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 table is permitted.

Q.1 Short Questions (14)

- 1 Draw the P-v diagram of Rankine Cycle when steam coming out from the boiler is dry and pump work is neglected.
- 2 Define effectiveness of regenerator.
- 3 Define coefficient of performance for Refrigeration.
- 4 Define thermal conductivity.
- 5 Enlist different applications of fins.
- 6 Draw the temperature distribution for evaporator.
- 7 Define dynamic viscosity.
- 8 Enlist different types of fluid flows.
- 9 Write advantages of triangular notch over rectangular notch.
- 10 Define specific speed of a centrifugal pump.
- 11 State the importance of the draft tube.
- 12 Draw the outlet velocity triangle for Pelton turbine.
- 13 Define emissivity.
- 14 Define absolute pressure.

- Q.2**
- (a) Explain any one method of improving thermal efficiency of Rankine cycle in detail. **(03)**
 - (b) How the subject “ATHE” is related to electrical engineering branch. **(04)**
 - (c) Determine Rankine cycle efficiency for a cycle working between pressure limits of 35 bar and 0.30 bar when steam is dry and saturated considering pump work. **(07)**

OR

- (c) State Bernoulli's equation and write assumptions and applications of Bernoulli's equation. **(07)**
- Q.3**
- (a) Plot schematic diagram, p-v and T-s diagram for open cycle gas turbine power plant. **(03)**
 - (b) Enlist the different methods of improving efficiency of Brayton cycle and explain any one in detail. **(04)**
 - (c) A 3 mm diameter and 5 m long electric wire is tightly wrapped with a 2 mm thick plastic cover (thermal conductivity is $k = 0.15 \text{ W/m} \cdot ^\circ\text{C}$). Electrical measurements indicate that a current of 10 A passes through the wire and there is a voltage drop of 8 V along the wire. If the **(07)**

insulated wire is exposed to a medium at $T_{\infty} = 30^{\circ}\text{C}$ with a heat transfer coefficient of $h = 12 \text{ W/m}^2 \cdot ^{\circ}\text{C}$, determine the temperature at the interface of the wire and the plastic cover in steady operation. Also determine whether doubling the thickness of the plastic cover will increase or decrease this interface temperature.

OR

- Q.3** (a) Explain in brief about various modes of heat transfer (03)
 (b) Draw the neat and labeled sketch of vapour compression refrigeration cycle with T-S and P-h diagram. (04)
 (c) Classify Francis Turbine. With neat sketch explain working and construction of Francis Turbine (07)

- Q.4** (a) Give broad classification of notches and weirs (03)
 (b) Explain in brief about thermal contact resistance. (04)
 (c) A hydraulic turbine is to operate under a head of 20 m at 140 rpm. The discharge is $5 \text{ m}^3/\text{sec}$. If efficiency of turbine is 85 %, determine (1) power generated by the turbine, (2) specific speed of turbine and (3) type of turbine. (07)

OR

- Q.4** (a) Explain different efficiencies related to centrifugal pump. (03)
 (b) Define (1) Surface Tension, (2) capillarity, (3) gauge pressure and (4) fluid. (04)
 (c) Explain the working of a simple air cooling system used for aircraft. (07)

- Q.5** (a) Explain cavitation in detail. (03)
 (b) Explain the concept of overall heat transfer coefficient. (04)
 (c) A rectangular notch has a discharge of $20 \text{ m}^3/\text{min}$, when the head of water is half the length (width) of notch. Find the length of notch. Assume coefficient of discharge = 0.60 (07)

OR

- Q.5** (a) Derive the equation to measure the quantity of water flowing through a venturimeter. (03)
 (b) Write short note on classification of centrifugal pump. (04)
 (c) Derive the equation for logarithmic mean temperature difference for single pass counter flow heat exchanger. (07)
