Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2161407 **Date:17/05/2016**

Subject Name: Food Plant Utilities & Sanitation

Time: 10:30 AM to 01:00 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)** Define boiler and enumerate the main components of a water tube boiler. Explain the following: **07**

i. Steam traps
ii. Economizer
iii. Non-IBR boilers
iv. Attemperators

(b) Define boiler efficiency and state the factors affecting it. In a boiler performance test, 1350 kg of bituminous coal was consumed in 24 hours generating 13500 kg dry saturated steam at mean absolute pressure of 7 bar. If the CV of the coal is 32 MJ/kg and the feed water temperature is maintained uniform at 27 ^{o}C, calculate the following: **07**

(i) Equivalent evaporation in kg per kg fuel.
(ii) Boiler efficiency.

Given: h_g(7 bar) = 2667 kJ/kg, h_f (27 ^{o}C) = 145 kJ/kg, h_{fg} (100 ^{o}C) = 2257kJ/kg

Q.2 **(a)** Define draught and state its objectives in a boiler. A chimney of 16 m height is used for providing natural draft to a boiler exhaust. If the chimney is operating under maximum discharge condition at flue gas and ambient air temperatures of 360 ^{o}C and 21 ^{o}C respectively, calculate the following: **07**

a. The draught produced in mm WC.
b. The hot gas column height in meter that would yield the requisite draught.
c. The air supplied in kg per kg of fuel.

(b) What are the laws of air movement? State at least 10 applications of compressed air in food industry. A single stage reciprocating air compressor operating at 300 RPM discharges 160 m^3 free air per minute. The air is compressed through a compression ratio of 1:8 and the clearance volume is 1/16th of the swept volume. Calculate the diameter and stroke of the compressor. Take L/D =1.5 and n =1.3. **07**

OR

(b) Draw and explain P-V diagram of an actual reciprocating air compressor. An inert gas is compressed in a reciprocating compressor from 1 bar to 6 bar. The FAD is 14 dm^3/s at a crank speed of 360 RPM. Calculate the swept volume and the volumetric efficiency. Take n=1.2 and c = 0.05. **07**

Q.3 **(a)** Draw a typical flow diagram for AC power generation, transmission and distribution. Why is it desirable to transmit long distance power at high voltages? Calculate the 3-phase line current in a wire transmitting 120 MW power at 10 kV. Take power factor as 0.9. **07**

(b) Discuss the basic elements of water supply system for a multi-product food processing plant? **03**

(c) Differentiate between cleaning and sanitation. Define CIP and COP with an example each. What are the desirable properties of a good cleaner? **04**

OR

Q.3 **(a)** What are the elements of a power distribution system? Explain the following: **07**

(i) Unit Auxiliary Transformer
(ii) Electric Grid
(iii) OCB
(iv) Power Factor

(b) Water is to be supplied to a township through a pipe line at a peak demand of 2.25×10^7 LPD against a total discharge head of 63m. If the demand has to be supplied in 8 hours, calculate the size of main and the BHP of the pump required. Take velocity in pipeline = 2.5 m/s and pump efficiency of 88%. **03**

(c) Explain the following briefly: **04**

(i) Sterilization
(ii) Disinfection
(iii) Quaternary Ammonium Compounds.
(iv) Methods of sterilization

Q.4 **(a)** Describe in detail the steps taken for cleaning of food processing machinery. **07**

(b) Define boil corrosion. Explain the need and methods of treatment of boiler feed water. **07**

OR

Q.4 **(a)** Enumerate different types of cleaners and state the properties of any three. **07**

(b) Explain the following: **07**

A. Water softening by cold lime method.
B. Quality attributes of a good detergent.

Q.5 **(a)** Discuss the following: **07**

(i) BOD and COD
(ii) Solid waste stabilization

(b) How is waste water characterized? Explain the physical and key chemical characteristics of waste water generated from a food plant. What is the need to measure waste water properties? **07**

OR

Q.5 **(a)** List methods for biological waste stabilization and mention their advantage over chemical methods. Describe the construction and working of trickling filter or AASP. **07**

(b) Explain the following: **07**

(i) BOD_5 and its measurement
(ii) Anaerobic waste treatment.

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