Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII • EXAMINATION – SUMMER 2014

Subject Code: 181401 Date: 05-06-2014

Subject Name: Food Plant Utilities and 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) Why is steam preferred as an effective medium for heating in food processing applications? State the location and function of the following components in a boiler system: (i) Economizer (ii) Super-heaters (iii) Steam Traps (iv) De-aerators (v) Optimizer (vi) Steam separator (vii) Feed Pump. **07**

A steam pipeline has developed a small hole of 1/8 inch diameter at a joint wherefrom saturated steam at 2 bar is leaking @ 5 kg/h. Estimate the leakage rate of steam from this hole if the steam pressure is increased to 8 bar while the steam remains in saturated state.

(b) Define Cleaning, sanitizing and sterilization. Discuss cleaning process in food processing industry. **07**

Q.2 (a) State water tube boiler design considerations in terms of operating and engineering parameters. A water tube boiler has to be installed with a natural draught chimney which should produce a static draught of 20 mm of WC. Calculate the height of chimney in meter. Given that: Mean temperature of flue gases = 257 ^{o}C, Ambient temperature = 27 ^{o}C, Density of ambient air at NTP = 1.29 kg/m^3, Density of flue gases at NTP = 1.34 kg/m^3. **07**

(b) Explain the laws of air movement. For a FFS packaging machine instrument operation, it is desired to compress 12 cmm of air at 1 bar and 300 K to 7 bar in a single stage single acting reciprocating compressor. Calculate the power required in kW to operate the compressor if the compression is **07**

(i) Polytropic with n = 1.3,
(ii) Isothermal
(iii) Adiabatic with $\gamma = 1.4$

OR

(b) Explain BOD and its measurements. Also explain need of waste water treatment. **07**

Q.3 (a) Identify and explain the critical characteristics of an effluent generated by dairy and soy based products manufacturing plant. A 10% diluted sample of this effluent was subjected to BOD test and the following observations were recorded: **07**

(i) DO of the seed water used for dilution = 3.5 mg/l
(ii) DO of the original effluent sample = 1 mg/l
(iii) DO of the diluted sample after 5-day incubation = 0.6 mg/l

Calculate : (a) BOD_5 of the effluent
(b) Ultimate BOD of the sample
(c) BOD remaining after 10 days. [Take k = 0.14/day]

(b) With the help of a schematic flow diagram explain the water supply system for a 10TPD fruit juice manufacturing plant to meet each of the following requirements: Process water, Boiler feed water, CIP water, De-ionized water, Water for toilets and Irrigation. Predict the nature and amount of effluent generated in such a plant and means to treat it. **04**

(c) What safety and back-up measures would you advise for an electric power supply system being installed for an alcohol processing industry? **03**

OR

Q.3 **(a)** Explain the oxygen demand of effluent represented as BOD_5 and COD? Explain their significance and state the limiting values prior to discharge. Explain in detail the Aerobic –Activated sludge process (AASP) for wastewater stabilization. **07**

(b) Write concise notes on the following: **07**

(i) Synchrophasers (ii) Plant Earthing (iii) Boiler water standards
(iv) Water Chlorination (v) De-mineralized water (vi) Transformers
(vii) Activated carbon filters.

Q.4 **(a)** What is corrosion? Discuss various types of corrosion. **07**

(b) Draw an indicator diagrams (P-V and T-s) of a single stage reciprocating compressor operating under ideal conditions and show that the work done per cycle for polytropic compression process is given by $W = \left(\frac{n}{n-1}\right) P_1 V_1 \left[\left(\frac{V_1}{V_2}\right)^{(1-n)} - 1\right]$. **07**

OR

Q.4 **(a)** List out various methods of BOD reduction in waste water and discuss any two methods. **06**

(b) Answer the followings. **08**

i) Discuss briefly chlorine as a sterilizing agent.
ii) How will you disinfect equipments?
iii) Write the steps for cleaning cycle.
iv) Explain in brief waste water measurement.

Q.5 **(a)** Discuss various methods to inhibit corrosion. **07**

(b) Write short notes (Any Two) **07**

i) Standards for waste water disposal
ii) Oxygen sag curve
iii) CIP system

OR

Q.5 **(a)** Answer any two of the followings. **07**

i) Explain briefly rotary can washing system.
ii) Describe in short cleaning and sterilizing agents.
iii) Explain food plant sanitation.

(b) Discuss water treatment against microbial contamination. Also discuss detergent types and their characteristics. **07**

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