

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VIII EXAMINATION – SUMMER 2016****Subject Code:181401****Date:10/05/2016****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)** List the main components of a water tube boiler system and state the function of each. Explain the following in brief: **07**
- i. IBR Boiler
  - ii. Culinary steam
  - iii. Steam purity
  - iv. Blow-down
  - v. HCV & LCV
  - vi. Types of steam traps
  - vii. Fusible plug
- (b)** Define draught and state its types and objectives. A boiler uses customized coal pellets @ 2000kg/h to generate steam. The temperature of hot flue gases flowing inside the chimney is 375 °C while the ambient temperature is 25 °C. The draught produced by the boiler chimney of 30 m height is 18 mm WC. Calculate the following in steady state conditions: **07**
- i. Air required for combustion of coal in kg per kg of coal.
  - ii. Draught produced in meters of hot gas column.
  - iii. Hot flue gas temperature for maximum discharge.
  - iv. Mass flow rate of the flue gases.
  - v. Velocity of flue gases in if the velocity coefficient is 0.51
  - vi. Diameter of the chimney if the sp. Vol. of hot flue gases is 1.75 m<sup>3</sup>/kg
- Q.2 (a)** Answer the following questions: **07**
- (i) What is SCADA?
  - (ii) Explain the function of earthing.
  - (iii) What fuels are recommended for boilers installed in food processing plants?
  - (iv) How can power factor of an electrical supply system be increased?
  - (v) What are synchro-phasers?
  - (vi) What is the purpose of FUSE in an electrical circuit?
  - (vii) What is SIP?
- (b)** State key operating parameters of air compressors? Define volumetric efficiency of reciprocating compressors and list techniques to improve it. A single acting reciprocating compressor is coupled to an electric motor running at 750 RPM. The bore to stroke dimension is 10 cm and 12 cm respectively. The inlet air is at 1 bar which is compressed polytropically through a compression ratio of 8. Calculate the power required by the motor if the mechanical efficiency of the compressor is 92%. [Take  $\eta_{vol} = 88\%$  & polytropic index,  $n = 1.33$ ] **07**

**OR**

- (b) Draw labelled P-V diagrams of an ideal and actual reciprocating air compressor showing various stages of operation. Explain the operation with the help of this diagram. It is required to compress air @15 m<sup>3</sup>/minute at 1 bar and 310 K to 6 bar by a single acting reciprocating compressor. Calculate the power required if the compression is (i) Adiabatic ( $\gamma = 1.4$ ) (ii) Isothermal. **07**
- Q.3 (a)** List different types of biological process for BOD reduction and explain in detail the operation of Aerobic Activated Sludge Process for waste stabilization. An AASP waste stabilization plant is operating under the following conditions: in **07**
- (i) Influent flow rate = 15,000 m<sup>3</sup>/day
  - (ii) NHRT = 8 hours
  - (iii) MCRT = 10 days
  - (iv) Specific micro-organism yield = 0.55 kg MLVSS/kg BOD<sub>5</sub>
  - (v) Influent BOD<sub>5</sub> = 260 mg/l
  - (vi) Specific micro-organism decay constant =  $k_d = 0.0452/\text{day}$ .
  - (vii) Flow type : Completely mixed
- Calculate the following: (i) MLVSS in kg (ii) Average (F/M) ratio in the reactor. (iii) Minimum concentration of the micro-organisms required in the reactor to make the BOD<sub>5</sub> of the treated effluent zero.
- (b) Explain Any Three of the following with the help of neat diagrams wherever applicable: **07**
- (i) USABP
  - (ii) Diffused aerators
  - (iii) Facultative Ponds
  - (iv) Type of Biological activity in facultative ponds
  - (v) Effect of pH on waste stabilization
- OR**
- Q.3 (a)** Classify waste water characteristics define BOD<sub>5</sub> and COD. A 10% dilution sample of an effluent was subjected to laboratory test and the following data was recorded: **07**
- Dissolved O<sub>2</sub> present in the original effluent = 2.5 mg/l
  - Dissolved O<sub>2</sub> of the seed water = 5 mg/l
  - Dissolved O<sub>2</sub> of diluted sample after 5-days = 0.25 mg/l
  - Specific decay constant,  $k = 0.16/\text{day}$  at 20 °C
- Calculate (i) BOD<sub>5</sub> of the sample in mg/l (ii) Ultimate BOD in mg/l and (iii) BOD remaining after 10-days in mg/l
- (b) Explain the following briefly: **07**
- i. Anaerobic waste stabilization reactors
  - ii. Aerated lagoons
  - iii. Ultimate BOD
  - iv. Plug flow in reactors
  - v. Trickling filters
- Q.4 (a)** Define CIP? Discuss types of CIP methods used in food industry. Work out and explain a CIP system for a small scale pickle processing plant. How will you assess its effectiveness? **07**

- (b) Answer the following: 07
- (i) List factors affecting the efficiency of sanitization?
  - (ii) Explain the working of wet scrubber.
  - (iii) State the process of applying sanitizers.
  - (iv) What are alkaline detergents?
  - (v) State methods of preventing corrosion.
  - (vi) Define rinsing and pre-rinsing.
  - (vii) State the attributes of a good detergent.
- OR**
- Q.4** (a) Explain in detail the rinsing, cleaning, sanitation and sterilization process with reference to any process industry giving examples. 07
- (b) Define corrosion and scaling state its types. List out the types and nature of hazards it poses. Explain the techniques for prevention of corrosion and scale formation in food equipment. 07
- Q.5** (a) Discuss Can cleaning methods, processes and equipment. Explain the construction and working of any one type of can washer with a neat diagram. 07
- (b) Explain the following briefly: 07
- (i) Boil corrosion
  - (ii) Chlorination and its dosage levels
  - (iii) Coating
  - (iv) Potable water
  - (v) Surfactants
  - (vi) Water quality parameters
  - (vii) Centrifugal pumps.
- OR**
- Q.5** (a) Discuss the types, properties and applications of detergents in food processing industry. State the criteria for selection of appropriate detergent? 07
- (b) Explain any seven with examples: 07
- |                              |                    |                                      |
|------------------------------|--------------------|--------------------------------------|
| (i) Cleaning                 | (ii) Sedimentation | (iii) Biological life in waste water |
| (iv) Bio-chemical processing | (v) Sterilizing    | (vi) Bleaching                       |
| (vii) Bio-reactors           | (viii) Sanitizing  | (ix) Process residues                |

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