

Enrolment No. \_\_\_\_\_

## BE - SEMESTER-VI • EXAMINATION – SUMMER • 2014

**Date: 19-05-2014**

**Total Marks: 70****Total Marks: 70**

- 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.**

- 1

OR

- Q.3 (a)** What do you understand by energy and material balance in processing of food products? Explain mass and energy balance in single and multiple effect evaporators with diagram. **07**
- (b)** Describe process hazards and material hazards with suitable examples of food processing industry. Also discuss their preventive safety measures. **07**

- Q.4 (a)** Describe different type of baffles and their dimensional limitations? What is the role of baffles in the process of agitation? **07**
- (b)** Design a pressure vessel head for pressure vessel (Diameter 1900mm and thickness is 6mm) having operating pressure of  $0.40 \pm 0.05 \text{ N/mm}^2$  and temperature of  $72^\circ\text{C}$ . The permissible stress at 30 and  $200^\circ\text{C}$  are 200 and  $144 \text{ N/mm}^2$  respectively. The joint efficiency and joint checking efficiency are 85 and 90 per cent respectively. The desired safety factor is 2. The If required following formula can be used: **07**

$$\begin{aligned} t_{\text{head}} &= C_e D_i \{p/f\}^{0.5} ; & t_{\text{head}} &= \{p R_i W\} / 2f \\ t_{\text{head}} &= p D V / 2f ; & t_{\text{head}} &= p D / 4f ; \\ V &= 0.25 (2 + K^2) ; & W &= 0.25 [3 + \{R_i / R_c\}^{0.5}] \\ \text{Available sheet thickness are:} & & & 5.5, 6, 8 \text{ and } 10 \text{ mm} \end{aligned}$$

OR

- Q.4 (a)** What is meant by BPR and how does it affect the evaporation process? Explain Duhring's rule. What are the various feeding methods in multi effect evaporators with relative advantage of each method? **07**
- (b)** Design the shaft of an agitator, having angular speed of 160 RPM operated by 5HP motor with a impeller of 45 cm. The maximum torque and bending moment on full load are estimated to be 195 and 325 Kg m. The safe permissible shear and tensile stress are 400 and  $600 \text{ kg/cm}^2$ . **07**

- Q.5 (a)** (i) Explain: **03**
1. H U F                      2. Capacity ratio                      and 3. Fouling factor

**04**

- (ii) Design a blower to carry the librated moisture from grain dryer (capacity 6 t) by hot air of  $55^\circ\text{C}$ . The dryer is fed with grains of 24% moisture content (WB) and dried to 14% moisture content (WB) in 6 hours. The density of the air is  $1.1 \text{ kg/m}^3$  and absolute humidity of inlet and outlet air is 0.014 and 0.023 kg water vapor per kg dry air. Maximum pressure drop of 5 cm of water column is observed.
- (b)** Discuss feature and dimensional limitations of turbine agitator. **07**

OR

- Q.5 (a)** With the Buckingham's  $\Pi$  thermo derive the power function of an agitator. What is its significance? **07**
- (b)** Design a pressure vessel to hold 8KL of juice specific gravity of 0.97 operating at maximum pressure of  $0.3 \pm 0.03 \text{ N/mm}^2$ . The safe permissible stress at the operating temperature considering butt joints and its efficiency is  $65 \text{ N/mm}^2$ . The sheets available in the stock are: **07**

|           |                              |
|-----------|------------------------------|
| Length    | Any                          |
| Width     | 1000, 1250, 1500 and 2200 mm |
| Thickness | 5.5, 7, 9 and 10 mm          |

If required use the following:  $V = \pi R_i^2 H$ ;  $t_{\text{vessel}} = p D_i / \{2f - p\}$

\*\*\*\*\*