KERALA AGRICULTURAL UNIVERSITY
B. Tech. (Food Technology) 2024 Admission
III Semester Final Examination – January 2026

FPE 2106 **Heat and Mass Transfer in Food Processing (2+1)** **Marks: 50**
Time: 2 hours

I **Fill in the blanks** **(10x1=10)**

1. During thermal circuit and electrical circuit comparison the Fourier law in thermal circuit compare with ..... law in electrical circuit
2. In a food processing industry, the steam is produced with the help of a .....
3. In natural convection process ..... effect produce natural circulation of fluid
4. Reynolds number is the ratio between.....
5. ..... mechanism for dissolving sugar in milk

State True or False

6. If the effectiveness of fins equal to one indicated that addition of fins to the surface does not affect the heat transfer
7. The energy transfer through radiation requires a medium
8. In oven, fans are used for forced convention to cook food evenly
9. Heat exchangers in the food industry always involve direct contact between the heating/cooling medium and the food product.
10. The refrigeration process is a mass transfer process

II **Write short notes on ANY FIVE of the following** **(5x2=10)**

1. What is thermal conductivity? How the thermal conductivity can be quantified?
2. What is fin efficiency and fin effectiveness?
3. Differentiate forced convection and free convection?
4. Define Prandtl number and Grashof number?
5. Define absorptivity, transmissivity and reflectivity?
6. What is fouling factor and effectiveness of heat exchangers?
7. State Ficks law of diffusion?

III **Answer ANY FIVE of the following** **(5x4=20)**

1. A large window glass 0.5 cm thick (k=0.78W/m K) is exposed to warm air at 25^0C,over its inner surface with convective heat transfer coefficient of 15 W/m^2K.The outside air is at -15^0C with convective heat transfer coefficient of 50W/m^2K.Determine the heat transfer rate and temperature at inner and outer surface of the glass? Take heat transfer area is 1m^2.
2. Write down the factors influencing fin effectiveness?
3. Describe the steps involved in using Heisler charts to find the temperature at the center of a long cylinder after a specific cooling time
4. What is 'Fouling' in heat exchangers? State it causes and how it impacts on Over all Heat transfer coefficient?
5. Discuss the role of mass transfer in the drying of dairy products?
6. State Fourier law of heat conduction? Describe each term associated in the law?
7. Compare the temperature profiles of a slab with uniform heat generation versus non-uniform heat generation ?

IV **Write an essay on ANY ONE of the following** **(1x10=10)**

1. Derive the expression for Log Mean Temperature Difference (LMTD) for a parallel-flow double-pipe heat exchanger. State the necessary assumptions?
2. Using the Buckingham pi theorem, show that for forced convection, the Nusselt number N_u is a function of the Reynolds number R_e and Prandtl number P_r

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