**Q. P. Code: 27702**

**(3 HOURS)** **(MAX. MARKS : 80)**

**Note:**

1. Question No. 1 is compulsory.
2. Attempt any three questions out of remaining five questions.
3. Assume suitable data wherever necessary.
4. Figures to right indicate full marks.

Q.1 Answer the following **( Any four)**

a. How will you define product shelf life? What is the effect of environment and food factor on shelf life of a product? 5

b. Compare active and intelligent packaging. 5

c. Design a thermal process for following food products; 5

i) Cook chilled food with pH > 5

ii) Moist high acid food with pH < 3.7

d. What are the challenges in microwave heating of food? 5

e. How is filling of liquid food done? 5

Q.2 a. How is shelf life of food improved by innovative techniques? 10

b. Derive the permeation rate equation. 10

Q.3 a. An edible oil is packed in a plastic bottle with a diameter of 10 cm and a height of 18 cm. The wall of bottle has a thickness of 2mm and contains an antioxidant of 1500mg/kg. The density of the plastic package material is 980kg/$m^3$. If the antioxidant is readily soluble in edible oil, what would be the maximum concentration of the antioxidant in the edible oil? Edible oil has density of 920 kg/$m^3$. 10

b. To define shelf life, it is necessary to establish a critical limit for each quality index. Explain. Also define subjective and objective quality index. 10

Q.4 a. What is the difference between pasteurization, in-container sterilization and aseptic packaging? 10

b. Why there is a need of study of water activity to determine the shelf life of food? 5

**[TURN OVER]**

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| | c. | How does MAP work? | 5 |
| Q.5 | a. | What are talking labels? | 5 |
| | b. | Discuss the kinetics of food deterioration. | 10 |
| | c. | Thiamin loss in a pasta product follows the first order reaction with rate constant of $1.99 \times 10^{-4}$ $day^{-1}$ at 25°C and activation energy of 129 kJ/mol. How long does it take for the retention of thiamin to reach 75% of the initial content at 25 and 35°C? | 5 |
| Q.6 | | Write a note on any four | |
| | a. | Microbial growth curve | 5 |
| | b. | Permeability coefficient | 5 |
| | c. | D and z value | 5 |
| | d. | Shelf life model of variable oxygen driving force | 5 |
| | e. | Rotary fillers | 5 |

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