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| **Course Code** | **14FP2018/18FP2021/17FP2021** | **Duration** | **3hrs** |
| **Course Name** | **FOOD SAFETY REGULATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Name the ex officio commissioner of food safety of India. | | CO1 | R | 1 |
| 2. | State the legislation enacted by GoI as a central legislation in the year 1954 to prevent adulteration of food. | | CO1 | R | 1 |
| 3. | State the term used for levels set by Codex Alimentarius for various harmful pesticides. | | CO3 | R | 1 |
| 4. | Identify the body that prepares the draft standards in the codex alimentatius setup. | | CO1 | U | 1 |
| 5. | Identify part I and III of the protocol of provisional application of GATT. | | CO3 | R | 1 |
| 6. | Indicate the price at which a person holding stock of grain is asked to sell to Central Government as per ECA (1955). | | CO3 | An | 1 |
| 7. | Define the term that is a measure of how far a given process deviates from perfection. | | CO4 | R | 1 |
| 8. | Indicate FDAs take on GM foods in relation to their non-GM counterparts. | | CO4 | U | 1 |
| 9. | Identify the audit carried out in food plants to evaluate the status of prerequisite programmes followed in the plant. | | CO6 | U | 1 |
| 10. | Describe the BIS standard for packaged natural mineral water. | | CO2 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | State any 3 reason for removal of any member of FSSAI from his office in accordance with the provisions of FSSA, 2006 (Section 8, CH:II ). The reason for removal should be without appeal. | | CO1 | R | 3 |
| 12. | Menachi marks her honey with a grade designation mark that has not been authorized to do so as per AGMARK standards. Point out the imprisonment term and fine levied upon her for the above mentioned infraction. | | CO5 | An | 3 |
| 13. | List the issues that are not covered under the labelling regulation 1139/98 for GMO foods. | | CO2 | R | 3 |
| 14. | State the 3 types of nutritional and health claims that are permitted in France. | | CO2 | R | 3 |
| 15. | Point out the necessary members of a HACCP multi-disciplinary core team. | | CO6 | An | 3 |
| 16. | Define and write the microbial, physical and radiological contaminants in bottled water as presented in Code of Federal Regulation - 110 (b). | | CO4 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the format followed while developing commodity standards as per the procedural manual of Codex Alimentarius Commission. | CO1 | An | 8 |
|  | b. | Describe the mandate of World Trade Organization. | CO1 | R | 4 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the functions of a food analyst. | CO2 | U | 4 |
|  | b. | Present the importance of “Due Diligence”. | CO2 | A | 2 |
|  | c. | Explain the roles and responsibilities of food safety officer. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Express the functions and responsibilities of WHA. | CO1 | U | 8 |
|  | b. | Draw a flow chart with timespan that outlines how a TBT measure becomes permanent standard as part of the TBTs objective of transparency. | CO5 | C | 4 |
|  |  |  |  |  |  |
| 20. | a. | Paraphrase the consumer needs that need to be implemented in labels developed by manufacturers. | CO2 | U | 8 |
|  | b. | Identify and write the license and registration procedure to be followed by FBOs (food business operators) as per FSSA, 2006. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 21. | a. | Summarise the statutory labelling requirements to be followed by manufactures vying to sell products in the UK Market. | CO4 | E | 7 |
|  | b. | Restate the functions and Responsibilities of ICGFI. | CO1 | R | 5 |
|  |  |  |  |  |  |
| 22. | a. | List the 7 principles of HAACP and how they can be implemented practice. | CO6 | U | 8 |
|  | b. | Distinguish between the role of Scientific Panel and Scientific Committees of the Food Safety Standards Authority of India. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 23. | a. | Summarize the 3 types of HACCP plan that can be implemented in a food processing line. Give relevant examples. | CO6 | E | 6 |
|  | b. | Illustrate the application of ISO22000 Food Safety Management system to a cheese manufacturing line. | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Breakdown the FDA requirements for bottled drinking water. | CO4 | An | 6 |
|  | b. | Discuss the BIS requirements for bottled drinking water. | CO5 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the regulations followed in various food industries. |
| CO2 | Define the food labeling patterns. |
| CO3 | Apply the knowledge in food industries. |
| CO4 | Analyze the safety operations involved in food systems. |
| CO5 | Evaluate the steps involved in the process operations in food industries. |
| CO6 | Prepare HACCP standards for food industries. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 14 | 9 | - | 12 | - | - | 35 |
| CO2 | 11 | 12 | 2 | 6 | - | - | 31 |
| CO3 | 2 | - | - | 1 | - | - | 3 |
| CO4 | 4 | 1 | - | 6 | 7 | - | 18 |
| CO5 | - | 6 | 6 | 3 | - | 4 | 19 |
| CO6 | - | 9 | - | 3 | 6 | - | 18 |
|  | | | | | | | **124** |



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| **Course Code** | **18FP2017** | **Duration** | **3hrs** |
| **Course Name** | **REFREGERATION, AIR CONDITIONING AND COLD STORAGE CONSTRUCTION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define “Net Refrigeration Effect” | | CO1 | R | 1 |
| 2. | State the Fourier law of heat conduction. | | CO1 | R | 1 |
| 3. | Write the liquid used as a refrigerant in Lithium Bromide Absorption Refrigeration system. | | CO1 | A | 1 |
| 4. | List ANY TWO secondary refrigerants. | | CO2 | R | 1 |
| 5. | State “Dalton’s law” of partial pressure. | | CO1 | R | 1 |
| 6. | Define COP in a refrigeration system. | | CO1 | R | 1 |
| 7. | List ANY TWO commercially frozen foods. | | CO4 | R | 1 |
| 8. | Expand IQF. | | CO6 | U | 1 |
| 9. | Mention the optimum temperature range for survival of *thermophiles*. | | CO4 | R | 1 |
| 10. | Mention the invasive pathogens in foods. | | CO4 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the four basic processes in a vapor compression refrigeration system. | | CO1 | R | 3 |
| 12. | List the desirable properties of primary refrigerants. | | CO1 | R | 3 |
| 13. | Differentiate between design bid and design build system in project development. | | CO5 | An | 3 |
| 14. | List the various advantages of using food cryogens. | | CO4 | R | 3 |
| 15. | Distinguish between minimum, optimum and maximum growth temperature for microorganisms. | | CO5 | An | 3 |
| 16. | Express the equation for calculation of overall heat transfer. | | CO5 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Briefly explain ANY FOUR controls in a refrigeration system. | CO5 | A | 8 |
|  | b. | Explain Air-cycle refrigeration with a NEAT SKETCH. | CO5 | An | 4 |
|  |  |  |  |  |  |
| 18. | a. | Explain the working of “Intermodal Freight Containers” in logistics. | CO2 | An | 6 |
|  | b. | Explain the usage of small delivery vehicles in cold chain management in food distribution sector. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the requirements for comfort air conditioning. | CO2 | A | 6 |
|  | b. | Explain ANY THREE Psychrometric properties used in the study of air-vapor mixture. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the various components of freezing with help of a graph. | CO4 | An | 8 |
|  | b. | Differentiate between nominal and effective freezing time. | CO4 | An | 4 |
|  |  |  |  |  |  |
| 21. | a. | Assume that you are a process engineer in a freezing plant. How would you apply IQF for chives? Discuss the process with a flowchart. | CO6 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain fluidized bed freezer with a NEAT SKETCH. | CO3 | U | 6 |
|  | b. | Explain the concept of cryogenic freezers in food industry. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the *Baudelot* type surface cooler in the chilling of carbonated drinks with a NEAT diagram. | CO5 | A | 6 |
|  | b. | Explain the advantages of using aluminum, paper and glass as packaging materials for chilled foods. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Briefly explain the various design and operational factors affecting temperature uniformity during transport or logistics. | CO2 | An | 6 |
|  | b. | Explain the different types of traceability in cold chain management in food distribution sector. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Understand refrigeration of food and its operational components |
| CO2 | Gain knowledge on various forms of food refrigeration in plants, stores and logistics. |
| CO3 | Learn advanced food freezing concepts and techniques. |
| CO4 | Study food safety aspects of chilled foods and frozen foods. |
| CO5 | Comprehend cold chain management in food distribution sector. |
| CO6 | Evaluate the cold storage and packaging of frozen perishable products. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 6 | 1 | - | - | - | 17 |
| CO2 | 1 | - | 12 | 12 | - | - | 25 |
| CO3 | - | 6 | 6 | - | - | - | 12 |
| CO4 | 6 | - | - | 12 | - | - | 18 |
| CO5 | - | 9 | 14 | 10 | - | - | 33 |
| CO6 | - | 1 | 6 | 12 | - | - | 19 |
|  | | | | | | | **124** |



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| **Course Code** | **18FP2020** | **Duration** | **3hrs** |
| **Course Name** | **BAKERY, BEVERAGES AND CONFECTIONERY TECHNOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define the term “Gristing”. | | CO1 | R | 1 |
| 2. | Differentiate between primary and secondary level of packaging. | | CO1 | An | 1 |
| 3. | Recall and write any two oxygen absorbers commercially used in bakeries. | | CO1 | R | 1 |
| 4. | List the different types of soluble and insoluble proteins in wheat flour. | | CO1 | R | 1 |
| 5. | Define the term “Massecuite**”.** | | CO3 | R | 1 |
| 6. | Define the term “Bagasse”. | | CO3 | R | 1 |
| 7. | **List the types of yeast used in the beer manufacturing process.** | | CO3 | R | 1 |
| 8. | Define Carbonation. | | CO1 | R | 1 |
| 9. | Describe the composition of cocoa beans. | | CO1 | R | 1 |
| 10. | Define confectionery. | | CO1 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Differentiate between the mechanical oven and the convection oven. | | CO2 | U | 3 |
| 12. | Classify alcoholic beverages. | | CO4 | U | 3 |
| 13. | Summarize the composition of Molasses. | | CO4 | U | 3 |
| 14. | Describe types of sugars. | | CO3 | U | 3 |
| 15. | Differentiate between couverture chocolate and gianduja chocolate. | | CO1 | R | 3 |
| 16. | Classify faults in confectionary, their causes, and prevention techniques. | | CO4 | Ap | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Paraphrase the various methods and importance of testing dough and gluten strength. Illustrate with graphitic sketches wherever necessary. | CO2 | U | 6 |
|  | b. | Describe the different types of biscuit dough. | CO2 | R | 6 |
|  |  |  |  |  |  |
| 18. | a. | Construct a flow chart that depicts the operations involved in the manufacture of cane sugar. Provide technical details of the process. | CO5 | U | 6 |
|  | b. | Summarize the Technology involved in the manufacture of jaggery. | CO5 | Ap | 6 |
|  |  |  |  |  |  |
| 19. | a. | Enumerate the technology used in aerated confectionery, detailing the methods of incorporating air or gas into confectionery products. Discuss how aeration affects texture, taste, and market demand. | CO4 | R | 6 |
|  | b. | Classify packaging materials and explain in detail about Retort Packaging and Modified Atmosphere Packaging. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Summarize the technology and quality aspects involved in the manufacture of soft carbonated beverages. | CO5 | U | 6 |
|  | b. | Describe probiotic and hydrodynamic cavitation assisted beverages. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Describe the process of hard-boiled candy manufacture. | CO6 | U | 6 |
|  | b. | Explain in detail about the chocolate manufacturing process. | CO6 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Summarize the different types of dough mixers. | CO1 | U | 6 |
|  | b. | Explain the manufacturing and quality aspects of beer. | CO4 | Ap | 6 |
|  |  |  |  |  |  |
| 23. | a. | Discuss the classification of wine and the general process of wine manufacture. | CO4 | U | 6 |
|  | b. | Explain the manufacturing and quality aspects of whiskey. | CO4 | Ap | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the techniques involved in cocoa processing. | CO5 | U | 6 |
|  | b. | Explain unit operations involved in toffee manufacturing. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Gain knowledge of the ingredients, process, and machinery involved in bakery, confectionery and beverage technology. |
| CO2 | Understand the factors affecting the quality of baked and confectionery products. |
| CO3 | Apply gained knowledge in manufacturing of new products |
| CO4 | Analyze the process for maintaining and improving the quality of the final product |
| CO5 | Evaluate the steps involved in the process and improve existing technologies or develop newer technologies |
| CO6 | Design and create newer processes and products that are better economically, nutritionally or technologically. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 9 | 6 | - | 1 | - | - | 16 |
| CO2 | 6 | 15 | - | - | - | - | 21 |
| CO3 | 3 | 3 | - | - | - | - | 6 |
| CO4 | 6 | 12 | 15 | - | - | - | 33 |
| CO5 | - | 24 | 6 | - | - | - | 30 |
| CO6 | - | 18 | - | - | - | - | 18 |
|  | | | | | | | **124** |



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| **Course Code** | **18FP2027** | **Duration** | **3hrs** |
| **Course Name** | **FOOD PROCESS EQUIPMENT DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | What is 18:8 steel content? | | CO1 | U | 1 |
| 2. | Deduce an equation for tensile stress. | | CO1 | R | 1 |
| 3. | Identify the head type, which is suitable for high pressure. | | CO2 | R | 1 |
| 4. | Suggest the type of arrangement needed, if the reaction vessel cover is to be opened frequently. | | CO2 | R | 1 |
| 5. | The rated capacity of reaction vessels normally varies between 120 litres to as large as 2000 litres, with the shell diameter varying between 40 cm and 150 cm. Suggest the types of heads used for such vessels. | | CO3 | U | 1 |
| 6. | List the parameters considered for selection of reaction vessel. | | CO3 | R | 1 |
| 7. | List the parameters consider for classification of heat exchanger. | | CO4 | U | 1 |
| 8. | Explain the situation, if the vessel is considered as an autoclave. | | CO4 | R | 1 |
| 9. | What are the main componenets of heat exhanger? | | CO5 | U | 1 |
| 10. | Suggest the turbine agitator for higher discharge velocity. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | A thin cylinder is subjected to internal pressure of 20 MPa, internal cylinder diameter is 1500 mm. if allowable stress is 130 MPa than determine wall thickness. | | CO1 | An | 3 |
| 12. | Design and selection considerations for food processing equipment. | | CO2 | E | 3 |
| 13. | Distinguish between thin and thick pressure vessel. | | CO3 | An | 3 |
| 14. | Draw neat diagram of different coil and channel welded to shell for reaction vessel. | | CO4 | U | 3 |
| 15. | Explain types of joints used for design of storage vessels. | | CO5 | An | 3 |
| 16. | Discuss propeller agitator. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Analyze stress – strain curve for food materials. | CO1 | An | 4 |
|  | b. | Analyze the stress developed in thin pressure vessel. | CO1 | An | 8 |
|  |  |  |  |  |  |
| 18. | a. | Explain the classification of food processing equipment. | CO2 | R | 6 |
|  | b. | Explain the types of corrosion of food processing equipment. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain bracket or lug type support | CO3 | A | 2 |
|  | b. | A thick cylinder has 200 mm inner diameter and 300 mm outer diameter. The internal pressure is 20MPa and external pressure is 5MPa. Find the longitudinal stress, maximum and minimum hoop stress. And also verify σc – σr = constant. | CO3 | E | 10 |
|  |  |  |  |  |  |
| 20. | a. | Explain design of rectangular tank for storage of liquids. | CO4 | An | 6 |
|  | b. | Explain hortospheres or spherical vessels for storage of gases. | CO4 | R | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain jackets and coils used in heating system for reaction vessels with neat diagram. | CO5 | C | 6 |
|  | b. | Explain agitation system for reaction vessels. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Design a reaction vessel shell with half coil. | CO5 | An | 8 |
|  | b. | Explain materials used for the construction of reaction vessel. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Briefly explain calendria type evaporator with neat sketch. | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain tray dryer with neat sketch. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the factors that will affect the design of equipments |
| CO2 | Classify the variables based on various properties |
| CO3 | Interpret the relation between various process variables |
| CO4 | Select the critical variables for the design of equipments |
| CO5 | Develop a conceptual design model |
| CO6 | Assess the validity of the conceptual model |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | - | 1 | 15 | - | - | 17 |
| CO2 | 2 | 8 | - | 7 | - | - | 17 |
| CO3 | 1 | 3 | - | 3 | 10 | - | 17 |
| CO4 | 1 | 4 | 6 | 6 | - | - | 17 |
| CO5 | - | 11 | 6 | 3 | 8 | - | 28 |
| CO6 | - | 4 | 12 | 12 | - | - | 28 |
|  | | | | | | | **124** |



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| **Course Code** | **18FP2030** | **Duration** | **3hrs** |
| **Course Name** | **FOOD ADDITIVES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define food preservatives. | | CO1 | R | 1 |
| 2. | State the role of stabilizers in improving the viscosity of beverages. | | CO3 | R | 1 |
| 3. | Expand NOEL. | | CO3 | R | 1 |
| 4. | List four artificial sweeteners that are commercially available. | | CO3 | R | 1 |
| 5. | Enlist the types of food additives. | | CO3 | R | 1 |
| 6. | Mention the function of chelating agents. | | CO4 | U | 1 |
| 7. | Define taste modifier. | | CO4 | R | 1 |
| 8. | Mention the role of benzoic acid as a food additive. | | CO6 | R | 1 |
| 9. | Give two examples of flavour enhancers. | | CO5 | R | 1 |
| 10. | Mention the role of the anticaking agent. | | CO4 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Differentiate between class I and class II preservatives. | | CO4 | An | 3 |
| 12. | Discuss the limits of usage of sodium benzoate as a preservative in fruit products. | | CO4 | A | 3 |
| 13. | Distinguish between fat mimetics and fat replacers. | | CO5 | An | 3 |
| 14. | Differentiate between emulsifiers and gums. | | CO5 | An | 3 |
| 15. | Write a short note on anti-browning agents. | | CO4 | R | 3 |
| 16. | Elaborate the acidulants used in the food industry. | | CO4 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Classify and discuss the sweeteners based on their calorific value. | CO3 | U | 6 |
|  | b. | Discuss the role of non-nutritive sweeteners in food preservation. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the PFA regulations for food additives. | CO6 | U | 6 |
|  | b. | Elaborate on the use of sulphites as a food preservative. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Discuss the role and application of natural pigments. | CO6 | U | 6 |
|  | b. | Explain the application of chemical preservatives with their permissible limits in the food industry. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the natural antioxidants and their application in food. | CO4 | U | 6 |
|  | b. | Differentiate between the taste modifiers and flavour enhancers with suitable examples. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Discuss the labelling requirements of colouring agents as per FSSAI. | CO6 | An | 6 |
|  | b. | Explain the impact of natural pigments on health. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the mechanism of action of chelating agents with their application in the food industry. | CO4 | U | 6 |
|  | b. | Discuss the preservatives used in the food industry with their permissible limits. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Discuss acidulants and their applications in the food industry. | CO4 | A | 6 |
|  | b. | Discuss the role of cocoa butter as a fat substitute. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the role of sweeteners in the food industry with a suitable example. | CO3 | U | 6 |
|  | b. | Discuss the role and application of emulsifiers in the food industry. | CO5 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Know about importance of additives in maintaining or improving food quality. |
| CO2 | Learn about the development of various instant premixes by addition of preservatives within the permissible limits. |
| CO3 | Understand the applications of food additives and how to study the toxicity of food additives. |
| CO4 | Study the importance of additives in maintaining or improving food quality. |
| CO5 | Identify and design newer products, with better quality using additives which are economical and safe. |
| CO6 | Describe the properties, levels of addition and toxicity data of various food additives. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | - | - | - | - | - | 1 |
| CO2 | - | 6 | 12 | - | - | - | 18 |
| CO3 | 4 | 12 | - | - | - | - | 16 |
| CO4 | 4 | 29 | 9 | 3 | - | - | 45 |
| CO5 | 1 | 6 | - | 18 | - | - | 25 |
| CO6 | 1 | 12 | - | 6 | - | - | 19 |
|  | | | | | | | **124** |



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| **Course Code** | **18FP2031** | **Duration** | **3hrs** |
| **Course Name** | **PLANTATION AND SPICES PRODUCT TECHNOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define coffee hulling process. | | CO1 | R | 1 |
| 2. | Name the commercially growing coffee species. | | CO2 | R | 1 |
| 3. | Identify the temperature employed for pan - frying in green tea. | | CO3 | R | 1 |
| 4. | Name some examples for fermented and non-fermented tea. | | CO4 | R | 1 |
| 5. | Name the equipment used for reducing size of the cocoa cake. | | CO1 | R | 1 |
| 6. | Define panning process in chocolate making. | | CO1 | R | 1 |
| 7. | Define essential oils as per European Pharmacopeia. | | CO5 | R | 1 |
| 8. | Identify the food grade solvents used in solvent extraction process. | | CO3 | U | 1 |
| 9. | Describe the method used to measure the pungency in chilli. | | CO2 | U | 1 |
| 10. | Name the component responsible for pungency in pepper. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Illustrate the process flow chart of wet and dry processing of coffee. | | CO1 | U | 3 |
| 12. | Classify the tea based on level of fermentation with suitable examples. | | CO2 | U | 3 |
| 13. | Illustrate the process flow chart for chocolate manufacturing. | | CO3 | U | 3 |
| 14. | State the principle of supercritical fluid extraction. | | CO5 | U | 3 |
| 15. | Write the manufacturing process of white pepper. | | CO4 | A | 3 |
| 16. | Infer the curing process of vanilla. | | CO1 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate the decaffeination process of green coffee with comparison to water, organic solvents and carbon dioxide. | CO3 | U | 9 |
|  | b. | Describe the cooling process of coffee beans. | CO1 | U | 3 |
|  |  |  |  |  |  |
| 18. | a. | Summarize the production of instant tea with flow chart. | CO2 | U | 8 |
|  | b. | Write the flavor incorporation methods for tea and explain any one method. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Summarize the physical and chemical changes occurring during roasting of cocoa beans. | CO4 | An | 6 |
|  | b. | Explain the conching process with neat diagram. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Elaborate the maceration process of essential oil extraction. | CO5 | A | 7 |
|  | b. | Explain in detail steam distillation with a diagram. | CO5 | U | 5 |
|  |  |  |  |  |  |
| 21. | a. | Describe the cardamom processing and explain the different drying methods. | CO1 | U | 7 |
|  | b. | Interpret the post-harvest processing of turmeric. | CO3 | U | 5 |
|  |  |  |  |  |  |
| 22. | a. | Explain the production methods of instant coffee. | CO6 | U | 6 |
|  | b. | Summarize the steps involved in production of cinnamon quills. | CO6 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Write a short note on cold press extraction of essential oils. | CO6 | A | 7 |
|  | b. | Interpret the sorting machines used for coffee beans. | CO1 | A | 5 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Identify the steps involved in cinnamon processing. | CO2 | U | 6 |
|  | b. | Illustrate the manufacturing process of vanilla extract and list the factors influencing the quality of vanilla extract. | CO5 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the different unit operations and equipments involved in coffee, tea, cocoa and spices processing. |
| CO2 | Understand the quality standards in coffee, tea, cocoa and spices processing industries. |
| CO3 | Apply their knowledge on processing and quality aspects in reducing quality losses and optimization of processing parameters in coffee, tea, cocoa and spices processing industries. |
| CO4 | Analyze the quality of plantation and spices products based on industrial standards. |
| CO5 | Evaluate and point out the appropriate technique for the extraction of spice oil and oleoresin from specific spices. |
| CO6 | Develop functional products based on the functional properties of plantation and spices crops. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 3 | 22 | 5 |  |  |  | 30 |
| CO2 | 1 | 18 |  |  |  |  | 19 |
| CO3 | 1 | 18 | 4 |  |  |  | 23 |
| CO4 | 1 | 3 | 6 |  |  |  | 10 |
| CO5 | 2 | 8 | 7 | 6 |  |  | 23 |
| CO6 |  | 12 | 7 |  |  |  | 19 |
|  | | | | | | | **124** |



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| **Course Code** | **18FP2033** | **Duration** | **3hrs** |
| **Course Name** | **TECHNOLOGY OF MEAT, POULTRY AND FISH** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Indicate the amino acid that is devoid in collagen. | | CO1 | U | 1 |
| 2. | Identify the fungus responsible for green spots in meat. | | CO1 | U | 1 |
| 3. | Indicate the stunning method for pigs. | | CO2 | U | 1 |
| 4. | Point out the scalding temperature for goats. | | CO2 | An | 1 |
| 5. | Indicate permitted levels nitrite and nitrate as a preservative. | | CO3 | U | 1 |
| 6. | Point out recommended storage temperature for frozen meat. | | CO3 | An | 1 |
| 7. | Describe the percentage weight of yolk in total egg. | | CO4 | R | 1 |
| 8. | Identify the protein that binds biotin and makes the vitamin unavailable. | | CO4 | R | 1 |
| 9. | Identify the fat percentage in fatty fishes. | | CO5 | R | 1 |
| 10. | Describe the protein content from fish. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Identify any three features of modern abattoir. | | CO4 | R | 3 |
| 12. | Write a short note on Nutritive value of raw fish. | | CO6 | C | 3 |
| 13. | Comment on preservative action of sodium chloride. | | CO3 | U | 3 |
| 14. | Draw and label the structure of egg. | | CO5 | C | 3 |
| 15. | Categorize muscle proteins based on the structure and function. | | CO1 | A | 3 |
| 16. | Classify sausages based on moisture content. | | CO3 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the post mortem muscle chemistry. | CO1 | U | 6 |
|  | b. | Describe the composition of animal fat and its modifiers. | CO1 | R | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the ante mortem handling and welfare of animals. | CO2 | U | 6 |
|  | b. | Describe the dressing operation of pig. | CO2 | R | 6 |
|  |  |  |  |  |  |
| 19. | a. | Describe the poultry meat processing operations. | CO5 | R | 6 |
|  | b. | Summarize the packaging of poultry products. | CO5 | R | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain intermediate moisture meat products. | CO3 | U | 6 |
|  | b. | Describe principles of HACCP in meat industry. | CO4 | R | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the microbiology of poultry meat. | CO1 | U | 6 |
|  | b. | Describe the process of manufacturing of whole egg powder. | CO5 | R | 6 |
|  |  |  |  |  |  |
| 22. | a. | Describe the process of canning meat. | CO3 | R | 6 |
|  | b. | Explain salient points about meat colour. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the factors responsible for spoilage of poultry meat. | CO5 | U | 6 |
|  | b. | Explain the preparation of fish protein concentrate. | CO6 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the changes during storage in RSW and CSW. | CO6 | U | 6 |
|  | b. | Explain salient points on field refrigeration and icing practice. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Enumerate the composition and role of microorganisms in meat |
| CO2 | Understand the slaughtering, carcass processing methods and equipments used for processing meat |
| CO3 | Apply the technological ideas in preparation of various types of meat products and design of equipments used for processing meat. |
| CO4 | Understand the HACCP and GMP of meat processing |
| CO5 | Evaluate the processing of poultry meat, meat products and egg products |
| CO6 | Predict the role of microorganisms in spoilage, biochemistry, preservation and fishery products |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 6 | 20 | 3 | -- | -- | -- | 29 |
| CO2 | 6 | 7 | -- | 1 | -- | -- | 14 |
| CO3 | 6 | 13 | -- | 1 | -- | -- | 20 |
| CO4 | 11 | -- | -- | -- | -- | -- | 11 |
| CO5 | 20 | 6 | -- | -- | -- | 3 | 26 |
| CO6 | -- | 12 | -- | -- | -- | 3 | 15 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **18FP2037** | **Duration** | **3hrs** |
| **Course Name** | **PROCESS ECONOMICS AND PLANT LAYOUT DESIGN** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | What does Schedule feasibility implies? | | CO1 | R | 1 |
| 2. | What does “I” in PIECES stand for? | | CO1 | R | 1 |
| 3. | Expand ASME. | | CO2 | R | 1 |
| 4. | Convert from Volumetric flowrate to Mass flowrate. | | CO3 | A | 1 |
| 5. | What is the indication of numbers in 18:8 stainless steel? | | CO2 | R | 1 |
| 6. | Expand PRP. | | CO5 | R | 1 |
| 7. | Expand HACCP. | | CO6 | R | 1 |
| 8. | Define capital cost. | | CO5 | R | 1 |
| 9. | Define return on inverstment. | | CO5 | R | 1 |
| 10. | Describe Amortisation. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Mr. X wants to know the amount (in kg) of tomato required for preparing 100 kg of sauce. Calculate the amount of tomato required for sauce. | | CO1 | An | 3 |
| 12. | Briefly outline the importance of deciding the scope of a project. | | CO6 | U | 3 |
| 13. | Mr.YY wishes to set up a fish processing industry in Coimbatore? Can you advise him on the suitability of such a project with due justification? | | CO3 | An | 3 |
| 14. | Differentiate between process and product layout design. | | CO2 | U | 3 |
| 15. | Mr. X wants to buy an evaporator of 1000kg/h capacity. He observed that Mr. Y has an evaporator of 50 kg/h capacity that costs Rs. 8 Lakhs. (bought in 2010). What will the projected cost of the evaporator that Mr. X wants to buy? Given – CEPCI index for 2021 and 2010 are 708 and 550.8 respectively. | | CO5 | An | 3 |
| 16. | Mr. Paisawala, a financial analyst, observed that the venture of XX has yielded 25 crores of total returns in 5 years. His initial investment was 1 crore. Calculate the Rate of return on investment of his venture. | | CO5 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. | a. | Outline the aspects that contribute to deciding the technical feasibility of a project. | CO1 | U | 3 |
|  | b. | Mr. Doodhwala plans to set up an industry manufacturing 100 kg/h of orange marmalade. Calculate the amount of raw materials required as also the process flow diagram for the same? | CO1 | An | 9 |
|  |  |  |  |  |  |
| 18. | a. | Explain in detail about the principles of sanitary design. | CO2 | U | 8 |
|  | b. | BB wants your input on the hygienic design of kettles used for jam manufacture. Design the kettles for jam manufacturing. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Hullu and Co. wants your input on the process of deciding the PRPs for an orange squash manufacturing unit. Can you help them? | CO3 | A | 9 |
|  | b. | Highlight the advantages of a process type layout design | CO3 | U | 3 |
|  |  |  |  |  |  |
| 20. | a. | *Iniya* sweets wants your suggestions on deciding the technical feasibility of starting a Zero calorie beverages venture. Prepare report on technical feasibility. | CO4 | A | 8 |
|  | b. | Write the principles of HACCP. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Mr. A wants to set up an industry manufacturing 100kg/h of mango concentrate. He has a plot measuring 1000 sq.m. Can you help him in designing the layout, based on your understanding of Richard Muther’s SSPL? | CO2 | A | 9 |
|  | b. | List the materials for fabrication of equipments used in food industry. | CO1 | U | 3 |
|  |  |  |  |  |  |
| 22. | a. | Mr. AA wants to set up a milk powder unit of 1000 kg/h capacity. His friend has a similar plant of 250kg/h capacity set up in 2017. Determine the total investment cost. Given – cost of the spray dryer in 2015 of 100 kg / h capacity was 10 Lakhs. Cost of homogenizer of similar capacity – 8 lakhs. Given – CEPCI index for 2021 and 2017 are 708 and 567.5 respectively | CO6 | A | 9 |
|  | b. | List the standards for a fruit squash. | CO3 | R | 3 |
|  |  |  |  |  |  |
| 23. | a. | Mr. YY wants to know the contribution of the following in deciding the product cost. Calculate the following –   1. Labour cost (ii) Utilities (iii) Maintenance and repair | CO5 | A | 9 |
|  | b. | Enlist the CCPs for a bakery unit. | CO5 | An | 3 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Mr. Rupaiyaa wants a clear picture on the cash flow diagram. Can you help him? | CO6 | U | 4 |
|  | b. | Based on the same – can you explain the following –   1. Discounted cash flow (ii) Net present worth | CO6 | A | 8 |

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|  | **COURSE OUTCOMES** |
| CO1 | To gain knowledge on the various factors involved in setting up a Food Processing Industry. |
| CO2 | To understand the process of food plant layout design. |
| CO3 | To apply their knowledge to design projects for setting up a Food Processing Industry. |
| CO4 | To analyse the problems involved in deciding the level of manufacture of a food product |
| CO5 | To evaluate the options involved and decide on the right choice based on the economics of the system |
| CO6 | To develop own industry or plan turn-key projects based on the request from customers |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 6 |  | 12 |  |  | 20 |
| CO2 | 2 | 11 | 13 |  |  |  | 26 |
| CO3 | 3 | 3 | 10 | 3 |  |  | 19 |
| CO4 |  | 4 | 8 |  |  |  | 12 |
| CO5 | 3 |  | 9 | 9 |  |  | 21 |
| CO6 | 1 | 16 | 9 |  |  |  | 26 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **18FP2040** | **Duration** | **3hrs** |
| **Course Name** | **MATERIAL SCIENCE FOR FOOD ENGINEERS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the types of secondary bond. | | CO1 | R | 1 |
| 2. | Define unit cell. | | CO1 | R | 1 |
| 3. | State Poisson’s ratio. | | CO5 | R | 1 |
| 4. | Justify the statement “Strain is dimensionless quantity”. | | CO2 | E | 1 |
| 5. | Define Fatigue. | | CO5 | R | 1 |
| 6. | Write the formula for corrosion rate. | | CO4 | An | 1 |
| 7. | Write a balanced reaction occurring at anode during corrosion of Iron. | | CO4 | E | 1 |
| 8. | Draw a well labeled diagram of corrosion triangle. | | CO4 | C | 1 |
| 9. | Define carbon steel. | | CO3 | R | 1 |
| 10. | Define passivation process. | | CO4 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Correlate your opinion on material science in food processing technology. | | CO2 | An | 3 |
| 12. | Compare carbon steel and stainless steel. | | CO3 | E | 3 |
| 13. | Distinguish between Trans granular and intergranular fracture. | | CO4 | An | 3 |
| 14. | Write a short note on high cycle fatigue. | | CO4 | U | 3 |
| 15. | Distinguish between ductile and brittle material. | | CO3 | An | 3 |
| 16. | State the Bragg’s Law of X- ray diffraction. | | CO6 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Compare Edge dislocation with screw dislocation. | CO1 | E | 6 |
|  | b. | Discuss the formation of ionic bond in sodium chloride crystal. | CO1 | E | 6 |
|  |  |  |  |  |  |
| 18. | a. | A mild steel wire of radius 0.5 mm and length 3m is stretched by a force of 49N. Calculate 1) longitudinal stress, b) longitudinal strain c) elongation produced in the body if Y=2.1x1011 N/m2. g = 9.8 m/s2 | CO4 | E | 6 |
|  | b. | Explain the Stress-strain curve for a material subjected to tensile stress. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Describe the Corrosion mechanism and its prevention. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Summarize the steps involved in ductile fracture with diagram. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the Quenching process. | CO6 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | A metal wire 1m long and of 2mm diameter is stretched by a load of 40 kg. If Y = 7 x 1010 N/m2 for the metal, find the 1) stress, 2) strain, 3) force constant of the material of the wire. | CO5 | An | 6 |
|  | b. | Write a note on primary, secondary and tertiary creep and explain it by appropriate graph. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the types of stresses. | CO3 | A | 6 |
|  | b. | Explain about the Frenkel and Schottky defects. | CO1 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the working principle of X-ray diffraction with neat diagram. | CO5 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Enumerate the fundamentals of various bonds. |
| CO2 | Understand the importance of strength of material. |
| CO3 | Have a knowledge of the imperfections of metals. |
| CO4 | Have a knowledge of alloying and its importance in everyday life. |
| CO5 | Understand the various methods of characterization. |
| CO6 | Examine the application of various techniques. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 6 | - | - | 12 | - | 20 |
| CO2 | - | - | - | 3 | 1 | - | 4 |
| CO3 | 1 | - | 6 | 3 | 3 | - | 13 |
| CO4 | 1 | 33 | - | 10 | 7 | 1 | 52 |
| CO5 | 2 | 12 | - | 6 | - | - | 20 |
| CO6 | - | 12 | - | - | 3 | - | 15 |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20FP1001** | **Duration** | **3hrs** |
| **Course Name** | **BASICS OF MICROBIOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Name the scientist who discovered the penicillin antibiotic. | | CO1 | R | 1 |
| 2. | Expand RFLP. | | CO1 | R | 1 |
| 3. | Mention the complete virus particle. | | CO2 | U | 1 |
| 4. | Name the protein found in bacterial flagella. | | CO2 | U | 1 |
| 5. | Locate the asexual spore found in the sporangium. | | CO3 | R | 1 |
| 6. | Name the photosynthetic organelles of red algae. | | CO3 | U | 1 |
| 7. | Quote an example for mesophiles. | | CO4 | R | 1 |
| 8. | Give an example of fecal odor bacteria. | | CO4 | U | 1 |
| 9. | Expand MTCC. | | CO5 | R | 1 |
| 10. | Give an example of ionizing radiation. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | State the scientific contributions of Louis Pasteur. | | CO1 | R | 3 |
| 12. | Define Prophage. | | CO2 | R | 3 |
| 13. | Write the importance of carpogonium. | | CO3 | A | 3 |
| 14. | Differentiate batch and continuous culture. | | CO4 | U | 3 |
| 15. | List any three functions of acid fast bacteria. | | CO5 | A | 3 |
| 16. | Define filtration with examples. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Define polyphasic taxonomy. Enumerate the phenotypic classification of bacteria. | CO1 | R | 8 |
|  | b. | State the five postulates of Robert Koch. | CO1 | R | 4 |
|  |  |  |  |  |  |
| 18. | a. | With a neat sketch, discuss the replication process of animal viruses in detail. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the lifecycle stages of *Entamoeba histolytica*. | CO3 | U | 8 |
|  | b | Write any four nutritional adaptations of fungi. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | E.coli is grown in a fresh nutrient broth by batch culture method. After 24 hours of incubation, growth characteristics are observed and the curve is plotted. Explain the growth curve pattern with a diagrammatic representation. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Construct a flow chart to enumerate the bacterial load found in spoiled chicken meat. | CO5 | A | 8 |
|  | b. | Write the principle of Gram staining. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | A pure culture has been isolated from a mixed population. Discover a few preservation techniques to preserve the isolated bacterial strains. | CO5 | A | 8 |
|  | b. | Record any two biochemical tests used to identify bacteria. | CO5 | R | 4 |
|  |  |  |  |  |  |
| 23. | a. | Define endospores. Discuss the sporulation of bacteria with a neat diagram. | CO4 | U | 6 |
|  | b. | Illustrate any three cultural characteristics of bacteria on media. | CO4 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Classify disinfectants. Describe their mode of action with suitable examples. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the developments in the discipline of Microbiology and the contributions made by prominent scientists in this field. |
| CO2 | Understand the classification of microorganisms. |
| CO3 | Identify key components and their functions in prokaryotic and eukaryotic microorganisms. |
| CO4 | Point out the bacteriological media and nutritional requirements for the growth of bacteria. |
| CO5 | Recommend the methods used for enumeration, identification and preservation of bacteria. |
| CO6 | Create a sterilization protocol for the control of microorganisms. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 17 | - | - | - | - | - | 17 |
| CO2 | 3 | 14 | - | - | - | - | 17 |
| CO3 | 1 | 9 | 7 | - | - | - | 17 |
| CO4 | 1 | 10 | 18 | - | - | - | 29 |
| CO5 | 5 | - | 23 | - | - | - | 28 |
| CO6 | 3 | 13 | - | - | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20FP2001** | **Duration** | **3hrs** |
| **Course Name** | **FOOD PROCESS CALCULATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Provide dimensions of surface tension. | | CO1 | U | 1 |
| 2. | Calculate the g moles of H in 22 g of H2SO4. | | CO2 | R | 1 |
| 3. | Name the base quantities of Dimensional formula. | | CO1 | R | 1 |
| 4. | Recall the unit of specific gravity. | | CO1 | R | 1 |
| 5. | Define isobaric system. | | CO3 | R | 1 |
| 6. | Write the equation for combined feed ratio. | | CO4 | R | 1 |
| 7. | Define the metric system of measurement. | | CO1 | R | 1 |
| 8. | State Avogadro’s law. | | CO2 | U | 1 |
| 9. | Explain the term “adiabatic system”. | | CO3 | R | 1 |
| 10. | State the law of conservation of mass. | | CO2 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Distinguish between base and derived units with examples. | | CO1 | U | 3 |
| 12. | A solution contains 40g of common salt in 320g of water. The concentration in terms of mass by the mass percentage of the solution. | | CO3 | A | 3 |
| 13. | List the factors that increase the rate of evaporation. | | CO3 | U | 2 |
| 14. | State equations for heat capacity at constant volume and constant pressure. | | CO3 | A | 2 |
| 15. | Water flows into a process through a 2-cm inner diameter pipe at 2.00 m3/h. Calculate the kinetic energy for the system in J/s. | | CO4 | An | 3 |
| 16. | Explain Dalton's law of partial pressure with an illustration. | | CO2 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | The ground nut seeds containing 45% oil and 45% solids are fed to the expeller, and the cake coming out of the expeller is found to contain 80% solids and 5% oil. Find the percentage recovery of oil. | CO3 | An | 6 |
|  | b. | A single effect evaporator is fed with 10,000 kg/hr of weak liquor containing 15% caustic by weight and is concentrated to get thick liquor containing 40% by weight caustic (NaOH).   * Draw a neat Block Diagram for making material balance * Calculate  1. kg/hr of water evaporated 2. kg/hr of thick liquor obtained. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | The waste stream from a nitrating process contains 30% H2SO4, 35% HNO3 and 35% H2O by weight. The acid is to be concentrated to contain 39% H2SO4 and 42% HNO3 by addition of concentrated sulphuric acid containing 98% H2SO4 and concentrated nitric acid containing 72% HNO3 (by weight). Calculate the quantities of three acids to be mixed to get 1000 kg of the desired mixed acid. Provide the block diagram, overall material balance, and individual component balance for H2SO4 and HNO3. | CO3 | An | 8 |
|  | b. | Define purge ratio and provide the equation. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | A dryer is used to dry 100 kg/h wet solids from 20% to 1% moisture (by weight) by hot air. The fresh air containing 0.02 kg water vapour per kg dry air is available at 303K (30C) and 101.325 kPa. Air leaving the dryer is found to contain 0.1 kg water vapour per kg dry air. If the recycle ratio is maintained at 3 kg dry air in the recycle air per kg dry air in the fresh air, calculate the volumetric flow rate of fresh air assuming molecular weight of fresh air to be 28.8. Basis: | CO3 | An | 8 |
|  | b. | An ideal gas at 300 K and 200 kPa is enclosed in a cylinder by a frictionless piston, and the gas slowly forces the piston so that the volume of the gas expands from 0.1 to 0.2 m3. Calculate the work done by the gas on the piston if two different paths are used.  Isobaric  Isothermal | CO4 | An | 4 |
|  |  |  |  |  |  |
| 20. | a. | Provide details on the following   1. recycling 2. draw a block diagram for recycle operation and 3. Reasons for performing recycling operations | CO5 | An | 8 |
|  | b. | Crude oil is pumped at a rate of 15 kg/s from a point 220 m below the ground to 20 m above ground level. Calculate the rate of increase in potential energy. | CO4 | An | 4 |
|  |  |  |  |  |  |
| 21. | a. | The proximate analysis of cow milk shows that it contains 3.85% fat, 3.48% protein, 5.08% lactose (milk sugar) and 0.72% mineral, comprising 13.13% total soluble solids (TSS). To obtain skim milk, the cow milk is centrifuged to separate 80% of the fat initially present. The skim milk is then evaporated to such an extent that its TSS is increased to 30%. Find out the final composition of evaporated milk. Basis can be taken as 100 kg milk. | CO4 | E | 8 |
|  | b. | Differentiate between steady-state and unsteady-state operations. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | A stream of nitrogen flowing a a rate of 100 kmol/h is heated from 303 K (30C) to 373 K (100C). Calculate the heat that should be transferred.  Data: | CO5 | E | 6 |
|  | b. | Explain Hess’s Law of constant heat summation providing an example. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | 1000 kg of a 30% (by weight) solution of acetone in water is contacted with pure methyl isobutyl ketone to extract acetone in a mixer-settler. The operating temperature is 298K (25C). From the settler, the two phases separated are withdrawn separately. Find the quantity of MIBK (methyl isobutyl ketone) that must be fed to the process to reduce the acetone concentration, in the water-rich phase to 5 weight % and also calculate the percentage of acetone in the original feed solution that remains unextracted. | CO5 | E | 8 |
|  | b. | Calculate the heat that must be added to 3 kmol air to heat it from 298K (25C) to 473 K (200C) using the mean molal heat capacity data for air given below: | CO5 | E | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Air has a percentage humidity of 60 at a temperature of 300K (27C) and a pressure of 100 kPa. Calculate the pressure to which air must be compressed at a constant temperature so as to remove 90% of the water present  Data: Vapour pressure of water at 300K (27C) = 3.565 kPa. | CO6 | E | 8 |
|  | b. | The DB and WB temperature on a particular day in Coimbatore are observed to be 308K (35C) and 299 K (26C) respectively. Using the psychrometric chart , find : a) The absolute humidity (H), b)%relative humidity, c) dew point. | CO6 | C | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Identify the compositions of mixtures and solutions. |
| CO2 | Compare the properties of ideal and real gases. |
| CO3 | Calculate material balance for various unit operations. |
| CO4 | Analyze energy balance for unit operations. |
| CO5 | Estimate GHV, NHV and composition of fuels. |
| CO6 | Integrate the properties of air water system. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 3 | 4 |  |  |  |  | 7 |
| CO2 | 1 | 2 | 7 |  |  |  | 10 |
| CO3 | 2 | 2 | 15 | 22 |  |  | 41 |
| CO4 | 1 |  | 6 | 11 | 28 |  | 46 |
| CO5 |  |  |  | 8 | 8 |  | 16 |
| CO6 |  |  |  |  |  | 4 | 4 |
|  | | | | | | | **124** |



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| **Course Code** | **20FP2002** | **Duration** | **3hrs** |
| **Course Name** | **FOOD CHEMISTRY** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Recall the H-O-H angle in water. | | CO1 | R | 1 |
| 2. | Name an example for water – in – oil food system. | | CO1 | R | 1 |
| 3. | Identify and write the disaccharide present in milk. | | CO1 | U | 1 |
| 4. | List the components of invert sugar. | | CO1 | R | 1 |
| 5. | Label the fatty acid coconut oil is rich in. | | CO1 | R | 1 |
| 6. | Expand DHA. | | CO1 | R | 1 |
| 7. | Cite an example for an amino acid with a side chain -NH2 group. | | CO1 | R | 1 |
| 8. | State the function of invertase. | | CO1 | R | 1 |
| 9. | Identify the natural colorant present in Red cabbages. | | CO1 | U | 1 |
| 10. | Oranges are rich in which of the water-soluble vitamins? | | CO1 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Explain briefly about the hydration shell of an isotherm. | | CO3 | U | 3 |
| 12. | Outline the principle of Willstatter’s method of reducing sugar estimation. | | CO2 | U | 3 |
| 13. | Define acid value and illustrate its significance. | | CO2 | A | 3 |
| 14. | Summarize on the film forming properties of proteins. | | CO4 | U | 3 |
| 15. | Illustrate the enzymes used for the following – a. Haze removal in beer. B. Haze removal in a fruit-based beverage. | | CO5 | An | 3 |
| 16. | Explain the oxidation reaction of Vitamin C. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss briefly on the structure of water and ice. | CO1 | U | 6 |
|  | b. | Articulate the relationship between constitutional water and the observed changes in an isotherm. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Summarize the effects of a. electrostatic repulsion and b. steric hindrance towards stabilizing an emulsion. | CO4 | U | 6 |
|  | b. | Explain the characteristic features of a. Ostwald ripening and b Creaming | CO4 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Mr. XX analyses a jam sample and reports the following readings – Reading obtained for Reducing sugar – 22 mL; Reading obtained for total sugars – 20 mL; Reading obtained for standardization of Fehling’s solution –18 mL. Determine the reducing sugar content, sucrose content and total sugar content of the jam sample and comment on the same. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Discuss in detail on the method of manufacture of corn sweetener. | CO2 | U | 9 |
|  | b. | Illustrate the steps involved in the production of caramel from sucrose. | CO3 | A | 3 |
|  |  |  |  |  |  |
| 21. | a. | Deduce the reasons for a soft and white dough being transformed to a dark brown tasty bread during baking. | CO4 | An | 9 |
|  | b. | Illustrate briefly on the β- pleated structure of proteins. | CO4 | U | 3 |
|  |  |  |  |  |  |
| 22. | a. | Outline the principle of interesterification. | CO6 | U | 3 |
|  | b. | YY performs the experiment for Iodine value determination and comes up with the following value – Blank value – 54 ml, Value of the sample – 46 mL. Weight of the sample taken – 1.2 g. If 0.098 N thiosulphate is used for the experiment, determine the Iodine value. Also briefly outline the procedure and make a suitable observation table. Comment on the nature of sample given. | CO2 | An | 9 |
|  |  |  |  |  |  |
| 23. | a. | Explain the reasons for the addition of –   1. Glucose oxidase to egg while manufacturing egg powder 2. Glucose isomerase to maltose syrup 3. Xylanases to multigrain bread 4. Pectinases to tomato puree during powder manufacture. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Deduce reasons for the following –   1. Anthocyanins bleach under acidic conditions. 2. Loss of ascorbic acid when heated. 3. Loss of Thiamine during washing of cut vegetables. 4. Blanching of green vegetables before drying | CO5 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Name and describe the general chemical structures of major components of foods (water, proteins, carbohydrates, and lipids) and selected minor components (vitamins and minerals). |
| CO2 | Understand, plan, perform and analyse a range of chemical investigations with emphasis on food analysis. |
| CO3 | Relate the chemical composition of foods to their functional properties |
| CO4 | Examine a molecular rationalization for the observed physical properties and reactivity of major food components |
| CO5 | Predict how changes in overall composition are likely to change the reactivity of individual food components. |
| CO6 | Evaluate and determine the approaches that may be used to control the reactivity of those food components that are likely to impact the overall quality of finished products. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 7 | 9 |  |  |  |  | 16 |
| CO2 |  | 12 | 3 | 9 |  |  | 24 |
| CO3 |  | 3 | 21 |  |  |  | 24 |
| CO4 |  | 12 | 6 | 9 |  |  | 27 |
| CO5 |  |  |  | 15 |  |  | 15 |
| CO6 |  | 6 | 12 |  |  |  | 18 |
|  | | | | | | | **124** |



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| **Course Code** | **20FP2004** | **Duration** | **3hrs** |
| **Course Name** | **FLUID MECHANICS FOR FOOD PROCESSING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Write the dimension for discharge. | | CO6 | A | 1 |
| 2. | Convert 20 poise to Ns/m2. | | CO1 | U | 1 |
| 3. | State Pascal’s law. | | CO2 | R | 1 |
| 4. | Define the term Buoyancy. | | CO3 | R | 1 |
| 5. | Mention the use of venturi meter. | | CO4 | U | 1 |
| 6. | Find the difference of pressure head (h) when the difference of mercury level in a differential manometer is 100 mm. Take sp.gr of oil = 0.8. | | CO2 | A | 1 |
| 7. | Write the expression for finding Reynold’s number. | | CO4 | A | 1 |
| 8. | List the applications of pipe network system. | | CO4 | An | 1 |
| 9. | Interpret the term Total Gradient Line (T.G.L). | | CO4 | U | 1 |
| 10. | Classify the orifices based on cross sectional area. | | CO5 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | The time period of a pendulum depends upon the Length (L) of the pendulum and acceleration due to gravity (g). Derive an expression for the time period. | | CO6 | C | 3 |
| 12. | Determine the total pressure on a circular plate of diameter 1.5 m which is placed vertically in water in such a way that the centre of plate is 3 m below the free surface of water. Find the position of centre of pressure also. | | CO3 | A | 3 |
| 13. | State Bernoulli’s theorem and list the assumptions made in Bernoulli’s equation. | | CO4 | R | 3 |
| 14. | Find the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. The rate of flow of water through the pipe is 250 litres/s. | | CO4 | U | 3 |
| 15. | Distinguish between major and minor energy losses through pipes. | | CO4 | An | 3 |
| 16. | Define the following i) coefficient of velocity ii) Coefficient of Discharge. | | CO5 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | A differential manometer is connected at two points A and B of two pipes as shown in figure. The pipe A contains a liquid of sp. gr = 1.5, while B contains a liquid of sp.gr = 0.9. The pressures at A and B are 1 and 1.8 kgf/cm2 respectively. Find the difference in mercury level in the differential manometer. | CO2 | A | 7 |
|  | b. | Define capillarity. Calculate the capillary rise in a glass tube of 2.5 mm diameter when immersed vertically in a) water and b) mercury. Take surface tension σ = 0.0725 N/m for water and σ = 0.52 N/m for mercury in contact with air. The specific gravity of mercury is 13.6 and angle of contact = 130°. | CO1 | An | 5 |
|  |  |  |  |  |  |
| 18. | a. | Determine the total pressure and center of pressure on an isosceles triangular plate of base 4m and altitude 4m when it is immersed vertically in an oil of sp.gr.0.9. The base of the plate coincides with the free surface of oil. | CO3 | A | 6 |
|  | b. | The velocity potential function is given by an expression  ɸ = - xy3/3 – x2 + x3y/3 +y2  i. Find the velocity components x and y direction.  ii. Show that ɸ represents a possible case of flow. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Derive an expression for finding rate of flow through venturi meter. | CO4 | C | 7 |
|  | b. | A horizontal venturi meter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 20 cm of mercury. Estimate the rate of flow. Consider Cd = 0.98. | CO4 | E | 5 |
|  |  |  |  |  |  |
| 20. | a. | Derive the Darcy - Weisbach equation for determining head loss due to friction in pipes. | CO4 | C | 7 |
|  | b. | A crude oil of kinematic viscosity 0.4 stoke is flowing through a pipe of diameter 300 mm at the rate of 300 litres/s. Find the head loss due to friction for a length of 50 m of the pipe. | CO4 | A | 5 |
|  |  |  |  |  |  |
| 21. | a. | A main pipe divides into two parallel pipes which again forms one pipe. The length and diameter for the first parallel pipe are 2000 m and 1.0 m respectively, while the length and diameter of second parallel pipe are 2000 m and 0.8 m. Find the rate of flow in each parallel pipe, if total flow in the main is 3.0 m3/s. The coefficient of friction for each parallel pipe is the same and equal to 0.005. | CO4 | E | 8 |
|  | b. | Describe the term water hammer and mention the cases of water hammering. | CO4 | R | 4 |
|  |  |  |  |  |  |
| 22. | a. | Derive an equation for finding total head loss through compound or pipes connected in series. | CO4 | C | 6 |
|  | b. | A stream function is given by Ψ = 7x – 6y. Calculate the velocity components and also magnitude and direction of the resultant velocity at any point. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Define the following i. Froude’s number ii. Euler’s number and iii. Weber’s number. | CO6 | R | 6 |
|  | b. | Describe the simple manometers with a neat sketch. | CO2 | R | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | The head of water over the centre of an orifice of diameter 20 mm is 1 m. The actual discharge through the orifice is 0.85 litre/s. Find the coefficient of discharge. | CO5 | U | 3 |
|  | b. | A rectangular orifice, 1.5 m wide and 1.0 m deep is discharging water from a tank. If the water level in the tank is 3.0 m above the top edge of the orifice, find the discharge through the orifice. Take the co-efficient of discharging for the orifice = 0.6. | CO5 | A | 3 |
|  | c. | A circular tank of diameter 4 m contains water up to a height of 5m. the tank is provided with an orifice of diameter 0.5 m at the bottom. Find the time taken by water i) to fall from 5m to 2m ii) for completely emptying the tank. Consider Cd = 0.6 | CO5 | An | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the various properties of fluids. |
| CO2 | Identify the various methods of pressure measurement. |
| CO3 | Calculate the forces acting on bodies submerged in different positions in liquids. |
| CO4 | Point out the type of flow of fluid and quantify the fluid flow through pipes. |
| CO5 | Measure the quantity of fluid flow. |
| CO6 | Create solutions for problems in dimensional analysis. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 1 | - | 5 | - | - | 6 |
| CO2 | 7 | - | 8 | - | - | - | 15 |
| CO3 | 1 | 12 | 9 | - | - | - | 22 |
| CO4 | 7 | 5 | 6 | 4 | 13 | 20 | 55 |
| CO5 | 3 | 3 | 4 | 6 | - | - | 16 |
| CO6 | 6 | - | 1 | - | - | 3 | 10 |
|  | | | | | | | **124** |



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| **Course Code** | **20FP2006** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED FOOD MICROBIOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Name the heat resistant structures of fungi that are important in processed foods. | | CO1 | R | 1 |
| 2. | Write the causative agent of noble rot disease found in grapes. | | CO1 | U | 1 |
| 3. | Give an example of a synbiotic. | | CO2 | U | 1 |
| 4. | Name a bacterium that contributes flavor in sauerkraut fermentation. | | CO2 | R | 1 |
| 5. | State any two heat stable enzymes that cause spoilage in milk. | | CO3 | R | 1 |
| 6. | Give an example of coliform. | | CO3 | U | 1 |
| 7. | Mention an enteric virus that causes intestinal infection. | | CO4 | U | 1 |
| 8. | Name an antiparasitic agent used to treat amoebiasis. | | CO4 | R | 1 |
| 9. | Give an example of a cryoprotectant. | | CO5 | U | 1 |
| 10. | Identify the optimum pressure applied to inactivate the milk enzymes. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | State the biogenesis theory. | | CO1 | R | 3 |
| 12. | Differentiate between prebiotics and probiotics. | | CO2 | U | 3 |
| 13. | Define water activity. | | CO3 | R | 3 |
| 14. | List any three reasons for Mycotoxicosis. | | CO4 | R | 3 |
| 15. | Define IQF with a diagrammatic representation. | | CO5 | R | 3 |
| 16. | State the principle of DNA hybridization. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Identify a suitable method to examine the microbiological quality of foods. | CO1 | R | 8 |
|  | b. | Describe the source of microorganisms of animal and plant origin.Add a note on control measures. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Define Lactic acid fermentation. Illustrate the process of sauerkraut production with a special mention of the spoilage. | CO2 | U | 6 |
|  | b. | Summarize the production process of any three oriental fermented foods. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Describe the significance of microorganisms in the spoilage of fermented foods. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the source, mode of action, pathogenesis and control measures of *Clostridium botulinum.* | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Articulate the role of any four preservatives used in food preservation. | CO5 | A | 8 |
|  | b. | Write a short note on aseptic packaging. | CO5 | R | 4 |
|  |  |  |  |  |  |
| 22. | a. | Sketch a flow diagram of the production of cultured buttermilk with a special reference to starter cultures. | CO2 | A | 8 |
|  | b. | Write the role of starter cultures of fermented sausage. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Classify Pasteurization. Give a detailed account on the processing of packaged and unpackaged foods. | CO5 | An | 6 |
|  | b. | Explain the sources, characteristics, and applications of irradiation of food. | CO5 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Define Immunoassay. Paraphrase the methods used to identify the foodborne disease causing pathogen. | CO6 | U | 8 |
|  | b. | Distinguish between surface plasmon resonance and fiber optic biosensors. | CO6 | U | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Identify the characteristics, sources and significance of predominant food microorganisms. |
| CO2 | Understand food spoilage by microorganisms and the strategies implemented to prevent spoilage. |
| CO3 | Relate beneficial microorganisms to their role in the fermentation of foods. |
| CO4 | Distinguish thermal and non-thermal modes of preservation of foods. |
| CO5 | Evaluate the food borne pathogens associated with intoxication and infections |
| CO6 | Create food safety protocols. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 12 | 5 | - | - | - | - | 17 |
| CO2 | 1 | 16 | 12 | - | - | - | 29 |
| CO3 | 4 | 13 | - | - | - | - | 17 |
| CO4 | 4 | 13 | - | - | - | - | 17 |
| CO5 | 8 | 1 | 8 | 12 | - | - | 29 |
| CO6 | 7 | 8 | - | \_ | - | - | 15 |
|  | | | | | | | **124** |



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| **Course Code** | **20FP2008** | **Duration** | **3hrs** |
| **Course Name** | **METABOLISM AND NUTRITION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | HMP – Expand. | | CO1 | R | 1 |
| 2. | NAD – Expand. | | CO1 | R | 1 |
| 3. | Can you suggest an example for an unsaturated fatty acid? | | CO4 | R | 1 |
| 4. | Can you tell us the number of acetyl CoA molecules generated during the breakdown of Palmitoyl CoA to Myristyl CoA | | CO4 | U | 1 |
| 5. | Can you give an example for a acidic amino acid? | | CO1 | R | 1 |
| 6. | Can you give an example for a pyrmidine base? | | CO4 | R | 1 |
| 7. | Can you calculate the calorific value of 2g of oil? | | CO2 | A | 1 |
| 8. | Expand – PEN. | | CO2 | R | 1 |
| 9. | Name the enzyme inhibitor found in cotton seed. | | CO5 | R | 1 |
| 10. | Nutrition designed for infants is also called \_\_\_\_\_\_\_\_\_\_. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Outline the steps involved in the formation of fructose-1,6-biphosphate from Glucose – 6-phosphate | | CO3 | U | 3 |
| 12. | Can you briefly explain the structure of Acetyl Coenzyme A? | | CO4 | A | 3 |
| 13. | Outline the steps involved in the conversion of asparagine to oxaloacetate. | | CO2 | U | 3 |
| 14. | Briefly outline the method for determination of Amino acid score of a protein. | | CO5 | U | 3 |
| 15. | Can you differentiate between food supplementation and food fortification? | | CO3 | A | 3 |
| 16. | Can you briefly outline the method of inactivation of urease? | | CO3 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | List the steps involved in the gluconeogenesis. | CO3 | U | 8 |
|  | b. | Discuss briefly on pyro phosphates. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Can you explain Mr. X the reactions involved in the conversion of Palmitoyl CoA to Myristyl CoA? | CO4 | A | 6 |
|  | b. | Discuss the reactions involved in the conversion of citrate to succinate. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | ***Ornithine is generated from citrulline during the ornithine cycle*** – Can you explain? | CO4 | U | 8 |
|  | b. | Outline the steps involved in the synthesis of asparagine. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the steps involved in the oxidation of palmitoyl CoA to Lauryl CoA. | CO4 | U | 6 |
|  | b. | List the steps involved in the synthesis of cholesterol from mevalonic acid. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Briefly outline the steps involved in the breakdown of the following amino acids – a. Arginine b. Tyrosine c. Glutamine | CO4 | U | 3X4 = 12 |
|  |  |  |  |  |  |
| 22. | a. | ***Miss M*** is a 16year old girl. As a dietitian, can you recommend a suitable diet for her healthy living, based on the nutritional requirements? | CO3 | A | 6 |
|  | b. | M/s. ***Healtho*** – a company involved in formulating health mix is seeking your help in labelling their product. Can you help them? | CO3 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Can you briefly explain about ***My pyramid***? | CO5 | U | 6 |
|  | b. | Can you brief ***Mr Y***. on the following – a. Cyanogens b. Phytoallexins? | CO5 | A | 2x3 = 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | ***M/s. Infanto*** seeks your help in developing a premix for persons who are above 60 years of age. Can you help them in formulating the mix, highlighting the importance of each of the raw materials you want to suggest? | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the structure of ATP and the major class of macromolecules to which ATP belongs. |
| CO2 | Describe the biochemistry process, basic concept of human nutrition and the relationship of the consumption of foods to nutritional status and health |
| CO3 | Apply their knowledge in food biochemistry and nutrition in designing new range of products with improved nutritional characteristics (Nutraceuticals and functional foods). |
| CO4 | Analyze the stages in catabolism of food molecules and describe what occurs during each stage. |
| CO5 | . Evaluate the biological functions of foods for health in addition to nutritional value |
| CO6 | Formulate specialized nutrition for pediatric, geriatric and sport’s needs. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 3 | 4 |  |  |  |  | 7 |
| CO2 | 1 | 3 | 1 |  |  |  | 5 |
| CO3 |  | 3+4 | 3+3+12 |  |  |  | 25 |
| CO4 | 1+1 | 1+6+8+6+12 | 3+6 |  |  |  | 44 |
| CO5 | 1 | 3+8+6+6 | 6 |  |  |  | 30 |
| CO6 | 1 |  | 12 |  |  |  | 13 |
|  | | | | | | | **124** |



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| **Course Code** | **20FP2010** | **Duration** | **3hrs** |
| **Course Name** | **PROCESS ENGINEERING THERMODYNAMICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | A closed system receives an input heat of 450 kJ and increases the internal energy of the system for 325 kJ. Determine the work done by the system. | | CO1 | A | 1 |
| 2. | Identify the conditions for an isolated system. | | CO1 | U | 1 |
| 3. | Illustrate the function of a nozzle. | | CO2 | A | 1 |
| 4. | Define COP for a heat pump. | | CO2 | R | 1 |
| 5. | State the quality of steam. | | CO3 | R | 1 |
| 6. | Recall triple point in phase diagram. | | CO3 | R | 1 |
| 7. | Define fugacity . | | CO4 | R | 1 |
| 8. | Indicate the driving force involved in chemical equilibria. | | CO4 | U | 1 |
| 9. | Determine the condition of the steam at a temperature of 220°C and enthalpy of 2750 kJ/kg. | | CO5 | A | 1 |
| 10. | Interpret specific humidity. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Conclude work is a path function. | | CO1 | An | 3 |
| 12. | An inventor claims to have developed an efficient heat engine which would have a heat source at 1000°C and reject heat to a sink at 50°C and gives an efficiency of 90%. Justify whether his claim is possible or not. | | CO2 | An | 3 |
| 13. | Define gibbs free energy definition. | | CO3 | U | 3 |
| 14. | State Raoult’s law applicable for ideal solution. | | CO4 | U | 3 |
| 15. | One kg of steam contains 1/3 liquid and 2/3 vapor by volume. The temperature of the steam is 150°C. Find the quality, specific enthalpy of mixture. | | CO5 | A | 3 |
| 16. | Atmospheric air at 1 bar has 25°C dry bulb temperature and 75% relative humidity. Using psychrometric chart, calculate dew point temperature, enthalpy and vapor pressure. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | A certain gas of volume 0.4 m3, pressure of 4.5 bar and temperature of 130°C is heated in a cylinder to 9 bar when the volume remains constant. Calculate i. Temperature at the end of the process ii. The heat transfer iii. Change in internal energy iv. Work done by the gas v. change in enthalpy and vi. Mass of the gas. Assume Cp = 1.005kJ/kg K and Cv = 0.71 kJ/kg K. | CO1 | An | 12 |
|  | | | | | |
| 18. | a. | Explain Joule Thompson porous plug experiment with a neat sketch. | CO1 | A | 10 |
| b. | State zeroth law of thermodynamics. | CO1 | R | 2 |
|  | | | | | |
| 19. | a. | 50 kg/min of air enters the control volume in a steady flow system at 2 bar and 100°C and at an elevation of 100m above the datum. The same mass leaves the control volume at 150m elevation with the pressure of 10 bar and temperature of 300°C. The entrance velocity is 2400 m/min and the exit velocity is 1200 m/min. During the process, 50000 kJ/hr. of heat is transferred to the control volume and the rise in enthalpy is 8kJ/kg. Calculate the power developed. | CO2 | E | 12 |
|  | | | | | |
| 20. | a. | Derive Steady state energy equation and obtain the relation for final velocity for nozzles. | CO2 | A | 9 |
| b. | State Clausius statement for second law of thermodynamics with line diagram. | CO2 | U | 3 |
|  | | | | | |
| 21. | a. | Summarize various equations of state for gases. | CO3 | E | 9 |
| b. | Write the limiting conditions for equations of state. | CO3 | A | 3 |
|  | | | | | |
| 22. | a. | Develop Gibbs Duhem equation from the concept of partial molar properties. | CO4 | A | 12 |
|  | | | | | |
| 23. | a. | Summarize various classification of boilers. | CO5 | U | 8 |
|  | b. | Report internal energy and entropy for wet and dry steam. | CO5 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Indicate the significance of various lines involved in the psychrometric chart with neat sketch. | CO6 | U | 6 |
|  | b. | Dry bulb and wet bulb temperatures of 1 atmospheric air stream are 40°C and 30°C respectively. Determine i. Humidity ratio ii. Relative humidity iii. Specific enthalpy using Psychrometric chart. | CO6 | E | 6 |

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Examine thermodynamic quantities for various systems. |
| CO2 | Explain various laws of thermodynamics related to food processing |
| CO3 | Calculate the properties of pure fluids |
| CO4 | Differentiate the properties of a component in a mixture |
| CO5 | Choose the properties of steam generated for food application |
| CO6 | Integrate the properties of air and water vapor system for food processing |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 2 | 1 | 11 | 15 | --- | --- | 29 |
| CO2 | 1 | 3 | 10 | 3 | 12 | --- | 29 |
| CO3 | 2 | 3 | 3 | --- | 9 | --- | 17 |
| CO4 | 1 | 4 | 12 | --- | --- | --- | 17 |
| CO5 | --- | 8 | 8 | --- | --- | --- | 16 |
| CO6 | --- | 7 | 3 | --- | 6 | --- | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **20FP2011** | **Duration** | **3hrs** |
| **Course Name** | **DAIRY PROCESS ENGINEERING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Indicate the SNF for cow milk. | | CO1 | U | 1 |
| 2. | Name the cleaning agent which is an effective emulsifier and dispersing agent. | | CO5 | R | 1 |
| 3. | Write the full form of MSDS. | | CO5 | U | 1 |
| 4. | Indicate the mean size of fat globule. | | CO1 | R | 1 |
| 5. | Define butter according to FSSAI. | | CO3 | U | 1 |
| 6. | What is the moisture content for hard cheese? | | CO3 | R | 1 |
| 7. | Name any one stabilizer used in ice cream. | | CO4 | R | 1 |
| 8. | Point the starter culture used in Swiss cheese. | | CO5 | R | 1 |
| 9. | Which part of spray drier is called as heart of drier. | | CO5 | R | 1 |
| 10. | What is the pressure range for nanofilteration. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Enlist the common preservatives used in milk. | | CO2 | R | 3 |
| 12. | Indicate the objectives of cleaning. | | CO4 | R | 3 |
| 13. | Mention the steps involved in CIP programme for Cold components. | | CO4 | R | 3 |
| 14. | Write the purpose of cream separation. | | CO5 | C | 3 |
| 15. | Write the characteristics of butter as given by FSSAI. | | CO5 | C | 3 |
| 16. | Mention the methods used to calculate ice cream mixes. | | CO5 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the types and working of can washers. | CO5 | R | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the sequential working of form fill seal machine. | CO5 | R | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe the process of bactofugation. | CO5 | U | 12 |
|  | b. | Explain physicochemical properties of cream. | CO4 | R | 12 |
|  |  |  |  |  |  |
| 20. | a. | Describe the process involved in manufacture of butter. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the process for manufacturing ice cream mix. | CO2 | R | 12 |
|  |  |  |  |  |  |
| 22. | a. | Describe various types of centrifuges. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain process of spray drying along with types of atomizers. | CO4 | R | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe different types of membrane techniques used in dairy industries. | CO3 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Gain knowledge on the physio-chemical properties of milk and milk constituents. |
| CO2 | Understand the various milk processing methods and technologies. |
| CO3 | Apply the knowledge of engineering principles involved in different unit operations in the formulation and processing of milk and milk products. |
| CO4 | Analyze the engineering and technological problems in dairy processing lines reaching substantiated solution or conclusion |
| CO5 | Evaluate the working of dairy equipments used in the dairy plant. |
| CO6 | Design operations and equipments for dairy processing |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 | -- | -- | -- | -- | 2 |
| CO2 | 12 | 12 | -- | -- | -- | -- | 24 |
| CO3 | 1 | 13 | -- | -- | -- | -- | 14 |
| CO4 | 31 | 12 | -- | -- | -- | -- | 43 |
| CO5 | 30 | 14 | -- | -- | -- | 6 | 50 |
| CO6 | -- | -- | -- | -- | -- | -- | -- |
|  | | | | | | | **124** |



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| --- | --- | --- | --- |
| **Course Code** | **20FP2012** | **Duration** | **3hrs** |
| **Course Name** | **UNIT OPERATIONS IN FOOD PROCESSING - I** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Mention the use of grizzly. | | CO1 | R | 1 |
| 2. | Interpret the term effectiveness of screen. | | CO1 | U | 1 |
| 3. | Define Equilibrium Moisture Content. | | CO3 | R | 1 |
| 4. | Propose the name of the dryers used for drying heat sensitive materials. | | CO3 | C | 1 |
| 5. | Write the principle of colloidal mill. | | CO2 | A | 1 |
| 6. | Appraise any two applications of size reduction in food processing. | | CO6 | E | 1 |
| 7. | Name any two filter aid materials used to enhance filtration rate. | | CO2 | R | 1 |
| 8. | Define terminal velocity of a freely falling body in a liquid medium. | | CO4 | R | 1 |
| 9. | Examine the term Sigma factor of centrifuges. | | CO5 | U | 1 |
| 10. | Prioritize the applications of centrifugation in food processing. | | CO5 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | A cyclone separator is used for separating the particles carried away by air during the operation. The density and average diameter of the particle are 1200 kg/m3 and 25µ, which enter into a cyclone of 600 mm diameter at a linear velocity of 20 m/s, calculate the centrifugal force and separation factor of the cyclone. | | CO1 | An | 3 |
| 12. | Determine the equilibrium moisture content of Brinjal seeds at RH = 10% and t = 50ºC using Henderson’s equation where c = 6.5 x 10-6 and n = 1.8. | | CO3 | A | 3 |
| 13. | Show the various types of size reduction with an example. | | CO2 | U | 3 |
| 14. | Explain the theory of filtration. | | CO2 | A | 3 |
| 15. | An emulsion of oil in water has oil droplets in the form of spheres of average diameter of 10µ. The specific gravity of oil is 0.95. Find the raised velocity of oil droplets. | | CO5 | E | 3 |
| 16. | List the applications of mixing in food processing. | | CO2 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Derive a mathematical expression for finding effectiveness of the screen. | CO1 | C | 7 |
|  | b. | During the evaluation of an air screen cleaner with two screens the following observation were made.  The impurities present in feed were 5.5%   1. The impurities present in clean grain were 0.6% 2. The outflow of blower contained 0.2% clean seed 3. The overflow of first screen contained 1% clean seed 4. The underflow contained 0.4% clean seed   Compute the cleaning efficiency of the cleaner. | CO1 | A | 5 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the direct methods of moisture content determination. | CO3 | A | 7 |
|  | b. | Determine the values of c and n from Henderson’s equation for the following data:  (a) RH = 40%, t = 60°C, Me = 8.65%  (b) RH = 80%, t = 60°C, Me = 14.62% | CO3 | E | 5 |
|  |  |  |  |  |  |
| 19. | a. | Categorize the size reduction equipment and explain any three of them with a diagram. | CO4 | An | 7 |
|  | b. | In a sorghum milling experiment it was found that to grind 4.33 mm sized grains to sieve 35 (0.351) mm opening, the power requirement was 8 kW. Calculate the power requirement for milling of sorghum by the same grinder to IS sieve 15 (0.157mm opening) using i. Rittinger’s law and ii. Kick’s law. Feed rate of milling is 200 kg/hr. | CO6 | U | 5 |
|  |  |  |  |  |  |
| 20. | a. | A fruit juice is filtered using a filter press having a cross sectional area of 0.03 m2 under a gauge pressure of 0.02 MN/m2. The solution has a solid content of 10 g/l whose density is 950 kg/m3. The volumes of the filtrate collected with time are as follows:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Time, min | 1.5 | 11 | 21 | 33.33 | 50 | | Volume, liter | 1.2 | 3 | 4.5 | 6 | 7.5 |   Find the specific cake resistance and equivalent cake thickness. | CO2 | E | 8 |
|  | b. | Derive an expression for finding terminal velocity of a particle in a settling tank. | CO6 | C | 4 |
|  |  |  |  |  |  |
| 21. | a. | Develop an equation for finding the radius of the neutral zone in the centrifuge. | CO5 | C | 7 |
|  | b. | A centrifuge is used for separation of a coagulated protein from a solution fed at the rate of 30 lpm. The solids have an average particle size of 100 µ and their density is 1010 kg/m3, while the density of mother liquid is 1000 kg/m3, and viscosity is 1 cp. Calculate the Sigma factor of the centrifuge. | CO2 | An | 5 |
|  |  |  |  |  |  |
| 22. | a. | Describe the construction and working of LSU dryer and Freeze dryer and specify their suitability. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the Isotenoscopic method of EMC determination. | CO4 | An | 6 |
|  | b. | 500 kg of paddy at 22% moisture content (wb) is dried to 14% moisture content (wb) for milling. Calculate the amount of moisture removed in drying using two methods of calculation. | CO3 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | A fortified high protein dough is being made by adding 20% soya flour to Maida flour. The two dry flours are mixed in a ribbon mixer to make the dough. After certain time say 10 min., six samples were collected and analyzed for soya flour, the following are the fractional compositions:  0.2195, 0.22, 0.19, 0.185, 0.205, 0.191.  Calculate mixing index and standard deviation. Find how much time, it needs to be mixed for getting a variance of 1x10-4. | CO6 | E | 8 |
|  | b. | Sketch the various type of agitators used in liquid mixing. | CO6 | U | 4 |

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the applications of mechanical separation in food materials. |
| CO2 | Understand the various unit operations performed in food processing |
| CO3 | Analyze the principle and operation of different types of dryers and understanding the drying of principles. |
| CO4 | Apply knowledge of unit operations into choice of equipments for processing. |
| CO5 | Evaluate the efficiency of equipments used in unit operations of foods. |
| CO6 | Design equipments for screening, grading, drying, size reduction, mechanical separation and mixing of foods. |

|  |  |  |  |  |  |  |  |
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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 1 | 5 | 3 | 0 | 7 | 17 |
| CO2 | 4 | 3 | 4 | 5 | 8 | 0 | 24 |
| CO3 | 1 | 12 | 16 | 0 | 5 | 1 | 35 |
| CO4 | 1 | 0 | 0 | 13 | 0 | 0 | 14 |
| CO5 | 0 | 1 | 0 | 1 | 3 | 7 | 12 |
| CO6 | 0 | 9 | 0 | 0 | 9 | 4 | 22 |
|  | | | | | | | **124** |



|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20FP2014** | **Duration** | **3hrs** |
| **Course Name** | **FRUIT AND VEGETABLE PROCESSING TECHNOLOGY** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Name the type of fruits containing one large pit or seed. | | CO1 | U | 1 |
| 2. | Identify the component that is responsible for Bitterness in carrot. | | CO1 | R | 1 |
| 3. | Point out the percent of Sodium hypochlorite used as sanitizing agent. | | CO2 | An | 1 |
| 4. | State the cause of lethal effect of ozone. | | CO2 | A | 1 |
| 5. | Recall the scientist who invented canning process. | | CO3 | R | 1 |
| 6. | Define the term lye peeling. | | CO3 | R | 1 |
| 7. | List few examples of Dried fruit product. | | CO6 | R | 1 |
| 8. | Mention the TSS of fruit Jelly. | | CO4 | R | 1 |
| 9. | Recall the Moisture content in IMF. | | CO5 | R | 1 |
| 10. | Define the term codex standards. | | CO2 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Classify fruits with the help of suitable examples. | | CO1 | An | 3 |
| 12. | Differentiate between Sanitization and disinfection. | | CO2 | U | 3 |
| 13. | State the definition of Jam and jelly given by FSSAI. | | CO4 | R | 3 |
| 14. | Scum formation in pickles – justify this statement. | | CO3 | E | 3 |
| 15. | Briefly explain the Multitarget preservation. | | CO5 | An | 3 |
| 16. | Differentiate Critical point and critical control point. | | CO5 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the chemical composition of fruits and vegetables. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Recall the different sorting methods used for fruits and vegetables. | CO1 | R | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe the steps involved in canning of fruits and vegetables. | CO3 | R | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain Intermediate moisture foods along with its advantages and disadvantages. | CO3 | U | 6 |
|  | b. | Report on problems in pickle making. | CO3 | C | 6 |
|  |  |  |  |  |  |
| 21. | a. | Indicate the principle of MAP in fruits and vegetables. | CO5 | U | 6 |
|  | b. | Appraise the advantages and disadvantages of MAP. | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | Describe the causes of Post harvest losses of fruits and vegetables | CO1 | R | 8 |
|  | b. | Explain the different layers in Tetra Pak. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the manufacturing process involved in making candied fruits. | CO2 | U | 7 |
|  | b. | Appraise the problems in preparation of candied fruits and preserves. | CO2 | E | 5 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the principle of HACCP. | CO2 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Observe the production status and post-harvest handling methods of fruits and vegetables. |
| CO2 | Understand the methods of processing and preservation of freshly harvested and cut fruits and vegetables. |
| CO3 | Apply their knowledge of unit operations to pick specific heat treatment for processing and preservation of fruits and vegetables. |
| CO4 | Analyze the various production and preservation methods of fruit juices. |
| CO5 | Evaluate the dehydration methods and aseptic technologies used in fruit and vegetable processing. |
| CO6 | Design of driers used for drying fruit and vegetables. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 21 | 13 | - | 3 | - | - | 37 |
| CO2 | 1 | 22 | 1 | 1 | 5 | - | 30 |
| CO3 | 14 | 6 | - | - | 3 | 6 | 29 |
| CO4 | 4 | - | - | - | - | - | 4 |
| CO5 | 1 | 9 | 4 | 3 | 6 | - | 23 |
| CO6 | 1 | - | - | - | - | - | 1 |
|  | | | | | | | **124** |



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| **Course Code** | **20FP2015** | **Duration** | **3hrs** |
| **Course Name** | **FOOD ADDITIVES** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Expand JECFA. | | CO1 | R | 1 |
| 2. | Predict a colorant that is added to cherries. | | CO1 | U | 1 |
| 3. | List out the oral LD50 of Nisin. | | CO3 | R | 1 |
| 4. | Name an exudate that is extracted from the *Astragalus* plant. | | CO2 | R | 1 |
| 5. | Locate a nitrogen source that is used as a yeast nutrient. | | CO2 | R | 1 |
| 6. | Give an example of a natural emulsifier. | | CO4 | U | 1 |
| 7. | Name any two compounds found in Annatto. | | CO4 | R | 1 |
| 8. | Cite an example of a flavor enhancer. | | CO4 | U | 1 |
| 9. | Quote the sweetening agent that is considered an “Arch Criminal” | | CO5 | R | 1 |
| 10. | Name the enzyme involved in the enzymatic browning reaction. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Define GRAS. Mention the regulations explained in 21 CFR 184.1 Sec. | | CO1 | R | 3 |
| 12. | Write any three factors affecting lipid oxidation. | | CO2 | U | 3 |
| 13. | Record any three functions of flour improvers. | | CO2 | A | 3 |
| 14. | Define synthetic colorants with suitable examples. | | CO4 | R | 3 |
| 15. | Report any three ideal requiremenst of sweeteners. | | CO5 | U | 3 |
| 16. | Express the role of nutritional additives. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the methods of estimating dietary intake of food additives. | CO5 | R | 6 |
|  | b. | Differentiate acute and chronic toxicity. Assess the safety of food additives based on animal studies. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Tabulate the chemical properties,specifications, and toxicological data of gums. (Any four) | CO2 | R | 8 |
|  | b. | Write a short note on HLB. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Define flour improvers. Discuss the properties and applications of flour improvers used in bakery products. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Classify flavorings. State the applications and toxicity of flavor enhancers in detail. | CO3 | An | 10 |
|  | b. | Write the types of synthetic food colorants. | CO2 | U | 2 |
|  |  |  |  |  |  |
| 21. | a. | List out any four nutritive sweeteners. Explain the source and role of sweeteners in food products. | CO4 | A | 8 |
|  | b. | Determine the role of fat based fat-replacers. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | Predict the nine steps of product formulation after emulsifier selection. | CO5 | U | 4 |
|  | b. | Illustrate the mechanism of destabilization of emulsions. | CO6 | A | 8 |
|  |  |  |  |  |  |
| 23. | a. | Predict the goals of food additive intake assessment. | CO5 | U | 4 |
|  | b. | Define the following terms: 1. Reference Dose 2. Maximal permissible intake per day. 3. Maximal Permissible level in food.4. Estimated Daily Intake | CO3 | U | 8 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the chemical properties and applications of nutritional additives. (Any three) | CO4 | An | 6 |
|  | b. | Record any four adulterants found in milk. Tabulate the methods of detection. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the importance of additives in maintaining or improving food quality. |
| CO2 | Understand the applications of food additives |
| CO3 | Interpret the toxicity of food additives through NOAEl, ADI and LD 50 values. |
| CO4 | Distinguish the characteristics of additives and their specific use in foods. |
| CO5 | Evaluate the dietary intake of individuals consuming foods with food additives. |
| CO6 | Development of various instant premixes by addition of preservatives within the permissible limits. |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 3 | 7 | - | - | - | - | 10 |
| CO2 | 10 | 8 | 11 | - | - | - | 29 |
| CO3 | 1 | 8 | - | 10 | - | - | 19 |
| CO4 | 4 | 2 | 8 | 6 | - | - | 20 |
| CO5 | 7 | 11 | - | - | - | - | 28 |
| CO6 | 1 | 3 | 14 | - | - | - | 18 |
|  | | | | | | | **124** |



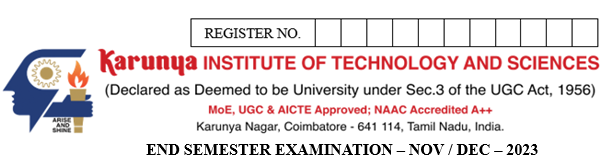
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| --- | --- | --- | --- |
| **Course Code** | **20FP2017** | **Duration** | **3hrs** |
| **Course Name** | **MATERIAL SCIENCE FOR FOOD ENGINEERS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Distinguish between transparent property and translucent property of materials. | | CO5 | U | 1 |
| 2. | Express the mechanism of thermal expansion. | | CO5 | U | 1 |
| 3. | Give two examples for thermo plastics. | | CO6 | An | 1 |
| 4. | Indicate the total number of atoms in a FCC unit cell. | | CO1 | A | 1 |
| 5. | Relate the effect of structural irregularities with fatigue life of materials. | | CO4 | A | 1 |
| 6. | Identify the metallic crystal structure which remain unaltered even at low temperatures and does not fail by cleavage. | | CO1 | U | 1 |
| 7. | Indicate the creep mechanism which is used to explain the creep observed in alloyed elements | | CO5 | U | 1 |
| 8. | Write the reason for the faster rate corrosion under wet condition compared to dry condition. | | CO3 | A | 1 |
| 9. | Indicate the primary crystalline structure in austenite. | | CO6 | U | 1 |
| 10. | Give an example for cold working process. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Compare the properties of thermoplastics with thermosetting plastics. | | CO6 | An | 3 |
| 12. | Distinguish the mechanical properties between FCC and BCC structured materials. | | CO1 | An | 3 |
| 13. | Discuss the mechanism of fatigue failure. | | CO5 | U | 3 |
| 14. | Describe the effect of salt content during wet corrosion. | | CO3 | U | 3 |
| 15. | Distinguish between ferrite and pearlite. | | CO1 | An | 3 |
| 16. | Identify the applications of X-Ray Diffraction analysis | | CO5 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Classify line defects and explain their causes and effects. | CO4 | An | 6 |
|  | b. | Explain Schottky and Frenkel defect in crystals. Identify the key differences between them. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the effect of atomic structure on the property of materials. | CO1 | An | 6 |
|  | b. | Yield strength is considered as more prominent property for ductile materials. Justify. Also compare yield strength with ultimate tensile strength. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. | a. | Write about the different approaches to improve the fatigue life of materials. | CO5 | A | 6 |
|  | b. | Explain the various factors which are affecting fatigue life of materials. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Write about the methods which can prevent creep failure of materials. | CO5 | A | 6 |
|  | b. | Explain the chemistry behind wet corrosion and also explain the preventive methods to control corrosion. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the stages involved in normalization of steel. Also explain the effect of normalization on mechanical properties of steel. | CO6 | A | 6 |
|  | b. | Write about the quenching process of steel highlighting its benefits. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the formation of metallic bond in metallic compounds with a suitable example. | CO1 | A | 6 |
|  | b. | Explain the factors to be considered for selection of material for design of machine elements. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Sketch and explain TTT diagram of eutectoid steel. Summarize its significance during heat treatment giving suitable examples. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the principle, working and applications of NMR Spectroscopy with suitable sketches. | CO5 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

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|  | **COURSE OUTCOMES** |
| CO1 | Enumerate the fundamentals of various bonds in materials. |
| CO2 | Understand the importance of strength of material in choice of material of construction. |
| CO3 | Apply knowledge of alloying and developing alloyed material for food systems. |
| CO4 | Analyze materials to check for imperfections of metals |
| CO5 | Evaluate and characterize metals. |
| CO6 | Design material manufacture techniques to develop materials for specific purposes. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 1 | 7 | 18 | - | - | 26 |
| CO2 | - | - | - | - | 6 | - | 6 |
| CO3 | - | 3 | 7 | - | - | - | 10 |
| CO4 | - | - | 1 | 12 | - | - | 13 |
| CO5 | - | 9 | 24 | 6 | - | - | 39 |
| CO6 | - | 2 | 24 | 4 | - | - | 30 |
|  | | | | | | | **124** |



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| **Course Code** | **20FP2018** | **Duration** | **3hrs** |
| **Course Name** | **HEAT AND MASS TRANSFER** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Write the formula for critical thickness of insulation for cylindrical walls. | | CO1 | A | 1 |
| 2. | State the dimension for the convective resistance. | | CO2 | R | 1 |
| 3. | Name the type of convection created by fans and blowers. | | CO2 | R | 1 |
| 4. | Write the expression for the displacement thickness in the hydrodynamic boundary layer. | | CO1 | A | 1 |
| 5. | Identify the number of dimensionless numbers involved if there are “m” physical quantities and “n” fundamental dimensions in a particular process. | | CO3 | U | 1 |
| 6. | Recall and write the physical significance of the Prandtl number. | | CO3 | R | 1 |
| 7. | Aluminium foil used for cooking food and storage sometimes has one shiny surface and one dull surface. Should the shiny side or the dull side be on the outside when the food is wrapped for baking and freezing respectively? | | CO4 | An | 1 |
| 8. | Reproduce the dimension for the overall heat transfer coefficient. | | CO5 | U | 1 |
| 9. | Define mass transfer flux. | | CO6 | R | 1 |
| 10. | Identify the unit operation suitable for the separation of miscible liquids. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Calculate the rate of heat loss Q, through a wall of red brick [k = 0.70 W/(m·K)] 5 m in length, 4 m in height and 250 mm in thickness, if the wall surfaces are maintained at 373 K (100°C) and 303 K (30 °C) respectively. | | CO1 | A | 3 |
| 12. | Define energy thickness in hydrodynamic boundary layer formation. | | CO2 | R | 3 |
| 13. | Compare natural and forced convection. | | CO3 | An | 3 |
| 14. | State the Kirchhoff’s law of radiation. | | CO4 | R | 3 |
| 15. | 100 kg of milk is cooled from 335 K to 273 K. If the specific heat of milk is 0.93, calculate the amount of heat removed. | | CO5 | A | 3 |
| 16. | Explain eddy diffusion. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Deduce the expression for steady state heat transfer through a hollow cylinder of uniform thermal conductivity. | CO1 | An | 9 |
| b. | Compare optimum and critical thickness of insulation for cylindrical walls. | CO1 | An | 3 |
|  |  |  |  |  |  |
| 18. | a. | Summarize the characteristics of boundary layer thickness and derive the expression for displacement and energy thickness for hydrodynamic boundary layer. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Show that the Nusselt number is the function of Reynolds number and Prandtl number for forced convection using dimensional analysis. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | It is necessary to insulate a flat surface so that the rate of heat loss per unit area of this surface does not exceed 450 W/m2. The temperature difference across the insulating layers is 400 K (127°C). Evaluate the thickness of insulation if (a) the insulation is made of asbestos cement having a thermal conductivity of 0.11 W/(m·K), and (b) the insulation is made of fire clay having a thermal conductivity of 0.84 W/(m·K). | CO1 | A | 6 |
| b. | A steam pipeline, 150/160 mm in diameter, carries steam. The pipeline is lagged with a layer of heat insulating material [k = 0.08 W/(m·K)] of thickness 100 mm. The temperature drops from 392.8 K (119.8°C) to 313 K (40°C) across the insulating surface. Determine the rate of heat loss per 1 m length of the pipeline. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Fruit juice having a specific heat of 3.85 kJ/kg K is being preheated from 5°C to 45°C in a counter flow double pipe heat exchanger. Heating agent is hot water entering at 75°C and leaving at 65°C. The flow of fruit juice is 1.5 kg/s and the area of the heat exchanger is 10 m2. Calculate the overall heat transfer coefficient. | CO5 | E | 6 |
| b. | 1000 kg milk at 80°C having specific heat 3900 J/kg °C is required to be heated to 140°C by injecting saturated steam at 150°C. If the latent heat of steam at 150°C is 2115 kJ/kg and the specific heat of liquid water is 4184 J/kg °C, find the amount of steam required to be injected into the milk. | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | Demonstrate the construction and operation of double pipe heat exchanger and state its advantages and limitations. | CO5 | A | 8 |
| b. | Explain log mean temperature difference for parallel and counter current flow with a neat sketch. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | An orange juice flowing at 0.80 kg/s enters a counter-current double pipe heat exchanger at 20°C and leaves at 72°C. The inlet and outlet temperatures of the hot water used as heating medium in the exchanger are 81°C and 74°C respectively. The specific heat of the orange juice is 3.74 kJ/kg K and overall heat transfer coefficient is 492 W/m2 K. Find the heat transfer area in m2. | CO4 | E | 7 |
| b. | Differentiate filmwise and dropwise condensation. | CO4 | U | 5 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Deduce an expression for steady state equimolar diffusion of gas A through non diffusing gas B. | CO6 | U | 12 |

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Calculate heat transfer rate by conduction through given geometry. |
| CO2 | Evaluate the convective heat transfer coefficient for various flows. |
| CO3 | Understand the role of radiation in heat transfer. |
| CO4 | Assess the overall heat transfer rate in a heat exchanger. |
| CO5 | Apply the principle of evaporation in food processing. |
| CO6 | Relate to the concept of mass transfer in food processing. |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | --- | --- | 11 | 18 | --- | --- | 29 |
| CO2 | 5 | 12 | --- | --- | --- | --- | 17 |
| CO3 | 1 | 13 | --- | 3 | --- | --- | 17 |
| CO4 | 3 | 5 | --- | 1 | 7 | --- | 16 |
| CO5 | --- | 5 | 11 | --- | 12 | --- | 28 |
| CO6 | 2 | 15 | --- | --- | --- | --- | 17 |
|  | | | | | | | **124** |



|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20FP2019** | **Duration** | **3hrs** |
| **Course Name** | **UNIT OPERATIONS IN FOOD PROCESSING - II** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define steam economy. | | CO1 | R | 1 |
| 2. | Name the evaporator used for high viscosity food materials. | | CO1 | U | 1 |
| 3. | Mention the common method used to determine number of plates in distillation unit. | | CO3 | R | 1 |
| 4. | Define distillation process. | | CO2 | R | 1 |
| 5. | Define compression ratio. | | CO4 | R | 1 |
| 6. | Write an example for liquid-liquid extraction. | | CO3 | U | 1 |
| 7. | Give an example for adsorption process. | | CO3 | U | 1 |
| 8. | State the mechanism of adsorption. | | CO1 | U | 1 |
| 9. | Define Kelvin equation. | | CO2 | R | 1 |
| 10. | Name the most common technical problem in industrial crystallization. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Classify the evaporators used in food industry. | | CO2 | U | 3 |
| 12. | Explain vapour-liquid equilibrium with suitable example. | | CO1 | U | 3 |
| 13. | List the parameters influencing the rate of extraction. | | CO4 | U | 3 |
| 14. | Differentiate between adsorption and absorption. | | CO5 | An | 3 |
| 15. | Classify the crystallization equipments used in food processing. | | CO1 | U | 3 |
| 16. | Give examples for extruded products. | | CO3 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the long tube evaporators with a neat sketch. | CO3 | U | 7 |
|  | b. | Analyze the changes in liquid characteristics during evaporation process. | CO1 | An | 5 |
|  |  |  |  |  |  |
| 18. | a. | Briefly discuss the vacuum distillation process. | CO2 | U | 6 |
|  | b. | Analyze the material balance for distillation of two component system. | CO6 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Discuss the working principle of Bollman extractor with a neat sketch. | CO3 | U | 6 |
|  | b. | Explain the working principle of Hildebrant extractor with a neat sketch | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain Langmuir adsorption isotherm with its assumptions and limitations. | CO1 | U | 8 |
|  | b. | Distinguish between physisorption and chemisorptions | CO4 | An | 4 |
|  |  |  |  |  |  |
| 21. | a. | Describe a draft tube baffle crystallizer with a neat diagram and explain its applications in food processing | CO6 | A | 8 |
|  | b. | Estimate the magnesium chloride crystallized out if the saturated concentration is only 52.5 kg/100 kg of water at 25⁰C. The solution contains 45 percent magnesium chloride solution in water at 25⁰C. | CO5 | E | 4 |
|  |  |  |  |  |  |
| 22. | a. | Apple juice with an initial solid concentration is 10 per cent is being concentrated in a single effect evaporator to a final solid concentration of 40 per cent under a vacuum of 40 kPa. Steam at a pressure of 101 kPa is used to concentrate the juice. The feed is entering at a temperature of 35oC and temperature of the final juice is 86 oC corresponding to vacuum of 40kPa prevailing in the evaporator. If the feed rate is 1000 kg/h, find the quantity of steam required and the heat transfer area of the evaporator. The specific heat of the feed which is reasonably constant is 5 kJ/kg oC, and the overall heat transfer coefficient is 1.9 kW/m2 oC. | CO5 | E | 9 |
|  | b. | List the factors that affect the rate of evaporation. | CO2 | An | 3 |
|  |  |  |  |  |  |
| 23. | a. | A continuous rectification column with striping is used to distil a 2000 kg mixture of acetic acid and water which contains 50 % acetic acid (molar). The feed is a saturated vapour at its boiling point. The reflex ratio used is 2.6. It is desired to purify acetic acid upto 90 %t concentration (molar) in the bottom product and the top product containing 10 % acetic acid (molar). Determine the number of ideal plates and the location of feed plate. The equilibrium data for acetic acid-water systems is given in the table.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **T,OC** | 118.3 | 110.6 | 107.8 | 105.2 | 104.3 | 103.5 | 102.8 | 102.1 | 101.5 | 100.8 | 100.5 | 100.2 | 100 | | **X** | 0 | 0.19 | 0.31 | 0.45 | 0.52 | 0.58 | 0.68 | 0.73 | 0.86 | 0.88 | 0.91 | 0.96 | 1 | | **Y** | 0 | 0.31 | 0.45 | 0.60 | 0.66 | 0.71 | 0.78 | 0.82 | 0.90 | 0.92 | 0.94 | 0.97 | 1 | | CO5 | E | 9 |
|  | b. | Explain the combined rectification and stripping process in distillation. | CO3 | U | 3 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the characteristics of extruded products. | CO4 | An | 7 |
|  | b. | Briefly discuss the extruder parts and components. | CO6 | U | 5 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recognize the properties of liquids and the unit operations related to them. |
| CO2 | Understand the principles of various unit operations used in food industries. |
| CO3 | Apply the knowledge of unit operations in mechanization of equipments for food industries. |
| CO4 | Analyze the requirements for successful operation of evaporators, extractors, extrusion, crystallization and distillatory units. |
| CO5 | Evaluate the efficiency of evaporators, extractors, extrusion, absorption, crystallization and distillatory units. |
| CO6 | Design and analyze evaporators, extractors, extrusion, absorption, crystallization and distillatory units for the food industries. |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 1 | 16 | - | 5 | - | - | 22 |
| CO2 | 2 | 9 | - | 3 | - | - | 14 |
| CO3 | 1 | 21 | 6 | - | - | - | 28 |
| CO4 | 1 | 3 | - | 11 | - | - | 15 |
| CO5 | - | 1 | - | 3 | 22 | - | 26 |
| CO6 | - | 5 | 8 | 6 | - | - | 19 |
|  | | | | | | | **124** |



|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20FP2020** | **Duration** | **3hrs** |
| **Course Name** | **MILLING TECHNOLOGY OF CEREALS, PULSES AND OIL SEEDS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | List the objectives of paddy parboiling. | | CO1 | R | 1 |
| 2. | Name any two products of rice husk. | | CO3 | R | 1 |
| 3. | Categorize the cleaning equipment’s used for cleaning of grains. | | CO2 | An | 1 |
| 4. | Examine the role of scratch system in wheat milling. | | CO2 | A | 1 |
| 5. | Mention the pre-milling treatments adopted in pulse milling. | | CO1 | R | 1 |
| 6. | Define pulse milling efficiency. | | CO2 | R | 1 |
| 7. | Indicate the industrial uses of corn. | | CO3 | R | 1 |
| 8. | State the health benefits of corn oil. | | CO3 | R | 1 |
| 9. | Which country is the third largest producer of coconut in the world? | | CO5 | R | 1 |
| 10. | List few solvents used in extraction of edible oils. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | List the various unit operations and equipment’s used in modern rice mill. | | CO1 | R | 3 |
| 12. | Describe the manufacturing process of pasta and noodles. | | CO3 | U | 3 |
| 13. | Distinguish between wet and dry milled pulses. | | CO5 | An | 3 |
| 14. | Tabulate the products of the corn milling process and its uses. | | CO3 | R | 3 |
| 15. | Express the process flow chart for oil milling operation. | | CO5 | C | 3 |
| 16. | Write short notes on the health benefits of millets. | | CO4 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the construction and working of Engleberg Huller. | CO2 | R | 6 |
|  | b. | Express the method of preparation of the following   1. Puffed rice 2. Flaked rice 3. Canned rice and d. Quick cooking rice. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the traditional and modern methods of Bulgar production. | CO5 | E | 8 |
|  | b. | Examine the various components of wheat milling. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Elaborate the commercial methods of pulse milling. | CO5 | U | 8 |
|  | b. | Schematically represent the production of SUFU from soybean. | CO3 | C | 4 |
|  |  |  |  |  |  |
| 20. | a. | Compose the various unit operations involved in corn wet milling process and explain the process with a flow chart. | CO3 | C | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the mechanical methods of oil extraction. | CO5 | A | 8 |
|  | b. | Illustrate the oil refining process using a flow chart. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | Describe the working rice grading machineries. | CO2 | R | 8 |
|  | b. | List the advantages and disadvantages of paddy parboiling process. | CO1 | R | 4 |
|  |  |  |  |  |  |
| 23. | a. | List the benefits of enzyme assisted aqueous extraction of corn oil and explain the process in detail. | CO3 | An | 6 |
|  | b. | Design the layout for cotton seed oil extraction plant. | CO6 | C | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss in detail about pearl millet processing. | CO4 | U | 6 |
|  | b. | Illustrate the preparation of finger millet-based value added products. | CO3 | An | 6 |

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Gain knowledge about the structure, composition and pre milling operations in processing of cereals, pulses and oil seeds. |
| **CO2** | Understand about paddy processing and rice milling equipment which will help them for developing entrepreneurial skills. |
| **CO3** | Apply the knowledge to process food grains into value added products. |
| **CO4** | Analyze the suitable technique for milling of various millets. |
| **CO5** | Evaluate the types of mills used for milling of cereals, pulses and oilseeds. |
| **CO6** | Design layout for milling plants. |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| **CO / P** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 9 | - | - | - | - | - | 9 |
| CO2 | 15 | - | 5 | 1 | - | - | 21 |
| CO3 | 6 | 9 | - | 12 | - | 16 | 43 |
| CO4 | - | 9 | - | - | - | - | 9 |
| CO5 | 2 | 8 | 12 | 3 | 8 | 3 | 36 |
| CO6 | - | - | - | - | - | 6 | 6 |
|  | | | | | | | **124** |