1. **Programme Educational Objectives (PEOs)**
   I. To prepare students as a qualified food technologists for Food industries, research organization and teaching.
   II. To provide students with a solid foundation in basic sciences related to food technology, food science and food technology & engineering.
   III. To enable the students with good scientific and engineering knowledge so as to comprehend, design, and create food products and device for food industry and provide solutions for the challenges in food industry as well as in agriculture.
   IV. To train students in professional and ethical attitude, effective communication skills, teamwork skills and multidisciplinary approaches related to food technology and engineering.
   V. To provide student with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career.

2. **Programme Outcomes (POs)**
   On successful completion of the programme,
   
   1. Graduates will demonstrate knowledge of mathematics, food science and engineering.
   2. Graduates will demonstrate an ability to identify, formulate and solve engineering problems related to food sector/industry.
   3. Graduate will able to focus on the importance of safe processed nutritious food.
   4. Graduates will demonstrate an ability to design or process food products as per the needs and specifications.
   5. Graduates will demonstrate an ability to work in Food industries, research organization and teaching.
   6. Graduate will demonstrate skills to use modern tools and equipment to analyze food prone infection and food spoilage.
   7. Graduates will demonstrate knowledge of professional and ethical responsibilities.
   8. Graduate will be able to understand economic importance of food products and food laws.
   9. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
   10. Graduate will develop confidence for self education and ability for life-long learning.
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- Communicative English
- Engineering Mathematics I
- Engineering Physics
- Engineering Chemistry
- Problem Solving and Python Programming
- Engineering Graphics
- Problem Solving and Python Programming Laboratory
- Physics and Chemistry Laboratory
- Technical English
- Engineering Mathematics II
- Physics of Materials
- Basic Civil and Mechanical Engineering
- Microbiology
- Biochemistry
- Engineering Practices Laboratory
- Biochemistry Laboratory
- Transforms and Partial Differential Equations
- Introduction to Food Processing
- Food Process Calculations
- Food Microbiology
- Principles of Fluid Mechanics
- Food Chemistry and Nutrition
- Food Microbiology Lab
- Food Chemistry and Nutrition Lab
- Interpersonal Skills/Listening and Speaking
- Probability and Statistics
- Food Analysis
- Fundamentals of Heat and Mass
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|        |       | Biochemical Engineering for Food Technologists ✔ |
|        |       | Refrigeration and Cold Chain Management ✔ |
|        |       | Food Processing and Preservation ✔️ ✔️ |
|        |       | Professional Communication ✔ |
|        |       | Food Processing and Preservation Lab ✔️ ✔️ |
|        |       | Biochemical Engineering Lab ✔️ ✔️ ✔️ |

| Year 3 | SEM 6 | Food Process Engineering and Economics ✔ |
|        |       | Baking and Confectionary Technology ✔️ ✔️ |
|        |       | Fruits and Vegetable Processing Technology ✔️ ✔️ |
|        |       | Fruits and Vegetable Processing Technology Lab ✔️ ✔️ |
|        |       | Baking and Confectionary Technology Lab ✔️ ✔️ |

| Year 4 | SEM 7 | Dairy Process Technology ✔️ ✔️ |
|        |       | Food Safety, Quality and Regulation ✔ |
|        |       | Food Packaging Technology ✔ |
|        |       | Testing of Packaging Materials Lab ✔️ ✔️ |
|        |       | Dairy Process Technology Lab ✔️ ✔️ |

| Year 4 | SEM 8 | Project Work ✔ |

| Year 4 | SEM 8 | |
|--------|-------| ✔️ ✔️ |
# ANNA UNIVERSITY, CHENNAI
## AFFILIATED INSTITUTIONS
### REGULATIONS 2017
#### B. TECH. FOOD TECHNOLOGY
##### CHOICE BASED CREDIT SYSTEM
###### I TO VIII SEMESTERS (FULL TIME) CURRICULA AND SYLLABI

## SEMESTER I

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| 8      | FD8312      | Food Chemistry and Nutrition Laboratory           | PC       | 4              | 0 | 0 | 4 | 2 |
| 9      | HS8381      | Interpersonal Skills/Listening and Speaking       | EEC      | 2              | 0 | 0 | 2 | 1 |
|         |             | **TOTAL**                                         |          |                | 33| 19| 4 | 10| 26|

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|        |             | **PRACTICALS**                          |          |                |   |   |   |   |
| 7      | FD8411      | Food Analysis Laboratory                | PC       | 4              | 0 | 0 | 4 | 2 |
| 8      | FD8412      | Unit Operations Laboratory              | PC       | 4              | 0 | 0 | 4 | 2 |
| 9      | HS8461      | Advanced Reading and Writing            | EEC      | 2              | 0 | 0 | 2 | 1 |
|         |             | **TOTAL**                              |          |                | 31| 19| 2 | 10|25|
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* Course from the curriculum of the other UG Programmes

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**SUMMARY**

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OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills.

UNIT I  SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS  12


UNIT II  GENERAL READING AND FREE WRITING  12

Reading - comprehension-pre-reading-post reading - comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading - short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register. Writing - paragraph writing - topic sentence - main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures. Listening - telephonic conversations. Speaking - sharing information of a personal kind—greeting – taking leave. Language development - prepositions, conjunctions. Vocabulary development - guessing meanings of words in context.

UNIT III  GRAMMAR AND LANGUAGE DEVELOPMENT  12

Reading - short texts and longer passages (close reading) Writing - understanding text structure-use of reference words and discourse markers-coherence-jumbled sentences. Listening - listening to longer texts and filling up the table - product description - narratives from different sources. Speaking - asking about routine actions and expressing opinions. Language development - degrees of comparison- pronouns- direct vs indirect questions. Vocabulary development - single word substitutes- adverbs.
UNIT IV        READING AND LANGUAGE DEVELOPMENT                          12
Reading- comprehension-reading longer texts- reading different types of texts- magazines
Writing- letter writing, informal or personal letters-e-mails-conventions of personal email-
Listening- listening to dialogues or conversations and completing exercises based on them.
Speaking- speaking about oneself- speaking about one’s friend- Language development-
Tenses- simple present-simple past- present continuous and past continuous- Vocabulary
development- synonyms-antonyms- phrasal verbs

UNIT V         EXTENDED WRITING                              12
Reading- longer texts- close reading –Writing- brainstorming -writing short essays – developing
an outline- identifying main and subordinate ideas- dialogue writing-Listening – listening to talks-
conversations- Speaking – participating in conversations- short group conversations-Language
development-modal verbs- present/ past perfect tense - Vocabulary development-collocations-
fixed and semi-fixed expressions

OUTCOMES:
At the end of the course, learners will be able to:
• Read articles of a general kind in magazines and newspapers.
• Participate effectively in informal conversations; introduce themselves and their friends and
  express opinions in English.
• Comprehend conversations and short talks delivered in English
• Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:
1. Board of Editors. Using English A Coursebook for Undergraduate Engineers and

REFERENCES
3. Dutt P. Kiranmai and RajeevanGeeta. Basic Communication Skills, Foundation Books:
   2013.
5. Redston, Chris &Gillies Cunningham Face2Face (Pre-intermediate Student’s Book&

MA8151                                         ENGINEERING MATHEMATICS   –   I                      L  T  P  C
4   0 0   4
OBJECTIVES :
• The goal of this course is to achieve conceptual understanding and to retain the best
  traditions of traditional calculus. The syllabus is designed to provide the basic tools of
  calculus mainly for the purpose of modelling the engineering problems mathematically and
  obtaining solutions. This is a foundation course which mainly deals with topics such as
single variable and multivariable calculus and plays an important role in the understanding
of science, engineering, economics and computer science, among other disciplines.

UNIT I  DIFFERENTIAL CALCULUS  12
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II  FUNCTIONS OF SEVERAL VARIABLES  12

UNIT III  INTEGRAL CALCULUS  12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV  MULTIPLE INTEGRALS  12

UNIT V  DIFFERENTIAL EQUATIONS  12

TOTAL : 60 PERIODS

OUTCOMES :
After completing this course, students should demonstrate competency in the following skills:
- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

TEXT BOOKS :
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].
REFERENCES:

PH8151 ENGINEERING PHYSICS L T P C
3 0 0 3

OBJECTIVES:
- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER

UNIT II WAVES AND FIBER OPTICS

UNIT III THERMAL PHYSICS

UNIT IV QUANTUM PHYSICS

UNIT V CRYSTAL PHYSICS
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of this course,

- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

REFERENCES:

CY8151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT 1 WATER AND ITS TREATMENT
Osmosis.

UNIT II SURFACE CHEMISTRY AND CATALYSIS


UNIT III ALLOYS AND PHASE RULE


UNIT IV FUELS AND COMBUSTION


UNIT V ENERGY SOURCES AND STORAGE DEVICES

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H_2-O_2 fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:
- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

REFERENCES:

GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C 3 0 0 3

OBJECTIVES:
- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING
Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS
Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

OUTCOMES:
Upon completion of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

**REFERENCES:**

**GE8152**  
**ENGINEERING GRAPHICS**  
**L T P C**  
2 0 4 4

**OBJECTIVES:**
- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination)**  
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I**  
**PLANE CURVES AND FREEHAND SKETCHING**  
7+12
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.
Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects.
UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACE  6+12
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III  PROJECTION OF SOLIDS  5+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES  5+12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  6+12
Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 90 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
•  familiarize with the fundamentals and standards of Engineering graphics
•  perform freehand sketching of basic geometrical constructions and multiple views of objects.
•  project orthographic projections of lines and plane surfaces.
•  draw projections and solids and development of surfaces.
•  visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size. The examination will be conducted in appropriate sessions on the same day.

GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
LABORATORY 0 0 4 2

OBJECTIVES:
- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS
1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

OUTCOMES:
Upon completion of the course, students will be able to
- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL : 60 PERIODS

BS8161 PHYSICS AND CHEMISTRY LABORATORY  (Common to all branches of B.E. / B.Tech Programmes)  0  0  4  2

OBJECTIVES:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)
1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young’s modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.

1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-
   Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:
- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis
  of water quality related parameters.

TOTAL: 30 PERIODS

TEXTBOOKS:

HS8251 TECHNICAL ENGLISH L T P C
4 0 0 4

OBJECTIVES:
The Course prepares second semester engineering and Technology students to:
- Develop strategies and skills to enhance their ability to read and comprehend engineering
  and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group
  discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their
  areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12
Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap
exercises- Speaking – Asking for and giving directions- Reading – reading short technical texts
from journals- newspapers- Writing- purpose statements – extended definitions – issue- writing
instructions – checklists-recommendations-Vocabulary Development- technical vocabulary
Language Development – subject verb agreement - compound words.

UNIT II READING AND STUDY SKILLS 12
Listening- Listening to longer technical talks and completing exercises based on them-Speaking
– describing a process-Reading – reading longer technical texts- identifying the various transitions
in a text- paragraphing- Writing- interpreting cgrats, graphs- Vocabulary Development-
Vocabulary used in formal letters/emails and reports Language Development- impersonal passive
voice, numerical adjectives.
UNIT III TECHNICAL WRITING AND GRAMMAR

Listening- Listening to classroom lectures/ talks on engineering/technology -Speaking – introduction to technical presentations-  
Reading – longer texts both general and technical, practice in speed reading; Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences

UNIT IV REPORT WRITING


UNIT V GROUP DISCUSSION AND JOB APPLICATIONS

Listening- TED/Ink talks; Speaking –participating in a group discussion -Reading– reading and understanding technical articles Writing– Writing reports- minutes of a meeting- accident and survey-Vocabulary Development- verbal analogies Language Development- reported speech.

OUTCOMES: At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:


REFERENCES


Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.

MA8251 ENGINEERING MATHEMATICS – II

OBJECTIVES :
This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES 12

UNIT II VECTOR CALCULUS 12
Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS 12
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions \( w = z + c, cz, \frac{1}{z}, z^2 \) - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

UNIT V LAPLACE TRANSFORMS 12

TOTAL: 60 PERIODS

OUTCOMES:
After successfully completing the course, the student will have a good understanding of the following topics and their applications:
- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS:

REFERENCES :

PH8254 PHYSICS OF MATERIALS  L  T  P  C
(Common to courses offered in Faculty of Technology except Fashion Technology)  3 0 0 3

OBJECTIVES:
• To introduce the physics of various materials relevant to different branches of technology

UNIT I  PREPARATION OF MATERIALS

UNIT II  CONDUCTING MATERIALS

UNIT III  SEMICONDUCTING MATERIALS

UNIT IV  DIELECTRIC AND MAGNETIC MATERIALS
magnetoresponse materials.

UNIT V  NEW MATERIALS AND APPLICATIONS  9

OUTCOMES:
At the end of the course, the students will able to
- gain knowledge on phase diagrams and various material processing methods,
- acquire knowledge on basics of conducting materials, superconductors and their applications
- get knowledge on the functioning of semiconducting materials and their applications in LED and solar cells,
- understand the functioning of various dielectric and magnetic materials ,
- have the necessary understanding on various advanced materials.

TEXT BOOKS:

REFERENCES

BE8252 BASIC CIVIL AND MECHANICAL ENGINEERING 4 0 0 4

OBJECTIVES:
- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power plant units, IC engines, and R & AC system.

A – OVER VIEW

UNIT I SCOPE OF CIVIL AND MECHANICAL ENGINEERING 10
Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering

**B – CIVIL ENGINEERING**

**UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS**


**UNIT III BUILDING COMPONENTS AND STRUCTURES**


**C – MECHANICAL ENGINEERING**

**UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS**

Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants — working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

**UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM**


**OUTCOMES:**

On successful completion of this course, the student will be able to

- appreciate the Civil and Mechanical Engineering components of Projects.
- explain the usage of construction material and proper selection of construction materials.
- measure distances and area by surveying
- identify the components used in power plant cycle.
- demonstrate working principles of petrol and diesel engine.
- elaborate the components of refrigeration and Air conditioning cycle.

**TOTAL: 60 PERIODS**

**TEXTBOOKS:**

REFERENCES:

BT8291 MICROBIOLOGY L T P C
3 0 0 3

OBJECTIVES
- To introduce students to the principles of Microbiology to emphasize structure and biochemical aspects of various microbes.
- To solve the problems in microbial infection and their control.

UNIT I INTRODUCTION 6
Basics of microbial existence; history of microbiology, classification and nomenclature of microorganisms, microscopic examination of microorganisms, light and electron microscopy; principles of different staining techniques like gram staining, acid fast, capsular staining, flagellar staining.

UNIT II MICROBES- STRUCTURE AND MULTIPLICATION 12
Structural organization and multiplication of bacteria, viruses, algae and fungi, with special mention of life history of actinomycetes, yeast, mycoplasma and bacteriophages.

UNIT III MICROBIAL NUTRITION, GROWTH AND METABOLISM 12
Nutritional requirements of bacteria; different media used for bacterial culture; growth curve and different methods to quantify bacterial growth; aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules.

UNIT IV CONTROL OF MICROORGANISMS 6
Physical and chemical control of microorganisms; host-microbe interactions; anti-bacterial, anti-fungal and anti-viral agents; mode of action and resistance to antibiotics; clinically important microorganisms.

UNIT V INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY 9
Primary metabolites; secondary metabolites and their applications; preservation of food; production of penicillin, alcohol, vitamin B-12; biogas; bioremediation; leaching of ores by microorganisms; biofertilizers and biopesticides; microorganisms and pollution control; biosensors

TOTAL: 45 PERIODS

TEXT BOOKS
OBJECTIVE

- To enable students learn the fundamentals of Biochemical Processes and Biomolecules.

UNIT I INTRODUCTION TO BIOMOLECULES
Basic principles of organic chemistry, role of carbon, types of functional groups, biomolecules, chemical nature of water, pH and biological buffers.

UNIT II STRUCTURE AND PROPERTIES OF IMPORTANT BIOMOLECULES
Carbohydrates (mono, di, oligo & polysaccharides) mutarotation, glycosidic bond, reactions of monosaccharides and reducing sugars Starch, glycogen, cellulose and chitin. Proteoglycans, glycosaminoglycans. hyaluronic acid, chondroitin sulfate.


UNIT III METABOLISM CONCEPTS

UNIT IV INTERMEDIARY METABOLISM AND REGULATION
Glycolysis, TCA cycle, gluconeogenesis, pentose phosphate shunt, glyoxalate shunt, fatty acid synthesis and oxidation, reactions of amino acids, deamination, transamination and decarboxylation, urea cycle, Bioenergetics - High energy compounds, electronegative potential of compounds, respiratory chain, ATP cycle, calculation of ATP yield during oxidation of glucose and fatty acids.

UNIT V CASE STUDIES
Case study on overproduction of primary and secondary metabolites - glutamic acid, threonine , lysine, methionine, isoleucine, propionic acid and ethanol.

TOTAL: 45 PERIODS

OUTCOMES

- To ensure students have a strong foundation in the structure and reactions of Biomolecules.
- To introduce them to metabolic pathways of the major biomolecules and relevance to clinical conditions.
- To correlate Biochemical processes with Biotechnology applications.

**TEXT BOOKS**

**REFERENCES**

**GE8261 ENGINEERING PRACTICES LABORATORY**

**OBJECTIVES:**
- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)**

**I CIVIL ENGINEERING PRACTICE**

**Buildings:**
- Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**
- Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- Study of pipe connections requirements for pumps and turbines.
- Preparation of plumbing line sketches for water supply and sewage works.
- Hands-on-exercise:
  - Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**
- Study of the joints in roofs, doors, windows and furniture.
- Hands-on-exercise:
  - Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE**

**Welding:**
(a) Preparation of butt joints, lap joints and T-joints by Shielded metal arc welding.
(b) Gas welding practice

**Basic Machining:**
(a) Simple Turning and Taper turning
(b) Drilling Practice

**Sheet Metal Work:**
(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

**Machine assembly practice:**
(a) Study of centrifugal pump
(b) Study of air conditioner

**Demonstration on:**
(a) Smithy operations, upsetting, swaging, setting down and bending. Example –
Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V-fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS)**

**III ELECTRICAL ENGINEERING PRACTICE**
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

**IV ELECTRONICS ENGINEERING PRACTICE**
1. Study of Electronic components and equipments – Resistor, colour coding
   measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

**OUTCOMES:**
On successful completion of this course, the student will be able to
- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**CIVIL**
1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos  
   (b) Demolition Hammer 2 Nos  
   (c) Circular Saw 2 Nos  
   (d) Planer 2 Nos  
   (e) Hand Drilling Machine 2 Nos  
   (f) Jigsaw 2 Nos

**MECHANICAL**
1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

**ELECTRICAL**
1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos  
   (b) Digital Live-wire detector 2 Nos

**ELECTRONICS**
1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply
AIM

- To learn and understand the principles behind the qualitative and quantitative estimation of biomolecules (proteins, carbohydrates, lipids, metabolites etc.,) and laboratory analysis of the same in the body fluids.

EXPERIMENTS

1. General guidelines for working in biochemistry lab (theory)
2. Units of volume, weight, density and concentration measurements and their range in biological measurements. Demonstration of proper use of volume and weight measurement devices.
3. Accuracy, precision, sensitivity and specificity (theory)
4. Preparation of buffer – titration of a weak acid and a weak base.
5. Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars and keto from aldo sugars.
7. Protein estimation by Biuret and Lowry’s methods.
8. Protein estimation by Bradford and spectroscopic methods.
9. Extraction of lipids and analysis by TLC.
10. Estimation of nucleic acids by absorbance at 260 nm and hyperchromic effect (demo).

Equipment Needed for 20 Students

- Autocalve 1
- Hot Air Oven 1
- Incubators 2
- Light Microscopes 4
- Incubator Shaker 1
- Colorimeter 2
- Laminar Flow Chamber 2
- Glassware, Chemicals, Media as required

TOTAL: 60 PERIODS

TEXT BOOKS

1. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
2. Introduction of Practical Biochemistry by David T. Phummer. (II Edition)

REFERENCES

OBJECTIVE:
- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I  PARTIAL DIFFERENTIAL EQUATIONS  12
Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II  FOURIER SERIES  12

UNIT III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  12
Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV  FOURIER TRANSFORMS  12

UNIT V  Z - TRANSFORMS AND DIFFERENCE EQUATIONS  12

TOTAL: 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students should be able to:
- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
• Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

REFERENCES:

FD8301 INTRODUCTION TO FOOD PROCESSING
L T P C
3 0 0 3

OBJECTIVE:
• The course aims to introduce the students to the area of Food Processing. This is necessary for effective understanding of a detailed study of food processing and technology subjects. This course will enable students to appreciate the importance of food processing with respect to the producer, manufacturer and consumer.

UNIT I PROCESSING OF FOOD AND ITS IMPORTANCE
Source of food - plant, animal and microbial origin; different foods and groups of foods as raw materials for processing – cereals, pulses, grains, vegetables and fruits, milk and animal foods, sea weeds, algae, oil seeds & fats, sugars, tea, coffee, cocoa, spices and condiments, additives; need and significance of processing these foods.

UNIT II METHODS OF FOOD HANDLING AND STORAGE
Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods.

UNIT III LARGE-SCALE FOOD PROCESSING
Milling of grains and pulses; edible oil extraction; Pasteurisation of milk and yoghurt; canning and bottling of foods; drying – Traditional and modern methods of drying, Dehydration of fruits, vegetables, milk, animal products etc; preservation by use of acid, sugar and salt; Pickling and curing with microorganisms, use of salt, and microbial fermentation; frying, baking, extrusion cooking, snack foods.
UNIT IV  FOOD WASTES IN VARIOUS PROCESSES  6
Waste disposal—solid and liquid waste; rodent and insect control; use of pesticides; ETP; selecting and installing necessary equipment.

UNIT V  FOOD HYGIENE  9
Food related hazards—Biological hazards—physical hazards—microbiological considerations in foods. Food adulteration—definition, common food adulterants, contamination with toxic metals, pesticides and insecticides; Safety in food procurement, storage handling and preparation; Relationship of microbes to sanitation, Public health hazards due to contaminated water and food; Personnel hygiene; Training & Education for safe methods of handling and processing food; sterilization and disinfection of manufacturing plant; use of sanitizers, detergents, heat, chemicals, Cleaning of equipment and premises.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students are expected to
  • Be aware of the different methods applied to processing foods.
  • Be able to understand the significance of food processing and the role of food and beverage industries in the supply of foods.

TEXT BOOKS:

FD8302  FOOD PROCESS CALCULATIONS  L T P C  3 2 0 4

OBJECTIVE:
• Units and Dimensions: Basic and derived units, use of model units in calculations, Methods of expression, compositions of mixture and solutions. Ideal and real gas laws – Gas constant - calculations of pressure, volume and temperature using ideal gas law

UNIT II  9+6
Fundamental Calculations and Humidity: Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity - Use of humidity in condensation and drying - Humidity chart, dew point.

UNIT III  9+6
Basic Principles of Stoichiometry - Importance of material balance and energy balance in a process Industry-Dimensions, Units, conversion factors and their use – Data sources, Humidity and applications. Material Balance: Stoichiometric principles, Application of material balance to unit operations like distillation, evaporation, crystallization, drying, extraction, Leaching.

UNIT IV  9+6
UNIT V
Enthalpy Changes: Standard heat of reaction, heats of formation, combustion, solution, mixing etc., calculation of standard heat of reaction - Effect of pressure and temperature on heat of reaction - Energy balance for systems without chemical reaction.

(Use of Psychometric chart is permitted in the examination)

TEXT BOOKS:

REFERENCES:

FD8303 FOOD MICROBIOLOGY
OBJECTIVES:
- The course aims to develop the knowledge of students in the basic area of Food Microbiology.
- This is necessary for effective understanding of food processing and technology subjects as well as food safety.
- This course will enable students to appreciate the role of microbes in food spoilage, preservation of foods and food borne infections.

UNIT I ROLE OF MICROBES IN SPOILAGE OF FOODS
Factors affecting spoilage of foods, Microbial flora associated with various food groups their spoilage potential. Microbiological spoilage problems associated with typical food products.

UNIT II CONTROL OF MICROBES IN FOODS
Use of antimicrobial chemicals- organic acids, sugars, sodium chloride, nitrites, phosphates, sulphites, benzoates, sorbates / propionates naturally occurring antimicrobials; physical methods- low and high temperatures, drying, radiation and high pressure; tolerance of microbes to chemical and physical methods in various foods.

UNIT III MICROBES IN FOOD FERMENTATIONS
Microbes of importance in food fermentations, – homo & hetero-fermentative bacteria, yeasts & fungi; biochemistry of fermentations – pathways involved, lactic acid bacteria fermentation and starter cultures, alcoholic fermentations -yeast fermentations - characteristics and strain selection, fungal fermentations. microbes associated with typical food fermentations- yoghurt, cheese, fermented milks, breads, idli, soy products, fermented vegetables and meats.

UNIT IV MICROBIAL AGENTS OF FOOD BORNE ILLNESS
Food borne infections and food poisoning, microbial toxins, Gram Negative and Gram positive food borne pathogens; toxigenic algae and fungi; Food borne viruses; helminths, nematodes and protozoa.

UNIT V MICROBIAL EXAMINATION OF FOODS
Detection & Enumeration of microbes in foods; Indicator organisms and microbiological criteria; Rapid and automated microbial methods - development and impact on the detection of food borne pathogens; Applications of immunological, techniques to food industry; Detection methods for E. coli, Staphylococci, Yersinia, Campylobacter, B. cereus, Cl. botulimum & Salmonella, Listeria monocytogenes Norwalk virus, Rotavirus, Hepatitis A virus from food samples.

**TOTAL: 45 PERIODS**

**OUTCOMES:**
On completion of the course the students are expected to
- Be able to understand and identify the various microbes associated with foods and food groups.
- Be able to understand and identify the role of these microbes in food spoilage, food preservation.
- Understand the role of pathogens in food borne infections.
- Understand the methods used to detect pathogens in foods.

**TEXT BOOKS:**

**REFERENCES:**

**FD8304 PRINCIPLES OF FLUID MECHANICS**

**OBJECTIVES:**
- To introduce the students to the mechanics of fluids through a thorough understanding of the properties of the fluids, behaviour of fluids under static conditions. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
- To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on vanes.

**UNIT I PROPERTIES OF FLUIDS**

39

UNIT II  FLUID FLOW ANALYSIS  9+6

UNIT III  FLOW MEASUREMENTS  9+6

UNIT IV  OPEN CHANNEL FLOW  9+6

UNIT V  DIMENSIONAL ANALYSIS & PUMPS  9+6

TOTAL: 75 PERIODS

OUTCOMES:
- The students will be able to get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- They will also gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.

TEXT BOOKS:

REFERENCES:
2. (P) Ltd., New Delhi, 2002
3. Grade, R.J.,“Fluid mechanics through problems”. Wiley eastern Ltd., Madras, 2002
FD8305  FOOD CHEMISTRY AND NUTRITION  L T P C  3 0 0 3

OBJECTIVE:
- The course aims to develop the knowledge of students in the basic area of Food Chemistry. This is necessary for effective understanding of food processing and technology subjects. This course will enable students to appreciate the similarities and complexities of the chemical components in foods.

UNIT I  AN OVERVIEW OF NUTRITION  9
Definition, six classes of nutrients, calculating energy values from food, using the RDA, nutritional status, nutritional requirement, malnutrition, nutritional assessment of individuals and populations, dietary recommendations, Balanced diet planning: Diet planning principles, dietary guidelines; food groups, exchange lists, personal diet analysis; Digestion, Absorption and Transport: Anatomy and physiology of the digestive tract, mechanical and chemical digestion, absorption of nutrients.

UNIT II  CARBOHYDRATES  9
Simple Sugars: mono and disaccharides, Properties, Caramelization, Maillard reaction; Sugar alcohols; Oligosaccharides: structure, nomenclature, occurrence, uses in foods. Polysaccharides: Starch- Structure, Properties, Functional role in food system, Modified starches, Resistant starch, Starch hydrolysates, Applications in food industry. Non-starch polysaccharides: Pectins, Gums & Hydrocolloid, Fiber - Cellulose & hemicellulose; Food sources, functional role and uses in foods. Digestion and absorption of carbohydrates, lactose intolerance; Glycemic and Non-glycemic carbohydrates, blood glucose regulation, recommendations of sugar intake for health, health effects of fiber and starch intake, Artificial sweeteners; Importance of blood sugar regulation, Dietary recommendations for NIDDM and IDDM.

UNIT III  PROTEINS & LIPIDS  9
Review of protein structure & conformation; Properties & reactions of proteins in food systems: Dissociation, optical activity, solubility, hydration, swelling, foam formation & stabilization, gel formation, emulsifying effect, thickening & binding, amino acids in Maillard reaction, denaturation; Food enzymes; Texturized proteins; Food sources, functional role and uses in foods. Review of structure, composition & nomenclature of fats. Non-glyceride components in fats & oils; Properties of fats & oils: crystal formation, polymorphism, melting points, plasticity, 44 isomerisation, unsaturation; Modification of fats: hydrogenation- cis and trans isomers, interesterification, acetylation, winterization; Hydrolytic rancidity & oxidative rancidity; radiolysis Shortening power of fats, tenderization, emulsification, frying - smoke point, auto oxidation, polymerization; Fat replacements; Food sources, functional role and uses in foods. Lipid digestion, absorption and transport; Functions of the triglycerides; essential fatty acids- n-3 and n-6 fatty acids; trans fatty acids, Medium Chain Triglycerides, phospholipids and sterols; Health effects and recommended intakes of lipids. Digestion and absorption of proteins; Functions of proteins; amino acids, Recommended intakes of proteins, Deficiency- short term and long term effects.

UNIT IV  WATER AND MICRONUTRIENTS  9
Chemistry, physical properties, free, bound & entrapped water, water activity. Drinking water, mineral water, water hardness, water quality for food processing. Mineral & vitamin content of foods- Food and Pharmaceutical grades; Recommended daily intake, toxicities, deficiencies, factors affecting bioavailability, Stability under food processing conditions.

UNIT V METABOLISM, ENERGY BALANCE AND BODY COMPOSITION 9
Review of catabolic and anabolic pathways of glucose, fats and amino acids; Definition, units, calorific value of foods – bomb calorimeter; energy requirements – basal metabolism, specific dynamic action of foods, energy balance, direct and indirect calorimetry, physiological energy value of foods; Energy Balance and Body Composition: Energy balance; body weight and body composition; health implications; obesity, BMR and BMI calculations; Weight Control: Fat cell development; hunger, satiety and satiation; dangers of weight loss; how to identify unsafe weight loss schemes; treatment of obesity; attitudes and behaviors toward weight control.

OUTCOMES:
On completion of the course the students are expected to

- Be able to understand and identify the various food groups; the nutrient components (macro and micro), proximate composition.
- Be able to understand and identify the non-nutritive components in food, naturally present.
- Understand and use effectively, food composition tables and databases.
- Grasp the functional role of food components and their interaction in food products in terms of colour, flavour, texture and nutrient composition

TEXT BOOKS:

REFERENCES:

FD8311 FOOD MICROBIOLOGY LABORATORY L T P C
0 0 4 2

OBJECTIVES:
• Enable students to understand the methods of isolating and characterizing various microbes associated with foods and food groups.
• Enable students to understand and use various microbiological techniques for the study of foods.
• Understand the methods used to detect pathogens in foods.

LAB EXPERIMENTS:
1. Introduction, Laboratory Safety, Use of Equipment; Sterilization Techniques; Culture Media-Types and Use; Preparation of Nutrient broth and agar
2. Culture Techniques, Isolation and Preservation of Cultures- Broth: flask, test tubes; Solid: Pour plates, streak plates, slants, stabs
3. Microscopy – Working and care of Microscope; Microscopic Methods in the Study of Microorganisms; Staining Techniques- Simple, Differential- Gram’s Staining
4. Quantification of Microbes: Sampling and Serial Dilution; Bacterial count in food products TVC
5. Microbiological Quality of Water (MPN)
6. Microbiological quality of milk
7. Enumeration of Lactic acid bacteria from fermented foods
8. Yeast & Mould count from fruits
9. Enumeration of spores from pepper
10. Inhibitory effect of spices on microbial load in fish & flesh foods
11. Enumeration & Isolation of E. coli from processed meat/chicken
12. Thermal destruction of microbes: TDT & TDP
13. Enumeration & Isolation of Staphylococci from ready to eat street foods
14. Effect of cleaning and disinfection on microbial load

TOTAL: 60 PERIODS

OUTCOMES:
• Complete understanding of isolation, characterization of various microbes associated with foods and food groups.
• Familiarize with microbiological techniques for the study of foods.
• Better understanding of methods to detect pathogens in foods.

Equipment Needed for 30 Students
Autoclave 1
Static Incubators 1
Light Microscopes 5
Incubator Shaker 1
Colorimeter 2
Lamina Flow Chamber 3
Refrigerator 2
Colony counter 5
Water bath 4
pH meter 2
Weighing Balance 2
Analytical Balance 1
Glassware / Chemicals / Media as required
OBJECTIVES:
- To study and understand the physical and chemical properties of foods
- This course will enable the students to – be familiar with nutrient composition of foods
- To gain knowledge in quantitative methods in assessing nutritional status of individuals and groups

EXPERIMENTS:
1. Estimation of Viscosity of foods
2. Properties of solutions- sugar & salt
3. Preparation of emulsions
4. Solubility, specific gravity, Refractive index and Oxidative rancidity of fats and oils
5. Iso-electric precipitation of casein, Effect of rennin on milk proteins
6. Gelling properties of starch
7. Study of gluten formation
8. Enzymatic Browning in foods
9. Enzymatic hydrolysis of sucrose and measurement of optical rotation
10. Calculation and Computing of nutrient composition of foods
11. Nutritional anthropometry - Standards for reference – WHO Growth Charts from birth to 18 years, Body Mass Index and reference value
12. Techniques of measuring height, weight, head, chest and arm circumference, waist to hip ratio, skin-fold thickness, Calculation of percent Body fat using skin folds callipers
13. Calculation of energy balance of individuals based on 3 day dietary recall.
14. Dietary survey of a group of individuals/community
15. Comparison of Food Composition data bases

TOTAL: 60 PERIODS

OUTCOMES:
- Better understanding the physical and chemical properties of food. Familiarize in precipitation of casein and gellation of starch.
- Understanding the food groups, constituents of food, energy from food
- Exposing to nutritional assessment, food constituents and their daily dietary allowances

Equipment Needed for 30 Students
Viscometer 2
Vortex 5
Pycnometer 5
Texture Analyser 1
Refractometer 2
Soxhlet 3
Muffle Furnace 1
Polarimeter 1
pH meter 3
Heating mantle 5
Weighing balance 2
Thermometer 5
Water bath 4
Colorimeter 5
Hot air oven 1
Analytical Balance 1
Moisture Balance 1
Stadiometer 2
Skin fold caliper 5
Weight machine 2

HS8381 INTERPERSONAL SKILLS/LISTENING AND SPEAKING  L  T  P  C
0  0  2  1

OBJECTIVES: The Course will enable learners to:
- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations.

UNIT I
Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II
Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III
Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

UNIT IV
Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V
Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL: 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:
- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal
MA8391 PROBABILITY AND STATISTICS

OBJECTIVE:
- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 12
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 12
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.
UNIT V  STATISTICAL QUALITY CONTROL

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students will be able to:

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS:

REFERENCES:

FD8401 FOOD ANALYSIS

OBJECTIVE:
- To expose the students to the principles, methods and techniques of chemical and instrumental methods of food analysis.

UNIT I  INTRODUCTION
Introduction, food regulations and standards; sampling methods, and sample preparation for analysis; statistical evaluation of analytical data. General methods of food analysis- Moisture determination by different methods; ash analysis-different methods; titrable acidity in foods; determination of crude fiber and dietary fibre.
UNIT II    LIPIDS, PROTEINS AND CARBOHYDRATE ANALYSIS    10
Analysis of oils and fats for physical and chemical parameters and quality standards, protein analysis by different techniques; analysis of carbohydrates by different techniques.

UNIT III   SPECTROSCOPIC TECHNIQUES    10
Basic principles; application of UV-Visible spectrophotometer in the analysis of food additives; IR Spectroscopy in online determination of components of food- FT-IR tintometer in color intensity determination; application of Atomic Absorption Spectrophotometer and ICP-AES in analysis of mineral elements and fluorimeter in vitamin analysis.

UNIT IV   CHROMATOGRAPHIC TECHNIQUES    10
Basic principles; application of paper chromatography and TLC in food analysis; detection of adulterants in foods; Column chromatography for purification analysis- Ion exchange and affinity chromatography; HPLC and GC in food analysis; Significance of MS detectors in HPLC and GC; FAME analysis in oils and fats.

UNIT V   ELECTROPHORESIS, REFRACTOMETRY AND POLARIMETRY    5
Basic principles; application of the electrophoresis in food analysis; Brix value of fruit juices; total soluble solids in fruit products; Refractive indices of oils and fats; specific rotations of sugars; Estimation of simple sugars and disaccharides by polarimeter.

TOTAL: 45 PERIODS

OUTCOMES:
- To understand the principles behind analytical techniques in food analysis.
- To know the methods of selecting appropriate techniques in the analysis of food products.
- Appreciate the role of food analysis in food standards and regulations for the manufacture and the sale of food products and food quality control in food industries.
- To familiarize with the current state of knowledge in food analysis.

TEXT BOOKS:

REFERENCES:

FD8491   FUNDAMENTALS OF HEAT AND MASS TRANSFER    L T P C
3 2 0  4

OBJECTIVE:
- To understand the principles and applications of heat and mass transfer operations.
UNIT I       HEAT TRANSFER – CONDUCTION  9+6

UNIT II       HEAT TRANSFER - CONVECTION  9+6

UNIT III       HEAT TRANSFER – HEAT EXCHANGER  9+6

UNIT IV       HEAT TRANSFER: RADIATION  9+6
Radiation heat transfer – concept of black and grey body - monochromatic total emissive power – Kirchoff’s law – Planck’s law - Stefan-Boltzman’s law – heat exchange through non-absorbing media - solving problems in heat transfer by radiation.

UNIT V        MASS TRANSFER  9+6

TOTAL: 75 PERIODS

OUTCOME:
- To understand and apply the principles in heat transfer phenomena
- To understand and apply the principles in mass transfer phenomena
- To design heat and mass transfer equipments.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY  14
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II  ENVIRONMENTAL POLLUTION  8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES  10
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in
conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT


UNIT V HUMAN POPULATION AND THE ENVIRONMENT


TOTAL: 45 PERIODS

OUTCOMES:
- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS:

REFERENCES:

FD8402 THERMODYNAMICS

OBJECTIVE:
- To introduce fundamental thermodynamic principles and their application.

UNIT I THERMODYNAMIC LAW AND PROPERTIES OF FLUIDS
First Law of thermodynamics, a generalized balance equation and conserved quantities, Volumetric properties of fluids exhibiting non ideal behavior; residual properties; estimation of thermodynamic properties using equations of state; calculations involving actual property exchanges; Maxwell’s relations and applications.

**UNIT II SOLUTION THERMODYNAMICS**

Partial molar properties; concepts of chemical potential and fugacity; ideal and non-ideal solutions; concepts and applications of excess properties of mixtures; activity coefficient; composition models; Gibbs Duhem equation.

**UNIT III PHASE EQUILIBRIA**

Criteria for phase equilibria; VLE calculations for binary and multi component systems; liquid-liquid equilibria and solid-solid equilibria.

**UNIT IV CHEMICAL REACTION EQUILIBRIA**

Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; calculation of equilibrium conversion and yields for single and multiple reactions.

**UNIT V THERMODYNAMIC DESCRIPTION OF MICROBIAL GROWTH AND PRODUCT FORMATION**

Thermodynamics of microbial growth stoichiometry thermodynamics of maintenance, Calculation of the Operational Stoichiometry of a growth process at Different growth rates, Including Heat using the Herbert –Pirt Relation for Electron Donor, thermodynamics and stoichiometry of Product Formation

**TOTAL: 45 PERIODS**

**OUTCOME:**

- Students will learn laws of thermodynamics, thermodynamic property relations and their application to fluid flow, power generation and refrigeration processes.

**TEXT BOOKS:**


**REFERENCE:**


**FD8403 UNIT OPERATIONS FOR FOOD INDUSTRIES**

**OBJECTIVE:**

- To understand the principles involved in separation methods.

**UNIT I EVAPORATION AND CONCENTRATION**

Unit operations in food processing – conservation of mass and energy – overall view of an engineering process-dimensions and units – dimensional and unit consistency – dimensionless
ratios-evaporation – definition – liquid characteristics – single and multiple effect evaporation-
performance of evaporators and boiling point elevation – capacity – economy and heat balance-
types of evaporators – once through and circulation evaporators – short tube evaporators and long
tube evaporators – agitated film evaporator

UNIT II MECHANICAL SEPARATION 9
Filtration – definition – filter media – types and requirements-constant rate filtration – constant
pressure filtration – filter cake resistance-filtration equipment – rotary vacuum filter – filter press-
sedimentation – gravitational sedimentation of particles in a fluid – Stoke’s law, sedimentation of
particles in gas-cyclones – settling under sedimentation and gravitational sedimentation-centrifugal

UNIT III SIZE REDUCTION 9
Size reduction – grinding and cutting – principles of comminuting – characteristics of comminuted
products – particle size distribution in comminuted products-energy and power requirements in
comminuting – crushing efficiency – Rittinger’s, Bond’s and Kick’s laws for crushing-size reduction
equipments – crushers – jaw crusher, gyratory crusher-crushing rolls – grinders – hammer mills –
rolling compression mills - attrition, rod, ball and tube mills – construction and operation.

UNIT IV CONTACT EQUILIBRIUM SEPARATION 9
Contact equilibrium separation processes – concentrations – gas-liquid and solid-liquid equilibrium
– equilibrium concentration relationships – operating conditions-calculation of separation in contact
– equilibrium processes-gas absorption – rate of gas absorption – stage – equilibrium gas –
absorption equipment-properties of tower packing – types – construction – flow through packed
towers-extraction – rate of extraction – stage equilibrium extraction-equipment for leaching coarse
solids – intermediate solids – basket extractor-extraction of fine material – Dorr agitator –
continuous leaching – decantation systems – extraction towers-washing – equipments

UNIT V CRYSTALLIZATION AND DISTILLATION 9
Crystallization – equilibrium -solubility and equilibrium diagram – rate of crystal growth –
equilibrium crystallization-crystallization equipment – classification – construction and operation-
tank, agitated batch, Swenson-Walker vacuum crystallizers-distillation – binary mixtures – flash
and differential distillation-steam distillation – theory – consumption – continuous distillation with
rectification – vacuum distillation - batch distillation – operation and process – advantages and
limitations-distillation equipments – construction and operation – factors influencing the operation.

TOTAL: 45 PERIODS

OUTCOME:
• To understand Principles of separation methods used in the process industry. To
  appreciate different equipments developed for separation.

TEXT BOOKS:
   Hill Int., 2001,
   Private Limited, New Delhi.
REFERENCE:

FD8411 FOOD ANALYSIS LABORATORY L T P C

OBJEKTIVE:
- Analysis of foods and food products for chemical components, compliance to standards; detection of adulterants in foods.

LAB EXPERIMENTS:
1. Determination of moisture in spices powder by distillation method and Hot air oven method.
2. Determination of total fat, protein in milk and milk products.
3. Rancidity test for fried foods to assess primary and secondary oxidative products.
4. Determination of Vitamin C in fruit juices.
5. Estimation of synthetic Food colour in sweets, confectioneries and beverages.
7. Determination of Iodine content in iodized salt.
8. Detection of Annatto, lead, MSG, sulphur-di-oxide, Emulsifiers and stabilizers in food products.
10. Determination of soluble and insoluble fibre in foods.
11. Detection of adulterants in edible oil and ghee.
12. Column chromatographic separation of colours
13. The identification of sugars in fruit juice using TLC.

TOTAL: 60 PERIODS

OUTCOMES:
- Better understanding in analysis of foods and food products for chemical components.
- Knowing standards for food products.
- Obtain knowledge of adulterants in foods.

Equipment Needed for 30 Students
Soxhlet apparatus 5
Kjeldahl apparatus 2
UV spectrophotometer 1
Colour comparator 1
Water bath 2
pH meter 3
Fume hood 1
Dean and stark apparatus 1
Weighing balance 1
Hot air oven 1
Simple distillation unit 2

TEXT BOOKS:

FD8412 UNIT OPERATIONS LABORATORY

OBJECTIVE:
- To develop knowledge in handling basic operation equipment’s

EXPERIMENTS:
1. Flow measurement a) Orifice meter b) Venturimeter, c) Rotameter
2. Determination of economy and thermal efficiency of rotary flash evaporator
3. Solving problems on single and multiple effect evaporator
5. Determination of collection efficiency in cyclone separator.
7. Determination of absorption efficiency in a packing tower
8. Determination of porosity, coefficient of friction and angle of repose of grains.
10. Determination of performance characteristics in size reduction using the burr mill.
11. Determination of energy requirement in size reduction using the ball mill and hammer mill.
13. Performance evaluation of a steam distillation process.
14. Visit to a solvent extraction, sugar industry.

TOTAL: 60 PERIODS

Equipment Needed for 30 Students
Orifice meter 1
Venturi meter 1
Rotameter 1
Packed column 1
Centrifugal separator 1
Steam distillation unit 2
Fluidized bed column 1
Rotary flash evaporator 1
Cyclone separator 1
Ball mill 1
Hammer mill 1
Burr mill 1
Pin mill 1

OUTCOMES:
Upon completion of this practical course the student will

- Have knowledge on the basic principles of chemical engineering and its applications.
- Be able to apply the skill of material balance and energy balance in unit operations unit process

HS8461 ADVANCED READING AND WRITING

OBJECTIVES:

- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students’ critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.

UNIT I
Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title
Writing - Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

UNIT II
Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT III
Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques- Writing- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT IV
Reading- Genre and Organization of Ideas- Writing- Email writing- visumes – Job application-project writing-writing convincing proposals.

UNIT V
Reading- Critical reading and thinking- understanding how the text positions the reader- identify Writing- Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:

- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
• Display critical thinking in various professional contexts.

TEXT BOOKS:

REFERENCES:

FD8501 FOOD ADDITIVES L T P C
3 0 0 3

OBJECTIVE:
• To expose the students to the use of different chemical additives in foods during food processing and preservation

UNIT I INTRODUCTION
Definition, role of food additives, classification of food additives based on their role, dual role of certain additives, INS numbering system of food additives, safety requirements of food additives, Acceptable daily intake of food additives, JECFA and Food Chemical Codex standards for food additives, status of food additives with respect to Indian laws, GMP and permissible upper levels of food additives under Indian food laws.

UNIT II ACIDITY REGULATORS AND PRESERVATIVES
Acidity Regulators – definition, chemical structure, role and importance, pH modulation and taste, acidity profile, permitted acidity regulators, levels of usage and food applications. Preservatives of chemical and microbial origin; mode of action on spoilage organisms and pathogens, factors affecting the performance of preservatives, active forms of preservatives, necessity in a food and levels of usage; permitted preservatives and food applications. Case studies / illustrations

UNIT III EMULSIFIERS, STABILIZERS AND THICKENERS
Emulsion, surface tension, oil in water and water in oil emulsion, Hydrophilic and Lipophilic balance (HLB), role of emulsifiers, different classes of emulsifiers and their chemical structure, their HLB values and role in emulsion stabilization; role of different stabilizers and other substances in emulsion stability; emulsion formation process and equipment; measurement of emulsion stability; permitted emulsifiers and stabilizers and food applications. Thickeners – definition, chemical structure, role in food processing and product end characteristics, list of permitted thickeners and food applications.
UNIT IV  ANTIOXIDANTS AND ANTI-CAKING AGENTS  9
Antioxidants - Chemistry of oxidative deterioration of food and its constituents and its effect on the
quality; defining antioxidant; water soluble and oil soluble antioxidants and their chemical structure,
permitted antioxidants; mechanism of action, permitted levels and food application. Anti-foaming
and propellants, Anti-caking agents – definition, role in preventing spoilage, mode of action,
permitted list of anti-caking agents and food application.

UNIT V  COLOR AND ARTIFICIAL SWEETENERS  9
Color – Natural and synthetic food colors, their chemical structure, shades imparted, stability,
permitted list of colors, usage levels and food application. Artificial Sweeteners – list, structure,
taste profile, permitted list, usage levels and food applications.

TOTAL: 45 PERIODS

OUTCOMES:
- To understand the principles of chemical preservation of foods
- To understand the role of different food additives in the processing of different foods
  and their specific functions in improving the shelf life, quality, texture and other physical
  and sensory characteristics of foods
- To know the regulations and the monitoring agencies involved in controlling the safer
  use of additives in foods

TEXT BOOKS:
   Hill, 2000

REFERENCES:
2. Peter A Williams and Glyn O Philips, " Gums and stabilizers for the Food Industry", RSC,
   2006.

FD8502  BIOCHEMICAL ENGINEERING FOR FOOD TECHNOLOGISTS  L T P C
4  0  0  4

OBJECTIVES:
- To understand the Enzyme kinetics, Inhibition kinetics, Immobilization
- To understand the concept of basic fermentation processes and its control systems etc.
- To get a practical knowledge about running the fermenter and its scale – up and modes
  of operation etc.

UNIT I  INTRODUCTION TO ENZYME  12
Classification of enzymes. Mechanisms of enzyme action; concept of active site and energetics of
enzyme substrate complex formation; specificity of enzyme action; principles of catalysis –
collision theory, transition state theory; role of entropy in catalysis.

UNIT II  KINETICS OF ENZYME ACTION  12
Kinetics of single substrate reactions; estimation of Michaelis – Menten parameters, multisubstrate
reactions- mechanisms and kinetics; turnover number; types of inhibition & models –substrate,
product. Allosteric regulation of enzymes, Monod changeuxwyman model, ph and temperature effect on enzymes & deactivation kinetics.

UNIT III ENZYME IMMOBILIZATION 9
Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages.

UNIT IV OVERVIEW OF FERMENTATION PROCESSES 12
Overview of fermentation industry, general requirements of fermentation processes, basic configuration of fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes.

UNIT V RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS 15
Criteria for good medium, medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation of optimal growth and product formation, examples of simple and complex media, design of various commercial media for industrial fermentations – medium optimization methods

TOTAL: 60 PERIODS

OUTCOMES:
The student will be able to
- Understand the fundamentals of Enzyme kinetics, Inhibition kinetics and Immobilization
- Understand the concept of basic fermentation processes and its application during scaleup operations.

TEXT BOOKS:

REFERENCES:

FD8503 REFRIGERATION AND COLD CHAIN MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:
- To understand the underlying principles of operation in different Refrigeration & cold storage systems and its components.
- To provide knowledge on design aspects of cold storage systems

UNIT I REFRIGERATION PRINCIPLES 9

UNIT II VAPOUR COMPRESSION REFRIGERATION AND COMPONENTS
Vapour compression system - refrigeration components – compressor and condenser – types, construction and working - expansion device and evaporators – types, construction and working

UNIT III REFRIGERANTS AND VAPOUR ABSORPTION CYCLE

UNIT IV SHELF – LIFE OF FOOD PRODUCTS
Defining overall Shelf-life, remaining shelf life in the context of Chilled & Frozen foods; - Deterioration modes of food items; Models of quality deterioration- Kinetic model; shelf-life model; Q10/q10 model; TTT model for the remaining shelf – life; General procedure for shelf – life testing – the 11 steps procedure.

Storage of frozen foods; - Basic design requirements of storage to uphold the shelf –life – size , insulation, entry –exit position, palletization, proper disk-space for air-circulation, automatic door – closing, proper lighting, temperature monitoring and recording facility; stacking systems, emergency exits, material handling devices like fork-lifts, pallet trucks, etc floor heaters, vapour barriers, etc.

UNIT V COLD CHAIN
What is cold chain? Need for the chain for chilled / frozen food item, various links of the chain; importance of shelf- life; just – in-time deliveries; Temperature limits;in various countries-Europe, US, Australia etc; Chilling and freezing; - Chilling injury, cook-chilling systems; cold – shortening; PPP and TTT concepts; Temperature monitoring; -Critical temperatures; Temperature –time indicators(TTI); Time –temperature –correlation-the kinetic approach, effective temperature; Transportation regulations; Role of packaging in cold chain– MAS, MAP, CAS, CAP etc; Thaw indicators.

OUTCOME:
- Upon completion of this course, the students will be able to demonstrate the operations in different Refrigeration & cold storage systems and also able to design Refrigeration & cold storage systems.

TEXT BOOKS:

REFERENCES:
FD8504 FOOD PROCESSING AND PRESERVATION L T P C 3 0 0 3

OBJECTIVE:
- To expose the students to the principles and different methods of food processing and preservation.

UNIT I PRINCIPLES OF MASS AND ENERGY BALANCE 9
Transport phenomena with respect to foods; Factors affecting heat and mass transfer; Study of heat transfer and its application in the design of thermal processes and freezing. Thermal processing; calculation of process time temperature-schedules.

UNIT II CANNING OF FOOD PRODUCTS 9
Newer methods of thermal processing; batch and continuous; application of infra-red microwaves; ohmic heating; control of water activity; preservation by concentration and dehydration; osmotic methods.

UNIT III DRYING PROCESS FOR TYPICAL FOODS 9
Rate of drying for food products; design parameters of different type of dryers; properties of air-water mixtures. Psychrometric chart, freezing and cold storage. freeze concentration, dehydration, freeze drying, IQF; calculation of refrigeration load, design of freezers and cold storages.

UNIT IV NON-THERMAL METHODS 9
Super Critical Technology for Preservation - Chemical preservatives, preservation by ionizing radiations, ultrasonics, high pressure, fermentation, curing, pickling, smoking, membrane technology. Hurdle technology.

UNIT V FOOD PACKAGING 9
Basic packaging materials, types of packaging, packaging design, packaging for different types of foods, retort pouch packing, costs of packaging and recycling of materials.

TOTAL: 45 PERIODS

OUTCOMES:
- To understand the principles of food processing and preservation.
- To understand the role of different methods the processing of different foods and their impact on the shelf life, quality, and other physical and sensory characteristics of foods.
- To familiarize with the recent methods of minimal processing of foods

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
To develop skills related to
- Preservation of foods
- Use of various techniques and additives for food processing and Preservation

EXPERIMENTS:
1. Heat transfer studies in a plate heat exchanger (Parallel and counter flow)
2. Refrigeration and Freezing of vegetables and fruits
3. Drying of vegetables and fruits with and without additives - Drying rate studies including, constant rate and falling rate periods and the effects of various factors on them.
4. Osmotic drying of foods with salt and sugar.
5. Canning & bottling of vegetable and fruit products
6. Filtration and concentration of fruit juices
7. Production of extruded products.
8. Spray drying of juices/milk
9. Pasteurization of milk
10. Retort processing of foods
11. Determination of Water vapor transmission rate of different packaging materials
12. Determination of migration characteristics of packaging materials
13. Determination of tensile and burst strength of given packaging material

TOTAL: 60 PERIODS

Equipment Needed for 30 Students
Plate heat exchanger 1
Refrigerator 2
Deep freezer 1
Tray dryer 1
Hot air oven 1
Refractometer 1
Extruder 1
RO equipment 1
Double seamer machine 1
Canning and bottling unit 1
Pasteurizer 1
Spray dryer 1
Retort unit 1
Thermometer 3
Water vapour permeability tester 1
Tensiometer 1
Viscometer 1
Desiccator 5
Weighing balance 2
Vegetable chopper 1
OUTCOMES:
- Ability to select the specific preservation technology suitable for a specific food
- Ability to Process the different categories of food

REFERENCES:

FD8512 BIOCHEMICAL ENGINEERING LABORATORY

OBJECTIVE:
- To enable the students to understand the concepts and operation of equipment in handling of enzymes and cultivation of microbes in industrial scale.

EXPERIMENT:
2. Medium optimization – Plackett Burman design, response surface methodology
3. Enzyme kinetics – Michaelis Menton parameter, effect of temperature and pH
4. Enzyme immobilization – gel entrapment, cross linking
5. Preparation of bioreactor, utilities for bioreactor operation
6. Thermal death kinetics
7. Batch sterilization design
10. Estimation of kla – sulphite oxidation method
11. Estimation of overall heat transfer coefficient

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS:
- Colorimeter 4
- UV/Vis spectrophotometer 2
- Bioreactor (Fermenter) 2
- Gas analyser (O2 and Co2) 2
- Shaking incubator 3
- Static incubator 3

OUTCOMES:
- To sterilize a bioreactor
- To operate a bioreactor
- To design experiments to evaluate the performance of the bioreactor.
- To develop enzyme immobilized processes.

REFERENCES:

HS8581 PROFESSIONAL COMMUNICATION L T P C

OBJECTIVES:
The course aims to:
• Enhance the Employability and Career Skills of students
• Orient the students towards grooming as a professional
• Make them Employable Graduates
• Develop their confidence and help them attend interviews successfully

UNIT I
Introduction to Soft Skills— Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II
Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV
Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V
Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

TOTLA: 30 PERIODS

OUTCOMES:
At the end of the course Learners will be able to:
• Make effective presentations
• Participate confidently in Group Discussions.
• Attend job interviews and be successful in them.
• Develop adequate Soft Skills required for the workplace
Recommended Software
1. Open Source Software
2. Win English

REFERENCES:

FD8601 FOOD PROCESS ENGINEERING AND ECONOMICS L T P C

OBJECTIVE:
- To expose the students to the fundamental knowledge of food, its properties and different methods of food processing

UNIT I RHEOLOGY AND TEXTURE OF FOOD MATERIALS

UNIT II THERMAL PROCESSING

UNIT III WATER BINDING AND DRYING
UNIT IV  METHODS OF FOOD PROCESSING
UNIT VI LAYOUT AND COST ESTIMATION

TOTAL: 45 PERIODS

OUTCOMES:
- Students will understand the importance of quality control and food packaging in shelf life of foods.
- Understand thermal processing of food and hygiene practices in food industry.

TEXT BOOKS:

REFERENCES:

FD8602 BAKING AND CONFECTIONERY TECHNOLOGY 8 3 0 0 3

OBJECTIVES:
This course will enable the student to
- Familiarize with the commercial methods of baking bread and recent advances in bakery industry
- Learn microbiological aspects of bakery products, sanitation and hygiene of baking industries.

UNIT I  INTRODUCTION TO BAKING
Classification of bakery products. Bakery ingredients and their functions-Essential ingredients: Flour, yeast and sour dough, water, salt- Other ingredients: Sugar, color, flavor, fat, milk, milk
UNIT II  EQUIPMENTS
Introduction to utensils and equipments used in bakery industry with their purpose. Bulk handling of ingredients- Dough mixing and mixers, Dividing, rounding, sheeting, and laminating- Fermentation enclosures and brew equipment - Ovens and Slicers; Extrusion. Rheology of dough-Farinograph, Amylograph, Alveograph and Extensiograph.

UNIT III  BREAD MAKING PROCESS

UNIT IV  BAKERY PRODUCTS

UNIT V  CONFECTIONERY PRODUCTS

TOTAL: 45 PERIODS

OUTCOMES:
- Better understanding of process technology of bakery and confectionery products
- Complete learning - use of sanitation and safety practices in bakery and confectionery production

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- The course aims to develop the knowledge of students in the area of vegetable and fruit processing and technology.
- This course will enable students to appreciate the application of scientific principles in the processing of fruits and vegetables.

UNIT I BASIC AGRICULTURAL ASPECTS OF VEGETABLES AND FRUITS 8
Ability to identify all commercially important fruits and vegetables with their names in important Indian languages, important regions, season, Morphology, structure and composition of fruit and vegetable. Production and processing scenario of fruits and vegetable: India and World. Scope of Fruit and Vegetable Preservation Industry in India. Present status, constraints and prospectus.

UNIT II FRESH FRUITS AND VEGETABLES 8
Physical, Textural characteristics, structure and composition. Maturity standards; Importance, methods of Maturity determinations maturity indices for selected fruits and vegetables. Harvesting of important fruits and vegetables. Fruit ripening- chemical changes, regulations, methods. Storage practices: Control atmospheric, Bead atmosphere, hypotactic storage, cool store, Zero emerge cool chamber, stores striation. Commodity pre-treatment’s - chemicals, wax coating, pre-packaging, phytonutrients in fruits and vegetables grading, cleaning, Physiological post harvest diseases chilling injury and disease. Handling and packaging of fruits and vegetables

UNIT III FREEZING & DEHYDRATION OF FRUITS AND VEGETABLES 9
General pre processing, different freezing methods and equipments, problems associated with specific fruits and vegetables; Dehydration – General pre processing, different methods of drying including sun, tray, spray drying and low temperature, osmotic dehydration and other modern methods; Indian Food Regulation and Quality assurance.

UNIT IV CANNING, PUREES AND JUICES 12
Canning- General pre processing, specific or salient points in fruits and vegetables like – Blanching, exhausting, processing conditions; Indian Food Regulation and Quality assurance Fruit Juice / pulp/ Nectar/Drinks, concentrates – General and specific processing, different packing including aseptic. Indian Food Regulation and Quality assurance Vegetable Purees/ pastes - General and specific processing, different packing including aseptic. Indian Food Regulation and Quality assurance

UNIT V FRUIT AND VEGETABLE PRODUCTS 8

TOTAL: 45 PERIODS
OUTCOMES:
On completion of the course the students are expected to
- Better understanding of the concepts of physiological characteristics of fruits and vegetables Better insight about fruit losses during storage and ways to prevent it.
- Thorough Knowledge and understandings of the specific processing technologies used for different foods and the various products derived from these materials.

TEXT BOOKS:

FD8611 FRUITS AND VEGETABLE PROCESSING TECHNOLOGY LABORATORY

OBJECTIVES:
To develop skills related to Preservation and analytical techniques in fruit and vegetable products
- Use of various techniques and additives for fruit and vegetable processing and quality analysis

EXPERIMENTS:
1. Preparation of orange squash and cordial.
2. Preparation of canned peas / pine apple.
3. Preservation and processing of certain vegetables by drying and dehydration
4. Preparation of Jam/Jelly and its preservation by sugar
5. Preparation of pickles
6. Osmotic concentration/dehydration of certain fruits and vegetables using concentrated sugar and salts solutions
7. Preparation of malt based drink.
8. Preparation of fruit juice/pulp and its preservation by chemical Preservatives/ thermal processing.
9. Preparation of tomato puree/ketchup and its preservation by chemical preservatives
10. Experiment on preparation of fruit bar.
11. Experiment on preparation of Ready to serve beverages.
12. Experiment on quality evaluation of fruit beverages.
13. Experiment on fermented fruit and vegetable preparation.
14. Experiment on quality evaluation of fermented fruit and vegetable products.

TOTAL: 60 PERIODS

OUTCOME:
- On the completion of the course, the students will able to get experience on fruit and vegetable process technology.

TEXT BOOKS:

REFERENCES:

Equipment Needed for 30 Students
Mixer 1
Canning unit 1
Metal can sealer 1
Tray dryer 1
Refractometer 1
Jelly cups/moulds 10
Cooking vat 5
Gas stove 2
Gas cylinder 2
Stainer 5
Blender 2
Retort processor 1
Laminar air flow chamber 1
Incubator 1
Viscometer 1

FD8612 BAKING AND CONFECTIONERY TECHNOLOGY  L T P C
LABORATORY 0 0 4 2

OBJECTIVE:
• This course will enable the student to acquaint with the preparation of various bakery products and perform quality analysis for the same

EXPERIMENTS
1. Study of ingredients (major and minor): characteristics of flour, yeast, shortening, sugar, egg and salts.
2. Experiment on leavening action of baking powder, sodium-bicarbonate and ammonium-bicarbonate.
3. Determination sedimentation value of flour
4. Estimation of water absorption power (atta, and maida)
5. Determination dough rising capacity of yeast
6. Studies of dough characteristics farinographic and extensographic
7. Preparation of biscuits-different types.
8. Preparation of bread-different types.
11. Preparation of candy.
12. Visit to a bakery/confectionary industry.

TOTAL: 60 PERIODS
### Equipment Needed for 30 Students

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Refrigerator</td>
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<tr>
<td>Sedimentation cylinder</td>
<td>1</td>
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<tr>
<td>Deck oven</td>
<td>1</td>
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<tr>
<td>Dough mixer</td>
<td>3</td>
</tr>
<tr>
<td>Fermentation cabinet</td>
<td>1</td>
</tr>
<tr>
<td>Humidity chamber</td>
<td>1</td>
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<tr>
<td>Hunter calorimeter</td>
<td>1</td>
</tr>
<tr>
<td>Cake &amp; candy moulds</td>
<td>10</td>
</tr>
<tr>
<td>Farinograph</td>
<td>1</td>
</tr>
<tr>
<td>Extensograph</td>
<td>1</td>
</tr>
<tr>
<td>Egg beater</td>
<td>3</td>
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<tr>
<td>Texture analyzer</td>
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<tr>
<td>Weighing balance</td>
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### REFERENCES / MANUALS/SOFTWARE:

### FD8701 DAIRY PROCESS TECHNOLOGY

<table>
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<td><strong>OBJECTIVE:</strong></td>
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<tr>
<td>To introduce the students to dairy industry, properties and processing of milk, manufacture of dairy products, sanitation and effluent treatment in dairy industry</td>
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### UNIT I PROPERTIES OF MILK

### UNIT II PROCESSING AND QUALITY PARAMETERS OF MILK

### UNIT III MILK PRODUCTS
Traditional dairy products, Manufacturing of Yogurt, Cheese, Butter, Ghee, Ice-cream, malted products, evaporated milk products - properties, Classification-processing Methods, Equipment used, standards and quality parameters.

### UNIT IV MILK POWDER PROCESSING AND MILK SUBSTITUTES

### UNIT V STORAGE SANITATION AND EFFLUENT TREATMENT

71
Storage of Milk in Tanks - Storage of ice cream and other milk products - in cold storage - Cleaning and Sanitation - Importance - Detergents - Properties - Cleaning procedures - Cleaning in place - Dairy effluent treatment and disposal.

**TOTAL: 45 PERIODS**

**OUTCOME:**
- The students will gain knowledge about dairy processing and understand the manufacturing processes of various dairy products

**TEXT BOOKS:**

**REFERENCES:**

**FD8702 FOOD SAFETY, QUALITY AND REGULATION**

**OBJECTIVES:**
- To characterize different type of food hazards, physical, chemical and biological in the industry and food service establishments
- To help become skilled in systems for food safety surveillance
- To be aware of the regulatory and statutory bodies in India and the world
- To ensure processed food meets global standards

**UNIT I**
Introduction to food safety and security: Hygienic design of food plants and equipments, Food Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food Additives (functional role, safety issues), Food Packaging & labeling. Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials. Control of rats, rodents, mice, birds, insects and microbes. Cleaning and Disinfection, ISO 22000 – Importance and Implementation

**UNIT II**
Food quality: Various Quality attributes of food, Instrumental, chemical and microbial Quality control. Sensory evaluation of food and statistical analysis. Water quality and other utilities.

**UNIT III**

Critical Quality control point in different stages of production including raw materials and processing materials. Food Quality and Quality control including the HACCP system. Food inspection and Food Law, Risk assessment – microbial risk assessment, dose response and exposure response modelling, risk management, implementation of food surveillance system to monitor food safety, risk communication

UNIT IV  9
Indian and global regulations: FAO in India, Technical Cooperation programmes, Bio-security in Food and Agriculture, World Health Organization (WHO), World Animal Health Organization (OIE), International Plant Protection Convention (IPPC)

UNIT V  9
Codex Alimentarius Commission - Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India – ToR, Functions, Shadow Committees etc.

TOTAL: 45 PERIODS

OUTCOMES:
- Thorough Knowledge of food hazards, physical, chemical and biological in the industry and food service establishments
- Awareness on regulatory and statutory bodies in India and the world

REFERENCES:
1. Handbook of food toxicology by S. S. Deshpande, 2002
2. The food safety information handbook by Cynthia A. Robert, 2009
4. Microbiological safety of Food by Hobbs BC, 1973

FD8703 FOOD PACKAGING TECHNOLOGY  L T P C
3 0 0 3

OBJECTIVE:
- The course aims to develop the knowledge of students in the area of packaging of foods and the related technology used. This course will enable students to appreciate the application of scientific principles in the packaging of foods.

UNIT I  6
BASICS OF PACKAGING
Packaging – Concepts, definition, Significance, classification. Packaging – Development, Retail/Unit; Packaging of foods –fresh and processed

UNIT II  12
PACKAGING MEDIA & MATERIALS
Primary packaging media – Properties and application, Paper boards, metals, plastics, wood and plywood, glass, flexible materials Labels, caps and closures and adhesives, inks and lacquers, cushioning materials, reinforcements; Testing & evaluation of packaging media – retail packs & transport packages

UNIT III  12
PACKAGING SYSTEMS AND METHODS
Vacuum packaging, gas flush packaging, CAP & MAP, aseptic & retort packaging, box in box. Food products-General classification and packaging types, varieties and trends Storage handling and distribution of packages-including pallets & containers; Modern methods of packaging.

UNIT IV  PACKAGING DESIGN  7
Food marketing and role of packaging; Packaging aesthetic and graphic design; Packaging – Laws and regulations

UNIT V  ENVIRONMENTAL ISSUES IN PACKAGING  8
Coding and marking including bar coding and Environmental, ecological & Economic issues, recycling and waste disposal.

TOTAL: 45 PERIODS

OUTCOMES:
To gain knowledge on
- The different types of materials and media used for packaging foods.
- Hazards and toxicity associated with packaging materials and laws, regulations and the monitoring agencies involved food safety, labelling of foods
- Methods of packaging, shelf life and food factors affecting packaging

TEXT BOOKS:

FD8711  TESTING OF PACKAGING MATERIALS
LABORATORY

OBJECTIVES:
To develop skills related to
- Testing methods for packaging materials to assure quality
- Use of various techniques to check the barrier properties of packaging materials to avoid contamination

EXPERIMENTS:
1. Testing of physical/mechanical properties of food packaging material.
5. Determination of grease resistance of papers used in food industry – butter paper & toffee wraps.
6. Determination of adhesive test of tapes
7. Determination of drop test using food packets
8. Estimation of water absorption test in paper based materials
9. Experiment on sealing of plastic cups
10. Experiment on retort packing
11. Edible packaging of Food Samples.
12. Study of Sorption Isotherm for Food Package Design.
13. Packaged food cut-out analysis.

**TOTAL: 60 PERIODS**

**Equipment Needed for 30 Students**

- Tensile testing machine digital 1
- Wall thickness gauge 1
- Friction tester 1
- Puncture resistance tester 1
- Modified Atmospheric cum Vacuum Packaging machine 1
- Moisture meter 1
- Drop tester 1
- Pouches 1
- Heat sealer 1
- Freshness tester 1
- Retort processor 1

**OUTCOME:**
- On the completion of the course, the students will be able to get experience on testing food packaging materials to assure quality of foods.

**TEXT BOOKS:**

**REFERENCES:**

**FD8712 DAIRY PROCESS TECHNOLOGY LABORATORY**

**OBJECTIVES:**
To develop skills related to
- Preservation and analytical techniques in milk and milk products
- Use of various techniques and additives for milk product processing and quality analysis

**EXPERIMENTS:**
Properties of milk
1. Analysis of milk
2. Platform test - Methylene Blue Reduction Test, clot on boiling test
3. Determination of protein in milk by formol titration (Pynes method)
4. Determination of lactose content of milk by polarimeter
5. Estimation of milk fat by Gerber method or Milko tester
6. Phosphatase test
7. Determination of adulterant and preservatives of milk
9. Determination of redox potential, acidity and pH of milk
10. Determination of viscosity, density and specific gravity of milk

Milk products and Quality Analysis
11. Preparation and analysis of Yoghurt
12. Preparation and analysis of Cottage cheese
13. Preparation and analysis of Ice-cream/ Cream
14. Preparation and analysis of Butter/ Ghee

TOTAL: 60 PERIODS

Equipment Needed for 30 Students
Gerber centrifuge  1
Butyrometer   15
Lactometer    4
Water bath    4
Refractometer  3
Polarimeter    1
Milko tester   1
pH meter       3
Deep freezer   1
Heating mantle 5
Thermometer    3
Weighing balance 2
Kjeldhal apparatus 1
Lovi bond comparator disc 1
Laminar air flow chamber 1
Incubator 1
Blast freezer  1
Homogeniser    1

OUTCOME:
• On the completion of the course, the students will able to get experience on dairy process technology.

REFERENCES:
OBJECTIVE:
- To objective of the project work is to make use of the knowledge gained by the student at various stages of the degree programme.

The students are assigned project work related to product/process development, solution to the technical problems in industry and current research at national and international level. The student is required to submit a report at the end of semester based on the findings. The evaluation is made as per the Regulations of University.

FD8001 BIOLOGY AND CHEMISTRY OF FOOD FLAVOURS

OBJECTIVES:
- To understand the flavour compounds involved in development of flavor
- To understand the analytical techniques involved in flavor analysis

UNIT I INTRODUCTION 9
Problems in flavour research – classification of food flavours; chemical compounds responsible for flavour.

UNIT II FLAVOUR COMPOUNDS 9
Chemical compound classes and their flavour responses; flavour development during biogenesis, flavour development during food processing; use of biotechnology to develop flavours.

UNIT III THE CHEMICAL SENSES 9
Anatomy of the chemical senses; neural development of the chemical senses; receptor mechanisms, neural coding; the control of eating.

UNIT IV FLAVOUR ANALYSIS 9
Subjective versus Objective methods of analysis; psychophysics and sensory evaluation and its types, ENOSE, ETONGUE; Instrumental analysis; sample handling and artifacts; data handling

UNIT V TEACHING FLAVOUR CONCEPTS 9
Problem based learning; tongue and nose; Onion-Beverage-Maillard reaction-Thio-stench

TOTAL: 45 PERIODS

OUTCOMES:
- Better understanding and knowledge of contribution of different compounds for the development of flavor and Analytical techniques involved in flavor analysis.

TEXT BOOKS:

REFERENCES:

FD8002 PULSE AND OIL SEED TECHNOLOGY L T P C

OBJECTIVE:
- The course aims to develop the knowledge of students in the area of pulse and oil seed processing and technology. This is necessary for effective understanding specific aspects of food processing related to these foods. This course will enable students to appreciate the application of scientific principles in the processing of these materials.

UNIT I INTRODUCTION

UNIT II LEGUMES

UNIT III SOYA PROCESSING
Soya as a source of protein and oil; Processing of Soya - soya milk, soy protein Isolate, soya paneer, soya sauce; extrusion technology and production of textured vegetable proteins.

UNIT IV OIL SEEDS
Chemical composition and characters of oil seed and Oils, Anti-nutritional factors, elimination Methods. Post Harvest Technology of Oil seeds, Handling Drying, Storage, Grading, Pre treatments, cleaning, Dehulling, Size reduction and flaking. Oil extraction: Traditional Methods, Ghani, Power Ghani, Expellers - Principle of Expeller, structure design of expeller. Solvent extraction process: Principle, Pre treatment - Breaking, Cracking, flaking.

UNIT V OIL SEED PROCESSING

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students are expected to

• Be able to understand and identify the specific processing technologies used for pulses and oil seeds and the various products derived from these materials.
• Understand the application of scientific principles in the processing technologies specific to the materials.
• Grasp the changes in the composition of foods with respect to the type of processing technology used.

TEXT BOOKS:

REFERENCES:

FD8003 TRADITIONAL FOODS L T P C
3 0 0 3

OBJECTIVE:
• To help students acquire a sound knowledge on diversities of foods, food habits and patterns in India with focus on traditional foods.

UNIT I HISTORICAL AND CULTURAL PERSPECTIVES 9
Food production and accessibility - subsistence foraging, horticulture, agriculture and pastoralization, origin of agriculture, earliest crops grown. Food as source of physical sustenance, food as religious and cultural symbols; importance of food in understanding human culture - variability, diversity, from basic ingredients to food preparation; impact of customs and traditions on food habits, heterogeneity within cultures (social groups) and specific social contexts - festive occasions, specific religious festivals, mourning etc. Kosher, Halal foods; foods for religious and other fasts.

UNIT II TRADITIONAL METHODS OF FOOD PROCESSING 9

UNIT III TRADITIONAL FOOD PATTERNS 9
Typical breakfast, meal and snack foods of different regions of India. Regional foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods, pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods

UNIT IV COMMERCIAL PRODUCTION OF TRADITIONAL FOODS 12
Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods – types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods – ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters.

UNIT V HEALTH ASPECTS OF TRADITIONAL FOODS 6
Comparison of traditional foods with typical fast foods / junk foods – cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments / illnesses.

TOTAL: 45 PERIODS

OUTCOMES:
- To understand the historical and traditional perspective of foods and food habits
- To understand the wide diversity and common features of traditional Indian foods and meal patterns.

TEXT BOOKS:

GE8071 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj

Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

TEXT BOOKS:

REFERENCES:
1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
FD8004 PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT

OBJECTIVE:
- To introduce process economics and industrial management principles to chemical engineers.

UNIT I PRINCIPLES OF PRODUCTION MANAGEMENT AND ORGANISATION 15
Planning, organization, staffing, coordination, directing, controlling, communicating, organization as a process and a structure; types of organizations Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning; routing; scheduling; dispatching; costs and costs control, inventory and inventory control.

UNIT II ENGINEERING ECONOMICS FOR PROCESS ENGINEERS - INTEREST, INVESTMENT COSTS AND COST ESTIMATION 10
Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital, invested capital and profitability.

UNIT III PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENT 8
Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

UNIT IV ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE 4
Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.

UNIT V ECONOMIC BALANCE AND QUALITY AND QUALITY CONTROL 8
Essentials of economic balance – Economic balance approach, economic balance for insulation, evaporation, heat transfer. Elements of quality control, role of control charts in production and quality control.

TOTAL: 45 PERIODS

OUTCOMES:
- The objective of this course is to teach principles of cost estimation, feasibility analysis, management, organization and quality control that will enable the students to perform as efficient managers.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.
- To understand the role of Nutraceuticals and functional food in health and disease

UNIT I  INTRODUCTION AND SIGNIFICANCE  6
Introduction to Nutraceuticals and functional foods; importance, history, definition, classification, list of functional foods and their benefits, Phytochemicals, zoo chemicals and microbes in food, plants, animals and microbes

UNIT II  ANALYSIS OF PHYTOCHEMICALS  12
Qualitative and quantitative methods: phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans, Chitin; Carotenoids - Factors affecting bioavailability, chemical and histochemical characterization of cell wall polysaccharides in almond seed in relation to lipid bioavailability.

UNIT III  ASSESSMENT OF ANTIOXIDANT ACTIVITY  12
In vitro and In vivo methods for the assessment of antioxidant activity, Comparison of different In Vitro methods to evaluate the antioxidant, Prediction of the antioxidant activity of natural phenolics from electrotopological state indices, Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources

UNIT IV  ROLE IN HEALTH AND DISEASE  12
Nutraceuticals and Functional foods in Gastrointestinal disorder, Cancer, CVD, Diabetic Mellitus, HIV and Dental disease; Importance and function of probiotic, prebiotic and symbiotic and their applications, Functional foods and immune competence; role and use in obesity and nervous system disorders.

UNIT V  SAFETY ISSUES  6
Health Claims, regulations and safety issues- International and national.
TOTAL: 45 PERIODS

OUTCOMES:

- Knowledge of the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction
- Understand the role of Nutraceuticals and functional food in health and disease

TEXT BOOKS:

5. Tipnis, H.P. “Bioavailability and Bioequivalence: An Update” New Age International,
REFERENCES:

FD8006 FOOD TOXICOLOGY AND ALLERGY L T P C
3 0 0 3

OBJECTIVES:
- Familiarize with hazards, and toxicity associated with food and their implications for health.
- Know the various kinds of allergens and basis of allergic reactions
- Be familiar with various natural toxins in food.

UNIT I INTRODUCTION
Definition and need for understanding food toxicology; Hazards - Microbiological, nutritional and environmental. Basics of immune resources - humoral and cell media resources. Allergen and mechanism of allergic resources.

UNIT II FOOD ALLERGY AND SENSITIVITY
Chemistry of food allergens, celiac disease, food disorders associated with metabolism, lactose intolerance, and asthma

UNIT III PRINCIPLES OF TOXICOLOGY
Natural food toxicants - toxicity of mushroom alkaloids, seafood, vegetables, fruits, pulses, and antinutritional compounds. Biological factors that influence toxicity, toxin absorption in the G.I. track, Industrial microflora, blood, brain barrier, storage and excretion of toxins

UNIT IV DETERMINATION OF TOXICANTS IN FOOD SAMPLING
Quantitative and qualitative analysis of toxicants in foods; Biological determination of toxicants Assessment of food safety – Risk assessment and risk benefit indices of human exposure, acute toxicity, mutagen city and carcinogenicity, reproductive and developmental toxicity, neurotoxicity and behavioural effect, immunotoxicity.

UNIT V TOXICANTS FORMED DURING FOOD PROCESSING
Intentional direct additives, preservatives, nitrate, nitrite, and N-nitroso compound flavour enhancers, food colours, indirect additives, residues and contaminants, heavy metals, other organic residues and packaging materials. Toxicity of heated and processed foods, food carcinogens and mutagens - Polycyclic aromatic hydrocarbons, N-nitrosamines, Acrylamide and their mode of action

TOTAL: 45 PERIODS

OUTCOME:
- Awareness about the different types of allergens and Natural toxins associated with food

TEXT BOOKS:
FD8007  SPICES AND PLANTATION TECHNOLOGY  L T P C  3 0 0 3

OBJECTIVES:
To enable the students to understand about
- Coffee and its processing techniques, instant coffee, and quality grading
- Different types of tea and its manufacturing techniques, instant tea, quality parameters of tea
- Cocoa and its processing, chocolate manufacturing technology Processing and chemistry of major spices
- Processing and chemistry of minor spices

UNIT I  IMPORTANCE AND PROCESSING OF SPICES  9
A. Major Spices
Post Harvest Technology, composition, processed products of - Pepper, Cardamom, onion, ginger and turmeric – Oleoresins and essential oils – Method of manufacture – Chemistry of the volatiles – Enzymatic synthesis of flavour identical - Quality control, Flavour of major spices - Spice oil and oleoresins.

B. Minor Spices
Post Harvest Technology, composition, processed products of - Cumin, Coriander, Cinnamon, fenugreek, pepper, Garlic, Clove and Vanilla - Oleoresins and essential oils – Method of manufacture – Chemistry of the volatiles – flavours, Quality control, Present trends in synthesis of volatiles – micro-organisms, plant suspension cultures

UNIT II  PROCESSING OF COFFEE AND TEA  12

UNIT III  CHEMISTRY AND TECHNOLOGY OF COCOA AND COCOA PRODUCTS  9
Occurrence - Chemistry of the cocoa bean – changes taking place during fermentation of cocoa bean – Processing of cocoa bean – cocoa powder – cocoa liquor manufacture Chocolates – Types – Chemistry and technology of chocolate manufacture – Quality control of chocolates

UNIT IV  PROCESSING OF COCONUT, OILPALM, ARECANUT AND CASHEW  9

UNIT V  PACKAGING, GRADING AND QUALITY ANALYSIS OF SPICES  6
Cleaning and grading of spices - packaging and storage of spices – grading specifications – Agmark, ASTA, ESA specifications - processes involved in the manufacture of oleoresins and essential oils – quality analysis of spices and their derivatives

TOTAL: 45 PERIODS

OUTCOMES:
- On completion of the subject, students will be able to understand the processing steps involved for different plantation products and spices.

TEXT BOOKS:

REFERENCES

GE8075  INTELLECTUAL PROPERTY RIGHTS  L T P C
3 0 0 3

OBJECTIVE:
- To give an idea about IPR, registration and its enforcement.

UNIT I  INTRODUCTION  9
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II  REGISTRATION OF IPRs  10
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad
UNIT III AGREEMENTS AND LEGISLATIONS

UNIT IV DIGITAL PRODUCTS AND LAW

UNIT V ENFORCEMENT OF IPRs
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL: 45 PERIODS

OUTCOME:
- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS:

REFERENCES:

FD8008 FOOD PROCESS EQUIPMENT DESIGN L T P C
3 0 0 3

OBJECTIVE:
- To understand the construction requirements, process design, fabrication and installation of equipments and to enhance the knowledge in the design of food processing equipments.

UNIT I INTRODUCTION
Material of construction: Introduction to material selection; Material properties; Environmental effects on material selection; Mechanical properties & strength of materials.

UNIT II CONSTRUCTION REQUIREMENTS
Design basis: Design code; Design pressure, stress & factor of safety; Corrosion allowance; Weld joint efficiency factor; Design loadings; Criteria of failure.

UNIT III DESIGN OFPIPES AND PRESSURE VESSELS
Design of pipe and pipe fittings. Process vessels under internal and external pressure; Design of attachments and closures;

UNIT IV DESIGN OF SUPPORTS
Design of flange connections & threaded fasteners; Design of supports; Bracket or Lug supports, Leg Supports, Skirt Supports
UNITV DESIGNOFPROCESSEQUIPMENTS


TOTAL:45PERIODS

OUTCOME:
- Ability to design, fabricate and operate processing equipments

TEXT BOOKS:

REFERENCES

FD8009 CEREAL TECHNOLOGY L T P C

OBJECTIVES:
- The course aims to develop the knowledge of students in the area of Cereal processing and technology.
- This is necessary for effective understanding specific aspects of food processing related to these foods.
- This course will enable students to appreciate the application of scientific principles in the processing of these materials.

UNIT I PRODUCTION, STRUCTURE AND COMPOSITION
Status, major growing areas and production of cereals and millets in India and the world, structure, Physical properties; Density, Bulk density, Angle of repose, Hardness, asperity, porosity, stack of milling and moisture on physical properties. Chemical composition, Distribution of nutrients and Aroma of cereals and millets; anti-nutritional factors.

UNIT II WHEAT AND RICE

UNIT III OTHER CEREALS
Corn - Morphology, Physico-chemical properties, Corn milling - Wet and dry milling, Milling fractions and modify starches Corn Products – Corn flakes, Corn starch, canned corn products,
puffed product; HFCS; Oats- Milling, Oat Products – Steel cut, rolled oats, quick cooking; Rye bread; Traditional and Fermented cereal products

UNIT IV MILLETS
Sorghum, Pearl Millet, Finger millet, Foxtail millet, Kodo Millet - storage, insect control; processing - Pearling, Milling, Malting, Malt based foods, flaked and fermented products; Traditional and Nutritional products based on finger millet.

UNIT V BAKED AND EXTRUDED PRODUCTS
Baked foods - chemical dough development, mechanical dough development, sheeting extrusion other rapid methods; Bread staling – theory, manifestation, retardation measures; Indian Confectionery. Extrusion processing – methods and products.

OUTCOMES:
On completion of the course the students are expected to
• Be able to understand and identify the specific processing technologies used for cereals
• Understand the application of scientific principles in the processing technologies specific to the materials.

TEXT BOOKS:

GE8076 PROFESSIONAL ETHICS IN ENGINEERING

OBJECTIVE:
• To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES

UNIT II ENGINEERING ETHICS

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics –
A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS

UNIT V GLOBAL ISSUES

TOTAL: 45 PERIODS

OUTCOME:
• Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

REFERENCES:

Web sources:
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

BT8091 INSTRUMENTATION AND PROCESS CONTROL

AIM:
• To familiarize the students with concepts of process dynamics and control leading to control system design.
OBJECTIVE:
- To introduce dynamic response of open and closed loop systems, control loop components and stability of control systems along with instrumentation.

UNIT I INSTRUMENTATION 9
Principles of measurements and classification of process instruments, measurement of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity, pH, concentration, electrical and thermal conductivity, humidity of gases.

UNIT II OPEN LOOP SYSTEMS 9
Laplace transformation, application to solve ODEs. Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag.

UNIT III CLOSED LOOP SYSTEMS 9
Closed loop control systems, development of block diagram for feed-back control systems servo and regulatory problems, transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transient response of closed-loop control systems and their stability

UNIT IV FREQUENCY RESPONSE 9
Introduction to frequency response of closed-loop systems, control system design by frequency response techniques, Bode diagram, stability criterion, tuning of controller settings

UNIT V ADVANCED CONTROL SYSTEMS 9
Introduction to advanced control systems, cascade control, feed forward control, Smith predictor controller, control of distillation towers and heat exchangers, introduction to computer control of chemical processes

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
- Understand the response of various control systems

TEXT BOOKS:

REFERENCES:

BT8071 BIOLOGICAL SPECTROSCOPY L T P C
3 0 0 3

OBJECTIVES:
- To deliver the knowledge of spectroscopic techniques and its functions
- To provide the technical information of spectroscopy for biological applications
UNIT I  OPTICAL ROTATORY DISPERSION  

UNIT II  TYPES OF NUCLEAR MAGNETIC RESONANCE  

UNIT III  TYPES OF MASS SPECTROMETRY  
Ion sources sample introduction – mass analyzers and ion detectors – bimolecular mass spectrometry – peptide and protein analysis – carbohydrates and small molecules – specific applications.

UNIT IV  X-RAY DIFFRACTION  

UNIT V  SPECIAL TOPICS AND APPLICATIONS  
Electron microscopy – transmission and scanning electron microscopy – scanning tunnelling and atomic force microscopy – combinatorial chemistry and high throughput screening methods.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the student would be able to understand and apply
- Basics of optical rotary dispersion methods and nuclear magnetic resonance
- Principles and applications of mass spectrometry and X-ray diffraction
- Microscopic techniques and its applications
- Spectroscopic techniques for various biological applications

TEXT BOOKS:

REFERENCES:
FD8010 MEAT, FISH AND POULTRY PROCESSING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:
• The course aims to develop the knowledge of students in the area of animal product processing and technology.
• This course will enable students to appreciate the application of scientific principles in the processing of these materials.

UNIT I INTRODUCTION 9

UNIT II MEAT PROCESSING 9

UNIT III FISH PROCESSING 9

UNIT IV POULTRY 9
Introduction, Types and characteristics of poultry products, composition, nutritive value, calculation of nutritive value of poultry products. Unit operation involved in poultry processing.

UNIT V EGG PROCESSING 9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students are expected to
• Be able to understand and identify the specific processing technologies used for meat and such foods and the various products derived from these materials.
• Grasp the changes in the composition of foods with respect to the type of processing technology used.

TEXT BOOKS:
REFERENCES:

OBJECTIVE:
- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION
- Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION
- Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS

UNIT IV CHARACTERIZATION TECHNIQUES

UNIT V APPLICATIONS

OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial
TEXT BOOKS:

REFERENCES:

FD8011 FOOD PLANT DESIGN L T P C
3 0 0 3

OBJECTIVE:
- To enable the students understand the various concepts of process development, design consideration and cost estimation in food industry.

UNIT I OVERALL DESIGN OF AN ENTERPRISE
Plant design, sales planning for plant design. Plant Location, levels of Plant location. Location of layout: location factors, plant site selection. Location theory and models, industrial buildings and grounds. Classification of Dairy and Food Plants, farm level collection and Chilling center. Space requirement.

UNIT II PREPARATION OF A PLANT LAYOUT

UNIT III DEVELOPMENT AND PRESENTATION OF LAYOUT
Development of the pilot layout, constructing the detailed layout: Functional design: Sitting of different sections in a plant, Layout installations.

UNIT IV QUANTITATIVE ANALYSIS FOR PLANT LAYOUT

UNIT V PRACTICAL LAYOUTS
PRACTICAL LAYOUTS: Common materials of construction of Food plant, building. Maintenance of Food Plant Building, Illumination and ventilation, Cleaning & sanitization, painting and colour coding, Fly and insect control.

TOTAL: 45 PERIODS

OUTCOME:
- The students will be able to apply their knowledge to design projects for setting up a Food Processing Industry.

TEXT BOOKS:

REFERENCE:
2. “Food plant economic” by Zacharias B. Maroulis and George D. Saravacos published by Taylor and Francis Group, LLC, 2008

FD8012 SPECIALITY FOODS

OBJECTIVE:
- To introduce students to various therapeutic and speciality foods.

UNIT I
Need and scope of specialty foods: Specialty food based on ease in preparation cost health benefits; Functional foods, Convenience food, Health care and medical benefits, Nutritional status, Low cost foods.

UNIT II
A. Specialty foods based on sources; Cereals and millets, Legumes and pulses, Fruits and vegetables, Animal food sources, By product based, Non conventional foods.

B. Specialty foods based on process; Innovative process technology, Food additives basis, Bioactive components, Novel nutraceuticals products, Packaging techniques, Adaptable technology basis, Fast and PET foods.

C. Specialty foods based on growing condition - organic, inorganic farming.

UNIT III
Specialty food based on genetics; Genetically modified foods, Transgenic foods, Biotechnological aspects of detoxification. Proprietary foods. Supplementary foods.

UNIT IV
Therapeutic foods; Modification of diets in disorders, feeding purposes Disease oriented of different organs ex: digestive tract, liver, cardiovascular system, kidney, metabolic disorders, allergy, endocrine disorders.

UNIT V
Specific consumer oriented foods; Defence persons, Space / astronaut, High altitude mountain climbers, Disaster situation – crises, care, maintenance.

TOTAL: 45 PERIODS

OUTCOME:
The students will be able to understand the benefits of various speciality foods.
TEXT BOOK:

REFERENCES:
2. Parvinder S. Bali, “Food Production Operation”, Oxford University, 2014

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UNIT I         9
• Should You Become an Entrepreneur?
• What Skills Do Entrepreneurs Need?
• Identify and Meet a Market Need
• Entrepreneurs in a Market Economy
• Select a Type of Ownership

UNIT II        9
• Develop a Business Plan

UNIT III       9
• Choose Your Location and Set Up for Business
• Market Your Business
• Hire and Manage a Staff

UNIT IV        9
• Finance, Protect and Insure Your Business
• Record Keeping and Accounting
• Financial Management

UNIT V         9
• Meet Your Legal, Ethical, Social Obligations
• Growth in Today’s Marketplace

TOTAL: 45 PERIODS

TEXT BOOK

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OBJECTIVE:
• The course aims to gain knowledge on machinery and process involved in beverage technology and fermentation process involved in making beverage process

UNIT I BASIC INGREDIENTS IN BEVERAGES 9
Beverage-definition-why we drink beverages-ingredients- water, carbon dioxide, bulk and intense sweeteners, water miscible and water dispersible flavouring agents, colours – natural and artificial,
Micro and nanoemulsions of flavors and colors in beverages, preservatives, emulsifiers and stabilizers.

UNIT II BEER AND WINE MANUFACTURE

UNIT III CARBONATED BEVERAGES
Procedures- carbonation equipments-ingredients-preparation of syrups-Filling system-packaging-containers and closures

UNIT IV NON CARBONATED BEVERAGE
Coffee bean preparation-processing-brewing-decaffeination- instant coffee-Teatypes- black, green and oolong- fruit juices, nectars, quash, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages

UNIT V QUALITY CONTROL
Effective application of quality controls, brix, acidity to brix ratio, single strength of juice- sanitation and hygiene in beverage industry-Quality of water used in beverages - threshold limits of various ingredients according to PFA, EFSA and FDA – Absolute requirements of Soluble solids and titrable acidity in beverages.

OUTCOMES:
On completion of the course the students are expected to
- Be able to understand various concepts, principles and procedures involved in processing of beverages.
- Demonstrate various unit operations involved in the food beverage manufacturing.
- List the quality control steps in beverage preparation.

TEXT BOOKS:

REFERENCES:
3. “Brewing yeast and fermentation Chris Boulton and David Quain”, Blackwell Science Ltd
AIM:
The course aims to develop the knowledge of students in the area of post harvest processing of various foods and related technology. This course will enable students to appreciate the application of scientific principles in the processing of these materials.

OBJECTIVES:
On completion of the course the students are expected to

- Be able to understand and identify the specific processing technologies used for different foods and the various products derived from these materials.
- Understand the application of scientific principles in the processing technologies specific to the materials.

UNIT I CEREALS AND PULSES
Cereal Grains- Basic agricultural aspects, structure and composition; Storage, Insect control; Processing: Wheat - milling, (Atta and maida), quality aspects of flour, wheat proteins and their function; wheat based baked products – Bread, Biscuit, Cakes, Extruded products, malting and malt products; Rice- Milling, Parboiling, Quick cooking rice. Pulses - Basic agricultural aspects, structure, composition, storage, insect control, processing Milling/splitting, dhal milling, products—puffed, flakes, flour, soya milk, soy protein Isolate.

UNIT II VEGETABLES AND FRUITS
Climatic and non climatic fruits, ripening process, phytonutrients in fruits and vegetables; Handling, transportation, controlled atmosphere ripening process, grading, cleaning, pre treatments, modified atmosphere packaging, chilling. General pre-processing, different freezing methods and equipments, problems associated with specific fruits and vegetables; Dehydration– General pre processing, different methods of drying, osmotic dehydration and other modern methods. Canning - General pre-processing, specific or salient points in fruits and vegetables like – Blanching, exhausting, processing conditions. Fruit Juice / pulp/ Nectar/Drinks, concentrates Vegetable Purees/pastes.

UNIT III OIL SEEDS, NUTS AND SUGARS
Basic agricultural aspects structure, composition, Storage, Insect control; processing: traditional and modern methods of oil extraction, refining, hydrogenation; oil blends. Honey- Composition and Quality aspects; Sugars- Manufacture of table sugar, High Fructose corn syrup and Glucose syrup; Jaggery – sources, manufacture.

UNIT IV MILK AND MILK PRODUCTS
Processing of Milk – Pasteurisation, homogenisation, sterilization, HTST and UHT processes; Processing and preservation of milk products - cream, sour cream, butter, ghee, skimmed 94 milk concentrate and skimmed milk powder, whey concentrate and whey powder, yoghurt, cheese and other products.

UNIT V MEAT, FISH & POULTRY
Common and commercially important meats; pre and post slaughter handling, meat inspection and grading; animal welfare and safety in slaughter plant. Structure and composition of meat, carcass chilling, ageing; storage of fresh meat - Modified atmosphere packaging, packaging of retail cuts; Processing and preservation - artificial tenderizing, chilling, freezing, curing, smoking, ready-to-eat meats and meat products; Kosher and Halal certification. Marine and fresh water fish, shell fish -
composition and nutrition; commercially important fish and shell fish; spoilage factors, ship board operations, storage and transport. Processing and Preservation - chilling, freezing, canning, smoking, curing, salting and drying, fish meal and fish oils. Types of poultry, production, classification & designation, grading. Processing plant operations - slaughter, bleeding, scalding, de-feathering, eviscerating, chilling, packaging; composition and nutrition, poultry meat products Eggs- structure, composition, quality factors, storage, pasteurization, freezing and drying, egg substitutes.

OUTCOMES:
• Better understanding of the concepts of physiological characteristics of fruits and vegetables
• Better insight about fruit losses during storage and ways to prevent it.
• Thorough Knowledge and understandings of the specific processing technologies used for different foods and the various products derived from these materials.
• Understandings of the application of scientific principles in the processing technologies specific to the materials.

TEXT BOOKS:

REFERENCES:
7. Sofos, J.N. “Improving and Safety of Fresh Meat” Wood Head Publishing / CRC, 2005
maintaining grain quality–types of storage structures.

UNIT II MILLING OF RICE

UNIT III MILLING PROCESS OF WHEAT


UNIT IV MILLING OF PULSES

UNIT V MILLING OF OIL SEEDS
Oil seed processing - natural sources of oil. Physio-chemical properties, mechanical extraction - Oil processing machinery, solvent extraction, factor influencing extraction, types of solvents. Refining of oil, hydrogenation, winterization, changes during storage. Oil seed flour concentrates and isolate.

TEXT BOOKS:

REFERENCES:

FD8017 CREATIVITY, INNOVATION AND NEW FOOD PRODUCT DEVELOPMENT L T P C
3 0 0 3

OBJECTIVE:
- To study the various issues related to Creativity, Innovation and New Product Development.

UNIT I INTRODUCTION
The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brain storming - different techniques
UNIT II PROJECT SELECTION AND EVALUATION 9
Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques)

UNIT III NEW PRODUCT PLANNING 9
Design of prototype - testing - quality standards - marketing research - introducing new products

UNIT IV NEW PRODUCT DEVELOPMENT 9

UNIT V MODEL PREPARATION & EVALUATION 9
Creative design - Model Preparation - Testing - Cost evaluation - Patent application

TOTAL: 45 PERIODS

OUTCOME:
- To impart the knowledge of various aspects of Creativity, Innovation and New Product Development

TEXT BOOKS:

REFERENCES:

BT8751 DOWNSTREAM PROCESSING L T P C 3 0 0 3

OBJECTIVES:
To enable the students to
- Understand the methods to obtain pure proteins, enzymes and in general about product development R & D
- Have depth knowledge and hands on experience with on Downstream processes required in multi-factorial manufacturing environment in a structured and logical fashion

UNIT I INTRODUCTION 9

UNIT II PHYSICAL METHODS OF SEPARATION 9
Unit operations for solid-liquid separation - filtration and centrifugation.

UNIT III ISOLATION OF PRODUCTS 9
Adsorption, liquid-liquid extraction, aqueous two-phase extraction, membrane separation – ultrafiltration and reverse osmosis, dialysis, precipitation of proteins by different methods.
UNIT IV    PRODUCT PURIFICATION  
Chromatography – principles, instruments and practice, adsorption, reverse phase, ion exchange, size exclusion, hydrophobic interaction, bio-affinity and pseudo affinity chromatographic techniques.

UNIT V    FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS  
Crystallization, drying and lyophilization in final product formulation.

OUTCOMES:  
Upon success completion of this course, the students will be able to:

- Define the fundamentals of downstream processing for product recovery
- Understand the requirements for successful operations of downstream processing
- Describe the components of downstream equipment and explain the purpose of each
- Apply principles of various unit operations used in downstream processing and enhance problem solving techniques

TEXT BOOKS:  

REFERENCES:  

GE8074 HUMAN RIGHTS  
L T P C 3 0 0 3

OBJECTIVE:  
- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I  

UNIT II  

UNIT III  
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV  
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

TOTAL: 45 PERIODS

OUTCOME:
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

GE8072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

OBJECTIVES:
- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT

UNIT II REQUIREMENTS AND SYSTEM DESIGN

UNIT III DESIGN AND TESTING
UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT


UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY


TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

REFERENCES:

FD8018 MANAGEMENT OF FOOD WASTE

OBJECTIVES:
- Importance of treating waste product from food industry.
- Treatment methods and recycling of waste product from food industry.

UNIT I CLASSIFICATION & CHARACTERIZATION OF FOOD INDUSTRY WASTE

Classification and characterization of waste from various food industries; Need for treating waste from various food industries.

UNIT II WASTE FROM MEAT, DAIRY AND VEGETABLE PROCESSING INDUSTRY

Classification, analysis and disposal of waste from meat; Bioremediation and utilization of dairy waste. Treatment of water from fruit and vegetable processing industry.
UNIT III  TREATMENT METHODS OF WASTE FROM FOOD INDUSTRY

Treatment methods for liquid waste from food industry; Design of activated sludge process, bioremediation, trickling filter process and Anaerobic Digestion. Treatment methods for solid waste from food industry—drying, incineration, and Design of solid waste management.

UNIT IV  RECYCLING AND UTILIZATION OF WASTE PRODUCT FROM FOOD INDUSTRY

Treatment of water from food industry—BOD, COD, RO. Recovery of protein from potato starch plant, utilization of molasses, utilization of waste from meat and fish for livestock and poultry.

UNIT V  REGULATORY ISSUES WITH FOOD INDUSTRY WASTE

International and national scenario on disposal of waste from food industries; Regulatory issues with food industry waste

TOTAL: 45 PERIODS

OUTCOMES:
- Awareness of Importance in treating waste product from food industry.
- Knowledge of Treatment methods and recycling of waste product from food industry

TEXT BOOKS:

REFERENCES:

FD8019  FOOD SAFETY MANAGEMENT SYSTEMS

OBJECTIVE:
To enable the students to
- To understand the rules and regulations given by different food authority around the world to maintain food quality and safety.

UNIT I
Introduction to food safety and security; Hygienic design of food plants and equipments, Food Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food Additives (functional role, safety issues), Food Packaging & labeling. Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials. Control of pests, rodents, mice, birds, insects and microbes. Cleaning and Disinfection, ISO22000—Importance and Implementation

UNIT II
Food quality: Various Quality attributes of food, Instrumental, chemical and microbial Quality control. Sensory evaluation of food and statistical analysis. Water quality and other utilities.
UNIT III
Critical Quality control point in different stages of production including raw materials and processing materials. Food Quality and Quality control including the HACCP system. Food inspection and Food Law, Risk assessment - microbial risk assessment, dose response and exposure response modelling, risk management, implementation of food surveillance system to monitor food safety, risk communication

UNIT IV
Indian and global regulations: FAO in India, Technical Cooperation programmes, Bio-security in Food and Agriculture, World Health Organization (WHO), World Animal Health Organization (OIE), International Plant Protection Convention (IPPC)

UNIT V
Codex Alimentarius Commission - Codex India - Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India - ToR, Functions, Shadow Committee etc.

OUTCOMES:
On Completion of this course students are expected to know the
  Importance of food quality and safety
  Rules and regulations related for processing foods

TEXT BOOKS:
1. Handbook of food toxicology by S.S. Deshpande
2. The food safety information handbook by Cynthia A. Robert, 2009
3. Nutritional and safety aspects of food processing by Tannenbaum SR

REFERENCES:
1. Microbiological safety of food by Hobbs BC, 1973
2. Food Safety Handbook by Ronald H. Schmidt, Gary E. Rodrick

FD8020 GENETIC ENGINEERING AND GENETICALLY MODIFIED FOODS  L T P C
3 0 0 3

OBJECTIVES:
Introduction to GM foods and their methods of production, advantages
  • To study genetically modified plants which are commercially available
  • To study transgenic animals and their engineering method
  • To understand genetically modified microorganisms and their applications in foods
  • To know about Pharmaceutical applications of genetically engineered plants
  • To understand Risk and safety assessment of the GM foods and their labeling

UNIT I BASICS OF RECOMBINANT DNA TECHNOLOGY
Manipulation of DNA and RNA – Restriction and Modification enzymes, Design of linkers and adaptors. Characteristics of cloning and expression vectors based on plasmid and bacteriophage, Vectors for insect, yeast and mammalian system, Prokaryotic and eukaryotic host systems, Introduction of recombinant DNA in to host cells and selection methods.

UNIT II DNA LIBRARIES
Construction of genomic and cDNA libraries, Artificial chromosomes – BACs and YACs, Screening of DNA libraries using nucleic acid probes and antisera.

UNIT III  SEQUENCING AND AMPLIFICATION OF DNA  9
Maxam Gilbert’s and Sanger’s methods of DNA sequencing. Inverse PCR, Nested PCR, AFLP-PCR, Allele specific PCR, Assembly PCR, Asymmetric PCR, Hot start PCR, inverse PCR, Colony PCR, single cell PCR, Real-time PCR/qPCR – SYBR green assay, Taqman assay, Molecular beacons. Site directed mutagenesis.

UNIT IV  TRANSGENIC TECHNOLOGY  9
DNA microinjection, Retroviral vectors, Transgenic animals – Knock in and knock out animals, Transgenic plants – Ti plasmid.

UNIT V  APPLICATIONS OF RDNA TECHNOLOGY IN FOODS (Remove company names)  9
Genetically engineered proteins: Bovine Somatotropin in Milk; Genetically engineered bacteria: ChymosinLite beer; Tryptophan; Transgenic plants: Calgene Flavr Savr TM tomato, Monsanto Round-Up TM Ready, Ciba GeigyBasta TM resistant crops; Edible vaccines: Cholera vaccine in potatoes; Transgenic Fish: Atlantic salmon.

TOTAL: 45 PERIODS

OUTCOMES:
- Better understanding of genetically modified plants, animals and modified microorganisms
- Familiarize in Pharmaceutical applications of genetically engineered plants
- Obtain knowledge in Risk and safety assessment of the GM foods and their label

TEXT BOOKS:

REFERENCE:

FD8021 STORAGE ENGINEERING

OBJECTIVES:
- The course aims to develop the knowledge of students in the area of Food storage
- This is necessary for effective understanding specific aspects of food storage

UNIT I  COLD STORAGE  9
Cold storage- Moist air and applied psychrometry, Estimation of cooling load, Air conditioning systems, Evaporators, Compressors, Condensers, Expansion devices, Cooling towers, Different types of refrigerants, Transmission and distribution system of cool air, Thermal and vapor insulation materials, Design of small capacity cold storage, Instrumentation and climate management in cold storage

UNIT II  FROZEN STORAGE  9
Quality loses in frozen foods- Physical changes, Chemical changes in food components, Nutritional aspects of freezing, Microbiology of frozen products, Glass transitions temperature and stability of frozen foods, Temperature requirements during frozen storage, Shelf-life of frozen foods- shelf-life testing, Modelling loss of quality in frozen foods, Time-Temperature integrators, Packaging of frozen foods, Different types of freezers.

UNIT III CONTROLLED ATMOSPHERIC STORAGE  9
Biochemical considerations of CAS, Gas exchange mechanisms, Mass balance principles, Gas generators, Equipment’s for producing and regulating controlled atmosphere, Design of controlled atmosphere storage chambers.

UNIT IV MODIFIED ATMOSPHERIC STORAGE  9
Overview of Modified atmospheric storage, Gases and Vapor applied to modified atmosphere processing operations, MAP modelling- Kinetics of food deteriorative reactions, Shelf-life testing, Enzyme kinetics applied to MAP, MAP design with oxygen modelling.

UNIT V HYPOBARIC STORAGE  9
History of Hypobaric storage, Experimental errors in hypobaric storage research, Gas and vapor mass transfer at low pressure, Requirements for installation- measurement devices (Relative humidity, Pressure, Air-change rate, Oxygen, Carbon dioxide, Ethyl alcohol, Acetaldehyde, hypobaric acid vapor), Flow control, Humidity control, Effects on food, Effects on microbes.

OUTCOMES:
• On completion of the course the students are expected to Understand the application of scientific principles in the processing technologies specific to the materials.

TEXT BOOKS:
2. “Frozen food science and Technology”- Judith.A.Evans
3. “Engineering for storage of fruits and vegetables”- Chandra Gopala Rao

FD8022 TECHNOLOGY OF FAT AND OIL  L T P C
3 0 0 3

OBJECTIVES:
• The course aims to develop the knowledge of students in the area of Fat and Oil processing and technology.
• This is necessary for effective understanding specific aspects of food processing related to these foods.
• This course will enable students to appreciate the application of scientific principles in the processing of these materials.

UNIT I RAW MATERIALS AND PROPERTIES  11
Overview of fats and oil, sources of fats and oils- vegetables, animal fat; properties of fats and oils – nomenclature ad structure; chemical properties and reactions – hydrolysis and free fatty acids, esterification, inter-esterification, saponification and iodine value, oxidative stability, peroxide value, conjugated dienes, anisidine value; physical properties – colour, crystal structure f fat, thermal properties, density, SFI, optical and spectroscopical properties.
UNIT II FAT AND OIL PROCESSING 8
Recovery of fats and oils from plant and animal sources, refining, bleaching hydrogenation, fractionation, process and product of inter-esterification deodorization.

UNIT III QUALITY OF FATS AND OILS 9
Flavour quality of fats and oils – formation of flavours and off-flavours, hydrolytic rancidity, oxidative rancidity, flavour impact of oxidation compound, factors affecting flavour quality – intrinsic and extrinsic, methods to measure flavour quality - chemical, sensory analysis, oil quality improvement through processing.

UNIT IV OILS AND FATS APPLICATIONS 6
Utilization of fats and oils: shortening technology, margarine types and preparation technology, liquid oil technology, speciality fats and oils, by product utilization.

UNIT V NOVEL DEVELOPMENT IN FATS AND OIL TECHNOLOGY 12

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students are expected to
• Be able to understand and identify the specific processing technologies used for Fats and oils
• Understand the application of scientific principles in the processing technologies specific to the materials.

TEXT BOOK:

FD8023 EMERGING TECHNOLOGIES IN FOOD PROCESSING L T P C
3 0 0 3

OBJECTIVES:
• The course aims to develop the knowledge of students in the area of emerging or alternative technologies applied to food processing.
• This course will enable students to understand the advantages and disadvantages over existing technologies.

UNIT I HIGH PRESSURE PROCESSING OF FOODS 9
Introduction, principles, use of high pressure to improve food safety and stability. Effects of high pressure on food quality, Applications of high pressure. HPP of Salads/Ready Meals – effects on microorganisms, enzyme activity, texture and nutrients.

UNIT II PULSED ELECTRIC FIELD PROCESSING 9
Mechanism of action, PEF treatment systems; PEF processing of liquid foods and beverages. High intensity electric field pulses on solid foods. Non thermal methods- its applications - Application of light pulses in sterilization of foods and packaging materials.
UNIT III NOVEL METHOD
Non thermal processing by radio frequency electric fields; Ultrasound as a food preservation tool; Freeze drying - Food irradiation - advantages and applications. – Super critical fluid extraction – Aseptic processing in foods - extrusion cooking – equipment.

UNIT IV HURDLE TECHNOLOGY
Basics of hurdle technology – Mechanism, Application to foods - Newer Chemical and Biochemical hurdles- organic acids – Plant derived antimicrobials – Antimicrobial enzymes– bacteriocins – chitin / chitosan (only one representative example for each group of chemical and biochemical hurdle).

UNIT V INNOVATION IN FOOD REFRIGERATION
Vacuum cooling of foods; High pressure freezing; Freeze drying (lyophilisation) – Theory – Equipment - Effect on foods – Freeze concentration – Theory - Equipment

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students are expected to
• Be able to understand and identify the different processing technologies and their application.
• Understand the application of scientific principles in the processing technologies specific to the materials.

TEXT BOOKS:

REFERENCES:

GE8077 TOTAL QUALITY MANAGEMENT

OBJECTIVE:
• To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION

UNIT II TQM PRINCIPLES
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9
Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM 9

TOTAL: 45 PERIODS

OUTCOME:
• The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

REFERENCES:
4. ISO9001-2015 standards