DEPARTMENT OF BIOTECHNOLOGY

ANNA UNIVERSITY, CHENNAI

Vision:

The Department of Biotechnology is committed to evolve as a world class science and technology centre by integrating quality and ethics in teaching and research.

Mission:

The mission of the department is

- To provide students a unique and multidisciplinary learning experience that will foster the young minds to develop as a researcher, entrepreneur etc.
- To enhance academic and industrial collaborative research initiatives for the development of biotechnological, food and therapeutic products.
- To emphasise and equip the students towards innovative industrial and research updates.
- To serve the society with utmost commitment, integrity, enthusiasm, and dedication.
1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The Food Technology curriculum is designed to prepare graduates having knowledge with high ethical values and industrial preparedness.

1. To understand and apply the concepts of basic sciences, Engineering and technology towards their application in the area of Food Technology.

2. Identification and analysis to solve problems for the development of products, processes, techniques to meet the demands of the society.

3. To apply the learnt theory and practical skills in Food Technology for industry, R&D and entrepreneurship.

4. To learn professional and ethical attitude especially its impact on safety, health and environment.

5. Build an environment that is conducive to higher academic pursuit and nurture creative and innovative thoughts.

2. PROGRAMME OUTCOMES (POs)

After completion of four years of study, the Food technology Graduates will be able to

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<th>Graduate Attribute</th>
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<td>Apply knowledge of mathematics, basic science and engineering.</td>
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<td>PO2 Problem Analysis</td>
<td>Identify, formulate and solve problems in the area of Food Technology.</td>
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<td>PO3 Design/ development of solutions</td>
<td>Design new processes/ modifying the existing system to improve the performance and to satisfy the constraints.</td>
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<td>PO4 Conduct investigations of complex problems</td>
<td>Perform experiments, analyze and interpret the data.</td>
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3. PROGRAMME SPECIFIC OUTCOMES (PSOs)

By the completion of Food Technology B. Tech programme the student will have following programme specific outcomes

- Students will develop theoretical and practical knowledge, develop effective communication and cognitive skills.
- Develop focus in the Food Technology and apply critical thinking and problem-solving skills to address current challenges in the food industry.
- Understand the importance of responsibility, dependability, punctuality, courtesy, sensitivity, respect for others and effort in the work place.
- Commit to the highest standards of professional integrity and ethical values.
4. MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVE WITH PROGRAMME OUTCOMES

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## 5. MAPPING OF COURSE OUTCOMES AND PROGRAMME OUTCOMES

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1, 2 and 3 are correlation levels with weightings on slight (low), moderate (medium) and substantial (high) respectively.
**ANNA UNIVERSITY, CHENNAI**
**UNIVERSITY DEPARTMENTS**
**B. TECH. FOOD TECHNOLOGY**
**REGULATIONS – 2019**
**CHOICE BASED CREDIT SYSTEM**
**CURRICULA AND SYLLABI FOR I TO VIII SEMESTERS**
(Applicable to students admitted from the Academic Year 2022-2023 onwards)

## SEMESTER I

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§ Skill Based Course

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**TOTAL** 20 1 8 29 22

* Audit Course is optional

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**TOTAL** 17 1 8 26 22

*Students should undergo Internship/ Training for which assessment will be done in the seventh semester*
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| 12. | FT5502      | Fruit and Vegetable Processing and Preservation  | 3       | 0       | 0       | 3       | V   
| 13. | FT5503      | Livestock and Marine Technology                  | 3       | 0       | 0       | 3       | V   
| 14. | FT5511      | Livestock and Marine Technology Laboratory       | 0       | 0       | 4       | 2       | V   
| 15. | FT5512      | Fruit and Vegetable Processing & Preservation Laboratory | 0   | 0       | 4       | 2       | V   
| 16. | FT5601      | Food Packaging Technology                        | 3       | 0       | 0       | 3       | VI  
| 17. | FT5602      | Food Refrigeration Systems                       | 2       | 1       | 0       | 3       | VI  
| 18. | FT5603      | Cereals, Pulses and oil seed Technology          | 3       | 0       | 0       | 3       | VI  
| 19. | FT5611      | Food Packaging Technology Laboratory             | 0       | 0       | 4       | 2       | VI  
| 20. | FT5612      | Cereal, Pulses and Oil Seed Technology Laboratory | 0       | 0       | 4       | 2       | VI  
| 22. | FT5701      | Food Safety, Quality and Regulation              | 3       | 0       | 0       | 3       | VII  
| 25. | FT5711      | Dairy Process Technology Laboratory              | 0       | 0       | 4       | 2       | VII  

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### HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

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<td>HU5172</td>
<td>Values and Ethics</td>
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### HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

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<td>HU5276</td>
<td>Understanding Society and Culture through Literature</td>
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AUDIT COURSES (AC)
Registration for any of these courses is optional to students

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EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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### SUMMARY

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OBJECTIVES

- To build lexical competency and accuracy that will help learners to use language effectively.
- To learn various reading strategies that will enable learners to comprehend the different modes of reading materials of varied levels of complexity.
- To comprehend the linguistic aspects of various rhetorical structures and functions of Technical English and use them effectively in writing.

UNIT I INTRODUCING ONESELF 9
Theory:
Reading: Descriptive passages (From Newspapers / Magazines) – Writing: Writing a coherent paragraph (Native Place, School Life) – Grammar: Simple present tense, Present continuous tense – Vocabulary development: One word substitution.

UNIT II DIALOGUE WRITING 9
Theory:
Reading: Reading a print interview (Comprehension and inference questions) - Writing: Writing a checklist - Dialogue writing – Grammar: Simple past tense – Question formation (Wh-Questions, ‘Yes’ or ‘No’ Questions, Tag Questions) – Vocabulary Development: Lexical items relevant to the theme of the given unit.

UNIT III FORMAL LETTER WRITING 9
Theory:

UNIT IV WRITING LETTERS OF COMPLAINT 9
Theory:

UNIT V WRITING DEFINITIONS AND PRODUCT DESCRIPTION 9
Theory:

LEARNING OUTCOMES:
On completion of the course, the students will be able to:
- Use appropriate language structures and lexical items in authentic contexts.
- Read both general and technical texts and comprehend their denotative and connotative meanings.
- Write different kinds of formal documents with grammatical and lexical appropriacy.

Assessment Pattern
• Two written internal assessments to test learner’s progress in grammar, vocabulary, reading and writing skills.
• End Semester exam to be tested in two parts: Theory exam for three hours and listening and speaking skills for two hours.

MA5158     ENGINEERING MATHEMATICS – I
            (Common to all branches of B.E. / B.Tech. Programmes in I Semester)

OBJECTIVES
The course aims to
☐ develop the use of matrix algebra techniques that is needed by engineers for practical applications.
☐ familiarize the students with differential calculus.
☐ familiarize the student with functions of several variables. This is needed in many branches of engineering.
☐ make the students understand various techniques of integration.
☐ acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I     MATRICES

UNIT II    DIFFERENTIAL CALCULUS

UNIT III   FUNCTIONS OF SEVERAL VARIABLES

UNIT IV    INTEGRAL CALCULUS
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 V   MULTIPLE INTEGRALS


TOTAL: 60 PERIODS

OUTCOMES
At the end of the course the students will be able to

   CO 1  use the matrix algebra methods for solving practical problems.
   CO 2  apply differential calculus tools in solving various application problems.
   CO 3  able to use differential calculus ideas on several variable functions.
   CO 4  apply different methods of integration in solving practical problems.
   CO 5  apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXTBOOKS

REFERENCES
OBJECTIVES
The course aims to
- make the students understand the importance of mechanics.
- equip the students on the knowledge of electromagnetic waves.
- introduce the basics of oscillations, optics and lasers.
- enable the students in understanding the importance of quantum physics.
- elucidate the application of quantum mechanics towards the formation of energy bands in crystalline materials.

UNIT I  MECHANICS

UNIT II  ELECTROMAGNETIC WAVES

UNIT III  OSCILLATIONS, OPTICS AND LASERS

UNIT IV  BASIC QUANTUM MECHANICS
Photons and light waves - Electrons and matter waves - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization - Particle in a infinite potential well - Normalization, probabilities and the correspondence principle.

UNIT V  APPLIED QUANTUM MECHANICS
The harmonic oscillator - Barrier penetration and quantum tunneling - Tunneling microscope - Resonant diode - Finite potential wells - particle in a three dimensional box - Bloch’s theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- CO 1  understand the importance of mechanics.
- CO 2  express the knowledge of electromagnetic waves.
- CO 3  know the basics of oscillations, optics and lasers.
- CO 4  understand the importance of quantum physics.
- CO 5  apply quantum mechanical principles towards the formation of energy bands in crystalline materials.
TEXT BOOKS:

REFERENCES:

CY5151
ENGINEERING CHEMISTRY
(COMMON TO ALL BRANCHES)

OBJECTIVES
The course aims to
☐ introduce the basic concepts of polymers, their properties and some of the important applications.
☐ impart knowledge on the basic principles and preparatory methods of nanomaterials.
☐ facilitate the understanding of the laws of photochemistry, photoprocesses and instrumentation & applications of spectroscopic techniques.
☐ familiarize the operating principles and applications of energy conversion, its processes and storage devices.
☐ inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I  POLYMER CHEMISTRY  9
Introduction Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization Bulk, emulsion, solution and suspension. Structure, Properties and uses of PE, PVC, PC, PTFE, PP, Nylon 6, Nylon 66, Bakelite, Epoxy; Conducting polymers – polyaniline and polypyrrole.

UNIT II  NANOCHEMISTRY  9

UNIT III  PHOTOCHEMISTRY AND SPECTROSCOPY  9
UNIT IV ENERGY CONVERSIONS AND STORAGE
Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant – fast breeder reactor. Solar energy conversion - solar cells. Wind energy. Batteries - types of batteries – primary battery (dry cell), secondary battery (lead acid, nickel-cadmium and lithium-ion-battery). Fuel cells – H₂-O₂ and microbial fuel cell. Explosives – classification, examples TNT, RDX, Dynamite; Rocket fuels and propellants – definition and uses.

UNIT V WATER TECHNOLOGY
Water – sources and impurities – water quality parameters colour, odour, pH, hardness, alkalinity, TDS, COD and BOD. Boiler feed water – requirement – troubles (scale & sludge, caustic embrittlement, boiler corrosion and priming & foaming. Internal conditioning – phosphate, calgon and carbonate treatment. External conditioning - zeolite (permulit) and ion exchange demineralization. Municipal water treatment process – primary (screening, sedimentation and coagulation), secondary (activated sludge process and trickling filter process) and tertiary (ozonolysis, UV treatment, chlorination, reverse osmosis).

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

CO 1 recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.

CO 2 identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO 3 identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.

CO 4 recognize different forms of energy resources and apply them for suitable applications in energy sectors.

CO 5 demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS

REFERENCES
OBJECTIVES
The course aims to
- know the basics of algorithmic problem solving.
- develop Python programs with conditionals and loops.
- define Python functions and use function calls.
- use Python data structures - lists, tuples, dictionaries.
- do input/output with files in Python.

UNIT I INTRODUCTION TO COMPUTING AND PROBLEM SOLVING  9

Suggested Activities
- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic operations.
- Installing Python.
- Simple programs on print statements, arithmetic operations.

Suggested Evaluation Methods
- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.

UNIT II CONDITIONALS AND FUNCTIONS  9

Suggested Activities
- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions.
- Implementation of a simple calculator.
- Developing simple applications like calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and iterative statements.
- External learning - Recursion vs. Iteration.

Suggested Evaluation Methods
- Tutorials on the above activities.
- Group Discussion on external learning.
UNIT III  SIMPLE DATA STRUCTURES IN PYTHON  10

Suggested Activities
☐ Implementing python program using lists, tuples, sets for the following scenario
  Simple sorting techniques
  Student Examination Report
  Billing Scheme during shopping.
☐ External learning - List vs. Tuple vs. Set – Implementing any application using all the three data structures.

Suggested Evaluation Methods
☐ Tutorials on the above activities.
☐ Group Discussion on external learning component.

UNIT IV  STRINGS, DICTIONARIES, MODULES  10

Suggested Activities
☐ Implementing Python program by importing Time module, Math package etc.
☐ Creation of any package (student’s choice) and importing into the application.

Suggested Evaluation Methods
☐ Tutorials on the above activities.

UNIT V  FILE HANDLING AND EXCEPTION HANDLING  7
Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception Errors and Exceptions, Exception Handling, Multiple Exceptions.

Suggested Activities
☐ Developing modules using Python to handle files and apply various operations on files.
☐ Usage of exceptions, multiple except blocks -for applications that use delimiters like age, range of numerals etc.
☐ Implementing Python program to open a non-existent file using exceptions.

Suggested Evaluation Methods
☐ Tutorials on the above activities.
☐ Case Studies.

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course the students will be able to
CO 1 develop algorithmic solutions to simple computational problems.
CO 2 develop and execute simple Python programs.
CO 3 write simple Python programs for solving problems.
CO 4 decompose a Python program into functions.
CO 5 represent compound data using Python lists, tuples, dictionaries etc.
CO 6 read and write data from/to files in Python programs.

TEXT BOOKS:
   (http://greenteapress.com/wp/thinkpython/).

REFERENCES:

GE5154
dhulirai

L T P C
1 0 0 1

AUSH 1. மதொல்பொமவக் மகவிமனப்
மகொவில்களின்
குமரிமுமனயில்
தெய்யும்
மற்றும்
அலகு
பொரதியொர்
பக்தி
–
tham

AUSH 2. மாபு – பானை
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círc

AUSH 3. மாபு – பானை
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círc

AUSH 1.

AUSH 2.

AUSH 3.
அலகு IV தமிழகத் திருத்தக் கல்விகள்:

தமிழ்நாட்டின் இருப்பிடங்களும், விலங்குகளும் – தமிழக பொது தொழில்நுட்ப அனுப்புத் தலைமையில் – கம்போனிட்ஸின் பொது தொழில்நுட்ப விளையாட்டு – கல்வியுடைய விளையாட்டு – தமிழர்களின் பங்களிப்ப் பொருள் பொதுக்கல்வியில் அடைய்கின்றன.

அலகு V இந்தியத் கதசியியக்கம் மற்றும் இந்தியப் பைத்திகள்:

இந்தியாவின் பொதுக்கல்வில் தமிழர்களின் பங்கு – இந்தியத் கதசியியக்கம் மற்றும் இந்தியப் பைத்திகள் – சுண்டாலியாயில் அறக்கமைப்பு, கல்வியுடைய விளையாட்டு – புத்தசமநூற்றாண்டு தமிழ்க் கல்வியுடைய விளையாட்டு – தமிழர் புத்தர்களின் ஆதாரங்கள்.

TEXT-CUM-REFERENCE BOOKS

2. தமிழ் விளையாட்டு – பொதுக்கல்வியியக்க விளையாட்டு (திருத்தக் கல்வியியக்க).
3. தமிழ் – தனியுடைய விளையாட்டு கல்வியியக்க தனியுடைய விளையாட்டு (ததொல்லியல் துமறை பிள்ளா). (கால பிள்ளா).
4. புத்தசமநார் – பங்களிப்பு படைப்பில் (ததொல்லியல் துமறை பிள்ளா).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

GE5154 HERITAGE OF TAMILS L T P C 1 0 0 1

UNIT I LANGUAGE AND LITERATURE

UNIT II  HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE  3

UNIT III  FOLK AND MARTIAL ARTS  3

UNIT IV  THINAI CONCEPT OF TAMILS  3
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V  CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE  3
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலை - மக்களும் பணைப்பொடும் - தகுதி. பிரசாத (தமிழ்ப்பு: தமிழில் பராமரிக்கும் கல்விப்பொடும் குழு).
2. கல்வித் தமிழ் - பல்வேளா நோயோர் (பி.ஸ்ரீபாலாம்).
3. நூற்றாண்டு - மலரச் சுத்தமானையின் கணிக்கான நகர தாழ்வியம் (தகுதி.செய்திக்குள் தொடங்கியப் பொருள்).
4. பூமிக்கும் - அழகாக நகரியம். (தகுதி.செய்திக்குள் தொடங்கியப் பொருள்).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
OBJECTIVES:
The course aims to
- inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- induce the students to familiarize with experimental determination of velocity of ultrasonic waves and band gap determination.

LIST OF EXPERIMENTS
1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young’s modulus
3. Uniform bending – Determination of young’s modulus
4. Lee’s disc - Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box - Determination of Band gap of a semiconductor.
13. Photoelectric effect
14. Michelson Interferometer.
16. Melde’s string experiment

TOTAL: 30 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- CO 1 determine various moduli of elasticity and also various thermal and optical properties of materials.
- CO 2 determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

CHEMISTRY LABORATORY (Minimum of 8 experiments to be conducted)

OBJECTIVES
The course aims to
- inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- demonstrate the analysis of metals and polymers by spectroscopy and viscometry methods.

LIST OF EXPERIMENTS
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. Phase change in a solid.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

At the end of the course the students will be able to

CO 1 analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
CO 2 determine the amount of metal ions through volumetric and spectroscopic techniques
CO 3 determine the molecular weight of polymers by viscometric method.
CO 4 quantitatively analyse the impurities in solution by electroanalytical techniques
CO 5 design and analyse the kinetics of reactions and corrosion of metals

**TEXTBOOKS:**


**GE5161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY**

**OBJECTIVES:**
The course aims to

- understand the problem solving approaches.
- learn the basic programming constructs in Python.
- articulate where computing strategies support in providing Python-based solutions to real world problems.
- use Python data structures - lists, tuples, dictionaries.
- do input/output with files in Python.

**LIST OF EXPERIMENTS**

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

**TOTAL: 60 PERIODS**
LEARNING OUTCOMES: 
At the end of the course the learners will be able to
- develop algorithmic solutions to simple computational problems
- develop and execute simple Python programs.
- structure simple Python programs for solving problems.
- decompose a Python program into functions.
- represent compound data using Python data structures.
- apply Python features in developing software applications.

OBJECTIVES:
- To improve the communicative competence of learners
- To help learners use language effectively in academic/work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students’ English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6
Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions( filling out a bank application for example).

UNIT II NARRATION AND SUMMATION 6
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 6
Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 6
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT V EXPRESSION 6
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking – making predictions- talking about a given topic-giving opinions-understanding a website-describing processes

TOTAL : 30 PERIODS

LEARNING OUTCOMES:
At the end of the course, learners will be able
- To listen and comprehend complex academic texts
- To speak fluently and accurately in formal and informal communicative contexts
- To express their opinions effectively in both oral and written medium of communication
ASSESSMENT PATTERN
- One online / app based assessment to test listening / speaking
- End Semester ONLY listening and speaking will be conducted online.
- Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.

HS5251 PROFESSIONAL COMMUNICATION

OBJECTIVES
- To comprehend various reading materials relevant to technical context and understand the main and supporting ideas of the reading materials.
- To write effective job applications along with detailed CV for internship or placements.
- To explore definitions, essay and report writing techniques and practice them in order to develop associated skills.

UNIT I TECHNICAL COMMUNICATION

Theory:
Reading: Reading the Interview of an Achiever and Completing Exercises (Skimming, Scanning and Predicting) – Writing: Writing a Short Biography of an Achiever Based on Given Hints – Grammar: Asking and Answering Questions, Punctuation in Writing, Prepositional Phrases

UNIT II SUMMARY WRITING

Theory:
Reading: Reading Technical Essays/ Articles and Answering Comprehension Questions – Writing: Summary Writing – Grammar: Participle Forms, Relative Clauses

UNIT III PROCESS DESCRIPTION

Theory:
Reading: Reading Instruction Manuals – Writing: Writing Process Descriptions – Writing Instructions – Grammar: Use of Imperatives, Active and Passive Voice, Sequence Words

UNIT IV REPORT WRITING

Theory:
Reading: Reading and Interpreting Charts/Tables and Diagrams – Writing: Interpreting Charts/Tables and Diagrams, Writing a Report – Grammar: Direct into Indirect Speech, Use of Phrases

UNIT V WRITING JOB APPLICATIONS

Theory:
Reading: Reading a Job Interview, SOP, Company Profile and Completing Comprehension Exercises – Writing: Job Applications and Resumes And Sops-Grammar: Present Perfect and Continuous Tenses.

TOTAL : 30 PERIODS

LEARNING OUTCOMES
On completion of the course, the students will be able to:
- Read and comprehend technical texts effortlessly.
- Write technical reports and job application for internship or placement.
- Learn to use language effectively in a professional context.

Assessment Pattern
- Two written internal assessments to test learner’s progress in grammar, reading and writing skills.
- End Semester exam to be tested in two parts: Theory exam for three hours and listening and speaking skills along with vocabulary for two hours.
OBJECTIVES
The course aims to
- acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.
- develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
- familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- acquaint the students with Differential Equations which are significantly used in Engineering problems.
- make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS 12

UNIT II ANALYTIC FUNCTION 12

UNIT III COMPLEX INTEGRATION 12

UNIT IV DIFFERENTIAL EQUATIONS 12
Method of variation of parameters – Method of undetermined coefficients – Homogenous equations of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

UNIT V LAPLACE TRANSFORMS 12

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- CO 1 calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.
- CO 2 construct analytic functions and use their conformal mapping property in application problems.
- CO 3 evaluate real and complex integrals using the Cauchy’s integral formula and residue theorem.
- CO 4 apply various methods of solving differential equation which arise in many application problems.
- CO 5 apply Laplace transform methods for solving linear differential equations.
TEXTBOOKS:

REFERENCES:

GE5151 ENGINEERING GRAPHICS  L  T  P  C  1  0  4  3

OBJECTIVES
The course aims to prepare the students for
- drawing free hand sketches of basic geometrical shapes and multiple views of objects.
- drawing orthographic projections of lines and planes.
- drawing orthographic projections of solids.
- drawing development of the surfaces of objects.
- drawing isometric and perspective views of simple solids.

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 FREE HANDSKETCHING  14
Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by different methods – 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- Free hand sketching of multiple views from pictorial views of objects

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES  15
Orthographic projection- principles-Principle 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 trapezoidal 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  15
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES  15
Sectioning of 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. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  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 and miscellaneous problems. Perspective projection of simple solids-Prisms pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)  3
Introduction to drafting packages and demonstration of their use

TOTAL: (L 15 + P 60)=75 PERIODS

OUTCOMES:
At the end of the course the students will be able to
CO 1 draw free hand sketching of basic geometrical shapes and multiple views of objects.
CO 2 draw orthographic projections of lines and planes
CO 3 draw orthographic projections of solids
CO 4 draw development of the surfaces of objects
CO 5 draw isometric and perspective views of simple solids.

TEXT BOOKS:

REFERENCES:

Publication of Bureau of Indian Standards
1. IS 10711 – 2001 Technical products Documentation – Size and lay out of drawing sheets
2. IS 9609 (Parts 0 & 1) – 2001 Technical products Documentation – Lettering.
5. IS 15021 (Parts 1 to 4) – 2001 Technical drawings – Projection Methods.

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.
4. The students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day.
OBJECTIVES
The course aims to
- understand the basic concepts of electric circuits, magnetic circuits and wiring.
- understand the operation of AC and DC machines.
- understand the working principle of electronic devices and circuits.

UNIT I  BASIC CIRCUITS AND DOMESTIC WIRING  9

UNIT II  THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS  9

UNIT III  ELECTRICAL MACHINES  9

UNIT IV  BASICS OF ELECTRONICS  9
Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics-Rectifier circuits-Wave shaping.

UNIT V  CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES  9
Working principle and characteristics - BJT, SCR, JFET, MOSFET.

TOTAL: 45 PERIODS

OUTCOMES:
CO1  To be able to understand the concepts related with electrical circuits and wiring.
CO2  To be able to study the different three phase connections and the concepts of magnetic circuits.
CO3  Capable of understanding the operating principle of AC and DC machines.
CO4  To be able to understand the working principle of electronic devices such as diode and zener diode.
CO 5 To be able to understand the characteristics and working of current controlled and voltage controlled devices.

TEXT BOOKS:
REFERENCES:

FT5201 FOOD MICROBIOLOGY L T P C
3 0 0 3

OBJECTIVES
The course aims to
☐ 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.

UNIT I MICROBES - STRUCTURE AND MULTIPLICATION 12
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, capsule staining and flagella staining. 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. Calculation of doubling time of bacteria.

UNIT II ROLE OF MICROBES IN SPOILAGE OF FOODS AND THEIR CONTROL 8
Factors affecting spoilage of foods, Microbial flora associated with various food groups their spoilage potential. Microbiological spoilage problems associated with typical food products. 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 BENEFICIAL MICROBES IN FOODS 9
Microbes of importance in food fermentations, – Homo & hetero-fermentative bacteria, yeasts and 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 8
Food borne infections and food poisoning, Microbial toxins - types, Gram Negative and Gram positive food borne pathogens – Salmonella, E. coli, Shigella, Vibrio cholerae, Staphylococcus aureus; Clostridium botulinum; Lysteria monocytogenes. Toxigenic algae and fungi; Food borne viruses; helminths, nematodes and protozoa.
UNIT V  MICROBIAL EXAMINATION OF FOODS
Detection & Enumeration of microbes in foods, Most Probable Number calculations; Indicator organisms and microbiological criteria; Rapid and automated microbial methods - development and impact on the detection of food borne pathogens; Applications of immunological techniques, importance of Clostridium botulinum to food industry; Detection methods for E. coli, Staphylococci, Yersinia, B. cereus, C. botulinum & Salmonella, Listeria monocytogenes, Norwalkvirus, Rotavirus, Hepatitis A virus from food samples.

TOTAL: 45 PERIODS

OUTCOMES
At the end of the course the students will be able to
CO 1 understand the structure and identify the various microbes associated with foods and food groups.
CO 2 understand and identify the role of these microbes in food spoilage, food preservation.
CO 3 understand the role of pathogens in food borne infections and how to detect them

TEXT BOOKS

REFERENCES
<table>
<thead>
<tr>
<th>Course outcomes Statement</th>
<th>Programme outcomes (PO)</th>
<th>Programme specific outcomes(PSO)</th>
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<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
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<tr>
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<td>1</td>
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</tr>
<tr>
<td>CO2 understand and identify the role of these microbes in food spoilage, food preservation</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO3 understand the role of pathogens in food borne infections and how to detect them</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Over all CO</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to
- ensure students have a strong grounding in structures and reactions of biomolecules.
- introduce them to metabolic pathways of the major biomolecules
- enable the students to understand roles of each nutrients in growth and metabolism

UNIT I  INTRODUCTION TO BIOMOLECULES  5
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  15
Carbohydrates mutarotation, glycosidic bond, reactions of monosaccharides and reducing sugars. Starch, glycogen, cellulose and chitin structures and functions. Proteoglycans, glycosaminoglycans, hyaluronic acid, chondroitin sulfate.

UNIT III  AN OVERVIEW OF NUTRITION AND ENERGY BALANCE  6
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; Glycemic and Non-glycemic carbohydrates, health effects of fiber and starch intake 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. Energy balance; body weight and body composition; health implications; obesity, BMR and BMI calculations.

UNIT IV  VITAMINS AND MINERALS  5
Water Soluble Vitamins B vitamins examined individually (Thiamine, Riboflavin, Niacin, Pyridoxine, Biotin, folate B12, choline, pantothenic acid, and carnitine) and in concert; B vitamin deficiencies, toxicities, and food sources; vitamin C roles and recommended intake, deficiency, toxicity and food sources. Fat Soluble Vitamins A, D, E, and K Function, recommended intakes, toxicities, food sources of vitamin A, D, E, and K; Water and Major Minerals Water balance and recommended intakes; fluid/electrolyte balance, acid-base balance; function, recommended intakes, and regulation of sodium, potassium, and calcium. Trace Minerals Food sources, function, recommended intakes, toxicities, deficiencies and transport of iron and zinc; importance of selenium, copper, fluoride, and chromium.

UNIT V  INTERMEDIARY METABOLISM AND REGULATION  14
Enzymes, introduction to biocatalysts, metabolic pathways, primary and secondary metabolites. 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.

OUTCOMES: TOTAL: 45 PERIODS
At the end of the course the students will be able to

CO 1 understand the fundamentals of biomolecules, biochemical reactions in a living organism.
CO 2 understand the importance of nutrients in growth and metabolism.
CO 3 gain knowledge of importance of nutrients in physiological function and biochemical pathways.

TEXT BOOKS:

REFERENCES:
### Course Articulation Matrix

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1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
TEXT-CUM-REFERENCE BOOKS
1. Tamil Grammar - கல்வியியல் தமிழின் (வளர்சி: கல்வியியல் தமிழின் குறித்து முதல்)
2. Historical Tamil - கல்வியியல் (வளர்சி: கல்வியியல் குறித்து முதல்)
3. மணிகள் - கல்வியியல் தமிழின் அரசங்கால விளக்கம் (வளர்சி: கல்வியியல் குறித்து முதல்)
4. International Institute of Tamil Studies (in print)
5. Social Life of Tamils (Jointly Published by: International Institute of Tamil Studies)
6. Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies)
7. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies)
8. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by:...
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)


GE5252 TAMILS AND TECHNOLOGY

UNIT I WEAVING AND CERAMIC TECHNOLOGY
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) - Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
2. குமின்சுந்தரம் - பலாரியுட் விளைச்சுந்தரம் (முதல் விளைச்சுந்தரம்).
3. விளைச்சுந்தரம் - தென்பாலக் குமின்சுந்தரம் விளைச்சுந்தரம் கீழான தாரங்கணிகம் (குமின்சுந்தரம் விளைச்சுந்தரம்)
4. பெண்கள் - விளைச்சுந்தரம் தாரங்கணிகம் (சுந்தரம்: விளைச்சுந்தரம்)
5. Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)


FT5211 BIOCHEMISTRY AND NUTRITION LABORATORY

OBJECTIVES
The course aims to
- learn and understand the principles behind the qualitative and quantitative estimation of biomolecules.
- understand the quantitative methods in assessing nutritional status of individuals and groups

LIST OF EXPERIMENTS
1. Units of volume, weight, density and concentration measurements and their range in biological measurements. Demonstration of proper use of volume and weight measurement devices.
2. Preparation of buffer – titration of a weak acid and a weak base.
3. Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars and keto from aldo sugars.
5. Protein estimation by Biuret and Lowry’s methods.
6. Protein estimation by Bradford and spectroscopic methods.
7. Extraction of lipids and analysis by TLC.
8. Enzymatic assay phosphatase from potato.
10. 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
11. Calculation of the calories from nutrient composition of foods
12. Comparison of Food Composition data bases

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course the students will be able to
CO 1 understand the experimental protocols for qualitative and quantitative analysis of biomolecules.
CO 2 familiarize with the calculation of energy values of foods and composition table.
CO 3 gain knowledge of Nutritional anthropometry techniques.

TEXT BOOKS:

REFERENCES:
## Course Articulation Matrix

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1, 2 and 3 are correlation levels with weightings on slight (low), moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to
- 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.

LIST OF 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

OUTCOMES:  
TOTAL: 60 PERIODS
At the end of the course the students will be able to
- CO 1 different techniques for the identification, isolation and culture of microbes.
- CO 2 analyse and identify microbial contamination in food
- CO 3 disinfection techniques

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OBJECTIVES

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.

UNIT I
Speaking: Role Play Exercises Based on Workplace Contexts, - talking about competition-discussing progress toward goals-talking about experiences-talking about events in life-discussing past events- Writing: writing emails (formal & semi-formal).

UNIT II
Speaking: discussing news stories-talking about frequency-talking about travel problems-discussing travel procedures-talking about travel problems-making arrangements-describing arrangements-discussing plans and decisions-discussing purposes and reasons-understanding common technology terms- Writing: writing different types of emails.

UNIT III
Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios-talking about purchasing-discussing advantages and disadvantages-making comparisons-discussing likes and dislikes-discussing feelings about experiences-discussing imaginary scenarios- Writing: short essays and reports-formal/semi-formal letters.

UNIT IV
Speaking: discussing the natural environment-describing systems-describing position and movement-explaining rules-(example-discussing rental arrangements)-understanding technical instructions- Writing: writing instructions-writing a short article.

UNIT V
Speaking: describing things relatively-describing clothing-discussing safety issues(making recommendations)-talking about electrical devices-describing controlling actions-Writing: job application(Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

LEARNING OUTCOMES

- Speak effectively in group discussions held in a formal/semi formal contexts.
- Write emails and effective job applications.

Assessment Pattern

- One online/app based assessment to test speaking and writing skills
- Proficiency certification is given on successful completion of speaking and writing.
OBJECTIVES
The course aims to
- introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes;
- introduce Fourier series analysis which is central to many applications in engineering.
- develop the analytic solutions for partial differential equations used in engineering by Fourier series;
- acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic;
- develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

UNIT I  PARTIAL DIFFERENTIAL EQUATIONS  12
Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Lagrange’s Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT II  FOURIER SERIES  12
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Complex form of Fourier series – Parseval’s identity – Harmonic Analysis.

UNIT III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION  12

UNIT IV  FOURIER TRANSFORM  12

UNIT V  TRANSFORM AND DIFFERENCE EQUATIONS  12

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course students will be able to
CO 1 solve partial differential equations which arise in application problems.
CO 2 analyze the functions as an infinite series involving sine and cosine functions.
CO 3 obtain the solutions of the partial differential equations using Fourier series.
CO 4 obtain Fourier transforms for the functions which are needed for solving application problems.
CO 5 manipulate discrete data sequences using Z transform techniques.

TEXTBOOKS:
REFERENCES:

FT5301 FOOD PROCESS CALCULATIONS L T P C 2 1 0 3

OBJECTIVES
The course aims to
- learn various units, dimensions and unit conversions
- learn mass and energy balance in unit operations and processes involved in food industries

UNIT I UNITS AND DIMENSIONS 9
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 HUMIDITY CALCULATIONS 9
Fundamental food process Calculations and Humidity Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity - Use of humidity in condensation and drying of foods - Humidity chart, dew point.

UNIT III STOICHIOMETRY AND MATERIAL BALANCE 9
Basic Principles of Stoichiometry - Importance of material balance and energy balance in a food Industry-Dimensions, Units, conversion factors and their use –Data sources, Humidity and applications. Material Balance Stoichiometric principles, Application of material balance in food operations like distillation, evaporation, crystallization, drying, extraction, Leaching.

UNIT IV ENERGY BALANCE 9
Energy Balance Heat capacity of solids, liquids, gases and solutions, use of mean heat capacity in heat calculations, problems involving sensible heat and latent heats for food products.

UNIT V ENTHALPY 9
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.

TOTAL: 45 PERIODS
(Use of Psychometric chart is permitted in the examination)
OUTCOMES:

At the end of the course the students will be able to

CO 1 make them understand different types of laws of chemistry of materials
CO 2 accurately calculate the stoichiometric relations between the materials involved in the unit operation process.
CO 3 perform elementary material and energy balance for different unit operations.

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OBJECTIVES
The course aims to
- train the students on the basics and applications of energy in Mechanical Engineering
- impart knowledge on thermodynamics and thermal engineering power generating units such as engines and theory of machines

UNIT I BASIC CONCEPTS

UNIT II LAWS OF THERMODYNAMICS

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE

UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS

UNIT V GAS MIXTURES AND PSYCHROMETRY
Mole and Mass fraction, Dalton’s and Amagat’s Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course the students will be able to
CO 1  apply thermodynamic principles to Engineering Applications
CO 2  apply mathematical fundamentals to study the properties of steam, gas and gas mixture.
CO 3  apply fundamentals of thermodynamics and to perform thermal analysis on their behaviour and performance

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OBJECTIVES
The course aims to
- introduce the mechanics of fluids through a thorough understanding of the properties of the fluids, behaviour of fluids under static conditions. The dynamics of fluids through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
- 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  9

UNIT II  FLUID FLOW ANALYSIS  9

UNIT III  FLOW MEASUREMENTS  9

UNIT IV  OPEN CHANNEL FLOW AND FLUID FLOW THROUGH BEDS  9

UNIT V  DIMENSIONAL ANALYSIS & PUMPS  9

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- CO 1 get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- CO 2 gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.
- CO 3 perceive knowledge on metering and transportation of fluids.
TEXT BOOKS:

REFERENCES:
2. Grade, RJ.,“Fluid mechanics through problems”. Wiley eastern Ltd., Madras, 2002
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OBJECTIVES
The course aims to
• develop the knowledge of students in the basic area of Food Chemistry such as the composition and properties of food and the chemical changes of nutrients during handling, processing, and storage.
• effective understanding of food processing and technology.
• appreciate the similarities and complexities of the chemical components in foods.

UNIT I  CARBOHYDRATES  10
The principal carbohydrates in the human diet. Chemical properties of carbohydrates-dehydration, caramelization, Maillard reaction. Types Simple Sugars mono and disaccharides, solubility; Artificial sweeteners; Glucose syrup, fructose syrup, Sugar alcohols; Oligosaccharides structure, nomenclature, occurrence, uses in foods. Polysaccharides Starch- amylose and amylpectin- properties, thickening & gelatinization, modified starches, resistant starch, Dextrins and dextrans, Starch hydrolysates – Maltodextrins and dextrins; Structure of glycogen. Fiber-Cellulose & hemicellulose Pectins Gums & seaweeds- gel formation & viscosity.

UNIT II  PROTEINS  9
The principal proteins in the human diet. Review of protein structure & conformation; Optical activity, solubility, hydration, swelling, foam formation & stabilization, gel formation, emulsifying effect, thickening & binding, amino acids in Maillard reaction, denaturation; Properties & reactions of proteins in food systems and Food enzymes and its role in food spoilage, application of food enzymes; Texturized proteins; Functional role and uses in foods.

UNIT III  LIPIDS  10
Review of structure, composition and nomenclature of fats. Properties of fats & oils Edible oil refining processes, winterization, melting points, plasticity, isomerisation, hydrolysis of triglycerides, Saponification number, iodine value, Reichert-Meissl number. Types of fatty acids; Modification of fats hydrogenation- cis and trans isomers, inter-esterification, acetylation, Hydrolytic rancidity & oxidative rancidity; Shortening power of fats, tenderization, frying - smoke point, auto oxidation, polymerization, lipids having emulsifying properties, its application in food industry and detergents; Shortening power of fats, chemistry of steroids, types of fat substitute.

UNIT IV  FOOD COMPOSITION, WATER, MINERALS AND VITAMINS  7
Proximate composition of food, water activity in food, moisture content of food, water quality for food processing. Mineral & vitamin content of foods- stability & degradation during food processing.

UNIT V  AROMA & IMPORTANT PHYTOCHEMICALS IN FOOD  9
Naturally occurring colours/pigments in food and impact on antioxidant level, Synthetic food grade Colours, enzymatic browning of food, flavour & aroma components present in herbs, spices, coffee, tea, cocoa, fruits, vegetables & fermented products; and Naturally similar/artificial flavours, Threshold values, off flavours & food taints. Naturally occurring toxic substances, protease inhibitors, bioactive components phytates, polyphenols, saponins, phytoestrogens etc.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students will be able to
  CO 1 gain knowledge on chemical nature of food components.
  CO 2 imparting knowledge on chemical changes of food components during food handling, processing, and storage.
  CO 3 facilitate basic platform for further understanding of food analysis.
TEXT BOOKS:

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OBJECTIVES
The course aims to
- study and understand the chemical properties of foods.
- study the physical, chemical, thermal properties of various food constituents

LIST OF EXPERIMENTS
1. Experiment to study the properties of carbohydrates- caramelize, Mailard reaction.
2. Experiment on enzymatic and acid hydrolysis of sucrose
3. Preparation of emulsions and study its stability
4. Determination of Foaming properties of proteins
5. Determination of Solubility, specific gravity and Refractive index of oils
6. Estimation of free fatty acid content of oil
7. Determination of peroxide value and Anisidine value of fats.
8. Experiment to study the effect of heat on proteins.
9. Determination of Iso-electric point of casein & experiment to study effect of rennin on milk proteins
10. Experiments to study the gelling properties of starch
11. Experimental study of gluten formation using wheat flour
12. Experimental study on enzymatic Browning in foods

TOTAL: 60 PERIODS

OUTCOMES
At the end of the course the students will be able to
- CO 1 gain practical knowledge on chemical nature of food components.
- CO 2 expertise on the protocols of chemical properties of individual components in foods.
- CO 3 facilitate for further understanding of food analysis lab.

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OBJECTIVES:

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: 10 Hours

Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL: 10 Hours

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

MS POWERPOINT: 10 Hours

Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

OUTCOMES:
On successful completion the students will be able to
Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects

GE5251 ENVIRONMENTAL SCIENCES L T P C

OBJECTIVES
The course aims to
- introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and environmental issues.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14
Definition, scope and function 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 – bio geographical 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 – soil 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 47 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


OUTCOMES

At the end of the course the students will be able to

CO 1 recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.

CO 2 identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.

CO 3 identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.

CO 4 recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.

CO 5 demonstrate the knowledge of societal activity on the long and short term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

TEXT BOOKS:


REFERENCE BOOKS:

OBJECTIVES

- To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
- To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the Central Limit theorem.
- To apply the small/large sample tests through Tests of hypothesis.
- To understand the concept of analysis of variance and use it to investigate factorial dependence.
- To monitor a process and detect a situation when the process is out of control.

UNIT I  RANDOM VARIABLES  12
Discrete and continuous random variables – moments – moment generating functions – binomial, poisson, geometric, uniform, exponential, gamma, weibull and normal distributions – functions of a random variable.

UNIT II  TWO-DIMENSIONAL RANDOM VARIABLES  12

UNIT III  TESTS OF SIGNIFICANCE  12
Type I and Type II errors – tests for single mean, proportion, difference of means (large and small samples) – tests for single variance and equality of variances – chi-square test for goodness of fit – independence of attributes – non-parametric tests: test for randomness and rank – sum test (wilcoxon test).

UNIT IV  DESIGN OF EXPERIMENTS  12
Completely randomized design – randomized block design – latin square design – factorial design – taguchi’s robust parameter design.

UNIT V  STATISTICAL QUALITY CONTROL  12
Control charts for measurements ($R$ and $R$ charts) – control charts for attributes (p, c and np charts) – tolerance limits – acceptance sampling.

TOTAL: 60 PERIODS

OUTCOMES
CO1  To analyze the performance in terms of probabilities and distributions achieved by the determined solutions
CO2  To be familiar with some of the commonly encountered two dimensional random variables and be equipped for a possible extension to multivariate analysis
CO3  To apply the basic principles underlying statistical inference (estimation and hypothesis testing)
CO4  To demonstrate the knowledge of applicable large sample theory of estimators and tests To obtain a better understanding of the importance of the methods in modern industrial processes.

TEXT BOOKS:
REFERENCES:

FT5401 HEAT AND MASS TRANSFER IN FOOD PROCESSES LT P C 2 1 0 3

OBJECTIVES
The course aims to
- learn the principles and applications of heat and mass transfer operations in food industries.
- understand the mechanisms and concept of heat transfer effectively.
- Investigate the mass transfer operational approaches.

UNIT I HEAT TRANSFER – CONDUCTION 9

UNIT II HEAT TRANSFER - CONVECTION 9
Heat transfer - convection – free and forced convection - factors affecting the heat transfer coefficient in free and forced convection heat transfer – overall heat transfer coefficient - solving problems in foods.

UNIT III HEAT TRANSFER – RADIATION AND HEAT EXCHANGER 9

UNIT IV MASS TRANSFER -DIFFUSION 9
UNIT V  MASS TRANSFER – DISTILLATION
Vapour liquid equilibria - Raoult’s law- Principle of distillation - flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by Mc.Cabe -Thiele method.

TOTAL: 45 PERIODS

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

CO 1   apply the different heat and mass transfer principles in different approaches.
CO 2   gain knowledge on types of heat exchangers used in food industry
CO 3   design the heat and mass transfer equipments.

TEXT BOOKS:
2. Geankoplis C.J. “Transport Process and Unit Operations”. Prentice-Hall of India
   Private Limited, New Delhi, 1999.

REFERENCES:
1. Jacob and Hawkins. “Elements of Heat Transfer”.John Willey and Sons Inc. New York,
   1983.
5. McCabe, W.L., J.C. Smith and P.Harriot “Unit Operations of Chemical Engineering”,6th
## Course Articulation Matrix

<table>
<thead>
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<td>apply the different heat and mass transfer principles in different approaches.</td>
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<td>design the heat and mass transfer equipment.</td>
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<td>gain knowledge on types of heat exchangers used in food industry.</td>
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1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to

- understand the principles involved in separation methods.
- study about the types of crystallization and evaporation.

UNIT I EVAPORATION

UNIT II MECHANICAL SEPARATION

UNIT III SIZE REDUCTION

UNIT IV CONTACT EQUILIBRIUM SEPARATION

UNIT V EXTRACTION AND CRYSTALLIZATION

TOTAL: 45 PERIODS

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

- CO 1 develop various separation techniques.
- CO 2 apply the knowledge on filtration and centrifugation in food processing units.
- CO 3 design the different crystallizers and evaporator equipment.
TEXT BOOKS:

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<tr>
<td><strong>CO1</strong> develop various separation techniques.</td>
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<td><strong>CO2</strong> design the different crystallizer s and evaporator equipment s.</td>
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<tr>
<td><strong>CO3</strong> apply the knowledge on filtration and centrifugation in food processing units.</td>
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<td><strong>Over all CO</strong></td>
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1,2 and 3 are correlation levels with weightings on slight (low), moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to
• expose the students to the principles, methods and techniques of food analysis.
• make the students to handle different chemical and instrumental methods of food analysis.

UNIT I  SAMPLING METHODS FOR FOOD ANALYSIS  6
Introduction, Food Regulations and Standards - Sampling methods - Sample preparation and preservation- Extraction methods and Separation process of food components; Statistical evaluation of analytical data - Official Methods of Food Analysis. Proximate analysis of foods-Moisture in foods, Ash content of foods - determination by different methods; Titratable Acidity in foods, Determination of dietary fibre and crude fibre,

UNIT II  LIPIDS AND PROTEINS ANALYSIS  9
Determination of Total fat in foods by different methods; Analysis of oils and fats for physical and chemical parameters, Quality standards, and adulterants.
Determination of Proteins Concentration- Colorimetric methods, Determination of Total nitrogen, Spectrophotometric determination; Protein Characterization- Electrophoresis and Isoelectric focussing; Analysis of Protein quality – Protein Efficiency Ratio (PER), Net Protein Utilization (NPU), Biological Value, Protein Digestibility- Corrected Amino acid Score (PDCAAS), In vitro Protein digestibility for C-PER; Measurement of Functional properties of proteins- Protein hydration properties, Surface properties of protein, Protein gel properties. Calculation of proximate and ultimate composition of foods.

UNIT III  CARBOHYDRATE ANALYSIS, REFRACTOMETRY AND POLARIMETRY  9
Refractions- Basic Principles and Instrumentation, and Applications-Brix Value of Fruit juices, Total soluble solids in fruit products.
Carbohydrate analysis- Colorimetric Quantification methods of Mono and Di-Saccharides, HPLC of Mono and Di-Saccharides using refractive index detection; Starch- Enzymatic quantification and Determination of Total amylose content; Cell wall polysaccharides-Determination of uronic acid content and β-Glucan content, Degree of Methylation and Acetylation of pectin.
Polarimetry- Basic principles, Instrumentation and Applications-Determination of specific rotations of sugars; Estimation of simple sugars and disaccharides.

UNIT IV  SPECTROSCOPIC AND CHROMATOGRAPHIC TECHNIQUES IN FOOD ANALYSIS  12
Spectrophotometry Basic Principles, Spectrophotometric analysis of food additives and food Components -IR Spectroscopy in online determination of components in foods; AAS and ICP-AES in mineral elements and toxic metals analysis; use of fluorimeter in vitamin assay- specific use of Tintometer in Vanaspati analysis.
Chromatography Basic Principles, Detection of adulterants in foods by paper chromatography and thin layer chromatography, Column chromatography for purification of pigments, Analysis of food additives, phytochemicals and aflatoxins, contaminants and other food components by HPLC, GC analysis of fatty acids, cis, trans Isomers - volatile oils, flavours and pesticides, contaminants and other volatile derivatives of food components; Significance MS detector in HPLC and GC. Ion Exchange Chromatography for amino acid purification, Affinity chromatography for protein purification, Problem solving using chromogram.
UNITV SENSORY EVALUATION TECHNIQUES

Introduction to quality attributes of food Appearance, flavour, textural factors and additional quality factors; Gustation importance of gustation, Mechanism of taste perception, Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami, Taste measurement-Electronic Tongue; Olfaction definition and importance of odour and flavour, Mechanism of odour perception, Theories of odour classification, chemical specificity of odour, Odour measurement technique- e- nose; Colour importance of colour, Dimensions of colour and attributes of colour and gloss, Perception of colour, Colour Measurement; Textured definition and importance of texture, Phases of oral processing, Texture perception, Rheology of foods, Texture classification, Texture measurement and recent advances in texture evaluation.

Sensory Evaluation Objectives, Type of food panels, Characteristics of panel member, Layout of sensory evaluation laboratory, Sensitivity tests, Threshold value, Paired comparison test, Duo trio test, Triangle test, Hedonic scale.

TOTAL: 45 PERIODS

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

CO 1 understand the principles behind analytical techniques in food analysis.
CO 2 know the methods of selecting appropriate techniques in the analysis of food products.
CO 3 appreciate the role of food analysis in food standards and regulations for the manufacture of food products and food quality control in food industries.
CO 4 familiarize with the current state of knowledge in food analysis.

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<td>CO2 know the methods of selecting appropriate techniques in the analysis of food products.</td>
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<td>CO3 appreciate the role of food analysis in food standards and regulations for the manufacture of food products and food quality control in food industries.</td>
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<tr>
<td>CO4 familiarize with the current state of knowledge in food analysis.</td>
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1, 2 and 3 are correlation levels with weightings on slight (low), moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to
- handle basic unit operation equipments in food industries
- measure fluid flows
- evaluate performance factors of various unit operation equipments

LIST OF 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.
11. Determination of performance characteristics in size reduction using the burr mill.
12. Determination of energy requirement in size reduction using the ball mill and hammer mill.

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- CO 1 have knowledge on the basic principles of various unit operations and its applications in food industry.
- CO 2 gain hands on experience in handling various chemical engineering equipments.
- CO 3 apply the skill of material balance and energy balance in unit operations.
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<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
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<tr>
<td>CO1 have knowledge on the basic principles of various unit operations and its applications in food industry.</td>
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<td>1 1 1 3 3 1 1</td>
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<tr>
<td>CO2 gain hands on experience in handling various chemical engineering equipments</td>
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<td>1 1 1 3 3 1 1</td>
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<tr>
<td>CO3 apply the skill of material balance and energy balance in unit operations.</td>
<td>3 3 2 3 2 - - - - 1</td>
<td>1 1 1 3 3 1 1</td>
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<td>Over all CO</td>
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<td>1 1 1 1 3 3 1 1</td>
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</table>

1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to
- equip students with characterization and estimation of chemical compounds in food for its compliance with standards.
- learn the analysis of foods for the detection of adulterants in foods.

LIST OF 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.
   a. Titrimetric method using dichlorophenolindophenol dye
   b. Spectrophotometric method using dinitrophenylhydrazine
   c. HPLC method
5. Extraction and identification of synthetic Food colour in sweets, confectioneries and beverages.
7. Determination of Iodine content in iodized salt.
10. Determination of soluble and insoluble fibre in foods.
11. Detection of adulterants in edible oil and ghee.
12. Column chromatographic separation of carotenoids
13. The identification of sugars in fruit juice using TLC.

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course the students will be able to
CO 1 understand the analysis of foods and food products for chemical components.
CO 2 learn standards for food products.
CO 3 obtain knowledge of adulterants in foods.

TEXT BOOKS:

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<tr>
<td>CO1 understating in analysis of foods and food products for chemical components.</td>
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<td>CO2 knowing standards for food products.</td>
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<tr>
<td>CO3 obtaining knowledge of adulterants in foods</td>
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1, 2 and 3 are correlation levels with weightings on slight (low), moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to:
- teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- explain the TQM Principles for application.
- define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- illustrate and apply QMS and EMS in any organization.

UNIT I  INTRODUCTION  9
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Definition of TQM - Basic concepts of TQM - Gurus of TQM (Brief introduction) - TQM Framework - Barriers to TQM - Benefits of TQM.

UNIT II  TQM PRINCIPLES  9

UNIT III  TQM TOOLS & TECHNIQUES I  9

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

UNIT V  QUALITY MANAGEMENT SYSTEM  9

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students will be able to:
- CO 1 ability to apply TQM concepts and principles in a selected enterprise.
- CO 2 ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- CO 3 ability to understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
- CO 4 ability to apply QMS and EMS in any organization.
TEXT BOOKS:

REFERENCES:

FT5501 FOOD PROCESS ENGINEERING L T P C 2 1 0 3

OBJECTIVES
The course aims to
- understand basic engineering properties of food.
- understand different thermal and non-thermal processes used in Food Industry.

UNIT I PROPERTIES OF FOOD 11
Engineering properties of food materials - Rheological and textural Properties, Thermal Properties, Thermodynamic Properties, surface and gas exchange properties, electric and dielectric properties
Water activity and states a thermodynamic quantity, water sorption isotherms, hysteresis, theories of sorption hysteresis, water activity measurement methods, water binding, control of water activity and moisture, principles of IMF and their application

UNIT II SEDIMENTATION AND CENTRIFUGATION 7
The velocity of particles moving in a fluid - terminal velocity - drag coefficient terminal velocity magnitude, Sedimentation - sedimentation equipment, Flotation, Sedimentation of Particles in a Gas Settling Under Combined Forces Cyclones- optimum shape, efficiency Impingement, separators Classifiers, Centrifugal separations - centrifugal force particle velocity Liquid Separation radial variation of pressure radius of neutral zone Centrifuge Equipment

UNIT III DRYING AND FREEZING 10
Freezing - Freezing curve for Homogenous and Non-homogenous food system, Freezing point depression, Freezing rate, Effect of freezing Physical and chemical changes in Foods, Enzyme activity, Microbe inactivation and Food quality sensory quality, nutritional aspects, freeze drying and freeze concentration.
UNIT IV  THERMAL PROCESSING  

UNIT V  FOOD MATERIAL PROCESSING  
Membrane processes Ultra filtration, Reverse osmosis, Electrodialysis, per-evaporation and micro filtration – principles - application in food industry, Extrusion - Extrusion cookers - cold extrusion, single and twin-screw extrusion - Low pressure and high-pressure extrusion - properties of Food materials and its significance in equipment design - processing and handling application in food industry; Baking Principles, baked foods, baking equipment; Roasting Principles of roasting, roasting equipment

TOTAL: 45 PERIODS

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

CO 1  learn and apply basic engineering properties of foods
CO 2  familiarize with separation techniques involved in food industry
CO 3  learn various engineering operations in food processing

TEXTBOOKS:

REFERENCES:
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<tr>
<td>CO1 learn and apply basic engineering properties of foods</td>
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<tr>
<td>CO2 familiarize with separation techniques involved in food industry</td>
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<tr>
<td>CO3 learn various engineering operations in food processing</td>
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<td>Over all CO</td>
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1, 2 and 3 are correlation levels with weightings on slight (low), moderate (medium) and substantial (high) respectively.
OBJECTIVES

The course aims to
- develop the knowledge of students in the area of vegetable and fruit processing and technology.
- 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. Problem solving in post-harvest quality of fruits and vegetables.

UNIT II  FRESH FRUITS AND VEGETABLES  8


UNIT III  PRESERVATION OF FRUITS AND VEGETABLES  9

Preservation by fermentation- Definition, Advantages, disadvantages, Types of fermentation, equipments; Fruit wine. Irradiation applications for fruits and Vegetable. Minimally processed fruits and vegetables, solving problems with respect to natural resistance of fruit, Emerging technologies for fruits and vegetables processing technologies General pre processing, drying and freezing problems associated with specific fruits and vegetables, problem solving in Post-cutting treatments to extend the shelf-life of fresh-cut products.

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. Technology for juice pressing, juice extraction and clarification, methods of bottling, enzymatic clarification and debittering of juices, fruit juice powders- preparation and packaging

UNIT V  FRUIT AND VEGETABLE PRODUCTS  8

Ready to eat fruit and vegetable products, Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys, Fruit Bar, Soup powders, Candied Fruits, Natural colors, Fruit and Vegetable Fibres- General and specific processing, different packing including aseptic, Dried Onion, Powder. Garlic Dried Garlic, Powder, Oil. Potato Wafer; starch, Papad, Carrot Preserve, candy, Pickle, Jam. Cauliflower and cabbage Dried cauliflower and cabbage, Sauerkraut, Pickle Leafy vegetables; Dried Leafy Vegetables. (Spinach, Fenugreek, Coriander leaves, Curry leaves).Bitter gourd Pickle, Dried bitter gourd. Indian Food Regulation and Quality assurance, Case studies- Improving the nutritional quality of processed fruits and vegetables, Waste management in fruit and vegetable processing industries.
OUTCOMES:
At the end of the course the students will be able to
- CO 1 understand the concepts of physiological characteristics of fruits and vegetables.
- CO 2 have insight about fruit losses during storage and ways to prevent it.
- CO 3 have thorough Knowledge and understandings of the specific processing technologies

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<td>CO3</td>
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1, 2, and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES

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

UNIT I  EGG PROCESSING  9

UNIT II  MEAT PROCESSING  9

UNIT III  MEAT PRODUCTS  9

UNIT IV  MARINE FOOD PROCESSING  9
Composition of marine fish, fresh water fish, finfish and shell fish – major species, structure and spoilage factors of fish. Post-mortem changes in fish. Handling and transportation of fish. Processing and preservation of shrimp, lobster, crab, crawfish, molluscan shellfish, surimi and surimi seafood.

UNIT V  MARINE FOOD PRODUCTS  9
Seaweed products and their economic significance, fish meal and oil, protein concentrates, industrial products, bioactive compounds, Seafood quality Assurance, sea food safety – illness associated with consumption –toxins, allergies and intolerances.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to
CO 1 understand and identify the specific processing technologies used for meat and marine products.
CO 2 familiarize with quality evaluation techniques for meat and marine products.
CO 3 grasp the changes in the composition of foods with respect to the type of processing technology used.
TEXT BOOKS:

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<td>understand and identify the specific processin g technologies used for meat and marine products.</td>
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<tr>
<td>CO2</td>
<td>familiarize with quality evaluation technique s for meat and marine products.</td>
<td>1 1 2 2 2 - - 3 2 1 1 2 2 2 - 1</td>
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<tr>
<td>CO3</td>
<td>grasp the changes in the compositio n of foods with respect to the type of processin g technolog y used.</td>
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OBJECTIVES

The course aims to
- enable students to perform and analyse, livestock, fish and marine products for its proximate and chemical constituents
- understand different industrial processes involved in livestock, fish and marine products.

LIST OF EXPERIMENTS

1. Proximate analysis of meat, poultry and fish - Direct and indirect method of Moisture Determination, fat Content, Vitamin, Mineral and Trace Element Analysis
2. Quality analysis of Meat, poultry and fish – Color, Texture, pH, Water/Protein Ratio
3. Determination of vitamin content in meat using HPLC.
4. Analysis of the Technological Quality of Fat in meat - Fatty Acid Profile, Lipid Fractions, Cholesterol, Fat Firmness, Oxidation Status
5. Determination of Microbial load and Toxins in Meat and Meat Products
6. Determination of Total Volatile Basic Nitrogen (TVBN)
7. Determination of Picric Acid Turbidity (PAT)
9. i) Assessment of Lipid and protein Oxidation in meat
   ii) Determination of proteolysis and lipolysis of meat
10. Determination of Meat Swelling Capacity (MSC)
11. Determine % of different components & constituents such as yolk portion, white portion, ash, Total solid, moisture, specific gravity of egg.
12. Determine the efficiency of reduction in microbial load during egg Pasteurization
13. Determine the effect of drying temperature on production of egg white powder using spray dryer.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to
- CO 1 understand the specific processing technologies used for meat and marine products.
- CO 2 familiarize with quality evaluation techniques for meat and marine products.
- CO 3 familiarize with physicochemical analytical techniques.

REFERENCES:

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1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to

- analyze spices, fruits and vegetable crops for its chemical compounds
- understand the processing and preservation techniques for storage of spices, fruits and vegetable crops

EXPERIMENTS
1. Proximate analysis of fruits and vegetables - moisture, ash, mineral matter, protein, starch, Crude fat and % Total sugars
2. Estimation of quality criteria- maturity indices, color, texture, brix, pH in various fruits and vegetables
3. Determination of effective freezing and cooling time for fruits and vegetables
4. Osmotic dehydration of fruits and vegetables
5. Accelerated shelf life testing of canned fruits and vegetables.
6. Optimization of ingredients (pectin and sugars) of Jam and its analysis – colour, texture, TSS, titratable acidity
7. Optimization of ingredients and its analysis of Ready to serve products - colour, viscosity, TSS
8. Experimental study on effect of thickeners, stabilizers and preservatives in tomato sauce.
9. Dehydration kinetics of
   i) Vegetable products – onion/garlic/ginger
   ii) Fruits products – grapes/fig/banana
10. Waste management in fruit and vegetable processing industries.
    i) Pectin (Extraction, purification, Characterization and Estimation)
    ii) Pigments (Extraction and characterization) - carotene, xanthophylls and lycopene
    iii) Polysaccharides
    iv) Phytochemicals (qualitative) – flavanoids, tannin, saponin, anthocyanin
11. Identification and characterization of flavouring compounds of spices
12. Estimation of oil contents in different spices – clove/pepper/cardamom/chilli
13. Extraction and quantification of oleoresins - Turmeric/ginger/pepper/clove
14. Phytochemicals (quantitative) estimation in spices - Turmeric/ginger/pepper/clove
15. Preparation of fermented soy products

TOTAL: 60 PERIODS

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

CO 1 understand the processing technologies used for fruit and Vegetable processing.
CO 2 familiarize with quality evaluation techniques
CO 3 familiarize with physiochemical, analytical and applications techniques.

REFERENCES:

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1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to

- understand the different methods involved in development of food packaging systems.
- understand the different packaging system available for food packaging

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

UNIT II  PACKAGING MEDIA & MATERIALS  12
Metal packaging- Metals Tinplate, tinning process, components of tinplate, tin free can (TFC) types of can, metallic films, lacquers. Glass as package material, manufacture, advantages, disadvantages; Paper as package material, its manufacture, types, advantages of corrugated and paper board boxes. Plastic as package material, classification of polymers, properties of each plastics, uses of each plastic; Caps and closures, inks and lacquers, cushioning materials, reinforcements

UNIT III  PACKAGING SYSTEMS AND METHODS  9
Lamination, need of lamination, types, properties, advantages & disadvantages of each type. Coating on paper & films, types of coatings. Need of coating, methods of coatings, Vacuum packaging, gas flush packaging - CAP & MAP, aseptic & retort packaging, box in box, edible, Active packaging systems and their food applications.

UNIT IV  PACKAGING OF FOOD PRODUCTS AND TESTING OF PACKAGE  9
General classification and packaging types - Packaging of Specific Foods with its properties like bread, biscuits coffee, milk powder, egg powder, carbonated beverages Snack foods etc, pallets & containers. Interaction of Food Material with Packaging Material, Testing & evaluation of packaging media – retail packs & transport packages

UNIT V  REGULATORY ASPECTS OF PACKAGING  9
Food marketing and role of packaging; Packaging aesthetic and graphic design; Food Packaging Laws and Regulations, Food Labelling, coding and marking including bar coding. Packaging Costs; Packaging Environmental consideration and restoration – sustainable development, biodiversity, global environment facility, environmental impact assessment, environmental protection act, national conservation strategies, ISO 14000. & wastemanagement, Sources-Reduce, Reuse and Recycling (3R’s), 7R’s of Packaging, Biodegradable materials, Recycling techniques/methods – Paper/Paperboard, Plastics, Metals, Glass

TOTAL: 45 PERIODS

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

- CO 1 understand the concepts, types of food packaging systems
- CO 2 analyse complex systems of food packaging and logistics.
- CO 3 understand the importance of law, regulations and monitoring agencies involved in labelling of foods.

TEXT BOOKS
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1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIONS

The course aims to
☐ study the principles of cooling, air conditioning and freezing
☐ achieve effective and efficient food refrigeration design solutions

UNIT I   REFRIGERATION PRINCIPLES AND REFRIGERANTS  5

UNIT II  VAPOUR REFRIGERATION SYSTEM  12

UNIT III  PSYCHROMETRIC PROPERTIES AND PROCESSES  8
Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air-conditioning processes, mixing of air streams

UNIT IV  FOOD REFRIGERATION  10

UNIT V   COLD CHAIN  10
Introduction, need for the chain for chilled / frozen food item, various links of the chain; importance of shelf- life; just – in-time deliveries; Refrigerated transport Handling and distribution, cold chain, refrigerated product handling, refrigerated vans, refrigerated display. Challenges in international food supply chain – managing challenges; Trends in supply chain relationships; PPP and TTT concepts; Temperature monitoring; -Critical temperatures; Temperature –time indicators (TTI); Thaw indicators.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to
CO 1 understand the principles and working of refrigeration, air conditioning, and cold chain.
CO 2 gain knowledge on refrigeration and problem solving ability on types of loads.
CO 3 design refrigeration and cold storage system for food products.
TEXT BOOKS:

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1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES

The course aims to
- develop the knowledge of students in the area of Cereal, pulse and oilseed processing and technology.
- effective understanding specific aspects of food processing related to these foods.

UNIT I  WHEAT AND RICE  10
Status, major growing areas and production of cereals, millets, pulses and oil seeds in India and the world, structure, Physical properties, Chemical composition, Distribution of nutrients, nutritional and anti-nutritional factors. Wheat Morphology, Physicochemical properties, Wheat Quality, Wheat Milling, quality aspects of flour, wheat proteins and their function, rheology of wheat flour. Paddy Processing and treatment for quality improvement, Milling of rice Conventional Milling, Modern milling, Advantages and disadvantages of milling machineries, calculation of milling efficiency, By products of rice milling, Parboiling of rice, Aging of rice, Enrichment and fortification.
Cereal based baked products – Bread, Biscuit, Cakes, Extruded processing and products, Pizza, Chapatis malting and malt products - Processed Foods from rice Breakfast cereals, flakes, puffing, canning and instant rice.

UNIT II  MILLETS AND OTHER CEREALS  9
Sorghum, Pearl Millet, Finger millet, Foxtail millet, Kodo Millet - storage, insect control; processing - Pearling, Milling, Malting, Malt based foods, value addition, by product utilization, flaked and fermented products; Traditional and Nutritional products based on finger millet. 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 III  LEGUME PROCESSING  10

UNIT IV  OIL SEEDS AND NUTS  8
Chemical composition and characters of oil seed and nuts, Anti-nutritional factors, elimination Methods. Post Harvest Technology of Oil seeds, Handling Drying, Storage, Grading, Pretreatments, cleaning, Dehulling, solving problems in size reduction and flaking.

UNIT V  OIL SEED PROCESSING  8
Oil seeds Processing Sesame, Coconut, Groundnut, Mustard, Soybean, Sunflower, Safflower. Oil extraction Traditional Methods, New Technologies in oil seed processing, calculation of extraction efficiency, Oil modification process- hydrogenation, inter esterification and dry fractionation , utilization of oil seed meals of different food uses. High protein product, like protein concentrates and isolates.

TOTAL: 45 PERIODS
OUTCOMES:

At the end of the course the students will be able to
   CO 1  gain knowledge on the identify the specific processing technologies for cereals, pulses and oilseeds
   CO 2  understand the application of scientific principles in the processing technologies related to these foods.
   CO 3  understand the specific aspects of products from these foods.

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1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to
- analyze different kinds of packaging materials.
- analyze and evaluate different packing characteristics for development of food packages

LIST OF EXPERIMENTS
1. Identification of different types of packaging and packaging materials
2. Measurement of thickness of packaging films, papers and boards
3. Measurement of water absorption of paper, paper boards
4. Measurement of bursting strength of paper of paper boards
5. Determination of tensile/compression strength of a given material
6. Destructive and non-destructive test on glass container, drop test
7. Determination of wax weights, tensile strength of papers, bursting strength
8. Determination of WVTR of various packaging materials
9. Determination of Oxygen Transmission Rate of various packaging materials
10. Determination of coating on package materials
11. Evaluation of residue migration from package to food

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- CO 1 understand the principles and working of refrigeration, air conditioning, and cold chain.
- CO 2 gain knowledge on refrigeration and problem solving ability on types of loads.
- CO 3 design refrigeration and cold storage system for food products.

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OBJECTIVES
The course aims to
- evaluate different physical and chemical properties of cereals, pulses and oil seeds.
- determine the effects of different processing and conditions for cereals, pulses and oil seeds.

LIST OF EXPERIMENTS
1. Determination of physical and chemical properties of grain and flour- thousand grain weight, sieve analysis, colour, sedimentation value, Liquid number, falling number, hardness, gluten index.
2. Production of malt and Value added products from cereals and millets.
3. Production and characterisation of modified starch.
4. Studies on cooking quality of cereals (cooking time, grain elongation, etc)
5. To study the methods of extraction of oil from oilseeds
6. Determination of under milled grains from polished rice
7. Production of Ready-to-eat breakfast cereals by extrusion cooking
8. Determination of alcoholic acidity of the sample of the wheat flour / Maida.
9. Experiment on leavening action of baking powder, sodium- bicarbonate and ammonium bicarbonate in cake.
10. Determination of dough rising capacity of yeast
11. Studies of dough characteristics- farinographic, amylograph and extensiographic
12. Preparation & evaluation of biscuits and bread
13. Shelf life studies of cereal and legume grains having different moisture levels.
15. Optimization and production of fermented bakery products.

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- CO 1 gain knowledge of processing technologies for cereals, pulses and oilseeds in compliance with food standards
- CO 2 understand the application of scientific principles in the processing technologies related to these foods.
- CO 3 understand the specific aspects of products from these foods.

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FT5701 FOOD SAFETY, QUALITY AND REGULATION  L T P C  3 0 0 3

OBJECTIVES

The course aims to
- characterize different type of food hazards, physical, chemical and biological in the industry and food service establishments
- help become skilled in systems for food safety surveillance
- aware of the regulatory and statutory bodies in India and the world

UNIT I INTRODUCTION TO FOOD SAFETY  10
Definition of food safety and concept of safe food; characterization of food hazards- physical, chemical and biological; 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.

UNIT II FOOD QUALITY  8
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 HAZARDS AND QUALITY CONTROL  10
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. ISO 22000 – Importance and Implementation.

UNIT IV REGULATIONS  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 CODEX COMMISSION  8
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:

At the end of the course the students will be able to
- CO 1 gain knowledge about adulteration and contamination in foods
- CO 2 acquire thorough Knowledge of food hazards, GMP, HACCP in industry and food service establishments
- CO 3 have 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
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<td>CO2 acquire thorough Knowledge of food hazards, GMP, HA CCP in industry and food service establishments</td>
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<td>CO3 have awareness on regulatory and statutory bodies in India and the world</td>
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OBJECTIVES
The course aims to
- introduce the students to dairy industry, properties and processing of milk
- enable the learning in manufacture of dairy products, sanitation and effluent treatment in dairy industry

UNIT I PROPERTIES OF MILK
History white revolution present milk industry scenario and its future. Milk-Types-Composition-
Physical-Chemical and Thermal Properties-Heat Capacity, Density Freezing-Boiling point-
Expansion-Agitation-Viscosity-Classification of milk Market and Special Milk Handling-effects of
Merits on Milk-toxicity of metals.

UNIT II PROCESSING AND QUALITY PARAMETERS OF MILK
Processing of Milk- calculation and standardisation of raw milk, Pasteurization-HTST, UHT,
sterilization, Homogenization, Filtering and Clarification of Milk-cream separation-Methods and
Equipment’s-Emulsification – Fortification, packaging of milk and milk products, judging and
grading of milk, national and international standards of milk and milk products. membrane
separation of milk – ultra filtration - reverse osmosis—membrane material and structures.

UNIT III MILK PRODUCTS
Traditional dairy products, Technology of traditional Indian dairy products. Technology of
fermented milk and milk products and probiotic milk based products., Manufacturing of Yogurt,
Cheese, Butter, Ghee, Ice-cream, overrun calculation in 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
Processing of Milk Powder- Composition - Properties- methods of drying,comparision of
different drying methodsand calculating of drying efficiency, quality evaluation, Instantization,
flow ability dustiness, reconstitutability, dispersability, wet ability, sink ability and appearance of
milk powders substitutes for milk and milk products – casein, lactose and other by-products and
its use in formulated foods , weaning foods, therapeutic foods, fortification and enrichment.

UNIT V STORAGE SANITATION AND EFFLUENT TREATMENT
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

OUTCOMES:
At the end of the course the students will be able to
- CO 1 gain knowledge about functioning of cooperatives and dairy processing methods.
- CO 2 understand the manufacturing processes of various dairy products.
- CO 3 gain knowledge of sanitation and effluent treatment in dairy industry.

TEXT BOOKS:
Dekker, 1999
REFERENCES:

Course Articulation Matrix

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1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES

The course aims to

- learn about the preservation and analytical techniques in milk and milk products
- educate about the use of various techniques in milk product processing and quality analysis

LIST OF EXPERIMENTS

1. Sampling, chemical and microbial examination of pasteurized, sterilized and UHT processed milk.
2. Determination of viscosity, density and specific gravity of milk.
3. Detection of adulterants and preservatives in milk.
4. Batch and Continuous pasteurization of milk – study on Different controls on pasteurizer and Different sterilizers.
5. Determination of the rate of filtration and settling.
7. Study and operation of Butter, Ghee, Ice-cream and cheese making equipment.
8. Study the Reverse Osmosis and Ultra filtration system.
10. Determination of thermal load during retort processing of milk and milk products.
12. Determination of degree of browning-chemical/physical methods.
15. Production of probiotic food products.

OUTCOMES:

At the end of the course the students will be able to

- CO 1 gain knowledge of platform test in dairy processing.
- CO 2 understand the manufacturing processes of milk and milk products and the equipments used.
- CO 3 gain knowledge of functional properties.

TEXT BOOKS:

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1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES
This course aims to
- encourage the students to get connected with any industry/ laboratory/research institute
- acquire knowledge on solving practical problems, gaining work experience and skills
- Learn to work in an academic/ industrial/research environment.

The students individually undergo training in reputed companies/ research institutes/ organizations for the specified duration.

OUTCOMES:
At the end of the industrial training the students will be able to
CO 1 work in an industry/academia/research institute
CO 2 gain experience to work as an individual as well as a member of a team
CO 3 acquire practical knowledge and enhance skills

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<td>CO2</td>
<td>gain experience to work as an individual as well as a member of a team</td>
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<td>CO3</td>
<td>Acquire practical knowledge and enhance skills</td>
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OBJECTIVES
The course aims to
- make the students identify a project/problem/process relevant to their field of interest that can be carried out
- make them equipped to search databases and journals to collect relevant data and identify a solution
- plan, learn and perform experiments to verify the solution

TOTAL: 90 PERIODS

OUTCOMES:
At the end of the project work the students will be able to
CO 1 identification of field of interest
CO 2 equip the students to search and think about logical solutions

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OBJECTIVES
The Course aims to
- train students to analyze a problem/think innovatively to develop a new product/process
- make them understand how to find solutions/ create products economically and in an environmentally sustainable way
- enable them to acquire technical and experimental skills to validate the solution, analyze the results and communicate
- enable them to effectively think about strategies to commercialize the product.

OUTCOMES:
At the end of the project the student will be able to
CO 1 formulate and analyze a problem/create a new product/process.
CO2 plan experiments to find solutions in a logical manner/work out sustainability
CO 3 analyze the results, interpret and communicate/strategies for commercialization

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<td>CO2 plan experiments to find solutions in a logical manner/work out sustainability</td>
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<td>CO3 analyze the results, interpret and communicate/strategies for commercialization</td>
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OBJECTIVES
The course aims to
- expose the students in enzyme studies and overview of fermentation processes so that the knowledge can be applied in food processing industries
- understand the Enzyme kinetics, Inhibition kinetics, Immobilization
- understand the concept of basic fermentation processes and its control systems etc.
- get a practical knowledge about running the fermenter and its scale – up and modes of operation etc.

UNIT I ENZYME STUDIES
Enzyme Kinetics- Single substrate reactions; Estimation of Michaelis – Menten parameters, turnover number, Multisubstrate reactions- mechanisms and kinetics; Enzyme Inhibition Kinetics-Enzyme Immobilization methods.

UNIT II BASICS OF FERMENTER & MEDIA FORMULATION
Basic configuration of fermenter and ancillaries, main parameters to be monitored and controlled in fermentation processes. - Medium formulation for optimal growth and product formation- Medium Optimization Methods-Sterilization Concepts- Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid, media & air.

UNIT III STUDIES ON CELL GROWTH
Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients, energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT IV REACTOR TYPES & MODES OF OPERATION

UNIT V GAS EXCHANGE & SCALE-UP OF BIOREACTORS
Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors – Mass transfer Coefficient- methods for the determination of mass transfer coefficients; mass transfer correlations; Power requirements of Bioreactors. Scale-up considerations on heat transfer, oxygen transfer, power consumption and impeller tip speed.

PRACTICALS
2. Medium optimization – Plackett Burman design, response surface methodology
3. Enzyme kinetics – MichaelisMenton 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 cultivation, estimation of kLa – dynamic gassing method

TOTAL:60 PERIODS

OUTCOMES:
At the end of the course the students will be able to
CO 1 get familiarized with the fundamentals about Enzymes and its reaction kinetics
CO 2 gained the knowledge on the concept of basic fermentation processes
CO 3 know the applications of both enzyme and fermentation studies which may
help during scale up operations in industries.

TEXT BOOKS:

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<td>CO2 gained the knowledge on the concept of basic fermentation processes</td>
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<td>CO3 knowing the applications of both enzyme and fermentation studies, may help during scale up operations</td>
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OBJECTIVES

The course aims to
- expose the students to the principles, methods and techniques of chemical and instrumental methods of food analysis.
- enable the students about the quality analysis of the functional groups in fruits and vegetables.

UNIT I ANALYSIS OF WATER

Parameters tested as per FSSAI Regulations- Organoleptic and Physico-chemical Parameters- Colour, Odour, pH, Taste, Turbidity, General Chemical parameters- Ammoniacal nitrogen, Anionic surface active agent, Boron, Nitrate, Chloride, Magnesium, Fluoride, Total hardness, Alkalinity, Sulphates, Residual free chlorine & Chloramines Sulphide, Cyanide, Calcium, Total Dissolved Solids, Phenol, Sodium, Hexavalent chromium, Total solids, Nitrite, Mineral Oil, Estimation of Anions in Drinking water by Ion Chromatography, Metals A By AAS- By Flame AAS (Zn, Mg, Ca.), By Graphite furnace AAS (Al, Cu, Fe, Mn, Se, Ag, Cd, Pb, Hg, Mo, Ni, As, Cr), By Cold Vapour AAS (Hg) B. By ICP-MS (Zn, Mg, Ca, Al, Cu, Fe, Mn, Se, Ag, Cd, Pb, Hg, Mo, Ni, As, Cr, Hg), Toxic substances- Pesticide Residues, Polychlorinated Biphenyls, Polyaromatic Hydrocarbons, IS protocol 10500 and 14543.

UNIT II ANALYSIS OF PLANTATION PRODUCTS

Tea & Coffee- Preparation of sample, Moisture content, Total ash, Water soluble ash, Determination of Caffeine content by different methods, Microscopic examination, Determination of solubility in boiling water, Determination of Iron filings and size of the particles, Test for presence of added colouring matter.
Spices- Sample preparation, Determination of moisture, Acid insoluble ash, Determination of Cold Water Extract, Determination of Alcohol Soluble Extract, Calcium Oxide, Non Volatile Ether Extract, Volatile Oil, Crude Fibre, Allyl isothiocyanate in Mustard, p-hydroxybenzyl isothiocyanate in white mustard, Microscopic Examination of Spices, Black Pepper- Determination of Bulk density, Light berries, Piperine content, Turmeric- Determination of curcumin content, Starch content, Detection of chromate content, Detection of Argemone seeds in Mustard, Detection of Mineral Oil in Black Pepper, Detection of Papaya seeds in Black Pepper, Detection of Turmeric in Chillies and Coriander, Detection of Oil Soluble Colour, Determination of Light and Heavy Filth in Spices and Condiments, Determination of capsaicin content in chilli powder.

UNIT III ANALYSIS OF FRUIT & VEGETABLE PRODUCTS, OILS & FATS

Thermally Processes fruits and vegetables- Physical examination, Determination of Vacuum, Drained weight, Internal conditions of can, Determination of sodium chloride in brine; Jams and Jellies- Insoluble matter, pH, Titratable Acidity, Volatile oils, Total sugars, Vitamin C, Determination of fruit content.

UNIT IV ANALYSIS OF BAKING AND CONFECTIONERY PRODUCTS

Bread- Sample preparation, Determination of alcoholic acidity, Acid-insoluble ash, Non-Fat milk solids in milk bread, Biscuits- Determination of acidity of extracted fat, Confectionery- Preparation of Sample, Determination of Moisture, Determination of Sulphated Ash, Determination of Sulphated Ash on salt free basis, Determination of Ash in dil. HCl, Test for presence of added synthetic colour, Determination of Total Protein, Determination of Fat, Determination of Reducing Sugar, Determination of Sucrose, Determination of Sulphur dioxide, Determination of Lead, Copper and Zinc.
UNITV ANALYSIS OF MEAT AND FISH PRODUCTS

Preparation of Sample for Meat and Processed Meat products, Determination of Nitrite in Processed animal foods, Determination of Ascorbic acid, Alternate method for Determination of Ascorbic acid, Determination of Total Phosphorous, Test for presence of Polyphosphates, Determination of Glucono-delta-lactone, Additional tests, Determination of physico-chemical quality of meat and meat products- pH, Extract Release Volume (ERV), Meat Swelling Capacity (MSC), Total Volatile Basic Nitrogen (TVBN), Picric Acid Turbidity (PAT), Determination of dye reduction capacity

Preparation of sample for Fish and Processed Fish, Frozen Fish- Determination of Histamine, Dried fish- Moisture content, Sodium chloride content, Acid insoluble ash.

Milk & Milk products- Preparation of sample, Detection test for adulterants and contaminants, Alkaline phosphatase test, Turbidity test, Determination of Total solids, Determination of fat.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the principles behind analytical techniques in food analysis.

CO 2 know the methods of selecting appropriate techniques in the analysis of food products.

CO 3 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.

CO 4 familiarize with the current state of knowledge in food analysis.

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1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to
- impart knowledge and skills related to process technologies in fermented food products
- learn about the different equipment used for the production of various fermented food products.

UNIT I INTRODUCTION
History of food fermentations; types of fermented foods and substrates/raw materials used, traditional fermented foods, major biotransformation of raw materials during fermentation, Modern fermented foods industry, Properties of fermented foods, Fermented foods in the twenty-first century, Health benefits of fermented foods and beverages.

UNIT II STARTER CULTURES AND FERMENTATIVE METABOLISM
Microorganisms and metabolism- Bacteria used in the manufacture of fermented foods, Yeasts and molds used in the manufacture of fermented foods. Fermentation and metabolism basics-Sugar metabolism, Protein metabolism. Other metabolic systems of bacteria, yeast and molds. Starter cultures History, Starter culture microorganisms- bacteria, yeast and mold starter cultures, Strain identification, Culture composition, Manufacture of starter cultures, Evaluation of culture performance, Usage of starter cultures, Starter culture maintenance- Bacteriophages and their control, Engineered phage resistance, Starter culture technology in the twenty-first century-Encapsulated and immobilized cells, Probiotics and culture adjuncts

UNIT III FERMENTED DAIRY, FRUIT AND VEGETABLE PRODUCTS

UNIT IV FERMENTED CEREAL AND LEGUME PRODUCTS
Fermented Legumes- Major legumes used for fermentation, biochemical changes during fermentation, Soy based products- Soy sauce, Miso, Natto and Tempeh Manufacturing steps, biochemical and microbiological changes during fermentation.

**UNIT V FERMENTED MEAT AND FISH PRODUCTS**


**TOTAL: 45 PERIODS**

**OUTCOMES:**
At the end of the course the students will be able to
CO 1 understand the concepts, principles and procedures involved in the area of fermented food production.
CO 2 evaluate the raw materials quality and their influence on the properties of final products
CO 3 describe malting, brewing, winemaking spirit and dairy production processes from raw materials to final products
CO 4 distinguish the characteristic faults of fermented food products

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<td>CO2 Evaluate raw materials quality and their influence on the properties of final products</td>
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<td>CO4 Distinguish the characteristic faults of fermented food products</td>
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OBJECTIVES
The course aims to
- understand 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

UNIT I CLASSIFICATION AND SIGNIFICANCE
Introduction to Nutraceutical Industry Organizational elements, classification of nutraceuticals, dietary supplements, fortified foods, classification of functional foods and their benefits, Phytochemicals, zoo chemicals and microbes in food, plants, animals and microbes. Scope involved in the industry, Indian and global scenario.

UNIT II ANALYSIS OF PHYTOCHEMICALS
Sources and role of Isoprenoids, Isoflavones, Flavonoids, carotenoids, Tocotrienols, polyunsaturated fatty acids, sphingolipids, lecithin, choline.terpenoids . Qualitative and quantitative methods phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans. In vitro and In vivo methods for the assessment of antioxidant activity. Comparison of different In Vitro methods to evaluate the antioxidant. Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources.

UNIT III ROLE IN HEALTH AND TREATMENT OF DISEASE
Nutraceuticals and Functional foods in Gastrointestinal disorder, Cancer, CVD, Diabetic Mellitus; Importance and function of probiotics, prebiotics and symbiotics and their applications, Functional foods and immune competence; role and use in obesity and nervous system disorders.

UNIT IV NUTRACEUTICAL STABILITY CONCERNS AND SHELF LIFE TESTING

UNIT V MARKETING, REGULATORY AND SAFETY ASPECTS

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- CO 1 have knowledge of the basic concepts of nutraceuticals and its role in health and disease
- CO 2 understand the chemical nature of nutraceuticals and methods of extraction
- CO 3 understand the role of Nutraceuticals and functional food in health and disease
TEXT BOOKS:

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OBJECTIVES
The course aims to
- To develop the knowledge of students in the area of post-harvest processing of various foods and related technology.
- To enable students to appreciate the application of scientific principles in the processing of post harvesting materials.

UNIT I    INTRODUCTION
Post-harvest engineering of crops – objectives - post harvest systems and losses in agricultural commodities structure, engineering properties of agricultural materials, optimum stage of harvest, importance of loss reduction; Post Harvest Handling operations. Pre-drying operation-Moisture content, RH measurement, air-grain measurement.

UNIT II   CLEANING, THRESHING AND GRADING
Threshing and shelling operation - principles and operation - various decorticators/dehullers/shellers, description of groundnut decorticators, maize shellers, etc. Cleaning – principles and machineries – Cleaning of grains, washing of fruits and vegetables, types of cleaners, screens, types of screens - rotary screens, vibrating screens, machinery for cleaning of fruits and vegetables (air cleaners, washers), cleaning efficiency, care and maintenance; Peeling, Sorting and Grading - grain grading system, effectiveness of separation and performance index., hydrothermal treatment and conditioning of grains, Size grading, colour grading, specific gravity grading; screening, equipment for grading of fruits and vegetables, grading efficiency. Separation - Magnetic separator, de-stoners, electrostatic separators, pneumatic separator

UNIT III  MATERIAL HANDLING
Introduction to different conveying equipment used for handling of grains, fruits and vegetables; Scope and importance of material handling devices Classification, principles of operation, conveyor system selection/design. Belt conveyor Principle, characteristics, design, relationship between belt speed and width, capacity, inclined belt conveyors, idler spacing, belt tension, drive tension, belt tripper. Chain conveyor -Principle of operation, advantages, disadvantages, capacity and speed, conveying chain. Screw conveyor Principle of operation, capacity, power, troughs, loading and discharge, inclined and vertical screw conveyors. Bucket elevator Principle, classification, operation, advantages, disadvantages, capacity, speed, bucket pickup, bucket discharge, relationship between belt speed, pickup and bucket discharge, buckets types, power requirement. Pneumatic conveying system types, air/product separators; Gravity conveyor design considerations, capacity and power requirement.

UNIT IV   PRINCIPLES AND PRACTICE OF STORAGE
Importance of scientific storage systems, post-harvest physiology of semi-perishables and perishables. Damages Direct damages, indirect damages, causes of spoilage in storage (moisture, temperature, humidity, respiration loss, heat of respiration, sprouting), destructive agents (rodents, birds, insects, etc.), sources of infestation and control. Storage structures Traditional storage structures, improved storage structures, modern storage structures; Farm silos Horizontal silos, tower silos, pit silos, trench silos, size and capacity of silos.

Storage of perishables Cold storage, controlled and modified atmospheric storage, hypobaric storage, evaporative cooling storage, conditions for storage of perishable products, control of temperature and relative humidity inside storage
UNIT V  PEST CONTROL

Primary and secondary insect pests, rodents and microorganisms of stored food grains and their control, integrated pest management, Fumigation and controlled atmosphere storage of food grains, Rodent Control.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand and identify the specific processing technologies used for different foods and the various products derived from these materials.

CO 2 understand the application of scientific principles in the processing technologies specific to the materials.

CO 3 understand and design storage systems for different food products

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OBJECTIVES
The course aims to
- understand about coffee and its processing techniques, instant coffee, and quality grading, cocoa and its processing, chocolate manufacturing technology
- understand about different types of tea and its manufacturing techniques, instant tea, quality parameters of Tea
- understand about the processing and chemistry of major and minor spices

UNIT I IMPORTANCE AND PROCESSING OF SPICES
A. Major Spices

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 – flavors, Quality control, Present trends in synthesis of volatiles – micro-organisms, plant suspension cultures

UNIT II PROCESSING OF COFFEE AND TEA


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

UNIT IV PROCESSING OF COCONUT, OILPALM, ARECANUT AND CASHEW

UNIT V PACKAGING, GRADING AND QUALITY ANALYSIS OF SPICES
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
OUTCOMES:

At the end of the course the students will be able to

CO 1  learn about processing steps involved in different types of coffee, tea, instant coffee, instant tea and quality grading parameters.
CO 2  acquire knowledge on cocoa processing and chocolate manufacturing technology
CO 3  learn about processing and chemistry of major and minor spices.

TEXT BOOKS:


REFERENCES:

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OBJECTIVES
The course aims to
- describe manufacturing procedures used to produce the common food flavouring materials
- understand the flavour compounds involved in development of flavour
- understand the analytical techniques involved in flavour analysis
- understand mechanisms of flavour perception

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

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

UNIT III FLAVOUR PERCEPTION
Flavour and taste perception, smell and taste sensation, olfaction, flavour compounds, volatile flavour compounds, chemesthesia and chemesthetic responses, tactile response, Aroma compounds, flavour profile, bio-flavour and reconstituted flavour.

UNIT IV FLAVOUR ANALYSIS
Subjective versus Objective methods of analysis; psychophysics and sensory evaluation; Instrumental analysis; sample handling and artifacts; data handling

UNIT V TEACHING FLAVOUR CONCEPTS
Problem based learning; tongue and nose; Onion-Beverage-Maillard reaction-Thio-stench, Flavour legislation, flavour release, Useful principles to predict the performance of polymeric flavor delivery systems, Delivery of flavours from food matrices, Packaging and flavour compounds.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of course students will be able to
- CO 1 understand mechanisms of flavour formation and flavour release
- CO 2 explain metabolic routes leading to flavour formation in plants
- CO 3 recognize off-flavour defects in foods and strategies of identification.

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OBJECTIVES
The course aims to
- Introduce the dynamic response of open and closed loop systems, control loop components and stability of control systems.
- Learn instrumentation for the measurement of key process variables in food processing
- Update the applications of sensors in food processing Industry

UNIT I PROCESS INSTRUMENTATION 12

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 7

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 7

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 7

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 SENSOR APPLICATIONS FOR FOOD PROCESSING 12

Ultrasound sensors - Electric impedance sensors - Gas sensors - Electronic noses, tongues and testers - Chemosensors, biosensors, immunosensors and DNA probes - Sensors for food flavour and freshness; Biosensors for process monitoring and quality assurance; Conductance/impedance techniques for microbial assay - Commercial devices based on biosensors; New biosensors.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of course students will be able to
- CO 1 gain skills and knowledge in instrumentation and process control of the food process system.
- CO 2 apply principles of process control to analyze the performance of industrial processes.
- CO 3 apply concepts of measurement and sensor selection to specify, install, configure, calibrate, troubleshoot, and maintain various process instruments commonly used in industry
- CO 4 understand the prerequisites of control strategies and design different process control systems
- CO 5 evaluate the suitable controllers for different food processes.
enable students aware of recent developments in monitoring and control of food processes using sensors

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OBJECTIVES
The course aims to
☐ deliver the knowledge of spectroscopic techniques and its functions
☐ provide the technical information of spectroscopy for biological applications

UNIT I CIRCULAR DICHOISM (CD) AND OPTICAL ROTATORY DISPERSION (ORD)

UNIT II FLUORESCENCE AND RAMAN SPECTROSCOPY

UNIT III NUCLEAR MAGNETIC RESONANCE

UNIT IV MASS SPECTROMETRY AND 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.

OUTCOMES:
At the end of the course the students will be able to
CO 1 understand the principle of spectroscopic techniques widely used in many quantitative experiments
CO 2 understand the central techniques associated with the elucidation of structure and composition molecules in natural and life sciences
CO 3 comprehend the high-resolution imaging techniques to assess surface and intracellular complexity.

TEXT BOOKS:
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**FT5009 BAKING AND CONFECTIONERY TECHNOLOGY**

**OBJECTIVES**

The course aims to
- familiarize with the different methods of baking bread and recent advances in baking 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 powder and bread improvers. Leaveners and yeast foods. Shortenings, emulsifiers and antioxidants.

**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. 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:

At the end of the course the students will be able to

- CO 1 understand and optimize different food Ingredients in baking process.
- CO 2 different methods of preparation of baking products
- CO 3 understand the rheological properties and microbiological aspects of baking products

TEXT BOOKS:


REFERENCES:

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OBJECTIVES
The course aims to
- understand the process development and design consideration of food plant layout.
- understand the quantitative analysis of cost estimation and practical consideration of food plant layout.

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 centre. 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 Siting of different sections in a plant. Layout installations.

UNIT IV QUANTITATIVE ANALYSIS FOR PLANT LAYOUT
Engineering economy, Linear programming, Queuing theory, Common Problems in Plant Layout and Process scheduling, Siting of Process sections, Equipment selection and capacity determination, Arrangement of process, and service equipment, Estimation of Services and Utilities, Office layout, line balancing, Flexibility.

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

OUTCOMES:
At the end of course students will be able to
- CO 1 design and setting up of new food processing plant as Entrepreneur and/or consultant
- CO 2 help to minimize the food industry losses and maximize the processed food production
- CO 3 prepare cost estimate and economic analysis of food industry

TEXT BOOKS:

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

The course aims to
- impart knowledge of reaction rate theories and reaction mechanisms to derive expressions for rate equations mass and energy balances.
- provide a core foundation for the analysis and design of chemical reactors.

UNIT I SCOPE OF CHEMICAL REACTION ENGINEERING
Broad outline of chemical reactors; rate equations; concentration and temperature dependence; development of rate equations for different homogeneous reactions. Industrial scale reactors.

UNIT II DEAL REACTORS
Isothermal batch, flow, semi-batch reactors; performance equations for single reactors multiple reactor systems; multiple reactions.

UNIT III IDEAL FLOW AND NON IDEAL FLOW
RTD in non-ideal flow; non-ideal flow models; reactor performance with non-ideal flow.

UNIT IV GAS-SOLID, GAS-LIQUID REACTIONS
Resistances and rate equations; heterogeneous catalysis; reactions step; resistances and rate equations.

UNIT V FIXED BED AND FLUID BED REACTORS
G/L reactions on solid catalysis; trickle bed, slurry reactors; three phase-fluidized beds; reactors for fluid-fluid reactions; tank reactors.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- CO 1 write the rate equation for any type of reaction
- CO 2 design reactors for homogeneous and heterogeneous reactions and optimize operating conditions
- CO 3 relate and calculate the conversions, concentrations and rates in a reaction and identify, formulate and solve chemical engineering problems.

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OBJECTIVES

The course aims to
- acquaint with the fundamentals of biotechnology in relation to raw materials for food processing.
- enable the students to learn about food fermentations, waste utilization and use better genetic resources in food industry.

UNIT I  INTRODUCTION TO GENETIC MATERIAL  9
Genetic material, Chemical nature, properties, and functions of the genetic material, Overview of bacterial DNA replication Origin of replication, Enzymes and proteins required for DNA replication, Overview of replication Bacterial transcription Types of RNA and overview of bacterial transcription, Bacterial translation Genetic code and overview of bacterial translation, Mutation and DNA repair Types of mutation, mechanisms of repair of damaged DNA (photo reactivation, excision repair, recombination repair, SOS repair and mismatch repair).

UNIT II  OVERVIEW OF GENETIC RECOMBINATION IN BACTERIA  9

UNIT III  INTRODUCTION TO RECOMBINANT DNA TECHNOLOGY  9
DNA modifying enzymes Restriction enzymes and other modifying enzymes, Cloning vectors Introduction, plasmid and other vectors, Steps of gene cloning Isolation and purification of insert DNA, selection and isolation of vector DNA, construction of recombined DNA, and introduction of recombined DNA into host cell, identification and selection of cells containing cloned genes.

UNIT IV  DNA LIBRARIES, SEQUENCING AND AMPLIFICATION OF DNA  9
DNA Library Construction of genomic and cDNA libraries, Artificial chromosomes – BACs and YACs, Screening of DNA libraries using nucleic acid probes and antisera.

DNA Amplification- 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 V  TRANSGENIC TECHNOLOGY & APPLICATIONS IN FOODS  9
DNA microinjection, Retroviral vectors, Transgenic animals – Knock in and knock out animals, Transgenic plants – Ti plasmid. Genetically engineered proteins Bovine Somatotropin in Milk; Genetically engineered bacteria Chymosin Lite beer; Tryptophan; Transgenic plants CalgeneFlavrSavr™ tomato, Monsanto Round-Up TM Ready, Ciba Geigy Basta TM resistant crops; Edible vaccines Cholera vaccine in potatoes; Transgenic Fish Atlantic salmon.

TOTAL: 45 PERIODS
OUTCOMES:

At the end of the course the students will be able to
CO 1 understand the Basics of Biotechnological concepts.
CO 2 understand the genetically modified plants, animals and modified microorganisms
CO 3 familiarize in Food Technological applications of genetically engineered plants

TEXT BOOKS:
4. Oliver Brandenberg, Zephaniah Dhlamini, Alessandra Sensi, Kakoli Ghosh and Andrea

REFERENCES:
   Education Publ. 1999.
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OBJECTIVES
The course aims to
• familiarize with hazards, and toxicity associated with food and their implications for health.
• know the various kinds of allergens and basis of allergic reactions
• familiarize 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, mutagenicity 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.

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

CO 1 understand the basics of immune system and its response
CO 2 learn about allergens, natural toxins and their nature
CO 3 understand the toxin production during food processing and their detection

TOTAL: 45 PERIODS

TEXTBOOKS:

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### Course Articulation Matrix

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<th>Course outcomes Statement</th>
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<tr>
<td><strong>CO1</strong> learnt basics about the immune system and its response.</td>
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<td><strong>CO2</strong> learnt and about allergens, natural toxins and their nature.</td>
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<td><strong>CO3</strong> toxin production during food processing and their detection.</td>
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1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to
- identify the core values that shape the ethical behaviour of an engineer.
- utilize opportunities to explore one’s own values in ethical issues
- learn about the ethical concerns and conflicts
- enhance familiarity with codes of conduct.
- increase the ability to recognize and resolve ethical dilemmas.

UNIT I ENGINEERING ETHICS
Senses of ‘Engineering Ethics’ – Variety of moral issues – Types of inquiry – Moral dilemmas –
Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy –
Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics -

UNIT III ENGINEER’S RESPONSIBILITY FOR SAFETY
The Government Regulator’s Approach to Risk - Chernobyl Case Studies and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS
Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality –
Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights –
Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES
Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role
in Technological Development – Weapons Development – Engineers as Managers – Consulting
Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership –
Sample Code of Conduct

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- CO 1 apply ethics in society,
- CO 2 have responsibility of an engineer towards safety
- CO 3 acquire social responsibility in society

TEXT BOOKS:
   (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, “Engineering Ethics

REFERENCES:
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and
4. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University
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<td>CO2 have responsibility of an engineer towards safety</td>
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<td>CO3 acquire social responsibility in society</td>
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1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES
The course aims to
- understand the traditional methods of food processing and production.
- understand the commercialization and health aspects of traditional and organic 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  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. Organic foods types of organic foods, identifying organic foods, organic food & preservatives

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- CO 1 understand the historical and traditional perspective of foods and food habits
- CO 2 understand the wide diversity and common features of traditional Indian foods and meal patterns.
- CO 3 familiarize with health benefits of bioactive components rich traditional foods over junk foods

TEXT BOOKS:
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<td>CO2</td>
<td>understand the wide diversity and common features of traditional Indian foods and meal patterns</td>
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<td>CO3</td>
<td>familiarize with health benefits of bioactive components rich traditional foods over junk foods.</td>
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1, 2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.
OBJECTIVES

The course aims to
- introduce the students about the process economics and industrial management principles.
- improve the management and planning skills in students thus enabling them for functional role in industries.

UNIT I 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 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:
At the end of the course the students will be able to
- CO 1 perform economic analysis for process to calculate equipment cost and profitability.
- CO 2 evaluate the economic feasibility analysis of an food industry.
- CO 3 perform various aspects behind management and organization that will enable the students to perform as efficient managers.

TEXT BOOKS:

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<tr>
<td>CO1 perform economic analysis for process to calculate equipment cost and profitability</td>
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<td>CO2 evaluate the economic feasibility analysis of an food industry.</td>
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<td>CO3 perform various aspects behind management and organization that will enable the students to perform as efficient managers</td>
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OBJECTIVES

The course aims to
- introduce students to key aspects of supply chain (SC) management which are critical to improving the overall resilience of the global food supply network.
- make them aware about various global regulatory guidelines in food supply management.

UNIT I INTRODUCTION

UNIT II LOGISTICS, SUPPLY AND DISTRIBUTION
Principles of Logistics Production and sale of food products at global level, and the life cycle of the product is short. The right and wrong of logistics are influencing the success or failure of corporate management. Learning CSF (critical success factor) of Logistics through the study of successful food industry. Quantitative Management Analysis Business logistics - The supply chain Importance of Logistics/Supply Chain (SC) Costs analysis Logistics customer service Supply and distribution lines lengthening with greater complexity Quick customized response Logistics, Food supply chain management from farm to fork, Elements of the supply chain, Transport and storage, Social and environmental concerns associated with the food supply chain

UNIT III MANAGEMENT CHALLENGES IN COLD CHAIN
Post-Harvest Food Management - Supply Chain Management, The major cold chain technologies Dry ice, Gel packs, Eutectic plates, Liquid nitrogen, Quilts, Reefers Refrigerated Containers, Managerial Economics - Fresh Food and Supply Chain Management Challenges, Life Cycle Assessment Studies of Food Product, Retail logistics changes and challenges Retail logistics and supply chain Transformation The Cold Chain and its Logistics, From a geographical perspective, the cold chain has the following impacts The major cold chain technologies, Value Chain, Global Value Chain

UNIT IV FOOD SAFETY MANAGEMENT
Food safety - The risk management, internationally agreed definition, framework and process of risk management. Risk analysis, risk assessment, risk management and risk communication. Food Safety and Standards - Agricultural Marketing - Production and Operations Management Commodity Markets and Futures Trading - Retail Management - Management Concepts - Business Communication, Traceability system In order to nurture a diverse viewpoint capable of understanding and analysing traceability, Recalls

UNIT V QUALITY CONTROL AND MANAGEMENT REGULATION

**TOTAL: 45 PERIODS**

OUTCOMES:

At the end of the course the students will be able to
- CO 1 assess the impact of different SC strategies on the competitive strategy in the Food and Drinks industry.
- CO 2 design a successful collaborative initiative through the use of frameworks and tools.
- CO 3 examine the challenges around managing sustainable supply chains.

**REFERENCES:**

4. Logistics Engineering and Management, Blanchard, pearson, 6th edition 2004
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<td>CO2 design a successful collaborative initiative through the use of framework s and tools.</td>
<td>3 3 3 3 2 1 1 1 2 -</td>
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<tr>
<td>CO3 examine the challenges around managing sustainable supply chains.</td>
<td>2 3 - 3 1 1 1 1 2 -</td>
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<tr>
<td>CO4 evaluate the risk inherent in the SC through the application of tools and techniques learnt.</td>
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OBJECTIVES

The course aims to
- understand the engineering properties of different materials for the development of food plant equipment
- understand the design of different processing requirement for food industry.

UNIT I MATERIALS AND PROPERTIES
Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes

UNIT II DESIGN CONSIDERATIONS
Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations

UNIT III DESIGN OF STORAGE VESSEL AND EXCHANGERS
Design of pressure and storage vessels Operating conditions, design conditions and stress; Design of shell and its component, stresses from local load and thermal gradient, mountings and accessories. Design of heat exchangers Design of shell and tube heat exchanger, plate heat exchanger, scraped surface heat exchanger, sterilizer and retort. Design of agitators and separators Design of agitators and baffles; Design of agitation system components and drive for agitation

UNIT IV DESIGN OF DRYER, FREEZER AND FERMENTERS
Design of freezing equipment Design of icecream freezers and refrigerated display system Design of dryers Design of tray dryer, tunnel dryer, fluidized dryer, spray dryer, vacuum dryer, freeze dryer and microwave dryer Design of fermenters Design of fermenter vessel, design problems

UNIT V EXTRUDERS AND EQUIPMENT SAFETY
Extrusion cookers - cold extrusion, single and twin screw extrusion- Low pressure and high pressure extrusion - properties of Food materials and its significance in equipment design - processing and handling - Cold and hot extruder design, design of screw and barrel, design of twin screw extruder. Hazards in process industries, analysis of hazards, safety measures, safety measures in equipment design, pressure relief devices

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to
- CO1 understand principle and working of food processing equipment.
- CO2 familiarize with the design of advanced machinery available for food processing sectors
- CO3 apply their knowledge to design projects for setting up a food processing industry.
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<td>CO3 apply their knowledge to design projects for setting up a food processing industry.</td>
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OBJECTIVES
The course aims to
- understand the need of different food ingredients and additives in the development of valuable food products.
- understand the law, regulation and standards involved in use of food additives

UNIT I INTRODUCTION
Definition, role of food additives, classification of food additives based on their role, Risks and benefits of food additives, Legal and regulations- INS numbering system, General standards for food additives/Codex standards, safety requirements of food additives- role of JECFA in safety assessment of food additives, Principles of safety assessment- Food additive intake assessment methods, Procedures to fix ADI and maximum levels of food additives, ADI Calculation, Excessive food additive intakes and population risk groups, Case studies on risk assessment of 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, ANTIOXIDANTS AND ANTIMICROBIAL AGENTS
Acidity Regulators – definition, chemical structure, role and importance, pH modulation and taste, acidity profile, permitted acidity regulators, levels of usage and food applications. 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. 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. Optimisation of emulsifiers and stabilizers – case study. Thickeners – definition, chemical structure, role in food processing and product end characteristics, list of permitted thickeners and food applications.

UNIT IV COLORS, FLAVORS, FLAVOR ENHANCERS AND SWEETENERS
Color – Natural and synthetic food colors, their chemical structure, shades imparted, stability, permitted list of colors, usage levels and food application. Flavouring agents- natural and synthetic flavourings, Flavours from vegetables, cocoa, chocolate, coffee, vanilla beans and Spices. Evaluation tests for flavours. Stability of flavours during food processing. Extraction techniques of flavours, Flavour emulsions; Essential oils and Oleoresins;Flavour enhancers- Chemical properties, Functions in foods, Glutamate in foods, Biochemicals & Toxicology
Sweeteners – list, structure, taste profile, permitted list, usage levels and food applications.

UNIT V OTHER FOOD ADDITIVES & FOOD INGREDIENTS
Anticaking agents, Antifoaming, Glazing agents, Bulking agents, Humectants, Firming agents, Softening agents, Crystal modifiers, Flour improvers, Flour treatment agents, Dough conditioners, and Enzymes – definition, role and mode of action, permitted list of agents and food application. Proteins, starches and lipids as functional ingredient; isolation, modification, specifications, functional properties and applications in foods.
OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the principles of chemical preservation of foods
CO 2 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
CO 3 know the regulations and the monitoring agencies involved in controlling the safer use of additives in foods

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<td>CO2 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</td>
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<td>CO3 Know the regulations and the monitoring agencies involved in controlling the safer use of additives in foods</td>
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AUDIT COURSES (AC)

AD5091 CONSTITUTION OF INDIA L T P C 3 0 0 0

OBJECTIVES:
- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I INTRODUCTION 9
History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES 9

UNIT III ORGANS OF GOVERNANCE 9
Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions

UNIT IV EMERGENCY PROVISIONS 9

UNIT V LOCAL ADMINISTRATION 9
District’s Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila Pachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level-Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy

OUTCOMES:
- CO1: Able to understand history and philosophy of Indian Constitution.
- CO2: Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- CO3: Able to understand powers and functions of Indian government.
- CO4: Able to understand emergency rule.
- CO5: Able to understand structure and functions of local administration.

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TEXTBOOKS:
4. The Constitution of India (Bare Act), Government Publication, 1950

AD5092
VALUE EDUCATION

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OBJECTIVES:
- Develop knowledge of self-development
- Explain the importance of Human values
- Develop the overall personality through value education
- Overcome the self destructive habits with value education
- Interpret social empowerment with value education

UNIT I  INTRODUCTION TO VALUE EDUCATION  9
Values and self-development – Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non-moral valuation, Standards and principles, Value judgements

UNIT II  IMPORTANCE OF VALUES  9
Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline

UNIT III  INFLUENCE OF VALUE EDUCATION  9
Personality and Behaviour development - Soul and Scientific attitude. Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth.

UNIT IV  REINCARNATION THROUGH VALUE EDUCATION  9

UNIT V  VALUE EDUCATION IN SOCIAL EMPOWERMENT  9
Equality, Non violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

TOTAL: 45 PERIODS

OUTCOMES:
CO1 – Gain knowledge of self-development
CO2 – Learn the importance of Human values
CO3 – Develop the overall personality through value education
CO4 – Overcome the self destructive habits with value education
CO5 – Interpret social empowerment with value education

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AD5093   PEDAGOGY STUDIES   L T P C
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OBJECTIVES:
- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

UNIT I   INTRODUCTION AND METHODOLOGY:  9
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT II   THEMATIC OVERVIEW  9
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III   EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES  9
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV   PROFESSIONAL DEVELOPMENT  9
Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes.

UNIT V   RESEARCH GAPS AND FUTURE DIRECTIONS  9
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 45 PERIODS

OUTCOMES:
- Understand the methodology of pedagogy.
- Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Know the factors necessary for professional development.
- Identify the Research gaps in pedagogy.
REFERENCES:
OBJECTIVES:
- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do’s and Don’t’s in life through Yama
- Categorize Do’s and Don’t’s in life through Niyama
- Develop a healthy mind and body through Yoga Asanas
- Invent breathing techniques through Pranayama

UNIT I INTRODUCTION TO YOGA
Definitions of Eight parts of yog.( Ashtanga )

UNIT II YAMA
Do’s and Don’t’s in life.
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT III NIYAMA
Do’s and Don’t’s in life.
Ahimsa, satya, asthaya, bramhacharya and aparigraha

UNIT IV ASAN
Various yog poses and their benefits for mind & body

UNIT V PRANAYAMA
Regularization of breathing techniques and its effects-Types of pranayama

TOTAL: 45 PERIODS

OUTCOMES:
CO1 – Develop healthy mind in a healthy body thus improving social health also improve efficiency
CO2 – Learn Do’s and Don’t’s in life through Yama
CO3 – Learn Do’s and Don’t’s in life through Niyama
CO4 – Develop a healthy mind and body through Yoga Asanas
CO5 – Learn breathing techniques through Pranayama

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REFERENCES:
1. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama
   (Publication Department), Kolkata
2. ‘Yogic Asanas for Group Training-Part-I” : Janardan Swami Yogabhyasi Mandal, Nagpur
AD5095 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

OBJECTIVES:
- Develop basic personality skills holistically
- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind, pleasing personality and determination
- Discover wisdom in students

UNIT I    NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I    9
Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)

UNIT II    NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II    9
Verses- 52,53,59 (don’t’s) - Verses- 71,73,75,78 (do’s)

UNIT III    APPROACH TO DAY TO DAY WORK AND DUTIES    9
Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35
Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV    STATEMENTS OF BASIC KNOWLEDGE – I    9
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V    PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA    9
Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 45PERIODS

OUTCOMES:
CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

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REFERENCES:
1. Gopinath,Rashtriya Sanskrit Sansthanam P, Bhartrihari’s ThreeSatakam , Nitisringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram,Publication Department, Kolkata,2016
COURSE OBJECTIVES
The course will introduce the students to
- get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I \hspace{1cm} INTRODUCTION TO CULTURE \hspace{8cm} 9
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II \hspace{1cm} INDIAN LANGUAGES AND LITERATURE \hspace{8cm} 9
Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III \hspace{1cm} RELIGION AND PHILOSOPHY \hspace{8cm} 9
Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)

UNIT IV \hspace{1cm} FINE ARTS IN INDIA (ART, TECHNOLOGY & ENGINEERING) \hspace{8cm} 9
Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V \hspace{1cm} EDUCATION SYSTEM IN INDIA \hspace{8cm} 9
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 45PERIODS

COURSE OUTCOMES
After successful completion of the course the students will be able to
- Understand philosophy of Indian culture.
- Distinguish the Indian languages and literature.
- Learn the philosophy of ancient, medieval and modern India.
- Acquire the information about the fine arts in India.
- Know the contribution of scientists of different eras.
- Understand education systems in India

REFERENCES:
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
AD5098 SANGA TAMIL LITERATURE APPRECIATION  L T P C  3 0 0 0

Course Objectives: The main learning objective of this course is to make the students an appreciation for:
1. Introduction to Sanga Tamil Literature.
2. ‘Agathinai’ and ‘Purathinai’ in Sanga Tamil Literature.
3. ‘Attruppadai’ in Sanga Tamil Literature.
4. ‘Puranaanuru’ in Sanga Tamil Literature.
5. ‘Pathitrupaththu’ in Sanga Tamil Literature.

UNIT I SANGA TAMIL LITERATUREANINTRODUCTION  9
Introduction to Tamil Sangam—History of Tamil Three Sangams—Introduction to Tamil Sangam Literature—Special Branches in Tamil Sangam Literature- Tamil Sangam Literature’s Grammar-Tamil Sangam Literature’s parables.

UNIT II ‘AGATHINAI’AND‘PURATHINAI’  9

UNIT III ‘ATTRUPPADAI’  9
AttruppadaiLiterature—Attruppadai’nPuranaanuru’-Attruppadai’nPathitrupaththu’-Attruppadai in ‘Paththupaattu’.

UNIT IV ‘PURANAANURU’  9
Puranaanuru onGood Administration,Rulerand Subjects—Emotion&itsEffect in Puranaanuru.

UNIT V ‘PATHITRUPATHTHU’  9
Pathitrupaththuin‘Elluthogai’—Pathitrupaththu’sParables—Tamildynasty:Valor,Administration, Charity in Pathitrupaththu- Message to Society from Pathitrupaththu.

Total (L:45) = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Appreciate and apply the messages in Sanga Tamil Literature in their life.
2. Differentiate ‘Agathinai’ and ‘Purathinai’ in their personal and societal life.
3. Appreciate and apply the messages in ‘Attruppadai’ in their personal and societal life.
4. Appreciate and apply the messages in ‘Puranaanuru’ in their personal and societal life.
5. Appreciate and apply the messages in ‘Pathitrupaththu’ in their personal and societal life.

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HU5171  LANGUAGE AND COMMUNICATION  LT P C  3 0 0 3

COURSE DESCRIPTION
This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non-verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

Objectives
✓ To familiarize students with the concept of communication using linguistic and non-linguistic resources.
✓ To help students ask critical questions regarding facts and opinions.
✓ To provide students with the material to discuss issues such as language and power structures.
✓ To help students think critically about false propaganda and fake news.

Learning Outcomes
➢ Students will be able to use linguistic and non-linguistic resources of language in an integrated manner for communication.
➢ Students will be able to analyse communication in terms of facts and opinions.
➢ Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I  LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION:  9
a) Writing and Speech
b) Distinction between language structure and language use, form and function, acceptability and grammaticality
c) Gestures and Body language, pictures and symbols, cultural appropriacy
d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II  STRUCTURE OF WRITING/CONVERSATION:  9
a) Language skills and the communication cycle; speaking and listening, writing and reading
b) Initiating and closing conversations, intervention, turn taking
c) Writing for target reader, rhetorical devices and strategies
d) Coherence and Cohesion in speech and writing

UNIT III  POWER STRUCTURE AND LANGUAGE USE:  9
a) Gender and language use
b) Politeness expressions and their use
c) Ethical dimensions of language use
d) Language rights as part of human rights

UNIT IV  MEDIA COMMUNICATION:  9
a) Print media, electronic media, social media
b) Power of media
c) Manufacturing of opinion, fake news and hidden agendas

UNIT V  PERSUASIVE COMMUNICATION AND MISCOMMUNICATION:  9
a) Fundamentals of persuasive communication
b) Persuasive strategies
c) Communication barriers

**TEXT BOOKS:**


**HU5172**

VALUES AND ETHICS

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**OBJECTIVES:**

- Teach definition and classification of values.
- Explain Purusartha.
- Describe Sarvodaya idea.
- Summarize sustenance of life.
- Conclude views of hierarchy of values.

**UNIT I**

DEFINITION AND CLASSIFICATION OF VALUES

Extrinsic values- Universal and Situational values- Physical- Environmental-Sensuous- Economic-Social-Aesthetic-Moral and Religious values

**UNIT II**

CONCEPTS RELATED TO VALUES

Purusartha-Virtue- Right- duty- justice- Equality- Love and Good

**UNIT III**

IDEOLOGY OF SARVODAYA

Egoism- Altruism and universalism- The Ideal of Sarvodaya and Vasudhaiva Kutumbakam

**UNIT IV**

SUSTENANCE OF LIFE

The Problem of Sustenance of value in the process of Social, Political and Technological Changes

**UNIT V**

VIEWS ON HIERARCHY OF VALUES

The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi

**OUTCOMES:**

CO1: Able to understand definition and classification of values.
CO2: Able to understand purusartha.
CO3: Able to understand sarvodaya idea.
CO4: Able to understand sustenance of life.
CO5: Able to understand views of hierarchy of values.
TEXTBOOKS:
2. Little, William: An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)

HU5173  HUMAN RELATIONS AT WORK  L T P C
3  0  0  3

OBJECTIVES:
• Illustrate human relations at work its relationship with self.
• Explain the importance of interacting with people at work to develop teamwork.
• Infer the importance of physical health in maintaining human relations at work.
• Describe the importance of staying psychologically healthy.
• Identify the essential qualities for progressing in career.

UNIT I  UNDERSTANDING AND MANAGING YOURSELF  9
Human Relations and You: Self-Esteem and Self-Confidence: Self-Motivation and Goal Setting;
Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and
Creativity.

UNIT II  DEALING EFFECTIVELY WITH PEOPLE  9
Communication in the Workplace; Specialized Tactics for Getting Along with Others in the
Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing
Teamwork; Diversity and Cross-Cultural Competence.

UNIT III  STAYING PHYSICALLY HEALTHY  9
Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV  STAYING PSYCHOLOGICALLY HEALTHY  9
Managing Stress and Personal Problems, Meditation.

UNIT V  DEVELOPING CAREER THRUST  9
Getting Ahead in Your Career, Learning Strategies, Perception, Life Span Changes, and
Developing Good Work Habits.

OUTCOMES:
Students will be able to
CO1: Understand the importance of self-management.
CO2: Know how to deal with people to develop teamwork.
CO3: Know the importance of staying healthy.
CO4: Know how to manage stress and personal problems.
CO5: Develop the personal qualities essential for career growth.
TEXT BOOK:

REFERENCES:

HU5174 PSYCHOLOGICAL PROCESSES

COURSE DESCRIPTION
Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people’s psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES
The major objectives of this course is
- To develop students’ awareness – on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT 1: INTRODUCTION

UNIT 2: SENSORY & PERCEPTUAL PROCESSES
Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation -Sensory bombardment; ESP - Social Perception.

UNIT 3: COGNITION & AFFECT
UNIT 4: THINKING, PROBLEM-SOLVING & DECISION MAKING

UNIT 5: PERSONALITY & INTELLIGENCE
Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.

References
Gurukul to ICT education – Teacher as facilitator – Macaulay’s Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

**UNIT II  LEARNING THEORIES**

**UNIT III  TECHNOLOGICAL ADVANCEMENTS**
Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

**UNIT IV  EDUCATIONAL TECHNOLOGY**
Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

**UNIT V  ETHICAL IMPLICATIONS**
Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

**TOTAL: 45 PERIODS**

**TEACHING METHODS**
Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.

**EVALUATION**
As this is course is not a content based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end semester examination. Internals marks can be taken for the total marks.

**INTERNAL (100 % WEIGHTAGE)**
(a) Written Test (40 marks)
(b) Assignment: Write a real time report of the technology use in any school / college (15 marks)
(c) Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)
(d) Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)
(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others’ posts. (10 marks)

**REFERENCES**
1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington

**HU5176  PHILOSOPHY  L T P C**
3 0 0 3

**OBJECTIVES**
• To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
• To foster critical thinking and imagination by dealing with inter-related concepts in literature and science.
• To bridge the gap between the sciences and humanities through introspective analyses.
• To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one’s self and others.

UNIT I KNOWLEDGE

UNIT II ORIGIN

UNIT III WORD

UNIT IV KNOWLEDGE AS POWER/OPPRESSION

UNIT V SELF KNOWLEDGE/BRAHMAN

TOTAL : 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Think sceptically, ask questions and to arrive at deductions.
2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:
7. Bacon, Francis: Power as Knowledge

HU5177 APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE

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TOTAL: 45 PERIODS

TEXTBOOKS
HSMC – ELECTIVES – HUMANITIES II (EVEN SEMESTER)

HU5271 GENDER, CULTURE AND DEVELOPMENT L T P C 3 0 0 3

COURSE DESCRIPTION
This course offers an introduction to Gender Studies that asks critical questions about the meanings of sex and gender in Indian society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary drawing from Indian literature and media studies, to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with class, caste and other social identities. This course also seeks to build an understanding of the concepts of gender, gender-based violence, sexuality, and rights and their impact on development through a number of discussions, exercises and reflective activities.

Objectives
✓ To familiarize students with the concepts of sex and gender through literary and media texts.
✓ To help students ask critical questions regarding gender roles in society.
✓ To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
✓ To help students think critically about gender based problems and solutions.

Learning Outcomes
➢ Students will be able to critically read literary and media texts and understand the underlying gender perspectives in them.
➢ Students will be able to analyse current social events in the light of gender perspectives.
➢ Students will be able to discuss, analyse and argue about issues related to gender and their impact on society, culture and development.

UNIT I: Introduction to Gender
• Definition of Gender
• Basic Gender Concepts and Terminology
• Exploring Attitudes towards Gender
• Social Construction of Gender

Texts:
1. Sukhu and Dukhu (Amar Chitra Katha)
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir. London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.)

UNIT II: Gender Roles and Relations
• Types of Gender Roles
• Gender Roles and Relationships Matrix
• Gender-based Division and Valuation of Labour

Texts:
1. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011)

UNIT III: Gender Development Issues
• Identifying Gender Issues
• Gender Sensitive Language
OBJECTIVES:

- Gender, Governance and Sustainable Development
- Gender and Human Rights
- Gender and Mainstreaming

Texts:
2. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta)

UNIT IV: Gender-based Violence

- The concept of violence
- Types of Gender-based violence
- The relationship between gender, development and violence
- Gender-based violence from a human rights perspective

Texts:
1. Lights Out (Play, Manjula Padmanabhan)
2. Lights Out (Video of play enacted)

UNIT V: Gender and Culture

- Gender and Film
- Gender, Media and Advertisement

Texts:
1. Mahanagar (Movie: Satyajit Ray)
2. Beti Bachao Beti Padhao Advertisements

READINGS: Relevant additional texts for readings will be announced in the class. Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

ASSESSMENT AND GRADING:
Discussion & Classroom Participation: 20%
Project/Assignment: 30%
End Term Exam: 50%

HU5272 ETHICS AND HOLISTIC LIFE

OBJECTIVES:

- To emphasize the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.
- To understand the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society.

UNIT I HUMAN LIFE, ITS AIM AND SIGNIFICANCE
The concept of a successful life, happy life and a meaningful life, Ethical and decision making
capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

UNIT II CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT
Intellectual, Emotional, Creative, Ethico - spiritual development, Aesthetic sense, Self-dependency, Activeness, Development of positive attitude.

UNIT III HARMONY IN PERSONAL AND SOCIAL LIFE:
Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all, Creating a value based work culture in hostel, classroom and other places in the campus and society.

UNIT IV CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE
Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance.

UNIT V DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE

OUTCOMES:
On completion of the course, the students will be able to:
1. Enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
2. Develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination.
3. Enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.
4. Develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5. Enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

HU5273 LAW AND ENGINEERING  L T P C 3 0 0 3

UNIT I THE LEGAL SYSTEM: SOURCES OF LAW AND THE COURT STRUCTURE  9
Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court) Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

UNIT II LAWS  9
Basic principles of contract law, sale of goods law, laws relating to industrial pollution, accident, environmental protection, health and safety at work, patent law, constitutional law: the supreme law of the land, Information technology law and cyber crimes.
UNIT III BUSINESS ORGANISATIONS

Sole traders (Business has no separate identity from you, all business property belongs to you).


UNIT IV LAW AND SOCIETY

Interdisciplinary nature of law, legal ideologies/philosophy/ schools of jurisprudence.

UNIT V CASE STUDIES

Important legal disputes and judicial litigations

TOTAL: 45 PERIODS

HU5274 FILM APPRECIATION

COURSE DESCRIPTION

This is an intensive course designed to promote comprehensive understanding and insights into the nature of cinema and other related forms and practices. Movies, though at times are used more as escapism, they are also a true art form and expressive tool used by writers, directors and actors. This course will explore the aesthetics of cinema, the concepts behind storytelling and various other elements of a film. It will also explore the impact of movies in our society and in our lives. It also encourages students to use films as a medium to analyse visual texts and read underlying messages.

OBJECTIVES:

- To help learners understand the various movie genres and its types.
- To understand various elements that contributes to film making.
- To make them realize the impact of film in society.
- To analyse the visual media and interpret the underlying messages.

UNIT I THE COMPONENTS OF FILMS

Story, Screenplay & Script – Actors – Director – Crew Members – Mis En Scene – Structure of A Film – Narrative Elements – Linear & Non-Linear – Types of Movie Genres: Mysteries, Romantic Comedies, Horror Etc.

UNIT II EVOLUTION OF FILM


UNIT III FILMS ACROSS THE WORLD


UNIT IV INDIAN FILMS


UNIT V INTERPRETING FILMS

Film Criticism & Appreciation – Censorship in Movies – Cultural Representation in Movies – Television – New Media & Online Media – Films Beyond Entertainment.

TOTAL: 45 PERIODS

OUTCOMES

On completion of the course, the students will be able to:

1. Understand the various movie genres and its types.
2. Analyse the visual media and interpret the underlying messages.
• Recognize types of films, their impact on society and their roles in our lives.
• Have an understanding of the concepts of storytelling, Mise en Scene, and other elements of film making.
• Interpret the underlying messages in the movies.

Teaching Methods
• Each unit consists of reading materials, learning activities videos, websites. Students are expected to watch movies sometimes in class and at times at home and discuss in class.

Evaluation
• As this is course is critical appreciation course on films, there is no written end semester examination. The course is more on learning how to critically analyse a movie and appreciate its finer elements. Therefore evaluation can be based on assignments and discussions. Internals marks can be taken for the total marks.

Internal (100 % weightage)
• Assignment 1: Write a movie review with critical analysis (20 marks).
• Assignment 2: Write a script for a scene taken from a short story / novella (20 marks).
• Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)
• Group discussion: Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
• Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others’ posts. (10 marks)

REFERENCES
1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983

HU5275 FUNDAMENTALS OF LANGUAGE AND LINGUISTICS

OBJECTIVES
• To broadly introduce students to the formal and theoretical aspects of linguistics.
• To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.

CONTENTS:

UNIT I LANGUAGE AND LINGUISTICS: AN OVERVIEW

UNIT II MORPHOLOGY - WORDS OF LANGUAGE
UNIT III SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS-THE MEANING OF LANGUAGE


UNIT IV PHONETICS – THE SOUNDS OF LANGUAGE


UNIT V APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE

Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

Teaching Methods:
Lectures, discussion.

Evaluation Internal and External:
Internal: 2 written tests + assignments, seminars, project (50+15+15+20).
External: A 3 hour written exam (50 marks)

REFERENCES:

HU5276 UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE

OBJECTIVES
- To internalize the importance of language by understanding its role in the transformation of man.
- To look at language, literature and culture as locus of identity and change.
- To extract meaning from existing literatures and cultures.
- To identify meanings in modern life by reconnecting with lost cultures.

Unit 1 Introduction
Why study literature? Tracing the origin – pictures. Tokens as precursors of writing. Movement from three dimensions to two dimensions- Pictography. From visual to oral -Logography. Reading out literature to young children- Edmund J Farrell.

Unit 2 Reading Culture
Reading culture through language, signs and consumables- Roland Barthes. Culture through poems- Nissim Ezekiel’s ‘The night of the Scorpion’. ‘Nothing’s Changed’- Tatamkhulu Afrika-Apartheid. Ruskin Bond- ‘Night train at Deoli’- How real life is different from movies.

Unit 3 Identifying Meaning
Searching and locating meaning through literature. Looking for order in a chaotic world. The Myth of Sisyphus (Albert Camus) and Adi Shankar’s ‘Jagat Mithya’- the world as an illusion. The Indian version as ‘meaningless meaning’.
Unit 4. Post Modernism

'If on a winter’s night a traveler'- Italo Calvino. The book about the reader- the experience of reading as reading. Metafiction. Selfie Culture. Visual Culture as purpose of modern life.

Unit 5. Returning to Pictures


Reading list
1. Bond, Ruskin: ‘Night train at Deoli’
2. Ezekiel, Nissim: 'The Night of the Scorpion'
3. Afrika,Tatamkhulu: ‘Nothing’s Changed’
4. Barthes, Roland: Mythologies
5. Shankaracharya: Viveka Chudamani
6. Camus, Albert- The Myth of Sisyphus
7. Calvino, Italo: If on a winter's night a traveler

Outcome
- Can identify the connections among language, literature and culture.
- Is able to relate between seemingly different aspects of life.
- Understands the fractions in modern life and can assimilate meanings.