Department of Food Technology

Syllabus of 1st to 8th Semester

(to be effective from 2016-17 admission batch)

Autonomy Curriculum and Syllabus of B.Tech in Food Technology Programme
Implemented from the Academic Year 2016

First Year First Semester

Group A: ECE, EE, BME, AEIE/EIE

Group B: CSE, IT, FT, ME, CE

Curriculum:

THEORY							
No	Paper Code	Theory	Contact Hours /Week				Credit Points
			L	T	P	Total	
1	M 101	Mathematics -I	3	1	0	4	4
2	CH 101/ PH 101	Chemistry (Gr. A) / Physics - I(Gr. B)	3	1	0	4	4
3	EE 101/ EC 101	Basic Electrical Engineering (Gr. A) / Basic Electronics Engineering (Gr. B)	3	1	0	4	4
4	HU 101	Communicative English	2	0	0	2	2
5	ME 101	Engineering Mechanics	3	1	0	4	4
Total no. of Theory						18	18
PRACTICAL							
6	HU191	Language Lab and Seminar Presentation	0	0	2	2	1
7	CH 191/ PH191	Chemistry Lab (Gr. A) / Physics -I Lab(Gr. B)	0	0	3	3	2
8	EE 191/ EC 191	Basic Electrical Engineering Lab (Gr. A) /Basic Electronics Engineering Lab(Gr. B)	0	0	3	3	2
9	ME 191/ME 192	Engineering Drawing & Graphics(Gr A)/ Workshop Practice (Gr-	0	0	3	3	2

		B)					
C. SESSIONAL							
10	XC181	Extra Curricular Activity (NSS/ NCC)	0	0	2	2	1
Total no. of Practical & Sessional						13	08

Syllabus:

Theory

Paper Name: Mathematics –I
Paper Code: M101
Total Contact Hours: 40
Credit: 4

Prerequisite: Any introductory course on matrix algebra, calculus, geometry.

Course Objective: The purpose of this course is to provide fundamental concepts matrix algebra, Calculus of Single and Several Variables and Vector Analysis.

Course outcome:

On successful completion of the learning sessions of the course, the learner will be able to:

M 101.1: Recall the distinctive characteristics of Matrix Algebra, Calculus of Single and Several Variables and Vector Analysis.

M 101.2: Understand the theoretical concept of Matrix Algebra, Calculus of Single and Several Variables and Vector Analysis.

M 101.3: Apply the principles of Matrix Algebra, Calculus of Single and Several Variables and Vector Analysis to solve various problems.

Course contents:

MODULE I [10L]

Matrix Algebra: Elementary row and column operations on a matrix, Rank of matrix, Normal form, Inverse of a matrix using elementary operations, Consistency and solutions of systems of linear equations using elementary operations, Linear dependence and independence of vectors, Concept & Properties of different matrices (unitary, orthogonal, symmetric, skew-symmetric, hermitian, skew-hermitian), Eigen values and Eigen vectors of a square matrix (of order 2 or 3), Characteristic polynomials, Caley-Hamilton theorem and its applications, Reduction to diagonal form (upto 3^{rd} order).

MODULE II [10L]

Calculus-I (Functions of single variable): Rolle's theorem, Mean value theorem- Lagrange & Cauchy, Taylor's and Maclaurin's theorems, Expansion of simple functions by Taylor's and Maclaurin's Theorems, Fundamental theorem of integral calculus, Evaluation of plane areas, volume and surface area of a solid of revolution and lengths, Convergence of Improper integrals, Beta and Gamma Integrals - Elementary properties and the Inter relations.

MODULE III [12L]

Calculus-II (Functions of several variables): Introduction to functions of several variables with examples, Knowledge of limit and continuity, Partial derivatives, Total Differentiation, Derivatives of composite and implicit functions, Euler's theorem on homogeneous functions, Chain rule, Maxima and minima of functions of two variables – Lagrange's method of Multipliers, Change of variables-Jacobians (up to three variables), Double and triple integrals.

MODULE IV [8L]

Vector Calculus: Scalar and vector triple products, Scalar and Vector fields, Vector Differentiation, Level surfaces, Directional derivative, Gradient of scalar field, Divergence and Curl of a vector field and their physical significance, Line, surface and volume integrals, Green's theorem in plane, Gauss Divergence theorem, Stokes' theorem, Applications related to Engineering problems.

Text Books:

1. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley, 1999.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publications, 2009.
3. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Pub. House, 2008.
4. H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley, 1995.
5. G. Strang, Linear algebra and its applications (4th Edition), Thomson, 2006.

Reference Books:

6. S. Kumaresan, Linear algebra - A Geometric approach, Prentice Hall of India, 2000.
7. M. Apostol, Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
8. TG. B. Thomas and R. L. Finney, Calculus and Analytic Geometry (9th Edition), ISE Reprint, Addison-Wesley, 1998.
9. Hughes-Hallett et al., Calculus - Single and Multivariable (3rd Edition), John-Wiley and Sons, 2003.
10. J. Stewart, Calculus (5th Edition), Thomson, 2003.
11. J. Bird, Higher Engineering Mathematics (4th Edition, 1st India Reprint), Elsevier,2006.
12. L.Rade and B.Westergen, Mathematics Handbook: for Science and Engineering (5th edition, 1st Indian Edition), Springer, 2009.
13. Murray R Spiegel and Seymour Lipschutz, Schaum's Outline of Vector Analysis.
14. Richard Bronson , Schaum's Outline of Matrix Operations.

CO-PO mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
M 101.1	3	2	-	-	-	-	-	-	-	-	-	1
M 101.2	3	2	-	-	-	-	-	-	-	-	-	1
M 101.3	3	2	2	-	-	-	-	-	-	-	-	1

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Chemistry
Paper Code: CH 101
Total Contact Hours: 40
Credit: 4

Pre requisites: 10+2 science with chemistry

Course Objective
Understanding of the fundamental theories and applications of thermodynamics, electrochemical principles in modern electrochemical cells and to get an insight into electronic structure of crystals and nanomaterials. Learning about the Synthesis, properties and applications of polymers , fuels and alternative energy sources & their significance in petrochemical industries. Analyzing water quality for its various parameters & its significance in industries.

Course Outcome

CH101.1: Able to apply fundamental concepts of thermodynamics in different engineering applications.
CH101.2: Able to analyze & design simple and technologically advanced electrical and energy storage devices.
CH101.3: Able to synthesize nanomaterials, composites, polymers.
CH101.4: Able to apply the basic concept of Organic Chemistry and knowledge of chemical reactions to industries , and technical fields.
CH101.5: Able to apply the knowledge of different fuels and corrosion to different industries
CH101.6: Able to analyse water quality parameter for its various parameters & its significance in industries.

Course contents

Module 1 [8L]

Chemical Thermodynamics –I

1.1 Concept of Thermodynamic system: Definition with example of diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property.

Introduction to first law of thermodynamics: Different statements, mathematical form.

Internal energy: Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas. **2L**

1.2 Enthalpy: Definition, Characteristics, Physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas.

Heat Capacity: Definition, Classification of Heat Capacity (Cp and CV): Definition and General expression of Cp - CV. Expression of Cp - CV for ideal gas.

Reversible and Irreversible processes: Definition, Work done in Isothermal Reversible and Isothermal Irreversible process for Ideal gas, Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P, V and T), slope of P-V curve in adiabatic and isothermal process.

Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation. **3L**

1.3 2nd law of thermodynamics: Statement, Mathematical form of 2nd law of thermodynamics (Carnot cycle). Joule Thomson and throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature (brief).

Evaluation of entropy: characteristics and expression, physical significance. Work function and free energy: Definition, characteristics, physical significance, mathematical expression of ΔA and ΔG for ideal gas, standard free energy and chemical potential, Condition of spontaneity and equilibrium reaction. **3L**

Module 2 [7L]

2.1 Reaction Dynamics

Reaction laws: rate and order; molecularity; zero and first order kinetics, second order kinetics (same reactant concentration), Pseudounimolecular reaction, Arrhenius equation. **3L**

Mechanism and theories of reaction rates (Content beyond the syllabus)

2.2 Solid state Chemistry

Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency).

Role of silicon and germanium in the field of semiconductor, n-type, p-type semiconductor, photo voltaic cell, fabrication of integrated circuits. **4L**

Module 3 [8L]

Electrochemistry

3.1 Conductance

Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration (Strong and Weak electrolyte). **1L**

3.2 Electrochemical cell

Cell EMF and its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half cell, calomel half cell (representation, cell reaction, expression of potential, Discussion, Application). **3L**

3.3 Concept of battery

Battery and Commercial electrochemical cell: Dry cell, acid storage cell, alkaline storage cell, fuel cell (construction, representation, cell reaction, expression of potential, discussion, application). **2L**

3.4 Corrosion and its control

Introduction, cause and effect of corrosion, types of corrosion: dry, wet and other: Electrochemical corrosion, galvanic corrosion, passivation and protective measure. **2L**

Module 4 [12L]

4.1 Structure and reactivity of Organic molecule

Electronegativity, electron affinity, hybridisation, Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals. Brief study of some addition, eliminations and substitution reactions. **3L**

4.2 Polymers

Concepts, classifications and industrial applications. Polymer molecular weight (number avg. weight avg.: Theory and mathematical expression only), Poly dispersity index (PDI).

Polymerization processes: addition and condensation polymerization (mechanism not required), degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity (concept of Tm) and amorphicity (Concept of Tg) of polymer.

Preparation, structure and use of some common polymers: plastic (HDPE, LDPE, PVC, PP, PMMA, Polyester, PTFE, Bakelite), rubber (natural rubber, SBR), fibre (nylon 6, nylon 6,6), Vulcanization of rubber, Conducting polymers and bio-polymers. **7L**

4.3 Nano material

Basic principles of nano science and technology, classification, preparation, properties and application of nano material. **2L**

Module 5 [5L]

5.1 Industrial Chemistry

Fuels

Solid Fuel: Coal, Classification of coal, constituents of coal, carbonization of coal (HTC and LTC), Proximate analysis of coal, Calorific value.

Liquid fuel: Petroleum, classification of petroleum, Refining, Octane number, Cetane number, Aviation Fuel (Aviation Gasoline, Jet Gasoline), Biodiesel.

Gaseous fuels: Natural gas, water gas, Coal gas, bio gas, CNG, LPG **3L**

5.2 Water

Introduction, source of water, water quality parameter, specification for drinking water (BIS and WHO standards), Chlorination of Water, Types of hardness- Units, Brief Softening methods. **2L**

Short overview of water treatment plants (Content beyond the syllabus)

Reference Books

1. Engineering Chemistry: Bandyopadhyay and Hazra
2. Physical Chemistry: P.C. Rakshit

3. Organic Chemistry: Finar, vol-1
4. Engineering Chemistry: B.Sivasankar, Tata Mc Graw Hill, 2008
5. A Text book of Engineering Chemistry: S.S.Dara, 10th Edition, S.Chand & Company Ltd., New Delhi, 2003.
6. Engineering Chemistry Simplified: S. Nandi and R. Bhattacharyya, Chayya Prakashani Pvt. Ltd.

CO-PO mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CH101.1	3	1	-	-	-	-	-	-	-	-	-	-
CH101.2	3	2	1	-	-	-	-	-	-	-	-	-
CH101.3	-	-	2	-	2	-	-	-	-	-	-	1
CH101.4	2	-	1	-	2	-	-	-	-	-	-	-
CH101.5	2	-	-	-	-	-	2	-	-	-	-	1
CH101.6	-	-	2	-	-	-	1	-	-	-	-	-

FOR GROUP B: CSE, IT, FT, ME, CE

Paper Name: Physics -I
Paper Code: PH 101
Total Contact Hours: 41
Credit: 4

Pre requisites: Knowledge of Physics upto 12^{th} standard.

Course Objective:

The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic physics principles along with the possible applications. The acquaintance of basic principles of physics would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. It can also create awareness of the vital role played by science and engineering in the development of new technologies. It also gives necessary exposure to the practical aspects, which is an essential component for learning sciences.

Course Outcome:

At the end of the course students' should have the

PH 101.1 : Ability to state and recall ➢ **De-Broglie hypothesis, and Heisenberg's Uncertainty Principle** ➢ **Amplitude and Velocity Resonance** ➢ **Malus's Law, Brewster's Law** ➢ **Characteristics of LASER light**	PO1 Or GA1
PH 101.2 : Ability to understand and explain ➢ **Polarizer and analyzer** ➢ **basic principles and different types of LASER and Optical Fibre** ➢ **structure of solids, Miller indices** ➢ **theory of Matter Wave, equation of motion of Matter Wave** ➢ **wave function and its role in representing wave nature of matter**	PO2 Or GA2
PH 101. 3 : Ability to apply the knowledge of ➢ **mechanical vibration in electrical circuits** ➢ **superposition principle in Newton's ring phenomenon, diffraction phenomenon** ➢ **quantum nature of e.m. waves for production of laser** ➢ **total internal reflection in transmitting light through optical fibres** ➢ **x-ray diffraction in crystal structure** ➢ **probability interpretation in Heisenberg's uncertainty principle**	PO3 Or GA3
PH 101.4 : Ability to analyze ➢ **grating as many slit system** ➢ **role of Q factor in a resonating circuit, conditions of different types of resonance** ➢ **minimum requirements for lasing action** ➢ **importance of light as a carrier of information** ➢ **the failures of classical physics in microscopic situation and need of quantum**	PO2 Or GA2

physics ➢ **Einstein's A, B coefficient and predict the wavelength domain of Lasing action** ➢ **Requirement of Miller indices for describing crystallographic planes**	
PH 101.5 : Ability to evaluate / justify / compare ➢ **X-ray production process is inverse of the process of Photoelectric Effect.** ➢ **different crystallographic structures according to their Co-ordination number and packing factors** ➢ **the outcome of Photo-electric effect, Compton effect and Davission-Germer experiment to justify wave-particle duality of matter**	PO12 Or GA12

Course contents

Module 1 (8L):-
Oscillations
1.1 Simple harmonic motion: Concepts with examples, Superposition of SHMs in two mutually perpendicular directions: Lissajous' figures, Engineering Applications and related Numerical problems 2L

1.2 Damped vibration: Differential equation and its solution, Logarithmic decrement, quality factor, Engineering Applications and related Numerical problems. 3L

1.3 Forced vibration: Differential equation and solution, Amplitude and Velocity resonance, Sharpness of resonance, relevant applications including LCR circuits, Numerical problems 3L

Module 2 (10L):-
Classical Optics:
2.1 Interference of light: Wave nature of light (Huygen's principle), Conditions of sustained interference double slit as an example; qualitative idea of spatial and temporal coherence, conservation of energy and intensity distribution; Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, Numerical Problems. 3L

Fresnel's biprism (beyond the syllabus). 1L(ext)

2.2 Diffraction of light: Fresnel and Fraunhofer class, Fraunhofer diffraction for plane transmission grating (elementary treatment of intensity distribution for N-slits), single slit and double slits as examples, missing order, Rayleigh criterion, resolving power of grating and microscope (Definition and formula; no deduction required). Engineering Applications, Numerical Problems. 4L

2.3 Polarization: Definition, plane of polarization, p**l**ane of vibration, Malus law, fundamental concepts of plane, circular and elliptical polarizations (only qualitative idea) with examples, Brewster's law, Double refraction: ordinary and extraordinary rays, Nicol's prism, Engineering applications, Numerical problems. 3L

Module 3 (9L):-
Quantum Physics:

3.1 Quantum Theory: Inadequacy of classical physics; Planck's quantum hypothesis-Qualitative (without deductions), particle concept of electromagnetic wave (example: photoelectric and Compton effect; qualitative discussions only), wave particle duality; phase velocity and group velocity; de Broglie wave; Davisson and Germer experiment. 4L

3.2 Quantum Mechanics 1: Concept of wave function, Physical significance of wave function, Probability interpretation; wave function normalization condition and its simple numerical applications; uncertainty principle-applications, Schrödinger equation (no mathematical derivation). 4L

Module 4 (6L):
X-ray & Crystallography

4.1 X**-rays** – Origin of Characteristic and Continuous X-ray, Bragg's law (No derivation), Determination of lattice constant, Applications, Numerical problems. 2L

4.2 Elementary ideas of crystal structure - lattice, basis, unit cell, Fundamental types of lattices – Bravais lattice, Simple cubic, fcc and bcc, **hcp** lattices, (use of models in the class during teaching is desirable) Miller indices and miller planes, Co-ordination number and Atomic packing factor, Applications, Numerical problems. 4L

Module 5 (8L):
Modern Optics-I:
5.1 Laser: Concepts of various emission and absorption process, working principle of laser, metastable state, Population Inversion, condition necessary for active laser action, optical resonator, ruby laser, He-Ne laser, **semiconductor laser**, Einstein A and B coefficients and equations, industrial and medical applications of laser. 5L

5.2 Fibre optics and Applications: Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle, V number, Types of optical fibres (material, refractive index, mode), Losses in optical fibre- attenuation, dispersion, bending, Numerical problems. 3L

Recommended Text Books for Physics I (PH101//201):

Oscillations:
1. Classical Mechanics- J. C. Upadhyay (Himalya Publishers)
2. Classical Mechanics-Shrivastav
3. Classical Mechanics-Takwal & Puranik (TMH)
4. Sound-N. K. Bajaj (TMH)
5. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
6. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
7. A text book of sound-M. Ghosh (S. Chand publishers)
8. Electricity Magnetism-Chattopadhyay & Rakshit (New Central Book Agency)
9. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
10. R.P. Singh (Physics of Oscillations and Waves)
11. A.B. Gupta (College Physics Vol. II)
12. Chattopadhya and Rakshit (Vibration, Waves and Acoustics)

Classical Optics & Modern Optics-I:

13. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
14. A text book of Light-Brijlal & Subhramanium, (S. Chand publishers)
15. Modern Optics-A. B. Gupta (Book & Allied Publisher)
16. Optics-Ajay Ghatak (TMH)
17. Optics-Hecht
18. Optics-R. Kar, Books Applied Publishers
19. Möler (Physical Optics)
20. E. Hecht (Optics)
21. E. Hecht (Schaum Series)
22. F.A. Jenkins and H.E White
23. C.R. Dasgupta (Degree Physics Vol 3)

Quantum Physics

24. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
25. Quantum Mechanics-Bagde Singh (S. Chand Publishers)
26. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
27. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
28. Quantum Mechanics-Bransden (Pearson Education Ltd.)
29. Perspective of Modern Physics-A. Beiser (TMH)
30. Eisberg & Resnick is published by Wiley India
31. A.K. Ghatak and S Lokenathan
32. E.E. Anderson (Modern Physics)
33 .Haliday, Resnick & Krane : Physics Volume 2 is Published by Wiley India
34. Binayak Dutta Roy [Elements of Quantum Mechanics]

X-ray & Crystallography

35. Solid state physics-Puri & Babbar (S. Chand publishers)
36. Materials Science & Engineering-Kakani Kakani
37. Solid state physics- S. O. Pillai
38. Introduction to solid state physics-Kittel (TMH)
39. Solid State Physics and Electronics-A. B. Gupta, Nurul Islam (Book & Allied Publisher)
40. S.O. Pillai (a. Solid state physics b. Problem in Solid state physics)

General Reference:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Basic Engineering Physics-I -Sujoy Bhattacharya, Saumen Paul (TMH)
4. Engineering Physics Vol: 1-Sudipto Roy, Tanushri Ghosh, Dibyendu Biswas (S. Chand).
5. Engineering Physics Vol:1-S. P. Kuila (New Central)
4. University Physics-Sears & Zemansky (Addison-Wesley)
5.B. Dutta Roy (Basic Physics)
6. R.K. Kar (Engineering Physics)
7. Mani and Meheta (Modern Physics)
8. Arthur Baiser (Perspective & Concept of Modern Physics)

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH 101.1	**1**											
PH 101.2		**2**										
PH 101.3	**3**											
PH 101.4		**1**										
PH 101.5												**1**

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Basic Electrical Engineering
Paper Code: EE101
Total Contact Hours: 41
Credit: 4

Pre requisite: Basic 12st standard Physics and Mathematics

Course Objective:
Basic electrical engineering is an introductory course in electrical engineering. Students are introduced to simple applied electrical circuits, theories and practice to impart skill set to have visualization of electrical engineering applications. It is a course suitable for students pursuing electrical engineering as well as other related engineering disciplines.

Course Outcomes:
At the end of this course, students will able

EE 101.1: To understand and analyse basic electric and magnetic circuits.

EE 101.2: To understand and analysis the AC single phase and three phase circuit

EE101.3: To understand and analysis of the basic principles of various electrical machines

Course Contents:

DC CIRCUITS (7L)
Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff's laws, Source equivalence and

conversion, Network Theorems-Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.

MAGNETIC CIRCUITS (3L)
Concept of Magnetic circuit, B-H curve, Analogous quantities in magnetic and electric circuits, Faraday's law, iron losses, self and mutual inductance, Energy stored in magnetic field.

AC SINGLE PHASE CIRCUITS (8L)
Sinusoidal quantities, Average and RMS values, peak factor, Form factor, Phase and Phase difference, concept of phasor diagram, V-I Relationship in R,L,C circuit, Combination R,L,C in AC series , parallel and series parallel circuits with phasor diagrams, impedance and admittance, Power factor, Power in AC circuit, Resonance in RLC series and parallel circuit, Q factor, band width of resonant circuit.

THREE PHASE CIRCUITS (3L)
Voltages of three balanced phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two watt meters method.

DC MACHINES (6L)
Construction, Basic concepts of winding (Lap and wave). DC generator: Principle of operation, EMF equation, characteristics (open circuit, load) DC motors: Principle of operation, Torque Equation ,Speed Torque Characteristics (shunt and series machine), starting (by 3 point starter), speed control (armature voltage and field control).

SINGLE PHASE TRANSFORMER (5L)
Constructional parts, Types of transformers, Emf equation, No Load no load and on load operation, phasor diagram and equivalent circuit, losses of a transformer, open and short circuit tests, regulation and efficiency calculation.

THREE PHASE INDUCTION MOTOR (6L)
Types, Construction, production of rotating field, principle of operation, Slip and Frequency ,rotor emf and current, Equivalent circuit and phasor diagram, Torque Slip characteristics torque-speed characteristics Starting of induction motor by star delta starter and(DOL starter). Speed Control of Three phase induction motor by variation of supply frequency, supply voltage and number of poles.

GENERAL STRUCTURE OF ELECTRICAL POWER SYSTEM (3L)
Power generation to distribution through overhead lines and underground cables with single line diagram, Earthing of Electrical Equipment, Electrical Wiring Practice

Text books

1. V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
2. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication
3. Chakrabarti,Nath & Chanda, Basic Electrical Engineering, TMH
4. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education

Reference books

1. H. Cotton, Willey Press
2. J.B. Gupta, Basic Electrical Engineering, Kataria & Sons .
3. Kothari & Nagrath, Basic Electrical Engineering, TMH

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE101.1	3	3	2	1								
EE101.2	2	2	1									
EE101.3	3	2	2									

FOR GROUP B: CSE, IT, FT, ME, CE

Paper Name: Basic Electronics Engineering
Paper code: EC101
Total Contact Hours: 40
Credits: 4

Prerequisites

A basic course in Electronics and Communication Engineering Progresses from the fundamentals of electricity, direct current (DC) devices and circuits , series and parallel circuits to the study of active and passive components, Ohm's Law, Kirchoff's Law i.e. KVL,KCL, Ampere's Law etc.

Course objectives:

Students will be able to Analyze the behaviour of semiconductor diodes in Forward and Reverse bias . To design a half wave and full wave rectifiers , Explore V-I characteristics of Bipolar Junction Transistor n CB, CE & CC configurations. To acquire the basic engineering technique and ability to design and analyze the circuits of Op-Amps. Students will be able to explain feedback concept and different oscillators . They will also be familiar with the analysis of digital logic basics and measuring Electronic devices. Students will have knowledge about characteristics of FET.

Course Outcomes:

EC 101.1	Study PN junction diode, ideal diode, diode models and its circuit analysis, application of diodes and special diodes.
EC 101.2	Learn how operational amplifiers are modeled and analyzed, and to design Op-Amp circuits to perform operations such as integration, differentiation on electronic signals.
EC 101.3	Study the concepts of both positive and negative feedback in electronic circuits.
EC 101.4	Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines,

	operating points and incremental analysis.
EC 101.5	Learn how the primitives of Boolean algebra are used to describe the processing of binary signals.

Course contents

Module-I: Basics of semiconductor **6L**

Conductors, Insulators, and Semiconductors- crystal structure, Fermi Dirac function, Fermi level, E-k and Energy band diagrams, valence band, conduction band, and band gap; intrinsic, and extrinsic (p-type and n-type) semiconductors, position of Fermi level in intrinsic and extrinsic semiconductor, drift and diffusion current – expression only (no derivation) , mass action law , charge neutrality in semiconductor, Einstein relationship in semiconductor , Numerical problems on- Fermi level, conductivity, mass action law, drift and diffusion current .

Module-II: P-N Junction Diode and its applications **8L**

p-n junction formation and depletion region , energy band diagram of p-n junction at equilibrium and barrier energy , built in potential at p-n junction , energy band diagram and current through p-n junction at forward and reverse bias, V-I characteristics and current expression of diode , temperature dependencies of V-I characteristics of diode , p-n junction breakdown – conditions , avalanche and Zener breakdown , Concept of Junction capacitance, Zener diode and characteristics.

Diode half wave and full wave rectifiers circuits and operation (I_{DC} , I_{rms} , V_{Dc} , V_{rms}) , ripple factor without filter, efficiency ,PIV,TUF; Reduction of ac ripples using filter circuit (Qualitative analysis); Design of diode clipper and clamper circuit - explanation with example, application of Zener diode in regulator circuit. Numerical problems.

Module-III : Bipolar junction transistor(BJT) **6L**

Formation of PNP/NPN Transistors ,energy band diagram, current conduction mechanism , CE ,CB,CC configurations , transistor static characteristics in CE ,CB and CC mode, junction biasing condition for active, saturation and cut-off modes ,current gain α ,β and γ, early effect.

Biasing and bias stability; biasing circuits - fixed bias; voltage divider bias; collector to base bias , D.C. load line and Quiescent point, calculation of stability factors for different biasing circuits.

BJT as an amplifier and as a switch – Graphical analysis; Numerical Problems.

Module-IV: Field effect transistor (FET) **4L**

Concept of field effect, channel width modulation Classification of FETs-JFET, MOSFET, operating principle of JFET. drain and transfer characteristics of JFET (n-channel and p-channel), CS,CG,CD configurations, Relation between JFET parameters. FET as an amplifier and as a switch– graphical analysis. E-MOSFET (n-channel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems .

Module-V: Feedback and Operational Amplifier **10L**

Concept of feedback with block diagram, positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation and Barkhausen criterion.
Operational amplifier – electrical equivalent circuit ,ideal characteristics , Non ideal characteristics of op-amp – offset voltages ;bias current ;offset current; Slew rate ; CMRR and bandwidth, Configuration of inverting and non-inverting amplifier using Op-amp, closed loop voltage gain of inverting and non-inverting amplifier , Concept of virtual ground, Applications op-amp – summing amplifier; differential amplifier; voltage follower ; basic differentiator and integrator .
Problems on Characteristics of Op-amp, CMRR, slew rate, amplifier and application of Op-amp to be discussed. Any other relevant problems related to topic may be discussed or assigned.

Module-VI: Cathode Ray Oscilloscope (CRO) **2L**
Operating principle of CRO with block diagram, measurement of voltage, frequency and phase.

Module-VII: Digital Electronics **4L**
Binary numbers and conversion, Basic Boolean algebra, Logic gates (AND,OR,NOR,NOT,NAND,XOR) and realization of functions.

Text Books:

1. D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2. Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3. Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.
4. Sedra & Smith, Microelectronics Engineering

Reference Books:

1. John D. Ryder, Electronic Fundamentals and Applications, PHI
2. J.B.Gupta, Basic Electronics, S.K. Kataria.
3. Malvino: Electronic Principle.
4. Schilling & Belove: Electronics Circuits.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EC 101.1	3	-	-	-	-	-	-	-	-	-	-	-
EC 101.2	2	3	-	-	-	-	-	-	-	-	-	1
EC 101.3	1	3	-	-	-	-	-	-	-	-	-	-
EC 101.4	1	2	3	-	-	-	-	-	-	-	-	1
EC 101.5	3	1	-	-	-	-	-	-	-	-	-	-

Paper Name: Communicative English
Paper Code: HU101
Total Contact Hours: 26
Credits: 2

Pre requisites:

Basic knowledge of high school English.

Course Objectives:

Designed to meet the basic survival needs of communication in the globalized workplace, including knowledge of and competency in the use of macro-skills in reading and writing proficiency, functional grammar and usage.

Course Outcomes:

At the end of this course, students will be

HU101.1: Able to comprehend and communicate in English through exposure to communication skills theory and practice.

HU101.2: Apply the basic grammatical skills of the English language through intensive practice.

HU101.3: Able to develop reading and comprehension skills.

HU101.4: Able to develop writing proficiency skills by writing Official Letters, Technical report, memo, notice, minutes, agenda, resume, curriculum vitae.

HU101.5: Able to apply/illustrate all sets of English language and communication skills in creative and effective ways in the professional sphere of their life

Course Content:

The proposed revised syllabus is as follows:

Module 1: Communication: Interface in a Globalized World [5L]

a .Definition of Communication& Scope of Communication

b. Process of Communication—Models and Types

c. Verbal—Non-Verbal Communication, Channels of Communication

d. Barriers to Communication & surmounting them

[to be delivered through case studies involving intercultural communication]

Module 2: Vocabulary and Reading [5L]

a. Word origin—Roots, Prefixes and Suffixes, Word Families, Homonyms and Homophones

b. Antonyms and Synonyms, One-word substitution

c. Reading—Purposes and Skills

d. Reading Sub-Skills—Skimming, Scanning, Intensive Reading

e. Comprehension Practice (Fiction and Non fictional Prose/Poetry)

Texts:

(i)Isaac Asimov, *I Robot* (―Robbie OR ―Little Lost Robot)

(ii)George Orwell, ―Shooting an Elephant

(iii)Ruskin Bond, ―The Cherry Tree OR ―The Night Train at Deoli

(iv) Robert Frost, ―Stopping by the Woods on a Snowy Evening.

f. Precis Writing

(Use of daily newspapers for reading practice is recommended)

Module 3: Functional Grammar and Usage [6L]

a. Articles, Prepositions, Verbs

b. Verb-Subject Agreement

c. Comparison of Adjectives

d. Tenses and their Use

e. Transformation of Sentences (Singular-Plural, Active-Passive, Direct-Indirect, Degrees of Comparison)

f. Error Correction

Module 4: Business writing [10L]

a. Business Communication in the Present-day scenario

b. Business Letters (Letters of Inquiry, Sales Letters, Complaint and Adjustment Letters, Job Application Letters)

c. Drafting of a CV and Résumé

d. Memo, Notice, Advertisement, Agenda, Minutes of Meetings

e. E-mails (format, types, jargons, conventions)

References:

1.Raymond Murphy. *English Grammar in Use*. 3rd Edn. CUP, 2001.

2. Seidl & McMordie. *English Idioms& How to Use Them*. Oxford:OUP, 1978.

3. Michael Swan. *Practical English Usage*. Oxford:OUP, 1980.

4. Simeon Potter. *Our Language*. Oxford:OUP, 1950.

5. Pickett, Laster and Staples. *Technical English: Writing, Reading & Speaking*. 8th ed. London: Longman, 2001.

6. IIT Kanpur, English Language & Communication Skills (ENG 112 C) syllabus.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU101.1	-	-	1	-	-	1	-	1	3	3	3	3
HU 101.2	-	-	-	-	-	2	-	-	2	3	3	3
HU 101.3	-	3	2	2	-	3	2	2	3	3	3	3
HU 101.4	-	-	-	2	-	2	-	-	3	3	2	3
HU 101.5	-	2	1	-	-	2	2	1	3	3	2	3

Paper Name: Engineering Mechanics
Paper Code: ME101
Total Contacts Hours: 45
Credit: 4

Pre requisites: Higher Secondary with Physics, Chemistry & Mathematics.

Course Objective:

1. Understand the vector and scalar representation of forces and moments.
2. Describe static equilibrium of particles and rigid bodies in two dimensions and three dimensions including the effect of Friction
3. Analyze the properties of surfaces & solids in relation to moment of inertia.
4. Illustrate the laws of motion, kinematics of motion and their interrelationship.
5. Study the concepts of engineering mechanics on deformable materials under applied loads.

Course Outcome:
Upon successful completion of the course, student should be able to:

ME 101.1. Construct free body diagram and calculate the reactions necessary to ensure static equilibrium.

ME 101.2. Study the effect of friction in static and dynamic conditions.

ME 101.3. Understand the different surface properties, property of masses and material properties.

ME 101.4. Analyze and solve different problems of kinematics and kinetics.

Course Content:

Module1: Importance of Mechanics in engineering; Introduction to Statics; Concept of Particle and Rigid Body; Types of forces: collinear, concurrent, parallel, concentrated, distributed; Vector and scalar quantities; Force is a vector; Transmissibility of a force (sliding vector). 2L

Introduction to Vector Algebra; Parallelogram law; Addition and subtraction of vectors; Lami's theorem; Free vector; Bound vector; Representation of forces in terms of i,j,k; Cross product and Dot product and their applications.
3L+1T

Two dimensional force system; Resolution of forces; Moment; Varignon's theorem; Couple; Resolution of a coplanar force by its equivalent force-couple system; Resultant of forces

4L+1T

Module2: Concept and Equilibrium of forces in two dimensions; Free body concept and diagram; Equations of equilibrium.
3L+1T

Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.

3L+1T

Module3: Distributed Force: Centroid and Centre of Gravity; Centroids of a triangle, circular sector, quadralateral, composite areas consisting of above figures. 4L+1T
Moments of inertia: MI of plane figure with respect to an axis in its plane, MI of plane figure with respect to an axis perpendicular to the plane of the figure; Parallel axis theorem; Mass moment of inertia of symmetrical bodies, e.g. cylinder, sphere, cone.
3L+1T

Principle of virtual work with simple application. 1L+1T

Module4: Concept of simple stresses and strains: Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain; Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic limit; Ultimate stress; Yielding; Modulus of elasticity; Factor of safety.

2L+1T

Module5: Introduction to Dynamics: Kinematics and Kinetics; Newton's laws of motion; Law of gravitation & acceleration due to gravity; Rectilinear motion of particles; determination of position, velocity and acceleration under uniform and non-uniformly accelerated rectilinear motion; construction of x-t, v-t and a-t graphs. 3L+1T

Plane curvilinear motion of particles: Rectangular components (Projectile motion); Normal and tangential components (circular motion). 2L+1T

Module6: Kinetics of particles: Newton's second law; Equation of motion; D.Alembert's principle and free body diagram; Principle of work and energy ; Principle of conservation of energy; Power and efficiency. 3L+2T

Books Recommended

1. Engineering Mechanics [Vol-I & II]by Meriam & Kraige, 5th ed. – Wiley India
2. Engineering Mechanics: Statics & Dynamics by I.H.Shames, 4th ed. – PHI
3. Engineering Mechanics by Timoshenko , Young and Rao, Revised 4th ed. – TMH
4. Elements of Strength of Materials by Timoshenko & Young, 5th ed. – E.W.P
5. Fundamentals of Engineering Mechanics by Debabrata Nag & Abhijit Chanda– Chhaya Prakashani
6. Engineering Mechanics by Basudeb Bhattacharyya– Oxford University Press.
7. Engineering Mechanics: Statics & Dynamics by Hibbeler & Gupta, 11th ed. – Pearson

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME101.1	3	3	2	2	-	-	-	-	1	-	-	-
ME101.2	3	3	2	2	-	-	-	-	1	-	-	1
ME101.3	3	2	3	2	1	-	-	-	1	-	-	1
ME101.4	3	3	3	3	-	-	-	-	1	-	1	-

Practical

Paper Name: Lang. Lab. and Seminar Presentation
Paper Code: HU191
Total Contact Hours: 26
Credit: 1

Pre requisites: Basic knowledge of LSRW skills.

Course Objectives: To train the students in acquiring interpersonal communication skills by focussing on skill acquisition techniques and error feedback.

Course Outcome:
HU191.1: Able to understand advanced skills of Technical Communication in English through Language Laboratory.
HU191.2: Able to apply listening, speaking, reading and writing skills in societal and professional life.
HU191.3: Able to demonstrate the skills necessary to be a competent Interpersonal communicator.
HU191.4: Able to analyze communication behaviors.
HU191.5: Able to adapt to multifarious socio-economical and professional arenas with the help of effective communication and interpersonal skills.

Course Contents:

Module 1: Introduction to the Language Lab
a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book
Module 2: Active Listening
a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note taking
c. Contextualized Examples based on Lab Recordings
Module 3: Speaking
a. Speaking (Choice of words, Speech Syntax, Pronunciation, Intonation)
b. Language Functions/Speech Acts
c. Speaking using Picture Prompts and Audio Visual inputs
c. Conversational Role Plays (including Telephonic Conversation)
d. Group Discussion: Principles and Practice
Module 4: Lab Project Work
a. Keeping a Listening Log
b. Writing a Film Review/Advertisements

References:
1.IIT Mumbai**, Preparatory Course in English** syllabus
2. IIT Mumbai, **Introduction to Linguistics** syllabus
3. Sasikumar et al. *A Course in Listening and Speaking*. New Delhi: Foundation Books, 2005.
4. Tony Lynch, *Study Listening*. Cambridge: Cambridge UP, 2004.

CO-PO-Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU 191.1	-	3	-	-	-	3	2	1	3	3	3	3
HU 191.2	-	3	-	2	-	3	-	-	3	3	3	3
HU 191.3	-	3	-	-	-	3	-	-	3	3	3	3
HU 191.4	-	3	2	3	-	3	2	-	3	3	3	3
HU 191.5	-	3	2	2	-	2	-	3	3	3	3	3

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Chemistry Lab
Paper Code: CH 191
Total Contact hour: 36
Credit: 2

Pre requisites: 10+2 science with chemistry

Course Objective

Acquiring knowledge on Standard solutions and the various reactions in homogeneous and heterogenous medium. Understanding the basic principles of pH meter and conductivity meter for different applications and analyzing water for its various parameters. Synthesis of Polymeric materials and Nanomaterials.

Course Outcome

CH191.1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CH191.2: Able to work as an individual also as an team member
CH191.3: Able to analyse different parameters of water considering environmental issues
CH191.4: Able to synthesize nano and polymer materials.
CH191.5: Capable to design innovative experiments applying the fundamentals of chemistry

Course contents

List of Experiments:

1. To Determine the alkalinity in given water sample.
2. Redox titration (estimation of iron using permanganometry)
3. To determine calcium and magnesium hardness of a given water sample separately.
4. Preparation of phenol-formaldehyde resin (Bakelite).

5. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water).
7. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
8. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
9. Determination of dissolved oxygen present in a given water sample.
10. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution).

Innovative experiment:

Preparation of silver nano-particles.

Note: From the list of 10 (Ten) experiments a minimum of 7 (seven) experiments shall have to be performed by one student of which Sl. No. 4 (Preparation of Bakelite) has to be mandatory.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CH191.1	3	2	1	1	1	1	-	-	2	-	-	-
CH191.2	-	-	-	-	-	-	-	-	3	-	-	-
CH191.3	-	-	-	-	-	2	3	-	-	-	-	1
CH191.4	-	-	-	-	2	1	-	-	-	-	-	-
CH191.5	2	-	2	-	1	-	-	-	-	-	-	1

FOR GROUP B: CSE, IT, FT, ME, CE

Paper Name: Physics I Lab
Paper Code: PH 191
Total Contact Hours: 40
Credit: 4

Pre requisites: Knowledge of Physics upto 12th standard.

Course Outcome of Physics-I practical (PH 191)

At the end of the course students' should have the

PH 191.1 : Ability to define, understand and explain ✓ **Error estimation, Proportional error calculation**	PO1

✓ **superposition principle in Newton's ring, Fresnel's biprism, laser diffraction** ✓ **Basic circuit analysis in LCR circuits**	
PH 191.2 : Ability to conduct experiments using ➢ **LASER, Optical fibre** ➢ **Interference by division of wave front, division of amplitude, diffraction grating, polarization of light** ➢ **Quantization of electronic energy inside an atom** ➢ **Torsional pendulum**	PO4
PH 191.3 : Ability to participate as an individual, and as a member or leader in groups in laboratory sessions actively	PO9
PH 191.4 : Ability to analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments	PO10

General idea about Measurements and Errors (One Mandatory):
i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
ii) Proportional error calculation using Carrey Foster Bridge.

Any 7 to be performed from the following experiments

Experiments on Oscillations & Elasticity:
1. Study of Torsional oscillation of Torsional pendulum & determination of time period using various load of the oscillator.
2. Experiments on Lissajous figure (using CRO).
3. Experiments on LCR circuit.
4. Determination of elastic modulii of different materials (Young's modulus and Rigidity modulus)

Experiments on Optics:
5. Determination of wavelength of light by Newton's ring method.
6. Determination of wavelength of light by Laser diffraction method.
7. Determination of numerical aperture and the energy losses related to optical fiber experiment
8. Measurement of specific rotation of an optically active solution by polarimeter.

Experiments on Quantum Physics:
11. Determination of Planck's constant using photoelectric cell.
12. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.

In addition it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Determination of wavelength of light by Fresnel's bi-prism method (beyond the syllabus).
2. Study of half-wave, quarter-wave plate (beyond the syllabus)
3. Study of dispersive power of material of a prism.
4. Study of viscosity using Poyseullie's caplillary flow method/using Stoke's law.
5. Measurement of nodal and antinodal points along transmission wire and measurement of wave length.
6. Any other experiment related to the theory**.**

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH 191.1	**2**											
PH 191.2	**1**											
PH 191.3				**2**								
PH 191.4									**3**			

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Basic Electrical Engineering LAB
Paper Code: EE191
Total Contact Hours: 36
Credit: 2

Pre requisites:

1. Basic Physics and applied physics.
2. Basic Mathematics.
3. Basic concept of Electric Circuit

Course Objective:

1. Provide knowledge for the analysis of basic electrical circuit.
2. To introduce electrical appliances, machines with their respective characteristics.

Course Outcome:

COs	CO Statement
EE191.1	Identify common electrical components and their ratings.
EE191.2	Make Circuit connection by wires of appropriate ratings.
EE191.3	Understand the usage of common electrical measuring instruments
EE191.4	Understand the basic characteristics of transformers and electrical machines

Course contents

LIST OF EXPERIMENTS

1. Characteristics of Fluorescent ,Tungsten and Carbon filament lamps
2. Verification of Thevenin's and Norton's Theorem
3. Verification of Superposition Theorem
4. Calibration of Ammeter and Wattmeter
5. Study of R-L-C series circuit
6. Open circuit and short circuit test of a single phase Transformer
7. Starting, Reversing of a and speed control of D.C shunt motor
8. Test on single phase Energy Meter
9. Familiarization of PMMC and MI type Meter
10. Familiarization with house wiring practice

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE191.1	2	3		1	3				1		2	1
EE191.2	2		2	1	3				1	1		
EE191.3		3				3	2				2	1
EE191.4	3						1			2	2	2

FOR GROUP B: CSE, IT, FT, ME, CE

Paper Name: Basic Electronics Engineering Lab
Paper Code: EC191
Total Contact Hours: 36
Credit: 2

Prerequisites
A basic course in electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohm's law, Ampere's law

Course objectives:
Students will become familiar with the circuit design using semiconductor diodes in Forward and Reverse bias, They will also be able to design rectifiers like half-wave, full-wave rectifiers etc. using diodes. The ability of circuit design with Bipolar Junction Transistor in CB, CE & CC configurations will be improved. The students will acquire the basic engineering technique and ability to design and analyze the circuits of Op-Amp. Basic concepts and Circuit design with logic gates will be developed in the students. The students will be able design circuit using FET .

Course Outcomes:

EC191.1	Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.
EC191.2	Analyze the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of Rectifier Circuits.
EC191.3	Determination of input-offset voltage, input bias current and Slew rate, Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
EC191.4	Able to know the application of Diode, BJT &OPAMP.
EC191.5	Familiarization and basic knowledge of Integrated Circuits

Course contents:

List of Experiments:

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimeters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.

7. Study of I-V characteristics of Field Effect Transistors.
8. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
9. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
10. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.
11. Study of Logic Gates and realization of Boolean functions using Logic Gates.
12. Study of Characteristic curves for CB, CE and CC mode transistors.
13. Innovative Experiment

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EC 191.1	3	3	-	-	-	-	-	-	-	-	-	-
EC 191.2	2	3	-	-	-	-	-	-	**1**	**1**	-	1
EC 191.3	1	3	3	-	-	-	-	-	-	2	-	-
EC 191.4	1	2	3	-	-	-	-	-	-	**1**	-	1
EC 191.5	3	1	**2**	-	-	-	-	-	-	-	-	-

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Engineering Drawing & Graphics
Paper Code: ME 191
Total Contact Hours: 36
Credit: 2

Pre requisites: Higher Secondary with Physics, Chemistry & Mathematics

Course Objective:

1. To learn basics of drafting and use of drafting tools.
2. To know about engineering scales, dimensioning and various geometric curves.
3. To Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.
4. To acquire the knowledge of Computer Aided drafting using design software.

Course Outcomes: Upon successful completion of this course, the student will be able to:

ME 191.1. Learn basics of drafting and use of drafting tools which develops the fundamental skills of industrial drawings.

ME 191.2. Know about engineering scales, dimensioning and various geometric curves necessary to understand design of machine elements.

ME 191.3. Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.

ME 191.4. Become familiar with computer aided drafting useful to share the design model to different section of industries as well as for research & development.

Course contents:

List of Experiments:

1. Lines, Lettering, Dimensioning, Scales (Plain scale & diagonal Scale).

2. Geometrical Construction and Curves – Construction of Polygons, Parabola, Hyperbola & ellipse

3. Projection of Points, Lines and Surfaces – orthographic projection- first angle and third angle projection, projection of lines and surfaces- Hexagon

4. Projection of Solids – (Cube, Pyramid, Prism, cylinder and Cone

5. Sectional Views – for simple sold objects

6. Introduction to Computer Aided Drafting – using auto cad & / or similar software- Introduction to Cartesian and polar coordinate systems, absolute and relative coordinates; Basic editing commands: line, point, trace, rectangle, polygon , circle, arc, ellipse, polyline; editing methods; basic object selection methods – window and crossing window, erase, move, copy, offset, fillet, chamfer, trim, extend, mirror; display command; zoom, pan, redraw, regenerate; simple dimensioning and text, simple exercises.

CO Codes	**PO1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
ME 191.1	2	-	1	2	-	1	-	-	1	-	-	1
ME 191.2	3	-	2	2	-	1	-	-	1	1	-	1
ME 191.3	2	2	2	1	-	1	-	-	1	-	-	1
ME 191.4	1	-	2	2	2	1	-	-	1	1	-	1

FOR GROUP B: CSE, IT, FT, ME, CE

Paper Name: Workshop Practice
Paper Code: ME192
Total Contact Hours: 36
Credit: 2

Pre requisites: Higher Secondary with Physics, Chemistry & Mathematics

Course Objective:

1. To understand the basic knowledge of Workshop Practice and Safety.
2. To identify and use of different hand tools and other instruments like Hand Saw, Jack Plane, Chisels etc and operations like such as Marking, Cutting etc used in manufacturing processes.
3. To get hands on practice in various machining metal joining processes such as Welding, Brazing, Soldering, etc.

Course Outcome:

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

ME192.1 Gain basic knowledge of Workshop Practice and Safety useful for our daily living.

ME192.2 Identify Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc and performing operations like such as Marking, Cutting etc used in manufacturing processes.

ME192.3 Gain knowledge of the various operations in the Fitting Shop using Hack Saw, various files, Scriber, etc to understand the concept of tolerances applicable in all kind of manufacturing.

ME192. 4 Get hands on practice of in Welding and various machining processes which give a lot of confidence to manufacture physical prototypes in project works.

Course contents

List of Activities:

Sl. No.	Syllabus	Contact Hrs
Module 1	Pattern Making	6
Module 2	Sheet Metal Work	6
Module 3	Fitting	9
Module 4	Machining in Lathe	9

Module 5	Welding	6

MODULE 1 – PATTERN MAKING.

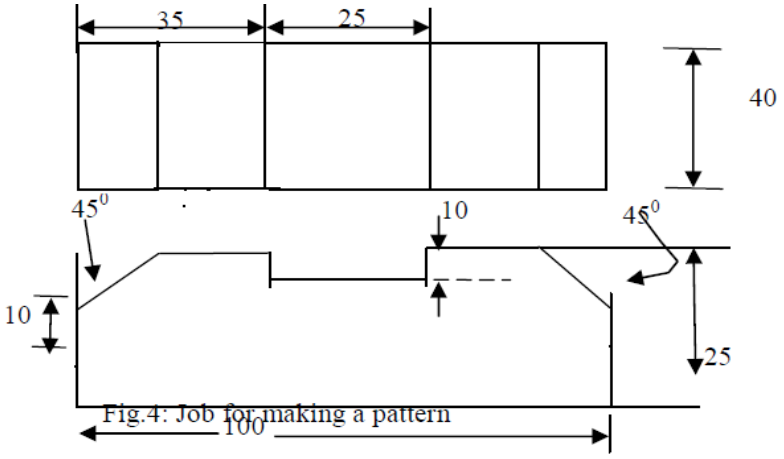
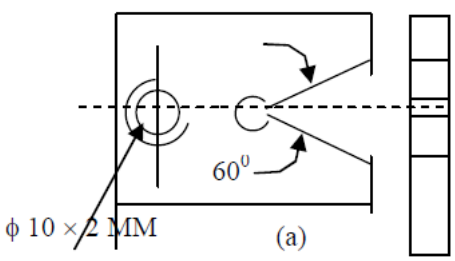
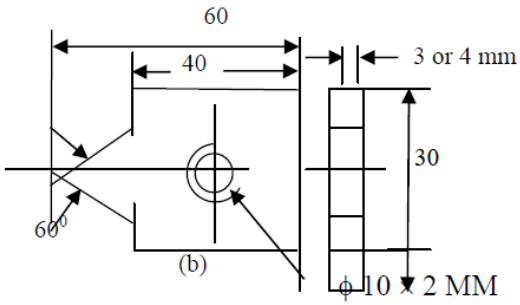


Fig.4: Job for making a pattern

MODULE 3- FITTING SHOP.



OR



MODULE 4 – MACHINING IN LATHE & SHAPING M/C

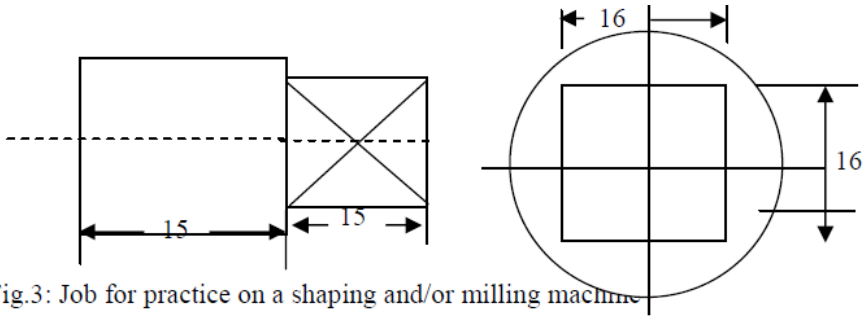
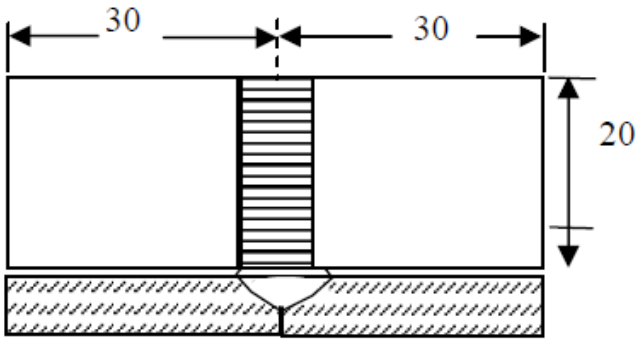


Fig.3: Job for practice on a shaping and/or milling machine

MODULE 5 – WELDING



CO-PO Mapping:

CO Codes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME 192.1	2	-	-	-	-	2	-	1	-	-	1	-
ME 192.2	2	-	-	-	-	1	-	2	-	-	-	-
ME 192.3	2	-	-	-	-	1	-	1	-	-	-	-
ME 192.4	1	-	-	-	1	3	-	3	-	-	-	1

Sessional

Paper Name: Extra Curricular Activity (NSS/ NCC)
Paper Code: XC 181
Total Contact hours: 20
Credit: 1

Course Objectives: The objectives of the course are as follows:

- To increase student awareness about the weaker and unprivileged sections of society
- To expose students to environmental issues and ecological concerns
- To make students self aware about their participatory role in sustaining society and the environment

Course contents

List of Activities:

a) Creating awareness in social issues
b) Participating in mass education programmes
c) Proposal for local slum area development
d) Waste disposal
e) Environmental awareness ``
f) Production Oriented Programmes
g) Relief & Rehabilitation work during Natural calamities

Creating awareness in social issues:

1. Women's development – includes health, income-generation, rights awareness.
2. Hospital activities – Eg. writing letters for patients, guiding visitors
3. Old age home – visiting the aging in-mates, arranging for their entertainment.
4. Children's Homes - visiting the young in-mates, arranging for their entertainment
5. Linking with NGOs to work on other social issues. (Eg. Children of sex-workers)
6. Gender issues- Developing an awareness, to link it with Women's Cell of college

Participating in mass education programmes

1.Adult education
2. Children's education

Proposal for local slum area development

One or two slums to be identified and according to the needs, activities to be developed and proposals and reports are to be submitted.

Environmental awareness

• Resource conservation – Awareness to be developed on water, energy,soil.
• Preservation of heritage monuments- Marches, poster campaigns
• Alternative energy consciousness amongst younger school-children.
• Plantation and beautification- Plantation of trees, their preservation and upkeep, developing NSS parks.

• Waste disposal- Proper methods of domestic waste disposal.

Production Oriented Programmes

5. Working with people and explaining and teaching improved agricultural practices
6. Rodent control land pest control practices;
7. Soil-testing, soil health care and soil conservation;
8. Assistance in repair of agriculture machinery;
9. Work for the promotion and strengthening of cooperative societies in villages;
10. Assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
11. Popularization of small savings and
12. Assistance in procuring bank loans

Relief & Rehabilitation work during Natural calamities

g) Assisting the authorities in distribution of rations, medicine, clothes etc.;

h) Assisting the health authorities in inoculation and immunization, supply of medicine etc.;

i) Working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;

j) Assisting and working with local authorities in relief and rescue operation; Collection of clothes and other materials, and sending the same to the affected areas;

First Year Second Semester

Group A: ECE, EE, BME, AEIE/EIE

Group B: CSE, IT, FT, ME, CE

Curriculum

THEORY							
Sl No	Paper Code	Theory	Contact Hours /Week				Credit Points
			L	T	P	Total	
1	M 201	Mathematics -II	3	1	0	4	4
2	CH 201/ PH 201	Chemistry (Gr. B) / Physics - I(Gr. A)	3	1	0	4	4
3	EE 201/ EC 201	Basic Electrical Engineering (Gr. B) / Basic Electronics Engineering (Gr. A)	3	1	0	4	4
4	CS 201	Computer Fundamentals & Principle of Computer Programming	3	1	0	4	4
5	ME 201	Engineering Thermodynamics & Fluid Mechanics	3	1	0	4	4
Total of Theory						20	20
PRACTICAL							
6	CS291	Computer Fundamentals & Principle of Computer Programming Lab	0	0	3	3	2
7	CH 291/ PH291	Chemistry Lab (Gr. B) / Physics -I Lab(Gr. A)	0	0	3	3	2
8	EE 291/ EC 291	Basic Electrical Engineering Lab (Gr. B) /Basic Electronics Engineering Lab(Gr. A)	0	0	3	3	2
9	ME 291/ME 292	Engg Drawing & Graphics(Gr B)/ Workshop Practice (Gr-A)	0	0	3	3	2
Total of Practical						12	08
C.SESSIONAL							
10	MC 281	Soft Skill Development	0	0	2	2	0

Syllabus

Theory

Paper Name: Mathematics-II
Paper Code: M 201
Total Contact Hours: 40
Credit: 4

Prerequisite: Any introductory course on calculus.

Course Objective: The purpose of this course is to provide fundamental concepts Ordinary Differential Equations, Graph Theory and Laplace Transform.

Course outcome:

On successful completion of the learning sessions of the course, the learner will be able to:

M 201.1: Recall the distinctive characteristics of Ordinary Differential Equations, Graph Theory and Laplace Transform.

M 201.2: Understand the theoretical workings of various algorithms related to graph theory and the theorems of differential equation and Laplace transforms.

M 201.3: Apply the principles of differential equation, graph theory and Laplace transforms to solve various problems.

Course contents:

Module I [10L]
Ordinary differential equations (First order): First order and first degree Exact equations,Necessary and sufficient condition of exactness of a first order and first degree ODE (statement only), Rules for finding Integrating factors, Linear equation, Bernoulli's equation, General solution of ODE of first order and higher degree (different forms with special reference to Clairaut's equation), Applications related to Engineering problems.

Module II [10L]
Ordinary differential equations (Higher order): General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods for finding P.I., Method of variation of parameters, Cauchy-Eulerequations, Solution of simultaneous linear differential equations, Applications related to Engineering problems.

Module III [10L]
Basic Graph Theory:Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Subgraph, Walks, Paths, Circuits, Euler Graph, Cut-sets and cut-vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph.Tree, Binary tree, Spanning tree of a

graph, Minimal spanning tree, properties of trees, Algorithms: Dijkstra's Algorithm for shortest path problem, Determination of minimal spanning tree using Kruskal's and Prim's algorithm.
** Extra lecture hours may be taken for this module

MODULE IV: [**10L**]
Laplace Transform (LT): Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property; LT of t f (t), LT of f (t)/t , LT of derivatives of f (t), L.T. of $\int f(u)\,du$. Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties; Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT. Applications related to Engineering problems.

Beyond Syllabus:
Combinatorics: Fundamental Principles, Permutations, Combinations, Binomial Coefficients.

Text Books:

1. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley, 1999.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publications, 2009.
3. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Pub. House, 2008.

ReferenceText Books:

4. W. E. Boyce and R. DiPrima, Elementary Differential Equations (8th Edition), John Wiley, 2005.
5. R.K. Ghosh and K.C.Maity, An Introduction to Differential Equations, New Central Book Agency.
6. V. K. Balakrishnan,Graph Theory, Schaum's Outline, TMH.
7. J. Clark and D. A. Holton, A first course at Graph Theory,Allied Publishers LTD.
8. D. B. West, Introduction to Graph Theory,Prentice-Hall of India.
9. N. Deo, Graph Theory, Prentice-Hall of India.
10. J. Bird, Higher Engineering Mathematics (4th Edition, 1st India Reprint), Elsevier, 2006.
11. L. Rade and B. Westergen, Mathematics Handbook: for Science and Engineering (5th edition, 1st Indian Edition), Springer, 2009.
12. Murray R.Spiegel, Laplace Transform, Schaum's Outline Series, McGRAW-HILL.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
M 201.1	3	2	-	-	-	-	-	-	-	-	-	1
M 201.2	3	2	-	-	-	-	-	-	-	-	-	1
M 201.3	3	2	2	-	-	-	-	-	-	-	-	1

FOR GROUP B: ME, CE, IT, CSE, FT

Paper Name: Chemistry
Paper Code: CH 201
Total Contact Hours: 40
Credit: 4

Pre requisites: 10+2 science with chemistry

Course Objective

Understanding of the fundamental theories and applications of thermodynamics, electrochemical principles in modern electrochemical cells and to get an insight into electronic structure of crystals and nanomaterials. Learning about the Synthesis, properties and applications of polymers , fuels and alternative energy sources & their significance in petrochemical industries. Analyzing water quality for its various parameters & its significance in industries

Course Outcome

CH201.1: Able to apply fundamental concepts of thermodynamics in different engineering applications.
CH201.2: Able to analyze & design simple and technologically advanced electrical and energy storage devices.
CH201.3: Able to synthesize nanomaterials, composites, polymers.
CH201.4: Able to apply the basic concept of Organic Chemistry and knowledge of chemical reactions to industries , and technical fields.
CH201.5: Able to apply the knowledge of different fuels and corrosion to different industries
CH201.6: Able to analyse water quality parameter for its various parameters & its significance in industries.

Course contents

Module 1 [8L]

Chemical Thermodynamics –I

1.1 Concept of Thermodynamic system: Definition with example of diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property.

Introduction to first law of thermodynamics: Different statements, mathematical form.

Internal energy: Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas. **2L**

1.2 Enthalpy: Definition, Characteristics, Physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas.

Heat Capacity: Definition, Classification of Heat Capacity (Cp and CV): Definition and General expression of Cp - CV. Expression of Cp - CV for ideal gas.

Reversible and Irreversible processes: Definition, Work done in Isothermal Reversible and Isothermal Irreversible process for Ideal gas, Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P, V and T), slope of P-V curve in adiabatic and isothermal process.

Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation. **3L**

1.3 2nd law of thermodynamics: Statement, Mathematical form of 2nd law of thermodynamics (Carnot cycle). Joule Thomson and throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature (brief).

Evaluation of entropy: characteristics and expression, physical significance. Work function and free energy: Definition, characteristics, physical significance, mathematical expression of ΔA and ΔG for ideal gas, standard free energy and chemical potential, Condition of spontaneity and equilibrium reaction. **3L**

Module 2 [7L]

2.1 Reaction Dynamics

Reaction laws: rate and order; molecularity; zero and first order kinetics, second order kinetics (same reactant concentration), Pseudounimolecular reaction, Arrhenius equation. **3L**

Mechanism and theories of reaction rates (Content beyond the syllabus)

2.2 Solid state Chemistry

Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency).

Role of silicon and germanium in the field of semiconductor, n-type, p-type semiconductor, photo voltaic cell, fabrication of integrated circuits. **4L**

Module 3 [8L]

Electrochemistry

3.1 Conductance

Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration (Strong and Weak electrolyte). **1L**

3.2 Electrochemical cell

Cell EMF and its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half cell, calomel half cell (representation, cell reaction, expression of potential, Discussion, Application). **3L**

3.3 Concept of battery

Battery and Commercial electrochemical cell: Dry cell, acid storage cell, alkaline storage cell, fuel cell (construction, representation, cell reaction, expression of potential, discussion, application). **2L**

3.4 Corrosion and its control

Introduction, cause and effect of corrosion, types of corrosion: dry, wet and other: Electrochemical corrosion, galvanic corrosion, passivation and protective measure. **2L**

Module 4 [12L]

4.1 Structure and reactivity of Organic molecule

Electronegativity, electron affinity, hybridisation, Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals. Brief study of some addition, eliminations and substitution reactions. **3L**

4.2 Polymers

Concepts, classifications and industrial applications. Polymer molecular weight (number avg. weight avg.: Theory and mathematical expression only), Poly dispersity index (PDI).

Polymerization processes: addition and condensation polymerization (mechanism not required), degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity (concept of Tm) and amorphicity (Concept of Tg) of polymer.

Preparation, structure and use of some common polymers: plastic (HDPE, LDPE, PVC, PP, PMMA, Polyester, PTFE, Bakelite), rubber (natural rubber, SBR), fibre (nylon 6, nylon 6,6), Vulcanization of rubber, Conducting polymers and bio-polymers. **7L**

4.3 Nano material

Basic principles of nano science and technology, classification, preparation, properties and application of nano material. **2L**

Module 5 [5L]

5.1 Industrial Chemistry

Fuels

Solid Fuel: Coal, Classification of coal, constituents of coal, carbonization of coal (HTC and LTC), Proximate analysis of coal, Calorific value.

Liquid fuel: Petroleum, classification of petroleum, Refining, Octane number, Cetane number, Aviation Fuel (Aviation Gasoline, Jet Gasoline), Biodiesel.

Gaseous fuels: Natural gas, water gas, Coal gas, bio gas, CNG, LPG **3L**

5.2 Water

Introduction, source of water, water quality parameter, specification for drinking water (BIS and WHO standards), Chlorination of Water, Types of hardness- Units, Brief Softening methods. **2L**

Short overview of water treatment plants (Content beyond the syllabus)

Reference Books

1. Engineering Chemistry: Bandyopadhyay and Hazra
2. Physical Chemistry: P.C. Rakshit
3. Organic Chemistry: Finar, vol-1

4. Engineering Chemistry: B.Sivasankar, Tata Mc Graw Hill, 2008
5. A Text book of Engineering Chemistry: S.S.Dara, 10th Edition, S.Chand & Company Ltd., New Delhi, 2003.
6. Engineering Chemistry Simplified: S. Nandi and R. Bhattacharyya, Chayya Prakashani Pvt. Ltd.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CH201.1	3	1	-	-	-	-	-	-	-	-	-	-
CH201.2	3	2	1	-	-	-	-	-	-	-	-	-
CH201.3	-	-	2	-	2	-	-	-	-	-	-	1
CH201.4	2	-	1	-	2	-	-	-	-	-	-	-
CH201.5	2	-	-	-	-	-	2	-	-	-	-	1
CH201.6	-	-	2	-	-	-	1	-	-	-	-	-

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Physics -I
Paper Code: PH 201
Total Contact Hours: 41
Credit: 4

Pre requisites: Knowledge of Physics upto 12^{th} standard.

Course Objective:

The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic physics principles along with the possible applications. The acquaintance of basic principles of physics would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. It can also create awareness of the vital role played by science and engineering in the development of new technologies. It also gives necessary exposure to the practical aspects, which is an essential component for learning sciences.

Course Outcome:

At the end of the course students' should have the

PH 201.1 : Ability to state and recall ➢ **De-Broglie hypothesis, and Heisenberg's Uncertainty Principle** ➢ **Amplitude and Velocity Resonance** ➢ **Malus's Law, Brewster's Law** ➢ **Characteristics of LASER light**	PO1 Or GA1
PH 201.2 : Ability to understand and explain ➢ **Polarizer and analyzer** ➢ **basic principles and different types of LASER and Optical Fibre** ➢ **structure of solids, Miller indices** ➢ **theory of Matter Wave, equation of motion of Matter Wave** ➢ **wave function and its role in representing wave nature of matter**	PO2 Or GA2
PH 201. 3 : Ability to apply the knowledge of ➢ **mechanical vibration in electrical circuits** ➢ **superposition principle in Newton's ring phenomenon, diffraction phenomenon** ➢ **quantum nature of e.m. waves for production of laser** ➢ **total internal reflection in transmitting light through optical fibres** ➢ **x-ray diffraction in crystal structure** ➢ **probability interpretation in Heisenberg's uncertainty principle**	PO3 Or GA3
PH 201.4 : Ability to analyze ➢ **grating as many slit system** ➢ **role of Q factor in a resonating circuit, conditions of different types of resonance** ➢ **minimum requirements for lasing action** ➢ **importance of light as a carrier of information** ➢ **the failures of classical physics in microscopic situation and need of quantum**	PO2 Or GA2

physics ➢ **Einstein's A, B coefficient and predict the wavelength domain of Lasing action** ➢ **Requirement of Miller indices for describing crystallographic planes**	
PH 201.5 : Ability to evaluate / justify / compare ➢ **X-ray production process is inverse of the process of Photoelectric Effect.** ➢ **different crystallographic structures according to their Co-ordination number and packing factors** ➢ **the outcome of Photo-electric effect, Compton effect and Davission-Germer experiment to justify wave-particle duality of matter**	PO12 Or GA12

Course contents

Module 1 (8L):-
Oscillations
1.1 Simple harmonic motion: Concepts with examples, Superposition of SHMs in two mutually perpendicular directions: Lissajous' figures, Engineering Applications and related Numerical problems 2L

1.2 Damped vibration: Differential equation and its solution, Logarithmic decrement, quality factor, Engineering Applications and related Numerical problems. 3L

1.3 Forced vibration: Differential equation and solution, Amplitude and Velocity resonance, Sharpness of resonance, relevant applications including LCR circuits, Numerical problems 3L

Module 2 (10L):-
Classical Optics:
2.1 Interference of light: Wave nature of light (Huygen's principle), Conditions of sustained interference double slit as an example; qualitative idea of spatial and temporal coherence, conservation of energy and intensity distribution; Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, Numerical Problems. 3L

Fresnel's biprism (beyond the syllabus). 1L(ext)

2.2 Diffraction of light: Fresnel and Fraunhofer class, Fraunhofer diffraction for plane transmission grating (elementary treatment of intensity distribution for N-slits), single slit and double slits as examples, missing order, Rayleigh criterion, resolving power of grating and microscope (Definition and formula; no deduction required). Engineering Applications, Numerical Problems. 4L

2.3 Polarization: Definition, plane of polarization, p**l**ane of vibration, Malus law, fundamental concepts of plane, circular and elliptical polarizations (only qualitative idea) with examples, Brewster's law, Double refraction: ordinary and extraordinary rays, Nicol's prism, Engineering applications, Numerical problems. 3L

Module 3 (9L):-
Quantum Physics:

3.1 Quantum Theory: Inadequacy of classical physics; Planck's quantum hypothesis-Qualitative (without deductions), particle concept of electromagnetic wave (example: photoelectric and Compton effect; qualitative discussions only), wave particle duality; phase velocity and group velocity; de Broglie wave; Davisson and Germer experiment. 4L

3.2 Quantum Mechanics 1: Concept of wave function, Physical significance of wave function, Probability interpretation; wave function normalization condition and its simple numerical applications; uncertainty principle-applications, Schrödinger equation (no mathematical derivation). 4L

Module 4 (6L):
X-ray & Crystallography

4.1 X**-rays** – Origin of Characteristic and Continuous X-ray, Bragg's law (No derivation), Determination of lattice constant, Applications, Numerical problems. 2L

4.2 Elementary ideas of crystal structure - lattice, basis, unit cell, Fundamental types of lattices – Bravais lattice, Simple cubic, fcc and bcc, **hcp** lattices, (use of models in the class during teaching is desirable) Miller indices and miller planes, Co-ordination number and Atomic packing factor, Applications, Numerical problems. 4L

Module 5 (8L):
Modern Optics-I:
5.1 Laser: Concepts of various emission and absorption process, working principle of laser, metastable state, Population Inversion, condition necessary for active laser action, optical resonator, ruby laser, He-Ne laser, **semiconductor laser**, Einstein A and B coefficients and equations, industrial and medical applications of laser. 5L

5.2 Fibre optics and Applications: Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle, V number, Types of optical fibres (material, refractive index, mode), Losses in optical fibre- attenuation, dispersion, bending, Numerical problems. 3L

Recommended Text Books for Physics I (PH101//201):

Oscillations:
1. Classical Mechanics- J. C. Upadhyay (Himalya Publishers)
2. Classical Mechanics-Shrivastav
3. Classical Mechanics-Takwal & Puranik (TMH)
4. Sound-N. K. Bajaj (TMH)
5. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
6. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
7. A text book of sound-M. Ghosh (S. Chand publishers)
8. Electricity Magnetism-Chattopadhyay & Rakshit (New Central Book Agency)
9. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
10. R.P. Singh (Physics of Oscillations and Waves)
11. A.B. Gupta (College Physics Vol. II)
12. Chattopadhya and Rakshit (Vibration, Waves and Acoustics)

Classical Optics & Modern Optics-I:

13. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
14. A text book of Light-Brijlal & Subhramanium, (S. Chand publishers)
15. Modern Optics-A. B. Gupta (Book & Allied Publisher)
16. Optics-Ajay Ghatak (TMH)
17. Optics-Hecht
18. Optics-R. Kar, Books Applied Publishers
19. Möler (Physical Optics)
20. E. Hecht (Optics)
21. E. Hecht (Schaum Series)
22. F.A. Jenkins and H.E White
23. C.R. Dasgupta (Degree Physics Vol 3)

Quantum Physics

24. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
25. Quantum Mechanics-Bagde Singh (S. Chand Publishers)
26. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
27. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
28. Quantum Mechanics-Bransden (Pearson Education Ltd.)
29. Perspective of Modern Physics-A. Beiser (TMH)
30. Eisberg & Resnick is published by Wiley India
31. A.K. Ghatak and S Lokenathan
32. E.E. Anderson (Modern Physics)
33 .Haliday, Resnick & Krane : Physics Volume 2 is Published by Wiley India
34. Binayak Dutta Roy [Elements of Quantum Mechanics]

X-ray & Crystallography

35. Solid state physics-Puri & Babbar (S. Chand publishers)
36. Materials Science & Engineering-Kakani Kakani
37. Solid state physics- S. O. Pillai
38. Introduction to solid state physics-Kittel (TMH)
39. Solid State Physics and Electronics-A. B. Gupta, Nurul Islam (Book & Allied Publisher)
40. S.O. Pillai (a. Solid state physics b. Problem in Solid state physics)

General Reference:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Basic Engineering Physics-I -Sujoy Bhattacharya, Saumen Paul (TMH)
4. Engineering Physics Vol: 1-Sudipto Roy, Tanushri Ghosh, Dibyendu Biswas (S. Chand).
5. Engineering Physics Vol:1-S. P. Kuila (New Central)
4. University Physics-Sears & Zemansky (Addison-Wesley)
5.B. Dutta Roy (Basic Physics)
6. R.K. Kar (Engineering Physics)
7. Mani and Meheta (Modern Physics)
8. Arthur Baiser (Perspective & Concept of Modern Physics)

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH 201.1	**1**											
PH 201.2		**2**										
PH 201.3	**3**											
PH 201.4		**1**										
PH 201.5												**1**

FOR GROUP B: CSE, IT, FT, ME, CE

Paper Name: Basic Electrical Engineering
Paper Code: EE 201
Total Contact Hours: 41
Credit: 4

Pre requisite: Basic 12st standard Physics and Mathematics

Course Objective:
Basic electrical engineering is an introductory course in electrical engineering. Students are introduced to simple applied electrical circuits, theories and practice to impart skill set to have visualization of electrical engineering applications. It is a course suitable for students pursuing electrical engineering as well as other related engineering disciplines.

Course Outcomes:
At the end of this course, students will able

EE 201.1: To understand and analyse basic electric and magnetic circuits.

EE 201.2: To understand and analysis the AC single phase and three phase circuit

EE 201.3: To understand and analysis of the basic principles of various electrical machines

Course Contents:

DC CIRCUITS (7L)

Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff's laws, Source equivalence and conversion, Network Theorems-Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.

MAGNETIC CIRCUITS (3L)

Concept of Magnetic circuit, B-H curve, Analogous quantities in magnetic and electric circuits, Faraday's law, iron losses, self and mutual inductance, Energy stored in magnetic field.

AC SINGLE PHASE CIRCUITS (8L)

Sinusoidal quantities, Average and RMS values, peak factor, Form factor, Phase and Phase difference, concept of phasor diagram, V-I Relationship in R,L,C circuit, Combination R,L,C in AC series , parallel and series parallel circuits with phasor diagrams, impedance and admittance, Power factor, Power in AC circuit, Resonance in RLC series and parallel circuit, Q factor, band width of resonant circuit.

THREE PHASE CIRCUITS (3L)

Voltages of three balanced phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two watt meters method.

DC MACHINES (6L)

Construction, Basic concepts of winding (Lap and wave). DC generator: Principle of operation, EMF equation, characteristics (open circuit, load) DC motors: Principle of operation, Torque Equation ,Speed Torque Characteristics (shunt and series machine), starting (by 3 point starter), speed control (armature voltage and field control).

SINGLE PHASE TRANSFORMER (5L)

Constructional parts, Types of transformers, Emf equation, No Load no load and on load operation, phasor diagram and equivalent circuit, losses of a transformer, open and short circuit tests, regulation and efficiency calculation.

THREE PHASE INDUCTION MOTOR (6L)

Types, Construction, production of rotating field, principle of operation, Slip and Frequency ,rotor emf and current, Equivalent circuit and phasor diagram, Torque Slip characteristics torque-speed characteristics Starting of induction motor by star delta starter and(DOL starter). Speed Control of Three phase induction motor by variation of supply frequency, supply voltage and number of poles.

GENERAL STRUCTURE OF ELECTRICAL POWER SYSTEM (3L)

Power generation to distribution through overhead lines and underground cables with single line diagram, Earthing of Electrical Equipment, Electrical Wiring Practice

Text books

5. V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
6. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication
7. Chakrabarti,Nath & Chanda, Basic Electrical Engineering, TMH
8. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education

Reference books

4. H. Cotton, Willey Press
5. J.B. Gupta, Basic Electrical Engineering, Kataria & Sons .
6. Kothari & Nagrath, Basic Electrical Engineering, TMH

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 201.1	3	3	2	1								
EE 201.2	2	2	1									
EE 201.3	3	2	2									

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Basic Electronics Engineering
Paper code: EC201
Total Contact Hours: 40
Credits: 4

Prerequisites

A basic course in Electronics and Communication Engineering Progresses from the fundamentals of electricity, direct current (DC) devices and circuits , series and parallel circuits to the study of active and passive components, Ohm's Law, Kirchoff's Law i.e. KVL,KCL, Ampere's Law etc.

Course objectives:

Students will be able to Analyze the behaviour of semiconductor diodes in Forward and Reverse bias . To design a half wave and full wave rectifiers , Explore V-I characteristics of Bipolar Junction Transistor n CB, CE & CC configurations. To acquire the basic engineering technique and ability to design and analyze the circuits of Op-Amps. Students will be able to explain feedback concept and different oscillators . They will also be familiar with the analysis of digital logic basics and measuring Electronic devices. Students will have knowledge about characteristics of FET.

Course Outcomes:

EC 201.1	Study PN junction diode, ideal diode, diode models and its circuit analysis, application of diodes and special diodes.
EC 201.2	Learn how operational amplifiers are modeled and analyzed, and to design Op-Amp circuits to perform operations such as integration, differentiation on electronic signals.

EC 201.3	Study the concepts of both positive and negative feedback in electronic circuits.
EC 201.4	Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.
EC 201.5	Learn how the primitives of Boolean algebra are used to describe the processing of binary signals.

Course contents

Module-I: Basics of semiconductor **6L**

Conductors, Insulators, and Semiconductors- crystal structure, Fermi Dirac function, Fermi level, E-k and Energy band diagrams, valence band, conduction band, and band gap; intrinsic, and extrinsic (p-type and n-type) semiconductors, position of Fermi level in intrinsic and extrinsic semiconductor, drift and diffusion current – expression only (no derivation) , mass action law , charge neutrality in semiconductor, Einstein relationship in semiconductor , Numerical problems on- Fermi level, conductivity, mass action law, drift and diffusion current .

Module-II: P-N Junction Diode and its applications **8L**

p-n junction formation and depletion region , energy band diagram of p-n junction at equilibrium and barrier energy , built in potential at p-n junction , energy band diagram and current through p-n junction at forward and reverse bias, V-I characteristics and current expression of diode , temperature dependencies of V-I characteristics of diode , p-n junction breakdown – conditions , avalanche and Zener breakdown , Concept of Junction capacitance, Zener diode and characteristics.

Diode half wave and full wave rectifiers circuits and operation (I_{DC} , I_{rms} , V_{Dc} , V_{rms}) , ripple factor without filter, efficiency ,PIV,TUF; Reduction of ac ripples using filter circuit (Qualitative analysis); Design of diode clipper and clamper circuit - explanation with example, application of Zener diode in regulator circuit. Numerical problems.

Module-III : Bipolar junction transistor(BJT) **6L**

Formation of PNP/NPN Transistors ,energy band diagram, current conduction mechanism , CE ,CB,CC configurations , transistor static characteristics in CE ,CB and CC mode, junction biasing condition for active, saturation and cut-off modes ,current gain α ,β and γ, early effect.

Biasing and bias stability; biasing circuits - fixed bias; voltage divider bias; collector to base bias , D.C. load line and Quiescent point, calculation of stability factors for different biasing circuits.

BJT as an amplifier and as a switch – Graphical analysis; Numerical Problems.

Module-IV: Field effect transistor (FET) **4L**

Concept of field effect, channel width modulation Classification of FETs-JFET, MOSFET, operating principle of JFET. drain and transfer characteristics of JFET (n-channel and p-channel), CS,CG,CD configurations, Relation between JFET parameters. FET as an amplifier and as a switch– graphical analysis. E-MOSFET (n-channel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems .

Module-V: Feedback and Operational Amplifier **10L**

Concept of feedback with block diagram, positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation and Barkhausen criterion.
Operational amplifier – electrical equivalent circuit ,ideal characteristics , Non ideal characteristics of op-amp – offset voltages ;bias current ;offset current; Slew rate ; CMRR and bandwidth, Configuration of inverting and non-inverting amplifier using Op-amp, closed loop voltage gain of inverting and non-inverting amplifier , Concept of virtual ground, Applications op-amp – summing amplifier; differential amplifier; voltage follower ; basic differentiator and integrator .
Problems on Characteristics of Op-amp, CMRR, slew rate, amplifier and application of Op-amp to be discussed. Any other relevant problems related to topic may be discussed or assigned.

Module-VI: Cathode Ray Oscilloscope (CRO) **2L**
Operating principle of CRO with block diagram, measurement of voltage, frequency and phase.

Module-VII: Digital Electronics **4L**
Binary numbers and conversion, Basic Boolean algebra, Logic gates (AND,OR,NOR,NOT,NAND,XOR) and realization of functions.

Text Books:

4. D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
5. Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
6. Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.
4. Sedra & Smith, Microelectronics Engineering

Reference Books:

1. John D. Ryder, Electronic Fundamentals and Applications, PHI
2. J.B.Gupta, Basic Electronics, S.K. Kataria.
3. Malvino: Electronic Principle.
4. Schilling & Belove: Electronics Circuits.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EC 201.1	3	-	-	-	-	-	-	-	-	-	-	-
EC 201.2	2	3	-	-	-	-	-	-	-	-	-	1
EC 201.3	1	3	-	-	-	-	-	-	-	-	-	-
EC 201.4	1	2	3	-	-	-	-	-	-	-	-	1
EC 201.5	3	1	-	-	-	-	-	-	-	-	-	-

Computer Fundamentals & Principle of Computer Programming
Code: CS 201
Total No. of Lectures: 40
Credits: 4

Prerequisites:

1. Number system
2. Boolean Algebra

Course Objective(s)

1. To develop the programming skills of students
2. To know the principles of designing structured programs
3. To write basic C programs using
   - i) Selection statements
   - ii) Repetitive statements
   - iii) Functions
   - iv) Pointers
   - v) Arrays
   - vi) Strings

Course Outcome:

CS201.1 Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming.
CS201.2 Write, Compile and Debug programs in C language and use different data types for writing the programs.
CS201.3 Design programs connecting decision structures, loops and functions.
CS201.4 Explain the difference between call by value and call by address.
CS201.5 Understand the dynamic behavior of memory by the use of pointers.

Use different data structures and create / manipulate basic data files and developing applications for real world problems.

Course content

Fundamentals of Computer: (10 L)

History of Computer, Generation of Computer, Classification of Computers 1L

Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices 2L

Binary and Allied number systems representation of signed & unsigned numbers, BCD, ASCII, Binary number Arithmetic – Addition and Subtraction (using 1's complement and 2's complement) 2L

Logic gates – AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR - only truth tables, logic gate symbols and logic equations for gates only

1L

Assembly language, high level language, machine level language, compiler and assembler (basic concepts) 1L

Basic concepts of operating systems like MS DOS, MS WINDOW, UNIX

1L

Problem solving-Algorithm & flow chart

2L

C Fundamentals: (30 L)

Variable and Data Types:
The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements 3L

C Operators & Expressions:
Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators - type conversion, C expressions, precedence and associativity.
Input and Output: Standard input and output, formatted output - printf, formatted input scanf, bit fields 5L

Branching and Loop Statements:
Statement and blocks, if - else, switch, goto and labels, Loops - while, for, do while, break and continue 3L

Fundamentals and Program Structures:
auto, external, static and register variables
Functions, function types, function prototypes, functions returning values, functions not returning values, scope rules, recursion, C preprocessor and macro

6L

Arrays, Strings and Pointers:
One dimensional arrays, Two-dimensional arrays, Multidimensional arrays. Passing an array to a function
Character array and string, array of strings, Passing a string to a function, String related functions

Pointers, Pointer and Array, Pointer and String, Pointer and functions, Dynamic memory allocation 6L

Files handling with C:
formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function 4L

Structures and Unions:
Basic of structures, arrays of structures, structures and pointers, structures and functions 3L

Text book:
Kerninghan B.W. & Ritchie D.M. - The C Programming Language

Gottfried - Programming with C Schaum

Kanetkar Y. - Let us C

Balaguruswamy - Programming in C

Recommended reference Books:

Pohl and Kelly - A Book on C

Kerninghan, B.W. - The Elements of Programming Style

Schied F.S. Theory and Problems of Computers and Programming

Rajaraman V. Fundamental of Computers

M.M.Oka Computer Fundamentals,EPH

Leon Introduction to Computers,Vikas

Leon- Fundamental of Information Technology,Vikas

Ram B. Computer Fundamentals, New Age International

Ravichandran D. Programming in C, New Age International

Xavier C. Introduction to Computers, New Age International

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO	PO9	PO10	PO11	PO12
CS201.1	3	3										
CS201.2		2										
CS201.3	3	3										
CS201.4												
CS201.5	3		3	3	3							

Paper Name: Engineering Thermodynamics & Fluid Mechanics
Paper Code: ME 201
Total Contact Hours: 48
Credits: 4

Pre requisites: Higher Secondary with Physics, Chemistry & Mathematics.

Course Objective:

1. To understand the basic principles of thermodynamics, heat and work transfer.
2. To acquire the knowledge of basic concepts of Heat Engine, Entropy from Second law of thermodynamics.
3. To get the knowledge of thermodynamic properties of a pure substance and inter-relationships between key properties of a system or state possessed by the substance.
4. To understand the basic principles of fluid mechanics, and ability to analyze fluid flow problems with the application of the momentum and energy equations.

Course Outcome:
Upon successful completion of this course, the student will be able to:

ME 201.1 Know about thermodynamic equilibrium, heat & work transfer, First law and its application.
ME 201.2 Understand the basic concepts of Heat Engine, Entropy from Second law of thermodynamics.
ME 201.3 Know the thermodynamic characteristics of a pure substance and its application in power cycles (Simple Rankine cycles, Air Standard cycles)
ME 201.4 Knowledge of basic principles of fluid mechanics, and ability to analyze fluid flow problems with the application of the momentum and energy equations

Course content

Module 1:
8L+3T

Basic Concepts of Thermodynamics

Introduction: Microscopic and Macroscopic viewpoints
Definition of Thermodynamic systems: closed, open and isolated systems Concept of Thermodynamics state; state postulate.
Definition of properties: intensive, extensive & specific properties. Thermodynamic equilibrium
Thermodynamic processes; quasi-static, reversible & irreversible processes; Thermodynamic cycles. Zeroth law of thermodynamics. Concept of empirical temperature.

Heat and Work

Definition & units of thermodynamic work.
Examples of different forms of thermodynamic works; example of electricity flow as work.
Work done during expansion of a compressible simple system
Definition of Heat; unit of Heat
Similarities & Dissimilarities between Heat & Work

Ideal Equation of State, processes; Real Gas

Definition of Ideal Gas; Ideal Gas Equations of State.
Thermodynamic Processes for Ideal Gas; P-V plots; work done, heat transferred for isothermal, isobaric, isochoric, isentropic & polytropic processes.
Equations of State of Real Gases: Van der Waal's equation; Virial equation of state.

Properties of Pure Substances

p-v, T-s & h-s diagrams of pure substance like H_2O
Introduction to steam table with respect to steam generation process; definition of saturation, wet & superheated status.
Definition of dryness fraction of steam, degree of superheat of steam.

Module 2:
4L+3T

1st Law of Thermodynamics

Definition of Stored Energy & Internal Energy 1st Law of Thermodynamics for cyclic processes Non Flow Energy Equation.
Flow Energy & Definition of Enthalpy.
Conditions for Steady State Steady flow: Steady State Steady Flow Energy Equation.

Module 3:
6L+3T

2nd Law of Thermodynamics

Definition of Sink, Source Reservoir of Heat.
Heat Engine, heat Pump & Refrigerator; Thermal efficiency of Heat Engines & co-efficient of performance of Refrigerators
Kelvin – Planck & Clausius statements of 2nd Law of Thermodynamics Absolute or Thermodynamic scale of temperature, Clausius Integral Entropy
Entropy change calculation for ideal gas processes. Carnot Cycle & Carnot efficiency
PMM-2; definition & its impossibility

Module 4:
6L+3T

Air standard Cycles for IC engines

Otto cycle; plot on P-V, T-S planes; Thermal efficiency Diesel cycle; plot on P-V, T-S planes; Thermal efficiency

Rankine cycle of steam

Chart of steam (Mollier's Chart)
Simple Rankine cycle plot on P-V, T-S, h-s planes Rankine cycle efficiency with & without pump work (Problems are to solved for each module)

Module 5:
9L+3T

Properties & Classification of Fluids

Ideal & Real fluids
Newton's law of viscosity; Newtonian and Non-Newtonian fluids
Compressible and Incompressible fluids

Fluid Statics

Pressure at a point

Measurement of Fluid Pressure

Manometers: simple & differential U-tube
Inclined tube

Fluid Kinematics

Stream line
Laminar & turbulent flow
external & internal flow
Continuity equation

Dynamics of ideal fluids

Bernoulli's equation
Total head; Velocity head; Pressure head Application of Bernoulli's equation

Measurement of Flow rate: Basic principles

Venturimeter, Pilot tube, Orificemeter

(Problems are to be solved for each module)

Engineering Thermodynamics

Text:

1 Engineering Thermodynamics - P K Nag, 4th edn, TMH.

References:

1 "Fundamentals of Thermodynamics" 6e by Sonntag & Van Wylin published by Wiley India.

2 Engineering Thermodynamics – Russel & Adeliyi (Indian edition), OUP

3 Engineering Thermodynamics – Onkar Singhh, New Age International Publishers Ltd.

4 Basic Engineering Thermodynamics – R Joel, 5th Ed., Pearson

Fluid Mechanics

Text:

1 Fluid Mechanics and Hydraulic Machines - R Bansal

References:

1 Introduction to Fluid Mechanics and Fluid Machines - S.K.Som and G.Biswas. 2nd edn, TMH

2 Fluid Mechanics by A.K.Jain.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME201.1	3	3	2	2	-	1	1	1	1	-	1	2
ME201.2	3	3	2	2	-	1	2	-	1	-	1	2
ME201.3	2	2	1	1	-	2	1	-	-	-	-	1
ME201.4	3	3	2	2	-	1	1	-	-	-	1	1

Practical

Paper Name: Computer Fundamentals & Principle of Computer Programming Lab
Paper Code: CS291
Total Contact Hours: 36
Credit: 2

Prerequisites:
3. Basic Computer Knowledge

Course Objective(s):
1. To develop an understanding of the design, implementation, and compilation of a C program
2. To gain the knowledge about pointers, a fundamental for understanding data structure issues
3. To understand the usage of user defined data type for application development

Course Outcome:

CS291.1. Understanding the working of different operating systems like DOS, Windows, Linux.

CS291.2. Write, Compile and Debug programs in C language.

CS291.3. Design programs connecting decision structures, loops.

CS291.4. Exercise user defined functions to solve real time problems.

CS291.5. Inscribe C programs using Pointers to access arrays, strings, functions, structures and files.

Experiment should include but not limited to the following:

- Some basic commands of DOS, Windows and Linux Operating System, File handling and Directory structures, file permissions, creating and editing simple C program, compilation and execution of C program.
- Writing C Programs on variable, expression, operator and type-casting.
- Writing C Programs using different structures of if-else statement and switch-case statement.
- Writing C Programs demonstrating use of loop (for loop, while loop and do-while loop) concept and use of break and continue statement.
- Writing C Programs demonstrating concept of Single & Multidimensional arrays.
- Writing C Programs demonstrating concept of Function and Recursion.
- Writing C Programs demonstrating concept of Pointers, address of operator, declaring pointers and operations on pointers.
- Writing C Programs demonstrating concept of structures, union and pointer to structure.
- Writing C Programs demonstrating concept of String and command line arguments.
- Writing C Programs demonstrating concept of dynamic memory allocation.
- Writing C Programs demonstrating concept of File Programming.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO	PO9	PO10	PO11	PO12
CS291.1	3	3										
CS291.2		2										
CS291.3	3	3										
CS291.4												
CS291.5	3		3	3	3							

FOR GROUP B: ME, CE, IT, CSE, FT

Paper Name: Chemistry Lab
Paper Code: CH 291
Total Contact Hours: 36
Credit: 2

Pre requisites: 10+2 science with chemistry

Course Objective
Acquiring knowledge on Standard solutions and the various reactions in homogeneous and heterogenous medium. Understanding the basic principles of pH meter and conductivity meter for different applications and analyzing water for its various parameters. Synthesis of Polymeric materials and Nanomaterials.

Course Outcome

CH291.1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CH291.2: Able to work as an individual also as an team member
CH291.3: Able to analyse different parameters of water considering environmental issues
CH291.4: Able to synthesize nano and polymer materials.
CH291.5: Capable to design innovative experiments applying the fundamentals of chemistry

Course contents

List of Experiments:

1. To Determine the alkalinity in given water sample.
2. Redox titration (estimation of iron using permanganometry)
3. To determine calcium and magnesium hardness of a given water sample separately.
4. Preparation of phenol-formaldehyde resin (Bakelite).
5. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water).
7. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
8. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
9. Determination of dissolved oxygen present in a given water sample.
10. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution).

Innovative experiment:
Preparation of silver nano-particles.

Note: From the list of 10 (Ten) experiments a minimum of 7 (seven) experiments shall have to be performed by one student of which Sl. No. 4 (Preparation of Bakelite) has to be mandatory.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CH 291.1	3	2	1	1	1	1	-	-	2	-	-	-
CH 291.2	-	-	-	-	-	-	-	-	3	-	-	-
CH 291.3	-	-	-	-	-	2	3	-	-	-	-	1
CH 291.4	-	-	-	-	2	1	-	-	-	-	-	-
CH 291.5	2	-	2	-	1	-	-	-	-	-	-	1

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Physics I Lab
Paper Code: PH 291
Total Contact Hours: 40
Credit: 4

Pre requisites: Knowledge of Physics upto 12^{th} standard.

Course Outcome of Physics-I practical (PH 191)

At the end of the course students' should have the

PH 291.1 : Ability to define, understand and explain ✓ **Error estimation, Proportional error calculation** ✓ **superposition principle in Newton's ring, Fresnel's biprism, laser diffraction** ✓ **Basic circuit analysis in LCR circuits**	PO1
PH 291.2 : Ability to conduct experiments using ➢ **LASER, Optical fibre** ➢ **Interference by division of wave front, division of amplitude, diffraction grating, polarization of light** ➢ **Quantization of electronic energy inside an atom** ➢ **Torsional pendulum**	PO4
PH 291.3 : Ability to participate as an individual, and as a member or leader in groups in laboratory sessions actively	PO9

PH 291.4 : Ability to analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments	PO10

General idea about Measurements and Errors (One Mandatory):
i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
ii) Proportional error calculation using Carrey Foster Bridge.

Any 7 to be performed from the following experiments

Experiments on Oscillations & Elasticity:
1. Study of Torsional oscillation of Torsional pendulum & determination of time period using various load of the oscillator.
2. Experiments on Lissajous figure (using CRO).
3. Experiments on LCR circuit.
4. Determination of elastic modulii of different materials (Young's modulus and Rigidity modulus)

Experiments on Optics:
5. Determination of wavelength of light by Newton's ring method.
6. Determination of wavelength of light by Laser diffraction method.
7. Determination of numerical aperture and the energy losses related to optical fiber experiment
8. Measurement of specific rotation of an optically active solution by polarimeter.

Experiments on Quantum Physics:
11. Determination of Planck's constant using photoelectric cell.
12. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.

In addition it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Determination of wavelength of light by Fresnel's bi-prism method (beyond the syllabus).
2. Study of half-wave, quarter-wave plate (beyond the syllabus)
3. Study of dispersive power of material of a prism.
4. Study of viscosity using Poyseullie's caplillary flow method/using Stoke's law.
5. Measurement of nodal and antinodal points along transmission wire and measurement of wave length.
6. Any other experiment related to the theory**.**

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH 291.1	**2**											
PH 291.2	**1**											
PH 291.3				**2**								
PH 291.4									**3**			

FOR GROUP B: ME, CE, IT, CSE, FT

Paper Name: Basic Electrical Engineering LAB
Paper Code: EE 291
Total Contact Hours: 36
Credit: 2

Pre requisites:

4. Basic Physics and applied physics.
5. Basic Mathematics.
6. Basic concept of Electric Circuit

Course Objective:

3. Provide knowledge for the analysis of basic electrical circuit.
4. To introduce electrical appliances, machines with their respective characteristics.

Course Outcome:

COs	CO Statement
EE 291.1	Identify common electrical components and their ratings.
EE 291.2	Make Circuit connection by wires of appropriate ratings.
EE 291.3	Understand the usage of common electrical measuring instruments
EE 291.4	Understand the basic characteristics of transformers and electrical machines

Course contents

LIST OF EXPERIMENTS

11. Characteristics of Fluorescent ,Tungsten and Carbon filament lamps
12. Verification of Thevenin's and Norton's Theorem
13. Verification of Superposition Theorem
14. Calibration of Ammeter and Wattmeter
15. Study of R-L-C series circuit
16. Open circuit and short circuit test of a single phase Transformer
17. Starting, Reversing of a and speed control of D.C shunt motor

18. Test on single phase Energy Meter
19. Familiarization of PMMC and MI type Meter
20. Familiarization with house wiring practice

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE 291.1	2	3		1	3				1		2	1
EE 291.2	2		2	1	3				1	1		
EE 291.3		3				3	2				2	1
EE 291.4	3						1			2	2	2

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Basic Electronics Engineering Lab
Paper Code: EC291
Total Contact Hours: 36
Credit: 2

Prerequisites
A basic course in electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohm's law, Ampere's law

Course objectives:
Students will become familiar with the circuit design using semiconductor diodes in Forward and Reverse bias, They will also be able to design rectifiers like half-wave, full-wave rectifiers etc. using diodes. The ability of circuit design with Bipolar Junction Transistor in CB, CE & CC configurations will be improved. The students will acquire the basic engineering technique and ability to design and analyze the circuits of Op-Amp. Basic concepts and Circuit design with logic gates will be developed in the students. The students will be able design circuit using FET .

Course Outcomes:

EC291.1	Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.
EC291.2	Analyze the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of Rectifier Circuits.

EC291.3	Determination of input-offset voltage, input bias current and Slew rate, Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
EC291.4	Able to know the application of Diode, BJT &OPAMP.
EC291.5	Familiarization and basic knowledge of Integrated Circuits

Course contents:

List of Experiments:

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimeters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.
7. Study of I-V characteristics of Field Effect Transistors.
8. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
9. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
10. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.
11. Study of Logic Gates and realization of Boolean functions using Logic Gates.
12. Study of Characteristic curves for CB, CE and CC mode transistors.
13. Innovative Experiment

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
EC 291.1	3	3	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
EC 291.2	2	3	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	1
EC 291.3	1	3	3	**-**	**-**	**-**	**-**	**-**	**-**	2	**-**	**-**
EC 291.4	1	2	3	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	1
EC 291.5	3	1	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

FOR GROUP B: ME, CE, IT, CSE, FT

Paper Name: Engineering Drawing & Graphics
Paper Code: ME 291
Total Contact Hours: 36
Credit: 2

Pre requisites: Higher Secondary with Physics, Chemistry & Mathematics

Course Objective:

To learn basics of drafting and use of drafting tools.
To know about engineering scales, dimensioning and various geometric curves.
To Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.
To acquire the knowledge of Computer Aided drafting using design software.

Course Outcomes: Upon successful completion of this course, the student will be able to:

ME 291.1. Learn basics of drafting and use of drafting tools which develops the fundamental skills of industrial drawings.

ME 291.2. Know about engineering scales, dimensioning and various geometric curves necessary to understand design of machine elements.

ME 291.3. Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.

ME 291.4. Become familiar with computer aided drafting useful to share the design model to different section of industries as well as for research & development.

Course contents:

List of Experiments:

1. Lines, Lettering, Dimensioning, Scales (Plain scale & diagonal Scale).

2. Geometrical Construction and Curves – Construction of Polygons, Parabola, Hyperbola & ellipse

3. Projection of Points, Lines and Surfaces – orthographic projection- first angle and third angle projection, projection of lines and surfaces- Hexagon

4. Projection of Solids – (Cube, Pyramid, Prism, cylinder and Cone

5. Sectional Views – for simple sold objects

6. Introduction to Computer Aided Drafting – using auto cad & / or similar software- Introduction to Cartesian and polar coordinate systems, absolute and relative coordinates; Basic editing commands: line, point, trace, rectangle, polygon , circle, arc, ellipse, polyline; editing methods; basic object selection methods – window and crossing window, erase, move, copy, offset, fillet, chamfer, trim, extend, mirror; display command; zoom, pan, redraw, regenerate; simple dimensioning and text, simple exercises.

CO Codes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
ME 291.1	2	-	1	2	-	1	-	-	1	-	-	1
ME 291.2	3	-	2	2	-	1	-	-	1	1	-	1
ME 291.3	2	2	2	1	-	1	-	-	1	-	-	1
ME 291.4	1	-	2	2	2	1	-	-	1	1	-	1

FOR GROUP A: EE, ECE, EIE/AEIE, BME

Paper Name: Workshop Practice
Paper Code: ME 292
Total Contact Hours: 36
Credit: 2

Pre requisites: Higher Secondary with Physics, Chemistry & Mathematics

Course Objective:

1. To understand the basic knowledge of Workshop Practice and Safety.
2. To identify and use of different hand tools and other instruments like Hand Saw, Jack Plane, Chisels etc and operations like such as Marking, Cutting etc used in manufacturing processes.
3. To get hands on practice in various machining metal joining processes such as Welding, Brazing, Soldering, etc.

Course Outcome:

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

ME 291.1 Gain basic knowledge of Workshop Practice and Safety useful for our daily living.

ME 291.2 Identify Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc and performing operations like such as Marking, Cutting etc used in manufacturing processes.

ME 291.3 Gain knowledge of the various operations in the Fitting Shop using Hack Saw, various files, Scriber, etc to understand the concept of tolerances applicable in all kind of manufacturing.

ME 291.4 Get hands on practice of in Welding and various machining processes which give a lot of confidence to manufacture physical prototypes in project works.

Course contents

List of Activities:

Sl. No.	Syllabus	Contact Hrs
Module 1	Pattern Making	6
Module 2	Sheet Metal Work	6
Module 3	Fitting	9
Module 4	Machining in Lathe	9
Module 5	Welding	6

MODULE 1 – PATTERN MAKING.

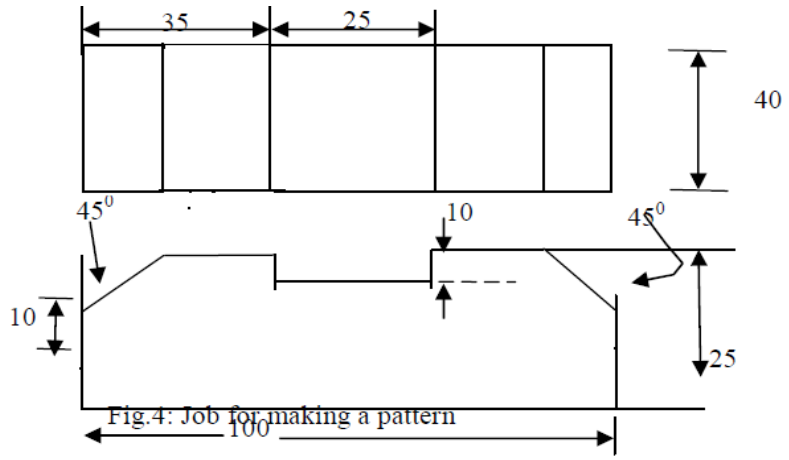
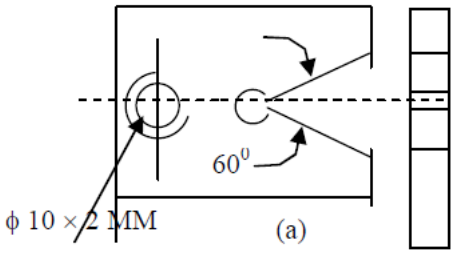
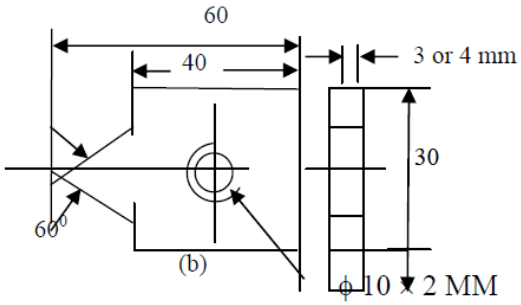


Fig.4: Job for making a pattern

MODULE 3- FITTING SHOP.





OR

MODULE 4 – MACHINING IN LATHE & SHAPING M/C

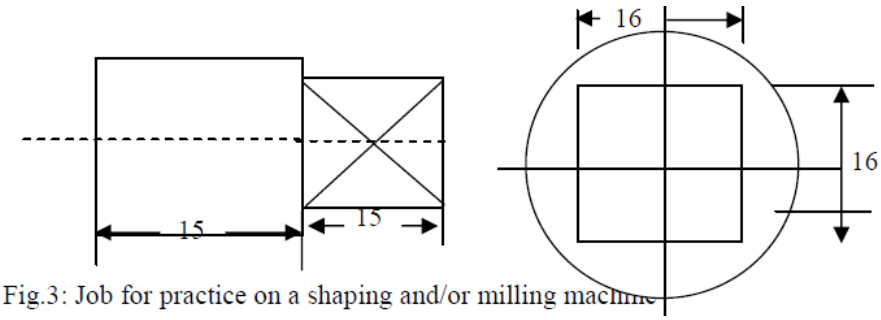
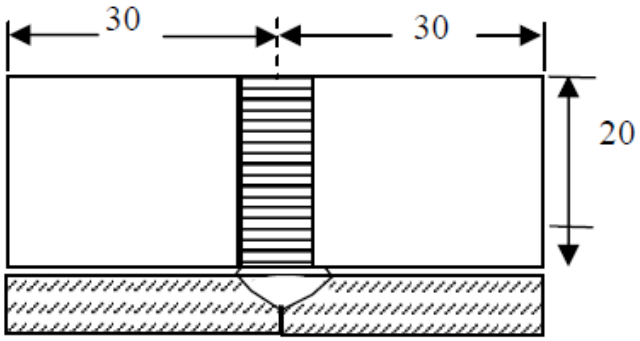


Fig.3: Job for practice on a shaping and/or milling machine

MODULE 5 – WELDING



CO-PO Mapping:

CO Codes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME 292.1	2	-	-	-	-	2	-	1	-	-	1	-
ME 292.2	2	-	-	-	-	1	-	2	-	-	-	-
ME 292.3	2	-	-	-	-	1	-	1	-	-	-	-
ME 292.4	1	-	-	-	1	3	-	3	-	-	-	1

SESSIONAL

Paper Name: Soft Skills Development
Paper Code: MC-281
Total Contact hours: 26

Course Objectives:

The objectives of this course are as follows:

- To expose the students to different aspects of corporate life and workplace behavior
- To introduce workplace behavioral norms, etiquettes and standards
- To equip students to face interviews, presentations and other professional interactions

MODULE	CONTENT
One	Communication Training
Two	Communication Training (Accent Neutralization)
Three	Business Etiquette
Four	CV / Resume Writing

Five	Corporate Life and Protocols
Six	Group Discussion
Seven	Leadership Skill
Eight	Team Work
Nine	Public Speaking and Interview Basics
Ten	Business Telephone Etiquette
Eleven	Reading skill

Rearrange ?

MODULE ONE – COMMUNICATION TRAINING (2L)

1. Organisational Communication and Structure.
2. Vocabulary related to Corporate Operation.
3. Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relation etc.
4. Communication with Clients, Customers, Suppliers etc.
5. Verbal and Non-Verbal Communication, Proxemics and Para Language.
6. Vocabulary Building (Synonym / Antonym / One word Substitution etc.)

MODULE TWO- COMMUNICATION TRAINING (ACCENT NEUTRALISATION) (2L)

7. Mother Tongue Influence
8. Vowel Sounds and Consonantal Sounds
9. Pronunciation and Neutral Accent.
10. Intonation.
11. Rate of Speech, Pausing, Pitch Variation and Tone.

MODULE THREE – BUSINESS ETIQUETTE (2L)

12. Presenting oneself in the Business Environment.
13. Corporate Dressing and Mannerism.

14. Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.)
15. Multi Cultural Etiquette.
16. Cultural Difference.
17. E-mail Etiquette.

MODULE FOUR – JOB APPLICATION AND CV / VIDEO RESUME (2L)

18. Format (Chronological, Skill Oriented, Functional etc.)
19. Style and Appearance.
20. Writing Tips and Video Content Presentation tips.
21. Types of Cover Letter or Job Application Letter.

MODULE FIVE - INTRODUCTION TO CORPORATE LIFE AND PROTOCOLS (2L)

22. Introduction of Companies (Domain Specific)
23. Opportunities and Growth Plan.
24. Performance and Corporate Behaviour.
25. Service Level Agreement and Corporate Jargon.
26. Networking and Adapting to Culture, Technology and Environment.

MODULE SIX – GROUP DISCUSSION (2L)

27. Introduction, Definition and Purpose.
28. Types of Group Discussion.
29. Strategies and Protocols of Group Discussion.
30. Skills and Parameters of Evaluation.
31. Practice Session and Video Viewing Task.

MODULE SEVEN – LEADERSHIP SKILL (2L)

32. Leadership Theories.
33. Traits and Skills of the Leader.
34. Roles, Duties and Responsibilities.
35. Case Study of Leaders.
36. Interpersonal relationship with Team.

MODULE EIGHT – TEAM WORK (2L)

37. Concept of Team Culture.
38. Stages of Team Development (Forming, Storming, Norming, Performing, Adjourning)
39. Team Working Agreement (Participation, Decision Making, Problem Solving.
40. Conflict Management, Flexibility, Negotiation Skill.
41. Team Building (Assess, Plan, Execute and Evaluate)

MODULE NINE – PUBLIC SPEAKING AND INTERVIEW BASICS (2L)

42. Extempore.
43. JAM.
44. Interview Skill
45. Interview over Telephone, Video Conference Interview etc.

MODULE TEN – BUSINESS TELEPHONE ETIQUETTE (2L)

46. Five Phases of a Business Call.
47. Pitch, inflection, Courtesy and Tone.
48. Understanding, Rate of Speech, Enunciation.
49. Hold Procedure.
50. Cold and Hot Transfer protocols.
51. Dealing with Different Types of Customers (Irate, Talkative, Turnaround etc.)

MODULE ELEVEN- READING SKILL

52. Vocabulary from context, speed reading, skimming, inferring, comprehension test etc.

ASSESSMENT		
1.	**Viva**	**10**
2.	**Personal Skill Enhancement Log**	**25**
3.	**Movie Making: Video Resume**	**25**
4.	**Term End Project**	**40**

LIST OF REFERENCE:

1. Effective Communication and Soft-Skills: Strategies for Success, Nitin Bhatnagar and Mamta Bhatnagar, Pearson, 2012.

2. Soft Skills: Know yourself and know the World, Dr. K.Alex, S Chand, 2009.

3. Soft Skills at Work: Technology for Career Success, Beverly Amer, Course Technology, 2009.

4. The Pronunciation of English, Daniel Jones, Cambridge University Press, 1998.

5. Global Business Etiquette: A Guide to International Communication and Customs, Jeanette S. Martin and Lillian H. Chaney, Praeger, 2012.

6. The CV Book: Your Definitive Guide to Writing the Perfect CV, James Innes, Pearson.

7. Understanding American Business Jargon: A Dictionary, W. Davis Folsom, Greenwood Press, 2005.

8. Navigating Corporate Life, Stanley Tyo.

9. Group Discussion: A Practical Guide to Participation and Leadership, Kathryn Sue Young, Julia T. Wood, Gerald M. Phillips and Douglas J. Pedersen, Waveland Press Inc., 2007.

10. The Leadership Skills Handbook, Jo Owen, KoganPage, 2006.

11. Teamwork Training, Sharon Boller, ASTD Press, 2005.

12. Public Speaking for Success, Dale Carnegie, Penguin, 2005.

13. Effective Interviewing Skills, Tracey A. Swift and Ivan T. Robertson, BPS Books, 2000.

14. Telephone Etiquette: Making Lasting First Impressions, Theo Gilbert-Jamison, Performance Solutions, 2013.

15. Reading Comprehension Strategies: Theories, Interventions and Technologies,

Danielle S. McNamara, Lawrence Earlbaum Associates, 2007.

16. www.mindtools.com.

2nd YEAR 3rd SEMESTER

Curriculum:

A.THEORY:

	Field	Code	Subjects	Contacts (Periods/				Credit points
				L	T	P	Total	
1	HS	CH(FT) 301	Environmental Engineering	2	1	0	3	3
2	BS	CH(FT) 302	Chemistry-2	2	2	0	4	3
3	ES	FT 301	Thermodynamics & Kinetics	2	2	0	4	3
4	PC	FT 302	Food Microbiology	2	2	0	4	3
5	PC	FT303	Chemistry of food	2	2	0	4	3
Total Theory							19	15

B.PRACTICAL:

	Field	Code	Subjects	Contacts (Periods/ week)				Credit points
				L	T	P	Total	
1	HS	CH	Environmental Engineering	0	0	3	3	2
2	BS	CH(FT)39	Chemistry-2 Lab	0	0	3	3	2
3	PC	FT391	Chemistry of Food Lab – I	0	0	3	3	2
4	PC	FT392	Food Microbiology Lab	0	0	3	3	2
C.SESSIONAL								
5	MC	MC381	Technical Skill Development	0	0	2	2	0
Total Practical and Sessional							14	8
Total 3rd Semester							33	23

THEORY

Paper Name: Basic Environmental Engineering

Paper Code: CHFT301

Contact: L-T-P=2-1-0

Credit: 3

Pre requisites: 10+2 science with chemistry

Course Objective

Understanding of the fundamentals of environment and its relation with human activities. Learning the environmental laws and regulations to develop guidelines for health and safety issues. Acquiring skills to solve problems related to air, water noise and land pollutions.

Course Outcome

CHFT301.1: Able to understand the natural environment and its relationships with human activities
CHFT301.2: Able to apply the fundamental knowledge of science and engineering to assess environmental and health risk
CHFT301.3: Able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
CHFT301.4: Able to acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Course Contents:

Module I (5L): Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development.

Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function.

Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.

Module II (4L): Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function.

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.

Biogeochemical Cycle: definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur].

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.

Module III (10L): Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause.

Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.

Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.

Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation Inversion).

Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.

Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant.

Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN.

Smog, Photochemical smog and London smog.

Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification.

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).

Module IV (8L): Hydrosphere, Hydrological cycle and Natural water.

Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds.

River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH.Lake: Eutrophication [Definition, source and effect].

Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)

Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition.

Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic.

Module V (5L): Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes, Recovery and disposal method: Open dumping, Land filling, incineration, composting, recycling.

Solid waste management and control (hazardous and biomedical waste).

Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]. Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, $L10$ (18hr Index), $n\ Ld$. Noise pollution control.

Revision: 4L

Text /Reference books:

1. Basic Environmental Engg. and Elementary Biology, Gourkrishna Mahapatra

2. Basic Environmental Engg. and Elementary Biology, Patra and Singha

3. Basic Course in Environmental Studies, Deswal and Deswal

CO-PO matrices of courses CHFT301

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CHFT301.1	3	2	3	-	-	-	3	-	-	-	1	2
CHFT301.2	-	-	1	-	-	-	-	-	-	-	-	-
CHFT301.3	2	-	2	-	1	-	**2**	-	-	-	-	-
CHFT301.4	-	-	2	-	-	**2**	**2**	-	-	-	-	-

Paper Name: Chemistry-2

Paper Code: CHFT302

Contact : L-T-P=2-2-0

Credit: 2

Pre requisites: 10+2 science with chemistry

Course Objective

Understanding of the fundamental theories and applications of the concepts of Dilute solutions , Colligative properties and Ionic Equilibrium and to get an insight into Instrumental Methods of Spectral Analysis. Learning about the Structure reactivity of the Organic molecules, Co-ordination chemistry and Colloid Chemistry.

Course Outcome

CHFT302.1: Able to understand fundamental concepts of Dilute solutions , Colligative properties and Ionic Equilibrium in different engineering applications.
CHFT302.2: Able to analyze the Structures of the molecules by the different spectral techniques.
CHFT302.3: Able to synthesize Colloid Systems and emulsions.
CHFT302.4: Able to apply the basic concept of Organic Chemistry and knowledge of chemical reactions to industries , and technical fields.
CHFT302.5: Able to analyze different types of co-ordination compounds and their structures with the help of Crystal Field Theory**.**

Course Contents:

Module I (9L): Dilute solutions – Colligative properties

Lowering of vapor pressure of solution, elevation of boiling point, freezing point depression, definition, principles, and laws of osmotic pressure.

Ionic equilibrium: Solubility and solubility product, common ion effect, ionic product of water, pH, pOH, hydrolysis of salt solutions: Strong acid and weak base, weak acid and strong base, weak acid and weak base, concepts of buffer. Hydrolysis of salt.

Module II (8L): Instrumental methods of spectral analyses

UV Spectra: Electronic transition (σ-σ*, n-σ*, π-π* and n-π*), steric effect, solvent effect, hyperchromic effect, hypochromic effect (typical examples).

IR Spectra: Modes of molecular vibrations, characteristic stretching frequencies of O-H, C-H, C=C, C=O functions.

NMR Spectra: Nuclear spin, NMR active nuclei, principle of proton magnetic resonance, equivalent and nonequivalent protons.

Photochemistry: Lambert's law and Beer's Law, Laws of photochemistry, Photochemical processes.

Module III (7L):

Coordination Chemistry

Double salt, Complex salt, Werner's Theory, Structures of coordination compounds corresponding to coordination number 6; types of ligands; Elementary idea about Crystal Field Theory (CFT), isomerism (geometrical, optical, ionization, linkage and coordination).

Colloid Chemistry

Definition of colloid, principle of colloid formation, types of colloid, colloid preparation, stability of colloid, association of colloid and emulsion.

Module IV (8L):

Basic concept of organic molecules, tetra covalency of carbon, hybridization, electronic effects.

Reactive intermediates: carbocations (cabenium and carbonium ions), carbanions, carbon radicals, carbenes: structure using orbital picture, electrophilic/nucleophilic behaviour, stability, generation and fate.

Nucleophilic substitution reactions: S_N1, S_N2, S_Ni mechanisms.

Addition reaction.

Elimination Reactions: E1, E2, and E1cB mechanisms. Saytzeff and Hofmann rules. Elimination vs substitution reaction. Electrophilic and Activated Nucleophilic substitution reactions of Benzene (Nitration, sulphonation, Halogenation and Friedel Craft reactions).

Chemistry and mechanism of some selective organic name reactions: Aldol condensation, Cannizaro reaction, Reimer-Teiman reaction, Pinacol-pinacolone rearrangement, Keto-enol tautomerism, Benzoin condensation

Revision: 4L

Text /Reference books:

1. Physical Chemistry, P.C. Rakshit

2. Inorganic Chemistry, R.L. Dutta

3. Concept of Inorganic Chemistry, J.D.Lee

4. Organic Spectroscopy, W. Kemp

5. A Guide book to Mechanism in Organic Chemistry, P. Sykes

CO-PO matrices of courses CH FT302

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CHFT302.1	3	1	-	-	-	-	-	-	-	-	-	-
CHFT302.1	3	2	1	-	-	-	-	-	-	-	-	-
CHFT302.1	-	-	2	-	2	-	-	-	-	-	-	1
CHFT302.4	2	-	1	-	2	-	-	-	-	-	-	-
CHFT302.5	2	-	-	-	-	-	2	-	-	-	-	1

Paper name: Thermodynamics & Kinetics

Paper Code: FT301

Contact: L-T-P: 2-2-0

Credit: 3

Pre requisites: Physics, Chemistry and Mathematics

Course Objective

To introduce the principles of chemical engineering thermodynamics and illustrate their applications in the design of chemical process plants and to learn about reaction kinetics for single, multiple, isothermal, non-isothermal reactions

Course Outcome(s)

FT301.1 Ability to understand the terminology associated with engineering thermodynamics and have knowledge of contemporary issues related to chemical engineering thermodynamics

FT301.2 Ability to have the knowledge of phase equilibria in two-component and multi-component systems

FT301.3 Ability to estimate thermodynamic properties of substances in gas or liquid state of ideal and real mixture

FT301.4 Ability to anticipate intermolecular potential and excess property behavior of multi-component systems

FT301.5 Ability to review concepts of order and molecularity of chemical reactions.

Course Contents:

Module I (8L): Review of 1^{st}, 2^{nd} and 3^{rd} law of thermodynamics, PVT behaviour of Pure Substances, Virial Equation of State, , Application of the Virial Equations, Cubic Equations of State, Generalized Correlations for Gases and Liquids. The Nature of Equilibrium, the Phase Rule, Duhem's Theorem

Module II (8L): Simple model's for vapour/liquid Equilibrium, Roult's Law, Henry's law, Modified Raoult's Law, Vapour Liquid Equilibrium, K-value correlations; VLE from Cubic Equations of State; Equilibrium and Stability; Liquid/liquid equilibrium; Solid/liquid equilibrium, Solid/vapour equilibrium.

Module III (8L): Thermodynamics and its Applications: The Chemical Potential and Phase Equilibria Fugacity and Fugacity, Coefficient: for pure species and solution; Generalised correlations for Fugacity, the Ideal Solution, Property Changes and Heat Effects of Mixing Processes. The Vapour-Compression Cycle, the Choice of Refrigerant, Absorption, Refrigeration and liquefaction: Low temperature cycle: Linde and Claude.

Module IV (8L): Kinetics: Rate of chemical reaction; Effect of Temperature on Rate Constant, Arrehnius equation, Collision Theory, Transition State Theory, Order and Molecularity of a

Chemical reaction,Elementary Reactions, First, Second and Third order reactions, Non Elementary Reactions, Pseudo-first order reaction, Determination of rate constant and order of reaction, Half life method, Fractional order reactions.

Revision: 4L

Text /Reference books:

1. Smith & Vanness, Thermodynamics for Chemical Engineers, MGH

2. Richardson, J.F., Peacock, D.G.Coulson & Richardson's Chemical Engineering- Volume 3

ed., First Indian ed. Asian Books Pvt. Ltd. 1998

3. Levenspiel.O., Chemical Reaction Engineering, Wiley Eastern Ltd.

4. Bailey & Olis,Biochemical Engg. Fudamentals, MGH, 1990

5. Physical Chemistry: Castellan, Narosa Publishing.

6. Physical Chemistry ;Moore, PHI

CO-PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT301. 1	3	3	2	-	-	-	-	-	2	-	-	3
FT301. 2	3	3	2	-	-	-	-	-	2	-	-	3
FT301. 3	3	3	2	-	-	-	-	-	2	-	-	3
FT301. 4	3	3	-	-	-	-	-	-	2	-	-	3
FT301. 5	3	2	2	-	-	-	-	-	1	-	-	3
Overall CO (FT301) mapping	3	2.8	2	-	-	-	-	-	1.8	-	-	3

Paper name: Food Microbiology

Paper Code: FT302

Contact: L-T-P=2-2-0

Credit: 3

Pre requisites: Biology, Chemistry

Course Objective

To familiarize students with procedures and techniques used to detect and enumerate microorganisms in foods and develop an understanding of spoilage microorganisms and their effects on food and integrate their basic knowledge of microbiology, chemistry, biochemistry, food processing.

Course Outcome(s):

FT302.1 Ability to classify different types of microorganism which are present in th environment.
FT302.2 Ability to describe the internal and external factors and predict microorganisms, which can cause food spoilage.
FT302.3 Ability to interpret the causes of food borne diseases and their etiology.
FT302.4 Ability to evaluate the measures required to control undesired microorganisms in food.
FT302.5 Ability to identify the possible health benefits from the consumption of health- promoting microorganisms or products derived from their fermentation.

Course Contents:

Module I (8L): Introduction – definition, historical development and significance of food microbiology; Microscope; Classification & morphology of microbes including pathogens and non pathogens; Techniques of pure culture; Bacterial growth kinetics; Bacteriology of air & water; Antimicrobial agents – physical & chemical – mechanism & action

Module II (8L): Disinfection & disinfectants; Energy metabolism of aerobic & anaerobic microbes; Thermal inactivation of microbes; Concept, determination & importance of TDT, F, Z & D values; Factors affecting heat resistance; Pasteurization and sterilization..

Module III (8L): Microbiology of milk & milk products like cheese, butter, ice-cream, milk powder; Microbiology of meat, fish, poultry & egg and their products.

Module IV (8L): Microbiology of fruits & vegetable and products like jam, jelly, sauce, juice; Microbiology of cereal and cereal products like bread, biscuits, confectionary

Revision: 4L

Text /Reference books:

1. Essentials of Microbiology; K. S. Bilgrami; CBS Publishers, Delhi
2. Food Microbiology; WC Frazier; Tata McGraw Hill, Delhi
3. Modern Food Microbiology; James M Jay; CBS Publishers, Delhi
4. Microbiology; Pelczar, Chan and Krieg; Tata McGraw Hill, Delhi
5. Basic Food Microbiology; Bannett, Chapman and Hall
6. Food Microbiology; M. R. Adams
7. Hand Book of Microbiology; Bisen

CO-PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT302. 1	-	3	2	-	-	2	-	-	2	2	-	3
FT302. 2	-	3	2	-	-	2	-	-	2	2	-	3
FT302. 3	-	3	2	-		2	-	-	2	2	-	3
FT302. 4	-	3	-	-		2	-	-	2	2	-	3
FT302. 5	-	2	2	-		2	-	-	1	2	-	3
Overall CO (FT302) mapping	-	2.8	2	-	-	2	-	-	1.8	2	-	3

Paper name: Chemistry of Food

Paper Code: FT303

Contact: L-T-P=2-2-0

Credit: 3

Pre requisites: Biochemistry

Course Objective

The main objectives of this course is for students to differentiate chemical interactions and reactions of food components and their effect on sensory, nutritional, and functional properties of foods, and how processing influences these properties.

Course Outcome(s):

FT 303.1 Ability to understand the structure and composition of different nutrients.
FT 303.2 Ability to demonstrate the physical and chemical properties of different nutrients.
FT 303.3 Ability to recognize the function of the nutrients in different food materials and understand their practical implications.
FT 303.4 Ability to analyze how processing conditions are likely to change the reactivity of food components.
FT 303.5 Ability to apply fundamental concepts to know the principles behind analytical techniques associated with food.

Course Contents:

Module I (8L): Introduction to different food groups (3, 5, 7 food groups) and importance of food chemistry; Water in foods and its properties: different types of moisture in food; Water activity, IMFs, Determination of moisture content, water absorption isotherm, drying curves.

Carbohydrate: Sources of food carbohydrates; Classifications.

Structure, Physico-chemical and functional properties: Monosaccharides, Disaccharides, Oligosaccharides, Polysaccharides, homosachharides and heterosachharides

Starch: Structure, sources, properties (hydrolysis, gelatinization, retrodradation, dextrinisation, crystallization); Glycogen: definition, properties, Cellulose, pectin, gums: Occurrences, properties, uses.

Module II (8L): Proteins: Sources and physico-chemical and functional properties: Amphoterism, hydration, binding of ions, precipitation with antibiotics, gel formation.

Purification of proteins: Different processes; Electrophoresis, Gel filtration, Spectrophotometric analysis, Lambert-Beer's law, Chromatographic analysis.

Amino acids: Essential and non essential amino acids, their structures, deficiency diseases; Acidic and basic amino acids.
Common food proteins: Meat protein: Mayoglobin, changes in colour during curing of meat, Egg proteins: Albumin, Globulin; Milk protein: Casein, rennet action on cheese, Cereal proteins, Fish proteins, different peptides

Module III (8L): Fats: Sources; Classifications; Fatty acids: Classifications with examples and structure (SAFA, MUFA, PUFA); Omega 3 and Omega 6 fatty acids.

Physico-chemical and functional properties; PUFA, Rancidity: Definition, types of rancidity of fats and oils (hydrolytic and oxidative rancidity); Reversion of fats; Antioxidants: Definition, examples, roles; Saponification number, iodine value, Reichert-Meissl number, Polenske value; Lipids of biological importance like cholesterol and phospholipids.

Module IV (8L): Minerals and Vitamins: Sources and structures of minerals & vitamins; Effect of processing and storage of vitamins; Pro vitamins A & D; Vitamins as antioxidants. Food Pigments &Flavouring Agent: Importance, types and sources of pigments (Chlorophyll, carotenoids, anthocyanin, and flavonoids) −their changes during processing and storages.

Revision: 4L

Text /Reference books:
1. Essentials of Food & Nutrition by Swaminathan, Vol. 1 & 2
2. Food Chemistry by L. H. Meyer
3. Hand Book of Analysis of fruits & vegetables by S. Ranganna
4. Chemical changes in food during processing by Richardson
5. Food Science by Norman N. Potter & Joseph H. Hotchkiss
6. Food Chemistry by H. K. Chopra & P. S. Panesar

CO-PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT303. 1	3	1	-	-	-	3	3	-	-	-	-	3
FT303. 2	3	3	3	2	-	-	-	-	-	-	-	3
FT303. 3	3	3	3	3	1	-	2	-	-	-	-	3
FT303. 4	3	3	2	2	-	-	2	-	-	-	-	3
FT303. 5	2	-	-	-	-	3	2	2	-	-	-	3
Overall CO (FT303) mapping	2.80	2.50	2.67	2.33	1.00	3.00	2.25	2.00	-	-	-	3

PRACTICAL

Paper Name: Environmental Engineering Lab

Paper Code: CHFT391

Contact: L-T-P: 0-0-3

Credit: 2

Pre requisites: 10+2 science with chemistry

Course Objective:

Acquiring knowledge on Standard solutions and the various reactions in homogeneous medium. Understanding the basic principles of pH meter for different applications and analyzing water and soil with respect to their various parameters.

Course Outcome :

CHFT391.1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CHFT391.2: Able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
CHFT391.3: Able to work as an individual also as an team member.
CHFT391.4: Able to analyse different parameters of water considering environmental issues.

CHFT391.5: Able to analyze the different parameters of soil considering environmental issues.

Course Contents:

Exp 1.

Physical examination of Sewage/Water:

a. Total Solid

b. Total dissolve solid

c. Total suspended solid

d. pH, color and odor

Exp 2.

Chemical estimation of Sewage/Water and soil

a. Determination of Chlorides

b. Estimation of Chemical oxygen Demand

Exp. 3.

Microbial examination of Sewage/Water: Biological oxygen demand

Exp. 4.

Determination of Soil nitrate and soil phosphate.

CO-PO matrices of courses CHFT391

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CHFT391.1	3	2	1	1	1	1	-	-	2	-	-	-
CHFT391.2	-	-	-	-	-	-	-	-	3	-	-	-
CHFT391.3	-	-	-	-	-	2	3	-	-	-	-	1
CHFT391.4	-	-	-	-	2	1	-	-	-	-	-	-
CHFT391.5	2	-	2	-	1	-	-	-	-	-	-	1

Paper Name: Chemistry-2 Lab

Paper Code: CH(FT)392

Contact: L-T-P=0-0-3

Credit: 2

Course Contents:

Exp 1.

Study on kinetics of iodine / ester hydrolysis

Exp 2.

Detection of aldehyde / aliphatic or aromatic alcohol / carboxylic / ester / amino group(s)

Exp. 3.

To identify the following Basic Radicals by dry and wet tests – Pb^{2+} , Cu^{2+} , Al^{3+}, Fe^{3+}, Zn^{2+} , Ni^{2+} , Ca^{2+}, Mg^{2+} , Na^{+} , K^{+} , $NH4^{+}$

Exp. 4.

To identify the following Acid Radicals by dry and wet tests – Cl^{-} , CO_3^{2-} , SO_4^{2-}, S^{2-} , NO_3^{-}

Exp. 5.

To identify an unknown water soluble salt containing one basic and one acid radical as mentioned above.

Exp. 6.

Preparation of Potash Alum.

Exp. 7.

Preparation of nano particles (innovative experiment)

CO-PO matrices of courses CHFT392

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CHFT392.1	3	2	1	1	1	1	-	-	2	-	-	-
CHFT392.2	-	-	-	-	-	-	-	-	3	-	-	-
CHFT392.3	-	-	-	-	-	2	3	-	-	-	-	1
CHFT392.4	-	-	-	-	2	1	-	-	-	-	-	-
CHFT392.5	2	-	2	-	1	-	-	-	-	-	-	1

Paper Name: Chemistry of Food Lab I

Paper Code: FT 391

Contact: L-T-P=0-0-3

Credit: 2

Pre requisites: Food Chemistry

Course Objective:
To provide an opportunity to the students to define chemistry as the study of the composition, structure, properties of food materials and identify methods and instruments that can be used to study of food chemistry and To focus on the development of skills to control the quality of food by providing an opportunity to the students prioritize different controlling parameters to improve shelf-life of food and to prevent adulteration.

Course outcome(s):

After the completion of the Chemistry of Food Lab-I the students will be able to:

FT.391.1. Define chemistry as the study of the composition, structure, properties of food materials and identify methods and instruments that can be used to study of food chemistry.

FT. 391.2. Recognize the importance of proximate analysis.

FT. 391.3. Develop skills to control the quality of food and to prevent adulteration.

FT. 391.4. Prioritize different controlling parameters to improve shelf-life of food.

FT. 391.5. Evaluate data generated by experimental methods for chemical characterization of food materials.

Course Contents:

1. Determination of Moisture in food sample

2. Determination of Protein in food sample

3. Determination of Ash in food sample

4. Determination of Crude Fat in food sample

5. Determination of Acidity and pH in food sample/beverages

6. Determination of total, non-reducing and reducing sugars in food sample

7. Determination of Vitamin C in food sample

Text /Reference books:

1. Essentials of Food & Nutrition by Swaminathan, Vol. 1 & 2

2. Food Chemistry by L. H. Meyer

3. Hand Book of Analysis of fruits & vegetables by S. Ranganna

4. Chemical changes in food during processing by Richardson

5. Food Science by Norman N. Potter & Joseph H. Hotchkiss

6. Food Chemistry by H. K. Chopra & P. S. Panesar

CO-PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT391.1	2	1	-	-	-	-	2	-	2	-	-	2
FT391.2	2	2	1	-	-	-	1	-	2	1	-	2
FT391.3	2	2	-	-	-	2	2	2	2	1	-	2
FT391.4	3	2	2	-	-	-	-	-	1	-	-	2
FT391.5	3	2	2	1	-	-	-	-	-	-	-	2
Overall CO (FT391) mapping	2.40	1.80	1.67	1.00	-	2.00	1.67	2.00	1.75	1.00	-	2

Paper Name: Food Microbiology Lab

Paper Code: FT392

Contact: L-T-P=0-0-3

Credit: 2

Pre requisites: Food Microbiology

Course Objective(s)
To help the students understand various methods of isolation, characterization and screening of bacteria, fungi and other related organisms and apply different preservation techniques relative to food safety and spoilage.

Course outcome(s):
After the completion of the Food Microbiology Lab the students will be able to:

FT392.1. Explain various methods of isolation, characterization and screening of bacteria, fungi and other related organisms
FT392.2. Develop skills to monitor various food processing operations in food industries.
FT392.3. Apply different preservation techniques relative to food safety and spoilage.
FT392.4. Illustrate the growth requirements of common food borne pathogens and spoilage microorganisms.
FT392.5. Identify which organisms would be likely to grow in a specific food product.

Course Contents:

1. Study of a compound microscope.
2. Gram Staining and Study of morphology of bacterial cells.
3. Study of autoclave, Preparation and sterilization of nutrient broth and agar.
4. Sub-culturing of a bacterial strain in liquid and solid medium.
5. Study of growth of *E. coli* by a spectrophotometer.
6. Study of microbiological quality of milk by MBRT test.
7. Preparation of synthetic medium for yeast and mould and inoculation with standard strains of yeasts and moulds.
8. Isolation of starch-hydrolyzing organism from soil. Dilution and Plating by spread –plate and pour –plate techniques.
9. Dilution and Plating by spread –plate and pour –plate techniques.
10. Isolation of pure culture.
11. Morphological study of bacteria, yeast & mold and taking of photograph using Binocular Microscope.

CO-PO Mapping:

CO	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT392.1	2	1	1	1	-	-	2	-	2	-	-	3
FT392.2	2	2	1	1	-	1	2	-	1	1	-	3
FT392.3	2	2	-	-	-	-	3	2	2	2	-	2
FT392.4	2	-	-	-	-	2	2	2	1	1	-	2
FT392.5	2	1	1	-	-	1	2	2	1	-	-	3
Overall CO (FT392) mapping	2.00	1.50	1.00	1.00	-	1.33	2.20	2.00	1.40	1.33	-	2.60

SESSIONAL

Paper Name: Technical Skill Development

Paper Code: MC381

Contact: L-T-P=0-0-2

Credit Point: 0

Pre requisites: Chemistry, Physics

Course Objectives:

The basic objectives of Technical Skill Development is-
To fulfill and match any gap present in Course Curriculum and to understand the latest technological development in context to Food Technology Discipline, enhancing the efficiency in professional field.

Course Outcome:

After the completion of the Technical Skill Development the students will be able to:

MC381.1 Identify different food processing instruments
MC381.2 Use different food processing instruments
MC381.3 Identify different instruments in proximate and ultimate analysis of food material.
MC381.4 Apply different instruments in proximate and ultimate analysis of food material.

Course Contents:

No. of Experiment	**Syllabus formed for Autonomy(based upon mini project)**
1	Preparation of Synthetic Jelly
2	Comparison of Viscosity of Natural and Synthetic Jelly
3	Spectrophotometric Analysis of different types of food pigments
4	Comparative study of quality characteristics between ordinary and value added biscuits
5	Extraction of pectin from fruits

6	Comparative study of textural characteristics between yoghurt and herbal yoghurt
7	Extraction and estimation of antioxidants present in fruits
8	Extraction and estimation of antioxidants present in vegetables

CO-PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
MC381.1	2	-	-	-	-	-	2	2	1	3	1	3
MC381.2	2	1	-	-	2	-	1	-	2	1	-	2
MC381.3	2	-	-	-	-	-	2	2	1	3	1	3
MC381.4	2	1	-	-	2	-	1	-	2	1	-	2
Overall CO (MC381) mapping	2.00	1.00	-	-	2.00	-	1.50	2.00	1.50	2.00	1.00	2.50

2nd YEAR, 4rd SEMESTER

Curriculum:

A: THEORY:

	Field	Code	Subjects	Contacts (Periods/ week)				Credit points
				L	T	P	Total	
1	BS	M(CS) 401	Numerical Methods	3	0	0	3	3
2	PC	FT 401	Biochemistry & Nutrition	2	2	0	4	3
3	ES	CH 401	Industrial Stoichiometry	2	2	0	4	3
4	PC	FT 402	Principles of Food	2	2	0	4	3
5	PE	CHE414 (A/B)	Unit Operation of Chemical Engineering-1/ Transport Phenomena	2	2	0	4	3
Total Theory							19	15

B: PRACTICAL:

	Field	Code	Subjects	Contacts (Periods/				Credit points
				L	T	P	Total	
1.	PC	FT491	Biochemistry Lab	0	0	3	3	2
2	PC	FT 492	Chemistry of Food Lab - II	0	0	3	3	2
3	PE	CHE 484 (A/B)	Unit operation Lab – I/ Transport phenomena Lab	0	0	3	3	2
4	BS	M(CS) 491	Numerical methods lab	0	0	3	3	2
5	HS	HU 481	Technical Report Writing & Language Lab Practice Lab Practice	0	0	2	2	1
Total practical							14	9
Total 4th semester							33	24

THEORY

Paper Name: Numerical methods
Paper Code: M(CS) 401
Contact: L-T-P = 3 - 0 - 0
Credit: 3

Prerequisite: Concept of Calculus and Algebra.

Course Objective: The purpose of this course is to provide basic understanding of the derivation and the use of the numerical methods along with the knowledge of finite precision arithmetic.

Course outcome:

On successful completion of the learning sessions of the course, the learner will be able to:

M(CS) 401.1: Recall the distinctive characteristics of various numerical techniques and the associated error measures.

M(CS) 401.2: Understand the theoretical workings of various numerical techniques and to solve the engineering problems.

M(CS) 401.3: Apply the principles of various numerical techniques to solve various problems.

Course Contents:

MODULE I: NUMERICAL METHOD I

Approximation in numerical computation: Truncation and rounding errors, Propagation of errors, Fixed and floating-point arithmetic. (2L)

Interpolation: Newton forward/backward interpolation, Stirling & Bessel's Interpolation formula, Lagrange's Interpolation, Divided difference and Newton's divided difference Interpolation. (7L)

Numerical integration: Newton Cotes formula, Trapezoidal rule, Simpson's 1/3 rule, Weddle's Rule, Romberg Integration, Expression for corresponding error terms. (5L)

Numerical solution of a system of linear equations: Gauss elimination method, Tridiagonal matrix algorithm, LU Factorization method, Gauss-Seidel iterative method, Successive over Relaxation (SOR) method.

(6L)

MODULE II: NUMERICAL METHOD II

Solution of polynomial and transcendental equations: Bisection method, Regula-Falsi, Secant Method, Newton-Raphson method. (5L)

Numerical solution of ordinary differential equation: Taylor series method,Euler's method, Euler's modified method, fourth order Runge- Kutta method and Milne's Predictor-Corrector methods.

(6L)

Numerical solution of partial differential equation: Finite Difference method, Crank–Nicolson method.

(2L)

Text Books:

1. Shishir Gupta & S. Dey, Numerical Methods, Mc. Grawhill Education Pvt. Ltd.
2. C.Xavier: C Language and Numerical Methods, New age International Publisher.
3. Dutta& Jana: Introductory Numerical Analysis. PHI Learning
4. J.B.Scarborough: Numerical Mathematical Analysis. Oxford and IBH Publishing
5. Jain, Iyengar,& Jain: Numerical Methods (Problems and Solution).New age International Publisher.
6. Prasun Nayek: Numerical Analysis, Asian Books.

References:

1. Balagurusamy: Numerical Methods, Scitech. TMH
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. SoumenGuha& Rajesh Srivastava: Numerical Methods, Oxford Universities Press.
5. Srimanta Pal: Numerical Methods, Oxford Universities Press.
6. Numerical Analysis, Shastri, PHI
7.Numerical Analysis, S. Ali Mollah. New Central Book Agency.
8.Numerical Methods for Mathematics ,Science&Engg., Mathews, PHI
9.NumericalAnalysis,G.S.Rao,New Age International
10.Programmed Statistics (Questions – Answers),G.S.Rao,New Age International
11.Numerical Analysis & Algorithms, PradeepNiyogi, TMH
12.Computer Oriented Numerical Mathematics, N. Dutta, VIKAS
13.NumericalMethods, Arumugam,ScitechPublication
14.Probability and Statisics for Engineers,Rao,ScitechPublication
15.Numerical Methods in Computer Application,Wayse,EPH

CO-PO Mapping:

PO / CO	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
M(CS) 401.1	3	2	-	-	-	-	-	-	-	-	-	1
M(CS) 401.2	3	2	-	-	-	-	-	-	-	-	-	1
M(CS) 401.3	3	2	2	-	-	-	-	-	-	-	-	1

Paper Name: Biochemistry and Nutrition

Paper Code: FT401

Contact: L-T-P = 2-2-0

Credit: 3

Pre requisites: Chemistry, Biology

Course Objective

To introduce the students to the biological basis of nutrition and the mechanisms by which diet can influence health and help them develop laboratory skills required for modern biochemical and molecular studies of nutrition.

Course Outcome(s)

FT401.1: Ability to describe the major metabolic pathways involved in the metabolism of nutrients in the human body.

FT401.2: Ability to understand the principles of biochemical methods and be able to use them with appropriate instruction.

FT401.3: Ability to interpret the basis of reactivity of biologically relevant molecules and their interactions.

FT401.4: Ability to analyze and evaluate experimental data.

FT401.5: Ability to explain the synthesis of proteins, lipids, nucleic acids, and carbohydrates and their role in metabolic pathways along with their regulation at the epigenetic, transcriptional, translational, and post-translational levels including RNA and protein folding, modification, and degradation.

Course Contents:

Module I (8L): Introduction to Biochemistry: Proteins and protein structures; Transamination; Metabolism of proteins (digestion and absorption); Nitrogen balance and nitrogen pool; Evaluation of quality of proteins: BV, PER, NPU, Chemical Score.

Module II (8L): Enzymes; Definition, function, classification, nomenclature & structure; Co-enzymes and its function; Mechanism of enzyme action: Single, bi and multi substrate reactions; Lock and Key model, Induced fit model;

Enzyme kinetics: MME, Significance of MM Constant, MME and Allosteric enzyme kintics; Enzyme inhibition: Reversible and Irreversible; LB Plot, Feedback inhibition, Substrate acts as inhibitor, Turn over number.

Module III (8L): Carbohydrates; Definition & classification; General chemistry of carbohydrates; Metabolic pathways for breakdown of carbohydrates: glycolytic pathway and its importance, energy yield; pentose phosphate pathway and its importance, energy yield; citric acid cycle and its importance, energy yield; Gluconeogenesis; Pathway, importance, energy yield, Cori cycle; Electron transport chain: Pathway, importance, Energy yield, Oxidative phosphorylation, ATP balance.

General chemistry of lipids; classification, Essential fatty acids, Metabolism of ketone bodies, alpha, beta and omega oxidation of fatty acids; Digestion & absorption of lipids: Rancidity in fats.

Module IV (8L): Vitamins & minerals: occurrence, physiological function of vitamins and minerals. Introduction to human nutrition; Nutritive values of foods; Basal metabolic rate; Techniques for assessment of human nutrition, Dietary requirements and deficiency diseases of different nutrients, Micronutrients

Revision: 4L

Text /Reference books:

1. Lehninger, Nelson & Cox, Principle of Biochemistry, CBS Publication
2. Modern Experimental Biochemistry, Boyer, Pearson Education
3. Lubert stryer, Biochemistry, Freeman & Co, N.Y.
4. Voet & Voet, Fundamentals of Biochemistry, Jonh Willey & Sons
5. Instant Notes in Biochemistry by D. Hames & N. Hooper
6. Biochemistry by Debojyoti Das
7. Textbook of Biochemistry by E. S. West & W. R. Todd

CO-PO Mapping:

CO	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT401. 1	3	2	2	2	-	1	1	-	-	-	-	3
FT401. 2	3	3	2	1	-	-	1	-	-	-	-	3
FT401. 3	3	3	2	2	-	1	-	-	-	-	-	3
FT401. 4	3	2	2	2	2	-	-	-	1	-	-	2
FT401. 5	3	3	3	2	-	1	1	-	-	-	-	3
Overall CO (FT401) mapping	3.00	2.60	2.20	1.80	2.00	1.00	1.00	-	1	-	-	2.80

Paper Name: Industrial Stoichiometry

Paper Code: CH401

Contact: L-T-P=2-2-0

Credit: 3

Pre requisites: Thermodynamics, Engineering Mechanics

Course Objective:
To help the students develop the concepts of different unit conversions, material balance and energy balances in different engineering systems by applying different mathematical interpretations.

Course Outcome(s):

CH401.1. Ability to illustrate the stoichiometric importance of an engineering process.
CH401.2. Ability to analyze with different systems of units and have the skill to convert units from one system to another.
CH401.3. Ability to read and apply graphical methods for representation of engineering data.
CH401.4. Ability to calculate mass and energy balance equations to engineering problems and optimize the process requirements.
CH401.5. Ability to predict how processing conditions are likely to change with respect to enthalpy requirements of a process.

Course Contents:

Module I (8L): Small units and dimensions, Rayleigh's Method of Dimensional analysis and Buckingham Pi-theorem, Dimensionless groups, Conversion of equations, Solution of simultaneous equations, use of log-log and semi-log graph paper, triangular diagram, Graphical differentiation and graphical integration

Module II (8L): Material balance: Introductory Concepts, Simplification of the general mass balance equation for steady and unsteady state processes, Procedure for material balance calculations, Material balance without chemical reactions, Material balance with chemical reaction, Material Balance with recycle, bypass and purge streams.

Module III (8L): Energy Balance: General energy balance equation for steady and unsteady state processes, Without Chemical Reaction, With Chemical Reaction, Enthalpy calculation procedures, Enthalpy change due to reaction: Heat of combustion

Module IV (8L): Combined Material and Energy Balances: Simultaneous material and energy balances, selected industrial process

Revision: 4L

Text /Reference books:

1. K. V. Narayanan and B. Lakshmikutty, Stoichiometry and Process Calculations, PHI

2. Ghosal, Sanyal and Dutta, Introduction to Chemical Engineering, TMH

3. Hougen and Watson, Chemical Process Principles (Part one): 2nd Ed, John Wiley.

4. Basic Principles and Calculations in Chemical Engineering: Himmelblau, 6th Ed. Prentice Hall

5. Bhatt and Bhora, Stoichiometry, 4th Ed., TMH

CO-PO Mapping:

CO	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CH401. 1	3	3	2	2	-	-	-	-	-	-	-	3
CH401. 2	3	3	2	2	2	1	-	-	-	-	-	3
CH401. 3	3	3	3	3	2	2	-	-	-	-	-	3
CH401. 4	3	3	3	3	-	-	-	-	-	-	-	3
CH401. 5	3	3	3	2	-	-	-	-	-	-	-	3
CH401.6	3	3	3	2	-	-	-	-	-	-	-	3
Overall CO (CH401) mapping	3.00	3.00	2.60	2.40	2.00	1.50	-	-	-	-	-	3

Paper Name: Principles of Food Preservation

Paper Code: FT402

Contact: L-T-P = 2-2-0

Credit: 3

Pre requisites: Food Microbiology, Food Chemistry

Course Objective:
To describe students, different principles involved in food preservation and processing and to make them aware about different concepts involved in food spoilage and its prevention by using different food preservation principles and technologies.

Course Outcome(s):

FT 402.1: Ability to describe actions taken to maintain foods with the desired properties or nature for as long as needed.

FT402.2: Ability to identify quality-loss mechanisms as biological, chemical, and Physical.

FT402.3: Ability to develop food handling practices that reduce the potential for food-borne illness.

FT402.4: Ability to apply preservation methods that make use of heat/cold, drying, acid, added chemicals, controlled air, pressure, and high-energy radiation.

FT402.5: Ability to use indirect approaches to food preservation – packaging, food hygiene, sanitation, Gas packaging.

Course Contents:

Module I (8L): Introduction to food preservation – Objectives and techniques of food preservation, Canning: Preservation principle of canning of food items, thermal process time calculations for canned foods, spoilage in canned foods

Module II (8L): Use of Norrish, Ross equations, MSI model. Dehydration and drying of food items; Low temperature preservation: cold storage, cold chain, freezing (including cryogenic freezing)

Module III (8L): Preservation by fermentation and chemical preservatives, curing, pickling. Bio-preservatives, Antibiotics, lactic acid bacteria.

Module IV (4L): Ionization Radiation including UV Radiation..

Module V (4L): Other non-conventional preservation methods, Hurdle technology Non-thermal preservation processes (High pressure processing, Osmodehydration, Use of ultrasonic sound).

Revision: 4L

Text /Reference books:

1. Technology of Food Preservation by Desrosier

2. Food Science by Potter

3. Fruits and vegetable processing by Cruess

4. Preservation of Fruits & Vegetables by IRRI

5. Principles of Food Preservation- Fennema

6. Handbook of Food Presrevation-M. Shafiur Rahman

CO-PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT402. 1	3	2	2	-	-	2	-	-	-	-	-	3
FT402. 2	3	3	2	2	-	1	1	-	-	-	-	3
FT402. 3	3	3	2	2	-	2	1	-	-	1	-	3
FT402. 4	3	3	3	2	-	-	2	-	-	-	-	3
FT402. 5	3	2	2	-	-	2	3	1	-	-	-	3
Overall CO (FT 402) mapping	3.00	2.60	2.20	2.00	-	1.75	1.75	1.00	-	1	-	3

Paper Name: Unit Operation of Chemical Engineering I

Paper Code: CHE414A

Contact: L-T-P=2-2-0

Credit: 3

Pre requisites: Engineering Mechanics, Thermodynamics

Course Objective:
To introduce history, importance and components of chemical engineering, concepts of unit operations and unit processes, and current scenario of chemical & allied process industries.

Course Outcome(s):
CHE414A.1: Ability to list chemical processes, units, and the corresponding equipment.
CHE414A.2: Ability to understand the basic principles of fluid mechanics
CHE414A.3: Capability to analyze pipe flows as well as fluid machinery
CHE414A.4: Ability to solve conduction, convection and radiation problems
CHE414A.5: Ability to design the performance of heat exchangers, crushers and grinders.

Course Contents:

Module I (8L): Dimensional Analysis: Introduction Basic Concepts of Fluid Mechanics : Conversion of equations. Basic equations of Fluid Flow, Hagen Poiseille equation, Bernoulli Equation, Fluid Friction. Friction in flow through packed beds, fundamentals of fluidization

Module II (8L): Flow measurements and machineries : Flow through pipes and open channels, Orifice and Venturimeters, Pitot Tube, Weirs, Rotameters and other types of meters, Transportation of fluids, Pipe Fittings and valves, Pumps – classification, centrifugal and positive displacement type – peristaltic. Blowers and compressors (oil-free)

Module III (8L): Heat transfer: Classification of heat flow processes, conduction, Thermal conductivity. Heat flow in fluids by conduction and convection. Countercurrent and parallel flow. Enthalpy balance in heat exchange equipment. Individual heat transfer coefficients, overall coefficient, Heating and cooling of fluids, Heat transfer equipment. Unsteady state heat transfer, Radiation.

Module IV (8L): Principle of pneumatic and hydraulic material transfer, Mechanical Operations: Principles of comminution, Types of comminuting equipment. Energy and power requirement, Crushers, Grinders, Mixing and Agitations, Power consumption in mixing, Mechanical separation, Screening, Types of screen, Filtration, Principle of Constant pressure and constant rate filtration, Settling classifiers, Floatation, Centrifugal separations.

Revision: 4L

Text /Reference books:

1. Unit Operations of Chemical Engineering: McCabe, Smith & Harriot, TMH, 5th edition

2. Transport Processes & Unit operations: Geankopolis, PHI, 3rd edition

3. Chemical Engineering, Vol-I & II: Coulson & Richardson, Butterworth Heinemann

4. Heat Transfer: D.Q. Kern, MGH

5. Foust, A.S., Wenzel, L.A., et.al. Principles of Unit Operations, 2nd edition, JWS

6. Perry, Chilton & Green, Chemical Engineers' Handbook, MGH

CO-PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CHE 414A. 1	3	3	2	2	2	1	-	-	-	-	-	3
CHE 414A. 2	3	3	2	2	-	-	-	-	-	-	-	3
CHE 414A. 3	3	3	2	-	3	1	-	-	-	-	-	3
CHE 414A. 4	3	3	3	2	2	-	-	-	-	-	-	3
CHE 414A. 5	3	3	3	3	2	1	-	-	-	-	-	3
Overall CO (CHE 414A) mapping	3.00	3.00	2.40	2.25	2.25	1.00	-	-	-	-	-	3

Paper Name: Transport Phenomena

Paper Code: CHE 414 B

Contact: L-T-P=2-2-0

Credit: 3

Pre requisites: Engineering Mechanics, Thermodynamics

Course Objective:
To be able to analyze various transport processes with understanding of solution approximation methods and their limitations.

Course Outcome(s):

CHE414B.1: Ability to understand the chemical and physical transport processes and their mechanism
CHE414B.2: Ability to do heat, mass and momentum transfer analysis
CHE414B.3: Ability to analyze industrial problems along with appropriate approximations and boundary conditions
CHE414B.4: Ability to develop steady and time dependent solutions along with their limitations

Course Contents:

Module I: 8L
Introduction: Concept of unified approach to Momentum, Heat and Mass Transport through Transport Phenomena - Assumptions of Transport phenomena; Similarity of Mass, Momentum and Energy transfer, Diffusivities, Transport Theorem

Module II: 8L
Momentum Transport: Viscosity, Newton's law of viscosity, calculation of momentum flux, Non-Newtonian fluids – Bingham model, Ostwald-de Waele model, Shell momentum balance and boundary conditions – Flow of a falling film with constant/variable viscosity, Flow through a circular tube, Flow through annulus, Flow of two adjacent immiscible fluids, Creeping flow around a sphere. Laminar flow between two flat stationary/moving plates, Shape of the surface of a rotating fluid. Concept of Boundary layer and Boundary layer theory. Concept of turbulence,

Module III: 8L
Energy Transport:
Modes of heat transfer; concepts of (a) thermal conductivity – constant and temperature dependent, (b) thermal diffusivity and (c) heat transfer coefficient. Fourier's law of heat conduction. Shell energy balance and boundary conditions – Heat conduction with electrical, nuclear, viscous and chemical heat source, Heat conduction through composite walls Dimensional analysis of equation of Energy.

Module IV: 8L

Mass Transport: Concentrations, Velocities and Mass and Molar fluxes. Concept of Mass diffusivity and Mass transfer coefficient. Fick's law of diffusion.

Shell mass balance and boundary conditions – Diffusion through stagnant gas film, Diffusion in a falling film, Diffusion with heterogeneous chemical reaction, Simultaneous mass and heat transfer problem.

Revision: 4L

Text /Reference books:

1. Mass Transfer Operations: Robert E. Treybal, MGH, International student Edition.
2. Transport process and Unit Operations: Geankoplis. 3rd Edn., PHI.
3. Unit Operations in Chemical Engfueering : McCabe, Smith, and Harriot. MGH, Sth Edn.
4. Multicomponent Distillation: Holland, C. D., PHI.
5. The Elements of Fractional Distillation: Robinson, C. S. and Gilliland, E. R. MGH.
6. Mass Transfer: Sherwood, Pigford, and Wilke, MGH.
7. Separation Processes: King, C. J. MGH.
8. Design of Equilibrium Stage Processes: Smith, B. D. MGH.
9. Distillation: van Winkle, M., MGH.

CO-PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CHE414B.1	3	3	2	2	-	-	-	-	-	-	-	3
CHE414B.2	3	3	2	-	3	1	-	-	-	-	-	3
CHE414B.3	3	3	1	1	1	-	-	-	-	-	-	3
CHE414B.4	3	3	3	3	2	1	-	-	-	-	-	3
Overall CO (CHE414B) mapping	3.00	3.00	2.00	2.00	2.00	1.00	-	-	-	-	-	3

PRACTICAL

Paper Name: Biochemistry Lab

Paper Code: FT491

Contact: L-T-P = 0-0-3

Credit: 2

Pre requisites: Biochemistry

Course Objective:

To assist the students develop skills to monitor various enzymatic reactions and to learn about association of food protein structure to help the students point out the threat of possible danger to health from contamination in water from effluent.

Course outcome(s):
After the completion of Biochemistry Lab students will be able to:
FT491.1: Learn various methods of sugars and amino acids separation.
FT491.2: Develop skills to monitor various enzymatic reaction.
FT491.3: Learn association of food protein structure with solubility, viscosity, gelation, texturization, emulsification and foaming.
FT491.4: Point out the threat of possible danger to health, or the very existence of certain species, it is essential to determine the quality of a water source before water is drawn off for consumption.
FT491.5: Gain knowledge of separation of immiscible liquids and solids from liquids.

Course Contents:

1. Separation of amino acids/sugars by Ascending Paper Chromatography.
2. Separation of sugars/amino acids by Thin Layer Chromatography.
3. Separation and isolation of proteins/amino acids by Paper Electrophoresis.
4. Enzyme kinetics and inhibition studies.
5. Preparation of cell-free extract: Bacterial cell by sonication, Chicken liver by homogenization.
6. Assay of enzyme activity (a) Phosphatase assay [Chicken liver] (b) Protease assay
7. Study of an enzymatic reaction.
8. Study on the presence of alkaline phosphatase enzyme in raw and pasteurized milk.
9. Determination of BOD5 and COD of a sample of waste water.

Text /Reference books:

1. Modern Experimental Biochemistry, Boyer, Pearson Education
2. An Introduction to Practical Biochemistry, David T Plummer

CO - PO Mapping:

CO	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT491.1	3	2	2	2	3	-	1	-	1	-	-	2
FT491.2	3	2	2	2	3	-	1	-	1	-	-	2
FT491.3	3	2	2	2	3	-	1	-	1	-	-	2
FT491.4	2	2	1	1	-	2	2	-	2	-	-	2
FT491.5	3	2	2	2	3	-	1	-	1	-	-	2
Overall CO (FT491) mapping	2.8	2	1.8	1.8	3	2	1.2	-	1.2	-	-	2

Paper name: Chemistry of Food Lab II

Paper Code: FT492

Contact: L-T-P = 0-0-3

Credit: 2

Pre requisites: Food Chemistry

Course Objective:

To help students in developing the concept and to learn various methods of estimation of minerals, pigments, crude fibre, antioxidants, pigments etc. by spectrophotometric and chemical analysis.

Course outcome(s):

After the completion of the Chemistry of Food Lab II the students will be able to:
FT492.1: Develop the concept of estimation of minerals, pigments, crude fibre and antioxidants.
FT492.2: Learn various methods to determination different minerals and antioxidant content of food materials.
FT492.3: Measure different food compositions by spectrophotometric analysis.

FT492.4: Evaluate data generated by experimental methods for chemical characterization of food materials.
FT492.5: Analyze how the pigments of the food materials change in different conditions.

Course Contents:

1. Determination of pigments in food sample.

2. Estimation of calcium in food sample.

3. Estimation of iron in food products.

4. Estimation of zinc in food sample.

5. Estimation of tin in canned foods.

6. Estimation of crude fiber in food sample.

7. Estimation of antioxidant(s) / polyphenol(s) in food sample.

8. Analysis of lysine content in animal /vegetable sources.

CO-PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT492.1	2	1	-	-	-	-	2	-	2	-	-	2
FT492.2	2	2	1	-	-	-	1	-	2	1	-	2
FT492.3	2	2	-	-	-	2	2	2	2	1	-	2
FT492.4	3	2	2	-	-	-	-	-	1	-	-	2
FT492.5	3	2	2	1	-	-	-	-	-	-	-	2
Overall CO (FT492) mapping	2.4	1.8	1.67	1	-	2	1.67	2	1.75	1	-	2

Paper Name: Unit Operation Lab I

Paper Code: CHE484A

Contact: L-T-P=0-0-3

Credit: 2

Pre requisites: Unit Operation, Stoichiometry

Course Objective:
To learn analytical experimental methods using sophisticated instruments and interpretation of experimental data.

Course outcome(s):
After the completion of the laboratory course students will be able to:
CHE484A.1: Define process equipment via hands-on learning.
CHE484A.2: Analyze the experiments on flow regime and different flow meter
CHE484A.3: Measure the Overall heat transfer coefficient of heat exchangers
CHE484A.4: Determine the pressure drop for flow through packed bed.
CHE484A.5: Examine the working characteristics of a crusher & grinder.

Course Contents:

1. Experiments on Reynolds's Apparatus –Determination of flow regime and construction of friction factor against NRE
2. Experiments on flow measuring device — in closed conduit using (a) Venturimeter, (b) Orifice meter, (c) Rotameter
3. Determination of Pressure drop for flow through packed bed & verification of Ergun Equation, Kozeny-Karman equation, Blake-Plummer Equation
4. To study the working characteristics of a Jaw Crusher, calculate the energy consumption as a function of size reduction and compare it with the actual energy requirements
5. To study the working characteristics of a Ball Mill, calculate the energy consumption as a function of size reduction and determine the critical speed
6. To determine the Overall heat transfer coefficient of a concentric pipe heat exchanger based on the inside diameter of the tube
7. To study the characteristics of film-wise/drop-wise condensation
8. To study the flow characteristics of fluid by Rheometer

Text /Reference books:

1. Unit Operations of Chemical Engineering: McCabe, Smith & Harriot, TMH, 5th edition
2. Transport Processes & Unit operations: Geankopolis, PHI, 3rd edition

3. Chemical Engineering, Vol-I & II: Coulson & Richardson, Butterworth Heinemann
4. Heat Transfer: D.Q. Kern, MGH

CO-PO Mapping:

CO	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CHE484A.1	3	2	2	2	2	1	-	1	2	-	-	3
CHE484A.2	3	2	2	2	2	-	-	1	2	-	-	3
CHE484A.3	3	2	2	2	2	-	-	1	2	-	-	3
CHE484A.4	3	2	2	2	2	-	-	1	2	-	-	3
CHE484A.5	3	2	2	2	2	-	-	1	2	-	-	3
Overall CO (CHE484A) mapping	3	2	2	2	2	1	-	1	2	-	-	3

Paper Name: Transport Phenomena Lab

Paper Code: CHE484B

L-T-P: 0-0-3

Credit: 2

Pre requisites: Transport Phenomenon, Stoichiometry

Course Objective:
To learn analytical experimental methods using sophisticated instruments and interpretation of experimental data.

Course Outcome:
CHE484B.1: Ability to plan experiments and present the experimental data meaningfully
CHE484B.2: Ability to apply theoretical concepts for data analysis and interpretation
CHE484B.3: Capability to visualize and understand chemical engineering unit operations related to fluid and particle mechanics, and mass transfer
CHE484B.4: Understand the experimental techniques related to chemical reaction engineering

Course Contents:

1. Determination of Drag Coefficient
2. Experiments on Tubing, interconnects flow measurement
3. Determination of flow measurement
4. Experiments on Industrial-scale equipment, valving
5. Experiments on Soldering, ice/boiling, thermocouples, multimeter
6. Experiments on Temp and flow control, calibration
7. Experiments on Psychrometric chart, vapor pressure, flow control, humidity sensors
8. Experiments on Dissolved oxygen sensors, spargers

CO - PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CHE484B.1	3	2	2	2	2	-	-	1	2	-	-	3
CHE484B.2	3	2	2	2	2	-	-	1	2	-	-	3
CHE484B.3	3	2	2	2	2	-	-	1	2	-	-	3
CHE484B.4	3	2	2	2	2	-	-	1	2	-	-	3
Overall CO (CHE484B) mapping	3	2	2	2	2	-	-	1	2	-	-	3

Paper Name: Numerical methods

Paper Code: M(CS) 491

L-T-P: 0: 0: 3

Credit: 2

Prerequisite: Any introductory course on C/ Matlab.

Course Objective: The purpose of this course is to provide basic programming skills for solving the problems in numerical methods.

Course outcome(s):
On successful completion of the learning sessions of the course, the learner will be able to:

M(CS)491.1: Apply the programming skills to solve the problems using multiple numerical approaches.

M(CS)491.2: Analyze if the results are reasonable, and then interpret and clearly communicate the results.

Course Contents:

1. Assignments on Newton forward /backward, Lagrange's interpolation, Sterling & Bessel's Interpolation formula, Newton's divided difference Interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule and Romberg Integration.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations. Successive over Relaxation (SOR) method, LU Factorization method.
4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi method, Secant Method, Newton-Raphson method
5. Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods, Taylor series method and Predictor-Corrector method.
6. Assignments on numerical solution of partial differential equation: Finite Difference method, Crank–Nicolson method.
7. Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab / Scilab / Labview / Mathematica/NAG (Numerical Algorithms Group/Python.

CO PO Mapping:

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
M(CS) 491.1	2	1	-	-	3	-	-	-	-	-	-	1
M(CS) 491.2	2	1	-	-	3	-	-	-	-	-	-	1

Paper Name: Technical Report Writing & Language Lab Practice
Paper Code: HU481

Contact: L-T-P = 0-0-2

Credit: 1

Pre-requisites: A basic knowledge of listening and speaking skills and the ability to infer meaning from audio-video/online lessons.

Course Objectives: By the end of the course the student should be able to

- 1.1:Understand and make use of a wide taxonomy of listening skills & sub-skills for comprehending & interpreting data in English
- 1.2:Speak in English, using appropriate vocabulary and pronunciation in contextualized situations
- 1.3:Understand and put into effective practice the pragmatics of Group Discussion
- 1.4:Understand and write a detailed technical report as per organizational needs
- 1.5: Understand and interact in professional presentations and interviews

Course outcome: To maximize exposure and train students in the professional use of English in the globalized workplace.

Course Contents:

Module 1: The Need for a Language Laboratory [2L+2P]
(a)Introduction to the Language Lab
(b)Skill-building exercises in the lab

Module 2: Power Listening [2L+3P]
(a)Taxonomy of Listening Skills & Sub-skills [Aural Skimming, Scanning, Listening for Details, Note taking, Evaluative Listening, Empathetic Listening, Paralinguistic and Kinesic Inferencing]
(b)Audio-based Lessons
(c) Repairing Listening 'Gaps' through Learner Feedback

Module 3: Speaking Skills [2L+6P]
(a)The Need for Speaking: Content and Situation-based speaking
(b)Speaking Activities: [Just a Minute, Paired Role Play, Situational Speaking Exercises]
(c)The Pragmatics of Speaking—Pronunciation practice and learner feedback.

Module 4: Group Discussion [2L+6P]
(a)Teaching GD Strategies
(b)In-house video viewing sessions
(c) Group Activities [Topic Brainstorming, Situational Analysis, Frame Story]
(d)Extended Practice and feedback

Module 5: Writing a Technical Report[2L+6P]
(a)Organizational Needs for Reports and types
(b)Report Formats
(c)Report Writing Practice Sessions and Workshops

Module 6: SWOT Analysis [2L+3P]
(a)SWOT Parameters
(b)Organizational SWOT
(c) Case Study

Module 7: Presentation [2L+6P]
(a)Teaching Presentation as a Skill
(b)Speaking Strategies and Skills
(c)Media and Means of Presentation
(d)Extended Practice and Feedback
Module 8: Personal Interview [2L+3P]
(a)Preparing for the Interview: Interview Basics, Dressing and Grooming, Q & A
(b)Mock Interview sessions and feedback

CO - PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CO.1	3	-	-	3	-	**3**	-	-	**3**	**3**	-	-
CO.2	2	3	2	3	-	**3**	-	-	**2**	**3**	-	1
CO.3	1	3	-	3	-	**2**	-	-	**2**	**3**	-	1
CO.4	1	2	3	3	-	**2**	-	-	**2**	**3**	-	-
CO.5	3	3	2	3	-	**2**	-	-	**2**	**3**	-	1

3rd YEAR, 5th SEMESTER

Curriculum:

A.THEORY:

Sl. no.	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	HS	HU 503	Economics for Engineers	2	0	0	2	2
2	PC	FT 501	Food process technology – I (cereals, fruits, vegetables,	2	2	0	4	3
3	PC	FT 502	Food process technology – II (fish, meat,	2	2	0	4	3
4	PC	FT 503	Food process engineering	2	2	0	4	3
5	PE	CHE 514 (A/B)	Unit operations of chemical engineering – II/ Separation Process	2	2	0	4	3
Total Theory							18	14

B.PRACTICAL:

Sl. no.	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	PC	FT 591	Food processing lab – I	0	0	4	4	3
2	PC	FT 592	Food analysis & quality control lab	0	0	4	4	3
3	PE	CHE 584 (A/B)	Unit operation lab – II/ Separation Process Lab	0	0	4	4	3
C.SESSIONAL								
4	**MC**	**MC 581**	Technical Model Development and Presentation	0	0	2	2	0
Total Practical and Sessional							14	9
Total 5th Semester							32	23

THEORY

Paper Name: Economics for Engineers

Paper Code: HU503

Contact: L-T-P = 2 – 0 – 0

Credit: 2

Pre-requisites: MATH – College Algebra, Pre-Calculus Algebra and Trigonometry.

Course Objective: This course emphasizes the strong correlation between engineering design and manufacturing of products/systems and the economic issues they involve.

Course Outcome:

1. Apply the appropriate engineering economics analysis method(s) for problem solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio.
2. Evaluate the cost effectiveness of individual engineering projects using the methods learned and draw inferences for the investment decisions.
3. Compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision between alternate facilities and/or systems.
4. Evaluate the profit of a firm, carry out the break even analysis and employ this tool to make production decision.
5. Discuss and solve advanced economic engineering analysis problems including taxation and inflation.

Course Content:

MODULE I Introduction 3L

Managerial Economics-Relationship with other disciplines-Firms: Types, Objectives and goals-Managerial Decisions-Decision Analysis.

MODULE II Demand and Supply Analysis 10 L

Demand-Types of demand-determinants of demand-Demand function-Demand Elasticity-Demand forecasting-Supply-Determinants of supply-Supply function-Supply Elasticity.

MODULE III Cost Analysis 10 L

Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – PV ratio,

MODULE IV Elementary economic Analysis – **06 L**

Inflation-Meaning of inflation, types, causes, measures to control inflation.
National Income-Definition, Concepts of national income, Method of measuring national income.

MODULEV: Financial Accounting 08 L

Concepts and Definition of Accounting,Journal,Ledger,Trial Balance.
TradingA/C,Profit & Loss A/C and Balance Sheet.

MODULE VI : Investment Decision 04L

Time value of money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence. Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects .

Text Books

1. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India
2. Principles of Economics, Deviga Vengedasalam; Karunagaran Madhavan, Oxford University Press.
3. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson
4. R.Paneer Seelvan, " Engineering Economics", PHI
5. Ahuja,H.L., "Principles of Micro Economics" , S.Chand & Company Ltd
6. Jhingan,M.L., "Macro Economic Theory"
7. Macro Economics by S.P.Gupta, TMH
8.Haniff and Mukherjee,Modern Accounting,Vol-1,TMG
9.Modern Economic Theory – K.K. Dewett (S.Chand)

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1											✓	
CO2				✓								
C03											✓	
CO4									✓			
CO5											✓	

Paper Name: FOOD PROCESS TECHNOLOGY – I (cereals, fruits and vegetables, beverages)

Paper Code: FT501

Contact: L-T-P=2-2-0

Credit: 3

Pre requisites: Food Chemistry, Food Preservation, Food Microbiology

Course Objective:
To provide the students an opportunity to gain knowledge about the storage procedure of different cereals, fruits and vegetables and to help students to understanding the different procedure of production of various cereal based, fruit based and vegetable based products.

Course outcome(s):
FT.501.1: Ability to understand the Processing and storage of cereals.
FT.501.2: Ability to identify suitable equipments for fruit and vegetable processing
FT.501.3: Ability to gain the knowledge of processing methods of fruits and vegetables in food industries.
FT.501.4: Ability to apply the principles underpinning the safe and effective production of beverages.
FT.501.5: Ability to implement their idea about detailed manufacturing technologies of carbonated and non carbonated nonalcoholic beverages consumed in daily life in food industries.

Course Contents:

Module I: 8L

Basic composition and utilization of cereals; Drying of grains; Milling of rice and processes for rice-based products; Milling of wheat and processes of wheat based products; Milling and utilization of corn, barley, oat and millets; Common infestation in grains; Principle and practice of storage of cereals; Storage structures.

Module II: 8L
Feed for livestock from wheat bran and germ; Production of starch, modified starch; Extraction of proteins from cereals; Potato processing (potato chips, flakes, powder).

Module III: 8L

Handling and quality assessment of fruits & vegetables; Storage of fruits & vegetables; Production of fruits and vegetable juices/puree/nectar, Intermediate moisture foods from fruits (jam, jelly, marmalade, leathers, candy); Sauce and ketchup from tomato., Dehydrated fruits & vegetables;

Utilization of by-products from fruit-based industries – extraction of pectin, fat/oil from peel and seeds, aroma from peel and pomace. candied peel.

Module IV: 8L

Non-alcoholic beverages; Processing of tea, coffee and cocoa, Instant coffee; Production of chocolate and cocoa butter; Extraction of caffeine from tea leaves; Food additives -coloring agents, humectants, anti-caking agents, natural and artificial low calorie sweeteners, pH control agents, thickeners, nutrients.

Revision: 4L

Text /Reference books:

1. Postharvest Technology of Fruits & Vegetables (vol 1 & 2): Handling, Processing, Fermentation and Waste Management – L. R. Verma & V. K. Joshi, Indus Pub, New Delhi, 2000.
2. Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices – A. Chakraverty, Arun S. Mujumdar, G. S. V. Raghavan & H. S. Ramaswamy - Marcel Dekker, 2003
3. Postharvest Technology and Food Process Engineering – A Chakraverty & R. Paul Singh, CRC Press, 2014
4. Food Science by Potter
5. Fruit and Vegetable Preservation by Srivastava and Sanjeev Kumar
6. Principles of Food Science, Vol-I by Fennma Karrel
7. Preservation of Fruits & Vegetables by Girdhari Lal, Sidhapa and Tandon
8. Food Science by Mudambi

CO - PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT501. 1	3	3	-	2	-	-	-	2	-	1	-	3
FT501. 2	3	3	-	2	-	-	-	2	-	1	-	3
FT501. 3	3	3	-	2	-	-	-	2	-	1	-	3
FT501. 4	3	3	-	2	-	-	-	2	-	1	-	3
FT501. 5	3	2	-	2	-	-	-	2	-	1	-	3
Overall CO (FT501) mapping	3.00	2.80	-	2	-	-	-	2	-	1	-	3

Paper name: FOOD PROCESS TECHNOLOGY – II (fish, meat, poultry)

Paper Code: FT502

Contacts: L-T-P=2-2-0

Credit: 3

Pre requisites: Food Chemistry, Food Preservation, Food Microbiology

Course Objective:
To provide an opportunity for students to classify different processing techniques required for preservation of fish, meat, poultry and classify the different by products related to these industries.

Course outcome(s):
FT502.1: Ability to identify the significance of fish processing and classify different processing techniques required for preservation of fish.
FT502.2: Ability to classify the different by products related to fish processing industries and describe their use.
FT502.3: Ability to differentiate various components of the meat muscle with special focus on slaughtering and post mortem changes in meat.
FT502.4: Ability to recognize the different processing techniques related to meat processing industry.
FT502.5: Ability to develop a general understanding on the structure, composition and nutritional values of eggs and recognize the effective preservation methods.

Course Contents:

Module I (8L):
Classification of fresh water fish and marine fish; Commercial handling, storage and transport of fish; Proximate composition and nutritive value of fish; Indices of freshness and its quality assessment; Spoilage of fish; Methods of Preservation of fish and fish products: Canning, Freezing, Drying, Curing, Smoking, Fermentation (fish sauce).

Module II (8L):
Fish byproducts - production of fish meal, fish protein concentrate, fish protein hydrolyzate fish liver oil and fish silage; Production of chitin, chitosan; Production of non-food items from fish; Processing of fish wastes.

Module III (8L):

Slaughtering of animals; Classification, composition and nutritive value of poultry meat; Post mortem changes of meat; Curing and smoking of meat; Fermented meat products (sausages and

sauces); Frozen meat & meat storage; By-products from slaughter houses and meat processing industries and their utilization.

Module IV (8L):
Structure, composition and nutritive values of eggs; Quality assessment (defects) of eggs; Processing of eggs; Byproduct Utilization – commercial processing of lecithin and other egg solids, Utilization of egg-derived products as food ingredients.

Revision: 4L

Text/ Reference Books:

1. Meat Science and Applications - Y H. Hu., Wai-Kit Nip, Robert W. Rogers& Owen A. Young, Marcel Dekker, 2001.
2. Advanced Technologies for Meat Processing - Leo M. L. Nollet & Fidel Toldrá, CRC Press, 2006.
3. Processed Meats; Pearson AM & Gillett TA; 1996, CBS Publishers.
4. Meat; Cole DJA & Lawrie RA; 1975, AVI Pub.
5. Egg and poultry meat processing; Stadelman WJ, Olson VM, Shemwell GA & Pasch S; 1988, Elliswood Ltd.
6. Developments in Meat Science – I & II, Lawrie R; Applied Science Pub. Ltd.
7. Egg Science & Technology; Stadelman WJ & Cotterill OJ; 1973, AVI Pub.
8. Fish as Food; Vol 1 & 2; Bremner HA; 2002, CRC Press.
9. Fish & Fisheries of India; Jhingram VG; 1983, Hindustan Pub Corp
10. Fish as Food, Vol. I-IV; George Borgstrom, Academic Press
11. Fish Processing Technology , Rogestein & Rogestein

CO - PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT502. 1	3	3	-	2	-	-	-	2	2	1	-	3
FT502. 2	3	3	-	2	-	-	-	2	2	1	-	3
FT502. 3	3	3	-	2	-	-	-	2	2	1	-	3
FT502. 4	3	3	-	2	-	-	-	2	2	1	-	3
FT502. 5	3	2	-	2	-	-	-	2	2	1	-	3
Overall CO (FT502) mapping	3.00	2.80	-	2	-	-	-	2.00	2.00	1.00	-	3

Paper name: FOOD PROCESS ENGINEERING

Paper Code: FT503

Contacts: L-T-P=2-2-0

Credit: 3

Pre requisites: Stoichiometry, Unit Operation

Course Objective:
To help the students design the process parameters for thermal processing, freezing, evaporation, dehydration, separation, extraction and to develop skills in formulating solutions to solve problems in food industry.

Course outcome(s):
FT503.1: Ability to design food processing systems including proper equipment sizing and operational parameters for thermal processing, evaporation, dehydration, separation, extraction.
FT503.2: Ability to evaluate current publications concerning food engineering topics.
FT503.3: Ability to use the knowledge of Food Process Engineering to conserve and minimize the losses of food produced.
FT503.4: Ability to focus the primary goal on food security
FT503.5: Ability to predict in formulating solutions to solve problems in food industry.

Course Contents:

Module I (8L): Batch and continuous sterilization processes (including steps and various machineries involved) used in canning of foods; Sterilization and aseptic packaging of liquid foods; Constructional and operational features of pasteurizer; homogenizer; Constructional features and principles of single effect evaporators (including mass and energy balances) used for concentration of liquid foods.

Module II (8L): Constructional features of cold storage and basic design approach; Different types of freezers including plate contact freezer, air blast freezer; Cryogenic freezing; Refrigerated mobile vans.

Module III (8L): Overview of Psychrometry and humidification-dehumidification processes; Theory of drying and mechanism of moisture transfer in drying; Drying kinetics and constant & falling rate periods in drying; Constructional & operational features of various types of cross-flow, through flow and recirculatory dryers – Tray dryer, roller dryer, spray dryer, fluidized bed dryer, freeze dryer and solar dryer, rotary dryer, tunnel dryer, other grain dryers (LSU-type).

Module IV (8L): Heat exchangers (Co-current and counter-current heat exchanger); Constructional features of various types of heat exchangers – DPHE, Shell& tube heat exchanger, Plate heat exchanger, extended surface heat exchangers; Theory and operation of extrusion systems used in food industry; Cold extrusion and Extrusion cooking systems; Single and twin-screw extruders – constructional and operational features including advantages/disadvantages.

Tutorials

Revision: 4L

Text/ Reference Books:

1. Introduction to Food Engineering (5th Ed.) – R. P. Sing & D. R. Heldman, Academic Press, 2014
2. Food Process Engineering & Technology (2nd Ed.) – Z. Berk, Academic Press, 2014
3. Fundamentals of Food Process Engineering (3rd Ed.) – R. T. Toledo, Springer, 2007.
4. Food Process Engineering Operations – G. D. Saravacos & Z. B. Maroulis, CRC Press, 2011.
5. Transport Processes & Separation Process Principles – C. J. Geankoplis, PHI, 2003
6. Introduction to Food Process Engineering – A. Ibraz & G. V. Barbosa-Canovas – CRC Press, 2014.
7. Introduction to Food Process Engineering (2nd Ed.) – P. G. Smith, Springer, 2011.
8. Postharvest Technology and Food Process Engineering- Amalendu Chakraverty & R. Paul Singh, CRC Press, 2014.
9. Fundamentals of Food Engineering – D. G. Rao, PHILearning, 2014.
10. Unit Operations of Chemical Engineering – W.L. McCabe, J. C. Smith & P. Harriott, McGraw Hill International, 1993.
11. Food Process Engineering & Technology – Md. Iffan A. Ansari – Jain Brothers
12. Processing & Food Engineering – M. K. Garg & P. Chandra, Jain Brothers
13. Solved Problems in Food Engineering -Stavros Yanniotis, Springer

CO - PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT503. 1	3	1	-	-	-	3	3	-	-	-	-	3
FT503. 2	3	3	3	2	-	-	-	-	-	-	-	3
FT503. 3	3	3	3	3	1	-	2	-	-	-	-	3
FT503. 4	3	3	2	2	-	-	2	-	-	-	-	3
FT503. 5	2	-	-	-	-	2	2	-	-	-	2	3
Overall CO (FT503) mapping	2.80	2.50	2.67	2.33	1.00	2.50	2.25	-	-	-	2.00	3.00

Paper Name: Unit Operation of Chemical Engineering II

Paper Code: CHE514A

Contacts: L-T-P = 2-2-0

Credit: 3

Pre requisites: Thermodynamics, Stoichiometry, Unit Operation

Course Objective:
The purpose of this course is to introduce the undergraduate students with the most important separation equipment in the process industry, and provide proper understanding of unit operations.

Course Outcome(s):
CHE 514A.1: Ability to have the knowledge of different types of mass transfer operations
CHE 514A.2: Ability to explain different types of mass transfer operations
CHE 514A.3: Ability to solve the problems of diffusion, distillation, extraction, drying and crystallization
CHE 514A.4: Ability to design absorption and distillation column
CHE 514A.5: Ability to explain the modern separation and purification processes

Course Contents:

Module I: 8L
Introduction to mass transfer: Molecular diffusion in fluids, diffusivity, mass transfer coefficients, inter-phase mass transfer, gas absorption, countercurrent multistage operation, packed tower.

Module II: 8L
Distillation: Vapor-liquid equilibrium, Rayleigh's equation, flash and differential distillation, continuous rectification, McCabe-Thiele method.

Module III: 10L
Extraction, Drying and Crystallization: Liquid-liquid equilibrium, liquid extraction, stage-wise contact, liquid-solid equilibria, leaching, batch drying and mechanism of batch drying, preliminary idea of crystallization.

Module IV: 6L
Advanced separation processes: Dialysis, ultrafiltration, reverse osmosis, pervaporation, electro dialysis and membrane separation.

Revision: 4L

Text /Reference books:

1. Unit Operations of Chemical Engineering; McCabe, Smith & Harriot; 6th ed, TMH.

2. Transport Processes & Unit operations; Geankopolis; 3rd ed, PHI.
3. Chemical Engineering, Vol-I & II, Colson & Richardson; Butterworth Heinemann.
4. Chemical Engineer's Handbook; Perry, Chilton & Green; MGH.

CO - PO Mapping:

CO	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CHE 514A.1	3	3	2	2	2	1	-	-	-	-	-	3
CHE 514A.2	3	3	2	2	-	-	-	-	-	-	-	3
CHE 514A.3	3	3	2	-	3	1	-	-	-	-	-	3
CHE 514A.4	3	3	3	2	2	-	-	-	-	-	-	3
CHE 514A.5	3	3	3	3	2	1	-	-	-	-	-	3
Overall CO (CHE 514A) mapping	3	3	2.4	2.25	2.25	1	-	-	-	-	-	3

Paper name: Separation Process

Paper Code: CHE 514 B

Contact: L-T-P=2-2-0

Pre requisites: Thermodynamics, Stoichiometry, Unit Operation

Course Objective:
To learn conceptual design of separation processes and design of equipment involved.

Course Outcome(s):
CHE514B.1 Knowledge of various chemical engineering separation processes
CHE514B.2 Ability to Select appropriate separation technique for intended problem
CHE514B.3 Ability to analyze the separation system for multi-component mixtures
CHE514B.4 Ability to design separation system for the effective solution of intended problem

Course Content

Module I: 8L
Principles of molecular diffusion and diffusion between phases, Fick's Law, Diffusivity, Equation of continuity, Diffusion in solids. A definition of Mass transfer coefficient, Correlation of mass transfer coefficients, Theories of Mass Transfer, mass transfer across interfaces, Analogy between momentum, heat and mass transfer, Concept of stage wise processes.

Module II: 8L
Introduction, Mechanism of absorption, Absorption equipments, Diameter and height calculations for packed columns, Kremser equation, H. E. T. P. , H. T. U. , and N. T. U. concepts, Packed tower design, height of column based on conditions in the gas, liquid film, and overall coefficients, plate type towers, number of plates by use of absorption factor.

Module III: 8L
Introduction, Vapor-liquid equilibria, Relative volatility, Ideal and non -ideal solutions, Batch, differential and equilibrium distillation, Enthalpy concentration diagram, Rectification of binary systems, Design of rectification column, calculation of number of ideal plates in a distillation column by McCabe-Thiele method, importance of reflux ratio, Azeotropic mixture & Extractive Distillations, Introduction to multi-component distillation.

Module IV: 8L
Introduction, nature of adsorbents, batch adsorption, Adsorption isotherms, Adsorption equipment, breakthrough curves, design of fixed bed adsorption column.

Revision: 4L

Text /Reference books:

1. Mass Transfer Operations: Robert E. Treybal, MGH, International student Edition.
2. Transport process and Unit Operations: Geankoplis. 3rd Edn., PHI.
3. Unit Operations in Chemical Engfueering : McCabe, Smith, and Harriot. MGH, Sth Edn.
4. Multicomponent Distillation: Holland, C. D., PHI.
5. The Elements of Fractional Distillation: Robinson, C. S. and Gilliland, E. R. MGH.
6. Mass Transfer: Sherwood, Pigford, and Wilke, MGH.
7. Separation Processes: King, C. J. MGH.
8. Design of Equilibrium Stage Processes: Smith, B. D. MGH.
9. Distillation: van Winkle, M., MGH.

CO - PO Mapping:

CO	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CHE514B.1	3	3	2	2	-	-	-	-	-	-	-	3
CHE514B.2	3	3	2	-	3	1	-	-	-	-	-	3
CHE514B.3	3	3	1	1	1	-	-	-	-	-	-	3
CHE514B.4	3	3	3	3	2	1	-	-	-	-	-	3
Overall CO (CHE514B) mapping	3	3	2	2	2	1	-	-	-	-	-	3

PRACTICAL

Paper Name: Food Processing Lab I

Paper Code: FT591

Contact: L-T-P=0-0-4

Credit: 2

Pre requisites: Principles of Food Preservation, Unit Operation

Course Objectives:
To assist the students use laboratory techniques common to basic Food Processing and to provide an opportunity to the students to evaluate the effective test methods used in sensory evaluation and analyze the resulting information.

Course outcome:
After the completion of the Food Processing Lab -I the students will be able to:
FT591.1 Use laboratory techniques common to basic Food Processing.
FT591.2 Understand the factors that affect heat transfer in food processing systems.
FT591.3 Apply the principles that make a food product safe for consumption.
FT591.4 Interpret government regulations pertaining to food manufacturing.
FT591.5 Evaluate the effective test methods used in sensory evaluation and analyze the resulting information.

Course Contents:

1. Preparation of citrus fruit squash/nectar/concentrated juice.
2. Preparation of fruit jam/mixed jam/marmalade.
3. Preparation of jelly/synthetic jelly.
4. Preparation of tomato ketchup/puree/sauce.
5. Preparation of fruit/vegetable pickles.
6. Preparation of dried vegetable.
7. Preparation of fermented cereal/vegetable (Sauerkraut) food products
8. Preparation of fruit leathers

CO - PO Mapping:

CO	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT591.1	2	2	1	1	2	2	2	-	-	-	2	2
FT591.2	3	2	2	2	-	-	-	-	-	-	-	3
FT591.3	2	2	2	-	-	2	3	2	-	-	2	3
FT591.4	2	1	1	-	-	2	3	-	-	-	-	3
FT591.5	3	2	2	2	2	-	-	-	-	-	-	3
Overall CO (FT591) mapping	2.40	1.80	1.60	1.67	2.00	2.00	2.67	2.00	-	-	2.00	2.80

Paper Name: FOOD ANALYSIS AND QUALITY CONTROL LAB

Paper Code: FT592
Contact: L-T-P = 0-0-4
Credit: 2
Pre requisites: Food Chemistry, Biochemistry

Course Objectives:
To help the students develop practical skill in analyzing various components e.g. carbohydrate, fat, protein, vitamin etc. available in various food materials and to measure the acidity, ash, sugar content, moisture, total solid content, viscosity, unsaturation, volatile fatty acid, hydrolytic rancidity, oxidative rancidity of these food samples.

Course outcome:
FT592.1 To help the students develop practical skill in analyzing various food components available in various food materials.
FT592.2 To assist he students understand the various test to detect adulterant in various food sample.

FT592.3 To provide an opportunity to the student measure the acidity, ash, sugar content, moisture, total solid content, viscosity determination of various food sample.
FT592.4 To create an environment for the students to estimate various nutritional parameters e.g. Carbohydrate, fat, protein, vitamin etc.
FT592.5 To help the students determine the unsaturation, volatile fatty acid, hydrolytic rancidity, oxidative rancidity of various food samples.

Course Content:

1. Analysis (acidity, reducing and non reducing sugar content) of jam/jelly/marmalade.
2. Analysis (ash content, moisture content and Polyphenol content) of spices.
3. Analysis (ash content, moisture content, fat content) of milk, milk powder.
4. Analysis (ash content, moisture content, bulk density, Polyphenol content, total extractive) of tea.
5. Analysis (ash content, moisture content, bulk density, Polyphenol content, total extractive, chicory) of coffee.
6. Analysis (ash content, moisture content, crude fibre content, loaf volume only for bread) of wheat flour, bread, biscuits.
7. Analysis (acidity, reducing and non reducing sugar, TSS) of non-alcoholic beverages.
8. Estimation of (a) Iodine value, (b) Saponification value (c) acid value (d) peroxide value, (e) RM value (f) P value, (g) K value of fats and oils P olenske Number, Krishner value of ghee and oil samples.
9. Analysis (lactic acid content) of Sauerkraut.

CO - PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
FT592.1	3	2	2	2	-	-	-	-	-	2	-	3
FT592.2	3	2	2	2	2	3	1	2	-	-	-	3
FT592.3	3	2	2	2	2	-	-	-	-	-	-	3
FT592.4	3	2	2	2	2	-	-	-	-	-	-	3
FT592.5	3	2	2	2	2	-	-	-	-	-	-	3
Overall CO (FT592) mapping	3.00	2.00	2.00	2.00	2.00	3.00	1.00	2.00	-	2.00	-	3

Paper Name: Unit Operation Lab II

Paper Code: CHE584 A

Contact: L-T-P=0-0-4

Credit: 2

Pre Requisites: Unit Operation

Course Objective:
To learn analytical experimental methods using sophisticated instruments and interpretation of experimental data.

Course outcome:
After the completion of the laboratory course students will be able to:

CHE584A.1 Define process equipment via hands-on learning.
CHE584A.2 Determine the filter medium resistance & cake resistance
CHE584A.3 Estimate separation coefficient in centrifugation and vacuum evaporation
CHE584A.4 Compare drying rates of food using different types of driers
CHE584A.5 Calculate the mass transfer coefficients and relative volatility of solvents.

Course Contents:

1. Determination of filter medium resistance & cake resistance in cake filtration
2. Determination of separation coefficient in centrifugation
3. Determination of separation coefficient by vacuum evaporation using Rotary Vacuum Evaporator
4. Determination of drying rates of food using different types of driers (Tray Drier, Fluidized bed Drier, Freeze Drier, Spray Drier)
5. To measure the heat flow during freezing of food products
6. Determination of Mass transfer coefficient / kLa
7. Determination of relative volatility of solvent mixtures by distillation.

CO - PO Mapping:

CO	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CHE584A.1	3	2	2	2	2	1	-	1	2	-	-	3
CHE584A.2	3	2	2	2	2	-	-	1	2	-	-	3
CHE584A.3	3	2	2	2	2	-	-	1	2	-	-	3
CHE584A.4	3	2	2	2	2	-	-	1	2	-	-	3
CHE584A.5	3	2	2	2	2	-	-	1	2	-	-	3
Overall CO (CHE 584A) mapping	3	2	2	2	2	1	-	1	2	-	-	3

Paper Name: Separation Process Lab

Paper Code: CHE584 B

Contact: L-T-P=0-0-4

Credit: 3

Pre-requisites: Separation process

Course Objective:
To learn analytical experimental methods using sophisticated instruments and interpretation of experimental data.

Course outcome:
CHE584B.1 Ability to understand, explain and select instrumental techniques for analysis
CHE584B.2 Ability to plan experiments and operate several specific instruments
CHE584B.3 Ability to analyze and interpret the experimental data

Course Contents:

1. Determination of diffusivity of volatile liquids in air using Stefan tube.
2. Determine of simple batch distillation to verify Rayleigh's equation.
3. To draw vapor-liquid equilibrium diagram using Othmer still.
4. To measure the mass transfer co-efficient on wetted wall column.
5. To measure the performance of a rectification column.
6. To measure the absorption coefficient in a packed tower.
7. To measure the drying characteristics of a material under constant drying air condition.
8. To determine adsorption isotherms on batch adsorption.

CO - PO Mapping:

CO	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CHE584B.1	3	2	2	2	2	-	-	1	2	-	-	3
CHE584B.2	3	2	2	2	2	-	-	1	2	-	-	3
CHE584B.3	3	2	2	2	2	-	-	1	2	-	-	3
Overall CO (CHE584B) mapping	3	2	2	2	2	-	-	1	2	-	-	3

SESSONAL

Name of the Paper: Technical Model Presentation Skill

Paper Code: MC 581

Contact: L-T-P=0-0-2

Credit: 0

Pre Requisites: Unit Operation, Food Processing Engineering, Food Chemistry.

Course Objective

To understand the latest technological development in context to Food Technology Discipline and to enhance the efficiency in professional field.

Course outcome:
MC581.1 Ability to understand and select recent techniques for food processing and packaging
MC581.2 Ability to plan experiments and operate several specific instruments
MC581.3 Ability to analyze and interpret the experimental data

Detailed Syllabus

No. of Experiment	**Syllabus formed for Autonomy(based upon mini project)**
1	Recent advances in thermal sterilization of packaged foods
2	Advanced level of packaging systems
3	Recent advances in drying technologies
4	Non-thermal processing of foods
5	Extraction of bioactive from fruits & vegetables
6	Natural pigments from food
7	Ready-mix, ready-to-cook (RTC), ready to-eat(RTE) foods
8	Extrusion and extruded foods

CO - PO Mapping:

CO	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
MC581.1	3	2	1	-	-	2	2	2	-	-	2	3
MC581.2	3	2	2	2	1	-	-	-	-	-	-	3
MC581.3	3	2	2	2	-	-	-	-	-	-	-	3
Overall CO (MC581) mapping	3.00	2.00	1.67	2.00	1.00	2.00	2.00	2.00	-	-	2.00	3.00

3rd Year:6thSEMESTER

A:THEORY:

Sl. no.	Field	Code	Subjects	Contacthours/week				Credit points
				L	T	P	Total	
1	PC	FT601	Food process technology–III(milk and milk products)	2	2	0	4	3
2	PC	FT602	Food process technology–IV(edible fats and oils)	2	2	0	4	3
3	PC	FT603	Bakery, confectionary and extruded foods	3	0	0	3	3
4	PC	FT604	Microbial technology & food biotechnology	2	2	0	4	3
5	OE	CS (FT)615 (A/B/C)	Data structure and algorithm/ Database Management System/Software Engineering	3	0	0	3	3
Total Theory							18	15

B. PRACTICAL:

Sl. no.	Field	Code	Subjects	Contacthours/week				Credit points
				L	T	P	Total	
1	PC	FT691	Food processing lab–II	0	0	4	4	3
2	PC	FT692	Microbial technology lab	0	0	3	3	2
3	OE	CS(FT)685 (A/B/C)	Data structure and algorithm Lab/ Database Management System Lab/Software Engineering Lab	0	0	3	3	2
4	HS	HU681	Group Discussion	0	0	2	2	1
Total practical							12	8
Total6thsemester							30	23

THEORY

Paper Name: Food process technology – III (milk and milk products)

Paper Code: FT 601

Contact: L-T-P = 2 – 2 – 0

Credit: 3

Pre requisites: Chemistry of Food, Food Preservation, Food Microbiology

Course Objective: To provide an opportunity for students to classify different processing techniques required for preservation of milk and classify the different by products related to this industry.

Course outcome(s):

FT601.1: Ability to define milk and to identify the varieties of milk.

FT601.2: Ability to describe the composition of milk and discuss cleaning and sanitization of different milk industry.

FT601.3: Ability to apply different testing methods to detect adulterant in milk and to demonstrate thermal processing of milk and milk products.

FT601.4: Ability to solve simple problem based on milk drying and to categorize different dried milk products.
FT601.5: Ability to formulate different milk based products and to prepare different traditional Indian dairy products.

Course Content:
Module I (8L):
Define milk; History of milk, Composition of milk; Varieties of milk; Checks for purity of milk; Method of detection of adulterant in milk; Handling of freshly produced milk; Cleaning and sanitization

Module II (8L):
Thermal processing of fluid milk – Pasteurization (LTLT and HTST), Sterilization and UHT techniques; Packaging of fluid milk, Fermentation of milk and fermented milk products – Cheese, Yogurt, Curd, Kefir, Kumiss, Flavoured yogurt, Therapeutic value of Fermented Products,Probiotics and probiotics dairy products

Module III (8L):
Processing of evaporated and dried milk products – Milk powder, Malted milk, Simple problem based on milk drying; SCM, etc.; Cream, butter, ghee, Ice-cream, Butter oil, Infant formulae.

Module IV (8L):
Traditional Indian sweets-Kheer, Dahi, Paneer, Channa,Srikhand Dairy processing by-products – Fermented, condensed and dried products from whey and Production of lactose and protein from whey.
Revision: 4L

Text/ Reference Books:

1. Robinson RK; 1996; Modern Dairy Technology, Vol 1 & 2; Elsevier Applied Science Pub.
2. Milk & Milk Processing; Herrington BL; 1948, McGraw-Hill Book Company.
3. Modern Dairy Products, Lampert LH; 1970, Chemical Publishing Company.
4. Developments in Dairy Chemistry – Vol 1 & 2; Fox PF; Applied Science Pub Ltd.
5. Outlines of Dairy Technology, De S; Oxford.

CO - PO Mapping:

CO	Statement	Program Outcomes											
		a	b	c	d	e	f	g	h	i	j	k	l
FT601. 1	Ability to define milk and to identify the varieties of milk.	3	3	1	-	-	2	-	-	-	-	-	3
FT601. 2	Ability to describe the composition of milk and discuss cleaning and sanitization of different milk industry.	3	3	3	2	-	1	1	-	-	-	-	3
FT601. 3	Ability to apply different testing methods to detect adulterant in milk and to demonstratethermal processing of milk and milk products.	3	2	1	1	-	-	-	-	-	-	-	3
FT601. 4	Ability to solve simple problem based on milk drying and to categorize different dried milk products.	3	3	1	-	-	-	-	-	-	-	-	3
FT601. 5	Ability to formulate different milk based products and to prepare different traditional Indian dairy products.	3	2	-	-	-	2	2	2	-	-	-	3
Overall CO (FT601) mapping		3	2	1	1	-	1	1	1	-	-	-	3

Paper Name: Food process technology – IV (edible fats and oils)

Paper Code: FT 602

Contact: L-T-P = 2 – 2 – 0

Credit: 3

Pre requisites: Chemistry of Food, Principles of Food Preservation

Course Objective: To study in depth the chemical, physical and nutritional properties of fatsand oils and the technologies involved in the production of products.

Course Outcome(s):

FT 602.1: Students will be able to analyze the various properties of fats and oils
FT 602.2: To know about the production and refining of vegetable oil.
FT 602.3: To know about the changes occurs during storage of fat and oil and preservation methods
FT 602.4: To develop technology for manufacture of designer fats
FT 602.5: To develop newer methods for analysis of non-oil constituents of oil bearing materials.

Course Contents:
Module I (8L):
Importance of fats and oils in foods; Sources, composition and properties of fats and oils (plant and animal origin); Extraction of fats and oils Rendering, pressing, solvent extraction, supercritical fluid extraction, enzyme-derived oil extraction.
Module II (8L):
Processing of oils – Degumming, refining, dewaxing, bleaching, deodorization, fractionation; Pyrolysis of fats, toxicity of frying oil.

Module III (8L):
Plastic fat –hydrogenation, esterification, inter-esterification and emulsification; Application of plastic fat in bakery, confectionary (including cocoa butter replacers), shortenings, margarine processing.

Module IV (8L):
By-products of fat/oil processing industries – Oil seed protein isolates; Quality standards of fats and fatty foods; Antioxidants and its mechanism of application.

Revision: 4L

Text /Reference books:

1. Bailey's Industrial Oil and Fat Products, Vol 1 & 2; Swern D; 4th ed, 1982, John Wiley & Sons.
2. The Chemistry & Technology of Edible Oils and Fats; Devine J & Williams PN; 1961, Pergamon Press.
3. Food Oils and their Uses; Weiss TJ; 1983, AVI.
4. Edible Oils & Fats: Developments since 1978 (Food Technology Review # 57); Torrey S; 1983, NDC.

CO - PO Mapping:

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT 602.1	Students will be able to analyze the various properties of fats and oils	3	1	-	-	-	-	-	-	-	-	-	3
FT 602.2	To know about the production and refining of vegetable oil.	3	2	2	-	-	1	-	-	-	-	-	3
FT 602.3	To know about the changes occurs during storage of fat and oil and preservation methods	3	3	3	3	1	-	2	-	-	-	-	3
FT 602.4	To develop technology for manufacture of designer fats	3	3	2	2	-	-	2	-	-	-	-	3
FT 602.5	To develop newer methods for analysis of non-oil constituents of oil bearing materials.	3	2	2	2	-	-	-	-	-	-	-	3
Overall CO (FT602) mapping		3	2	2	1	1	1	1	-	-	-	-	3

Paper Name: Bakery, confectionary and extruded foods

Paper Code: FT 603

Contact: L-T-P = 3 – 0 – 0

Credit: 3

Pre requisites: Chemistry of Food, Food Preservation, Food Microbiology

Course Objective: To provide an optimum environment for students to gain knowledge on the different functional properties of the ingredients, processes and machinery involved in production of different bakery and confectionery products. Students can also get idea about the safety, hygiene and maintenance of different bakery industries.

Course outcome(s):

FT603.1. Ability to gain knowledge on the ingredients, process and machinery involved in bakery and Confectionery technology.
FT603.2. Ability to evaluate the function, properties and interaction of raw materials by manufacturing a range of products and to use a selected range of testing procedures to assess the performance of raw materials in the product.
FT603.3. Ability to analyze production faults and suggest corrective actions and to assess product quality for industry and consumer requirements.
FT603.4. Ability to demonstrate a detailed knowledge of the law relating to the composition, labeling and advertising of food and food products within this area sold for human consumption.
FT603.5. Ability to illustrate the technical knowledge for the development of Bakery and Confectionary industry.

Course Contents:

Module I (8L): Introduction to baking; Bakery ingredients and their functions; Machines and equipment for batch and continuous processing of bakery products: metering and weighing equipment, mixing, moulding, laminating equipment, different types of ovens, depaner etc.

Module II (8L): Testing of flour; Preparation techniques of different baked products: bread, cake and biscuits; Cake icing techniques, wafer manufacture, cookies, crackers, dusting or breading.; Analysis of bakery products;

Module III (8L): Preparation techniques of confectionary: pies and pastries, doughnuts, chocolates and candies; Coating or enrobing of chocolate (including pan-coating); Maintenance, safety and hygiene of bakery plants.

Module IV (8L): Importance and applications of extrusion in food processing; Pre and post extrusion treatments; Manufacturing process of extruded products: Texturized vegetable protein; Change of functional properties of food components during extrusion.

Revision: 4L

Books:

1. Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press.
2. Bakery Technology & Engineering; Matz SA; 1960; AVI Pub.
3. Up to-date Bread Making; Fance WJ &Wrogg BH; 1968, Maclasen& Sons Ltd.
4. Modern Cereal Chemistry; Kent-Jones DW & Amos AJ; 1967, Food Trade Press Ltd.

CO - PO Mapping:

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT603. 1	Ability to gain knowledge on the ingredients, process and machinery involved in bakery and Confectionery technology.	3	2	-	-	-	-	-	-	-	-	-	3
FT603. 2	Ability to evaluate the function, properties and interaction of raw materials by manufacturing a range of products and to use a selected range of testing procedures to assess the performance of raw materials in the product.	3	2	2	-	-	2	-	-	-	-	-	3
FT603. 3	Ability to analyze production faults and suggest corrective actions and to assess product quality for industry and consumer requirements.	3	3	2	1	2	-	-	1	-	-	-	3
FT603. 4	Ability to demonstrate a detailed knowledge of the law relating to the composition, labeling and advertising of food and food products within this area sold for human consumption.	2	2	-	3	-	3	2	2	-	-	-	3
FT603. 5	Ability to illustrate the technical knowledge for the development of Bakery and Confectionary industry.	3	2	2	1	2	1	-	-	-	-	-	3
Overall CO (FT603) mapped		3	2	1	1	1	1	1	1	-	-	-	3

Paper Name: Microbial technology & food biotechnology

Paper Code: FT 604

Contact: L-T-P = 2-2-0

Credit: 3

Pre requisites: Chemistry of Food, Food Preservation, Food Microbiology

Course Objective: To provide an opportunity for students to know about the pathogenic & nonpathogenic beneficial organisms and the use of beneficial organisms in food industry along with genetic engineering.

Course outcome(s):

FT604.1: Ability to use the idea of biotechnology

FT604.2: Ability to understand microbiological quality of water and food

FT604.3: Ability to know about production method of organic acids, alcoholic beverages and glycerol

FT604.4: Ability to apply fermentation method to produce different food and medicines

FT604.5: Ability to collect basic knowledge on genetic engineering and genetically modified crop

Course Contents:

Module I (8L):
Methods for the microbiological examination of water and foods, Coliform bacteria, Coliform test; Food borne illnesses and diseases

Module II (8L):
Production of organic acids (vinegar, lactic
acid), alcoholic beverages (beer, wine, and distilled alcoholic beverages such as whiskey, rum, vodka), glycerol

Module III (8L):
Propagation of baker's yeasts; Microbial production of vitamins (B2 and B12), antibiotics (penicillin, streptomycin,
tetracycline); SCP and mushrooms

Module IV (8L):
Basics of microbial genetics – Gene, DNA, RNA; Replication, transcription, transformation, transduction, conjugation;
Regulation of gene expression; Application in GM foods.

Revision: 4L

Text Books:
1. Industrial Microbiology Prescott & Dunn, CBS Publishers
2. Modern Food Microbiology by Jay JM, CBS Publishers

3. Comprehensive Biotechnology by Murray &Mooyoung, Academic press
4. Industrial Microbiology by Casida L.R., New Age International Pvt. Ltd.
5. Food Microbiology; Frazier WC; 4th ed, Tata-McGrowhill Pub.
6. Microbiology by Pelczar, Chan, and Krieg, TMH
7. Fermentation Biotechnology, Principles, Processed Products by Ward OP, Open University Press.

CO - PO Mapping:

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT604.1	Ability to use the idea of biotechnology	3	3	2	2	-	2	2	-	-	-	-	3
FT604.2	Ability to understand microbiological quality of water and food	3	3	-	-	-	2	2	-	-	-	-	3
FT604.3	Ability to know about production method of organic acids, alcoholic beverages and glycerol	3	3	-	-	-	1	-	-	-	-	-	3
FT604.4	Ability to apply fermentation method to produce different food and medicines	3	3	1	-	-	2	3	2	-	-	-	3
FT604.5	Ability to collect basic knowledge on genetic engineering and genetically modified crop	3	3	2	-	-	2	2	-	-	-	-	3
Overall CO (FT604) mapping		3	3	1	1	-	2	2	1	-	-	-	3

Paper Name: Data Structure and Algorithm

Paper Code: CS (FT) 615A

Contact: L-T-P= 3-0-0

Credit: 3

Prerequisite:

1. Familiarity with the fundamentals of C or other programming language
2. A solid background in mathematics, including probability, set theory.

Course Objective(s):

- To learn the basics of abstract data types.
- To learn the principles of linear and nonlinear data structures.
- To build an application using sorting and searching.

Course Outcome(s):

On completion of the course students will be able to

CS(FT)615A.1. Differentiate how the choices of data structure & algorithm methods impact the performance of program.
CS(FT)615A.2. Solve problems based upon different data structure & also write programs.
CS(FT)615A.3. Identify appropriate data structure & algorithmic methods in solving problem.
CS(FT)615A.4. Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing
CS(FT)615A.5. Compare and contrast the benefits of dynamic and static data structures implementations.

Course Content:

Module I: Linear Data Structure 10L

Introduction (2L):
Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type.
Algorithms and programs, basic idea of pseudo-code **(1L)**
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations **(1L)**
Array (2L):
Different representations – row major, column major **(1L)**
Sparse matrix - its implementation and usage, Array representation of polynomials **(1L)**
Linked List (4L):
Singly linked list – operations, Doubly linked list – operations **(3L)**
Circular linked list – operations, Linked list representation of polynomial and applications **(3L)**

Module II: Linear Data Structure 6L

Stack and Queue (4L):
Stack and its implementations (using array, using linked list) (1L)
Applications (infix to Postfix, Postfix Evaluation) (1L)
Queue, circular queue de-queue (1L)
Implementation of queue- both linear and circular (using array, using linked list) (1L)
Recursion (2L):
Principles of recursion - use of stack, tail recursion. (1L)
Applications - The Tower of Hanoi, Eight Queens Puzzle (1L)

Module III: Nonlinear Data structures 12L

Trees (8L):
Basic terminologies, forest, tree representation (using array, using linked list) **(1L)**
Binary trees - binary tree traversal (pre-, in-, post- order) **(1L)**
Threaded binary tree **(1L)**
Binary search tree- operations (creation, insertion, deletion, searching) **(1L)**
Heap(creation, insertion, deletion, searching) **(1L)**
Height balanced binary tree – AVL tree (insertion with examples only) **(1L)**
Height balanced binary tree – AVL tree (deletion with examples only) **(1L)**
m –Way Search Tree, B^+ Tree – operations (insertion, deletion with examples only) **(1L)**

Graphs (4L):

Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut-vertex/articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path, isomorphism) **(1L)**

Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge) **(2L)**
Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods) **(1L)**

Module IV: Searching, Sorting **8L**

Sorting Algorithms (4L):
Bubble sort, Insertion sort, Selection sort– with complexity (1L)
Quick sort, Merge sort – with complexity (2L)
Radix sort – with complexity (1L)
Searching (2L):
Sequential search – with complexity (1L)
Binary search, Interpolation Search– with complexity(1L)
Hashing (2L):
Hashing functions (1L)
Collision resolution techniques (1L)

Text books:

1. "Fundamentals of Data Structures of C" by Ellis Horowitz, SartajSahni, Susan Anderson-freed

Recommended books:

1. "The Art of Computer Programming" by Donald Knuth
2. "Data Structures, Algorithms, and Software Principles in C" by Thomas A. Standish
3. "Data Structures" by S. Lipschutz
4. "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung
5. "Data Structures in C" by Aaron M. Tenenbaum

CO PO MAPPING

CO	a	b	c	d	e	f	g	h	i	j	k	l
CS(FT)615A.1	3	3	2	2	3	2	2	3	3	3	2	3
CS(FT)615A.2	3	2	2	2	2	2	3	2	2	3	3	2
CS(FT)615A.3	3	3	3	2	3	3	3	2	2	3	3	2
CS(FT)615A.4	3	3	3	3	3	3	3	3	3	3	3	3
CS(FT)615A.5	3	3	3	3	3	3	3	3	3	3	3	3
CS(FT)615A overall mapping	3	3	3	2	3	3	3	3	3	3	3	3

Paper Name: Database Management System
Paper Code: CS(FT)615B
Contact Hours: 3L /Week
Contact: L-T-P= 3-0-0
Credits: 3

Prerequisite:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives

1. To learn the data models, conceptualize and depict a database system
2. To design system using E-R diagram.
3. To learn SQL & relational database design.
4. Tounderstandtheinternalstoragestructuresusingdifferentfileandindexingtechniques.
5. To know the concepts of transaction processing, concurrency control techniques and recovery procedure**.**

Course Outcomes (COs)

On completion of the course students will be able to

CS(FT)615B.1 Apply the knowledge of Entity Relationship (E-R)diagram for an application.

CS(FT)615B.2 Create a normalized relational database model

CS(FT)615B.3 Analyze real world queries to generate reports from it.

CS(FT)615B.4 Determine when therthe transaction satisfies the ACID properties.

CS(FT)615B.5 Create and maintain the database of an organization..

Course Content:

Module 1:

Introduction [3L]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module 2:

Entity-Relationship and Relational Database Model [11L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

Module 3:

SQL and Integrity Constraints [6L]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Module 4:

Relational Database Design [8L]

Functional Dependency, Different anamolies in designing a Database., Normalization using funtional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued dependencies, 4NF, 5NF , Case Study

Module 5:

Internals of RDBMS [9L]

Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling

Module 6:

File Organization & Index Structures [6L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes

Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and NovatheShamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing Company.

Reference:

1. Jain: Advanced Database Management System CyberTech
2. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
3. "Fundamentals of Database Systems", RamezElmasri, ShamkantB.Navathe, Addison Wesley Publishing Edition
4. "Database Management Systems", ArunK.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

CO PO Mapping

	CO & PO Mapping														
PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CS(FT)615B.1	2	2	2	2	3	2	1	1	2	2	3	3	2	2	1
CS(FT)615B.2	2	3	3	3	3	1	1	1	2	2	3	3	2	2	2
CS(FT)615B.3	3	3	2	3	3	2	2	2	3	3	3	3	3	2	2
CS(FT)615B.4	3	3	2	2	2	1	1	1	1	1	2	3	2	1	1
CS(FT)615B.5	3	3	3	3	3	2	2	2	3	3	3	3	3	2	2
CS(FT)615B A(average)	3	3	2	3	3	2	1	1	2	2	3	3	2	2	2

Paper Name: Software Engineering
Code: CS(FT)615C
Contacts: L-T-P =3-0-0
Credits: 3
Allotted hours: 34L

Prerequisite:

1. An understanding of basic computer software
2. Object Oriented programming skills.

Course Objective(s)

1. To develop basic Knowledge in Software Engineering and its applications.
2. To understand software Engineering layered architecture and the process frame work.
3. To analize software process models such as the waterfall, spiral, evolutionary models and agile method for software development.
4. To design software requirements and specifications of documents.
5. To understand project planning, scheduling, cost estimation, risk management.
6. To describe data models, object models, context models and behavioral models.
7. To learn coding style and testing issues.
8. To know about the quality checking mechanism for software process and product.

Course Outcomes

CS(FT)615C.1	To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements
CS(FT)615C.2	To analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project
CS(FT)615C.3	To design applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.
CS(FT)615C.4	To develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.
CS(FT)615C.5	To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning.

Course Content:

Module I (6L)
Software Engineering –Characteristics, Components, Application, Definitions, Software Process models - Waterfall Model, Prototype model, RAD, Evolutionary Models, Incremental, Spiral.,Software Project Planning- Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, Basics of estimation : COCOMO (Basic, intermediate, Complete) model

Module II (6L)

System Analysis: Principle of Structure Analysis, Requirement Analysis, DFD, Entity Relationship Diagram, Data Dictionary, Data Modeling, Software Requirements Specification
Software Design Aspects: Objectives, Principles, Concepts, HLD and LLD, Top-Down and Bottom-Up design; Decision tree, decision table and structured English, Structure chart, Transform analysis Functional Vs. Object- Oriented approach.

Module III (3L)
Introduction to Agile Methodology , Agile Testing , Quality in agile software development

Module IV (4L)
Unified Modeling Language: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity, diagram, implementation diagram, Use Case diagram

Module V (10L)
Coding & Documentation – Structured Programming, Modular Programming, Module Relationship-Coupling, Cohesion, OO Programming, Information Hiding, Reuse, System Documentation.
Testing – Levels of Testing, Integration Testing, System Testing**.**
Test Cases- White Box and Black Box testing Software Quality, Quality Assurance, Software Maintenance, Software Configuration Management, Software Architecture.

Module VI (5L)
Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement Project Monitoring.

Text Book
1. Software Engineering : A practitioner's approach– Pressman(TMH)

Reference Books:

1. Software Engineering- PankajJalote (Wiley-India)
2.Software Engineering- Rajib Mall (PHI)
3. Software Engineering –Agarwal and Agarwal (PHI)

CO	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(FT) 615C.1	1	1	2	2	1	-	-	-	-	-	-	-
CS(FT) 615C.2	2	2	1	-	-	-	-	-	-	-	-	-
CS(FT) 615C.3	-	-	-	-	-	2	-	1	-	1	-	-
CS(FT) 615C.4	-	-	-	-	-	-	-	-	3	-	1	2
CS(FT) 615C.5	-	-	-	-	-	-	-	-	2	1	2	2

PRACTICAL

Paper Name: Food Processing Lab II

Paper Code: FT691

Contact: L-T-P=0-0-4

Credit: 3

Pre requisites: Principles of Food Preservation, Unit Operations, Chemistry of Food

Course Objective: To assist the students use laboratory techniques common to basic Food Processing and to provide an opportunity to the students to evaluate the effective test methods used in sensory evaluation and analyze the resulting information.

Course outcome(s):

After the completion of the Food Processing Lab -II the students will be able to:
FT691.1 Use laboratory techniques common to basic Food Processing.
FT691.2 Understand the factors that affect heat transfer in food processing systems.
FT691.3 Apply the principles that make a food product safe for consumption.
FT691.4 Interpret government regulations pertaining to food manufacturing.
FT691.5 Evaluate the effective test methods used in sensory evaluation and analyze the resulting information.

Course Contents:

1. Preparation of dry onion/ chilli/ garlic.
2. Preparation of bread
3. Manufacture of macaroni by extruder.
4. Manufacture of potato powder.
5. Manufacture of ice cream.
6. Manufacture of Rosogolla and Sandesh.
7. Manufacture of candied fruits.
8. Production of milk powder by spray drying
9. Preparation of sponge cake.
10. Comparison of shelf life (nutritional Value and sensory test) of slow frozen and quick frozen food.

CO-PO Mapping:

CO	**Statement**	**Program Outcomes**											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT691.1	Use laboratory techniques common to basic Food Processing.	2	2	1	1	2	-	-	-	2	-	2	2
FT691.2	Understand the factors that affect heat transfer in food processing systems.	3	2	2	-	-	-	-	-	-	-	-	3

FT691.3	Apply the principles that make a food product safe for consumption.	2	2	2	-	-	2	2	2	-	-	2	3
FT691.4	Interpret government regulations pertaining to food manufacturing.	2	-	-	-	-	2	3	1	-	-	-	3
FT691.5	Evaluate the effective test methods used in sensory evaluation and analyze the resulting information.	3	2	2	2	2	-	-	-	1	-	-	3
Overall CO (FT691) mapping		3	2	1	1	1	1	1	1	1	-	1	3

Paper Name: Microbial Technology Lab

Paper Code: FT692

Contact: L-T-P=0-0-3

Credit: 2

Pre requisites: Principles of Food Preservation, Unit Operation, Food Microbiology

Course Objective: To help the students understand various methods of isolation, characterization and screening of bacteria, fungi and other related organisms and apply different preservation and fermented food productions techniques relative to food safety and spoilage.

Course outcome(s):

FT692.1. Ability to define intrinsic and extrinsic properties of food materials for the growth of microorganisms.
FT692.2. Ability to understand and apply biotechnological processing/engineering principles to variety of fermented products.
FT692.3. Ability to develop new fermented products.
FT692.4. Ability to interpret and report data in scientific format.
FT692.5. Ability to understand new development in this field with analytical thinking of the various aspects of the new technology.

Course Contents:

1. Alcohol fermentation
2. Organic acid fermentation – Vinegar / citric / lactic acid production
3. Propagation of baker's yeast
4. Fermented dairy products
5. Detection of *E.coli*
6. Enzyme preparation
7. Amino acid production
8. Detection of various types of microorganism in different food items

CO - PO Mapping:

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT692.1	Ability to define intrinsic and extrinsic properties of food materials for the growth of microorganisms.	3	-	-	-	-	2	-	-	-	-	-	3
FT692.2	Ability to understand and apply biotechnological processing/engineering principles to variety of fermented products.	3	-	-	-	-	2	-	-	2	-	-	3
FT692.3	Ability to develop new fermented products.	3	2	2	-	-	-	-	-	2	-	-	3
FT692.4	Ability to interpret and report data in scientific format.	3	3	2	2	-	-	-	-	1	-	-	3
FT692.5	Ability to understand new development in this field with analytical thinking of the various aspects of the new technology.	3	2	-	-	2	2	-	-	1	-	-	3
Overall CO (FT692) Mapping		3	1	1	1	1	1	-	-	1	-	-	3

Paper Name: Data structure and Algorithm Lab
Paper Code: CS(FT)685A
Contact: L-T-P= 0-0-3
Credit: 2

Pre requisites: Computer Fundamentals and principal of computer programming Lab

Course Objective:

- To write and execute programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables and search trees.
- To write and execute write programs in C to implement various sorting and searching methods

Course Outcome(s):

CS(FT)685A.1 Ability to identify the appropriate data structure for given problem.
CS(FT)685A.2 Graduate able to design and analyze the time and space complexity of algorithm or program.
CS(FT)685A.3 Ability to effectively use compilers includes library functions, debuggers and trouble shooting

Course Contents:

Module 1

1. Write a C program that uses functions to perform the following:
   a. Create a singly linked list of integers.
   b. Delete a given integer from the above linked list.
   c. Display the contents of the above list after deletion.
2. Write a C program that uses functions to perform the following:
   a. Create a doubly linked list of integers.
   b. Delete a given integer from the above doubly linked list.
   c. Display the contents of the above list after deletion.
3. Write a C program to implement Polynomial addition and Polynomial multiplication using Linked List.
4. Write a C program that uses stack operations to convert a given infix expression into its postfix Equivalent, Implement the stack using an array.
5. Write C programs to implement a queue ADT using i) array and ii) doubly linked list respectively.

Module 2

6. Write a C program that uses functions to perform the following:
   a. Create a binary search tree of characters.
   b. Traverse the above Binary search tree recursively in Postorder.
7. Write a C program that uses functions to perform the following:
   a. Create a binary search tree of integers.
   b. Traverse the above Binary search tree non recursively in inorder.

Module 3

8. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
   a. Insertion sort
   b. Merge sort
9. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
   a. Quick sort
   b. Selection sort
10. Write C programs for implementing the following searching methods:
    a. Linear Search
    b. Binary Search

Write a C program to implement all the functions of a dictionary (ADT) using hashing.

Module 4

11. Write C programs for implementing the following graph traversal algorithms:
    a. Depth first search
    b. Breadth first search

Text Books:

1. C and Data Structures, Third Edition, P.Padmanabham, BS Publications.
2. C and Data Structures, Prof. P.S.Deshpande and Prof. O.G. Kakde, Dreamtech Press.

Recommended books:

1. Data structures using C, A.K.Sharma, 2nd edition, Pearson.
2. Data Structures using C, R.Thareja, Oxford University Press.
3. C and Data Structures, N.B.Venkateswarlu and E.V.Prasad,S.Chand.
4. C Programming and Data Structures, P.Radha Krishna, Hi-Tech Publishers.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2					2				1
CO2	3		3			2						
CO3	3	3										1

Paper Name: Database Management System Lab
Paper Code: CS(FT)685B
Contact: 3P/Week
Contact: L-T-P =0-0-3
Credits: 2
Prerequisite:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives

1. To learn the data models, conceptualize and depict a database system
2. To learn the fundamental concepts of SQL queries.
3. To understand the concept of designing a database with the necessary attributes.
4. To know the methodology of Accessing, Modifying and Updating data & information from the relational databases.
5. To learn database design as well as to design user interface and how to connect with database.

Course Outcome(s)

On completion of the course students will be able to

CS(FT)685B.1 Understand the basic concepts regarding database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database facilities including concurrency control, backup and recovery.

CS(FT)685B.2 Understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases like partial multimedia and mobile databases.

CS(FT)685B.3 Differentiate between DBMS and advanced DBMS and use of advanced database concepts and become proficient in creating database queries.

CS(FT)685B.4 Analyze database system concepts and apply normalization to the database.

CS(FT)685B.5 Apply and create different transaction processing and concurrency control applications.

Text Book:

1) "SQL, PL/SQL the Programming Language of Oracle" by Ivan Bayross, BPB Publications
2) "Oracle Applications Development", by Ivan Bayross, BPB Publications
3) "SQL The Complete Reference 3rd Edition", by James Groff and Paul Weinberg, McGrawHill

CO-PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CS(FT)685 B.1	2	2	2	2	3	2	1	1	2	2	3	3	2	2	1
CS(FT)685 B.2	2	3	3	3	3	1	1	1	2	2	3	3	2	2	2
CS(FT)685 B.3	3	3	2	3	3	2	2	2	3	3	3	3	3	2	2
CS(FT)685 B .4	3	3	2	2	2	1	1	1	1	1	2	3	2	1	3
CS(FT)685 B.5	3	3	3	3	3	2	2	2	3	3	3	3	3	2	2
CS(FT)685 B (average)	3	3	2	3	3	2	1	1	2	2	3	3	2	2	2

Name of the Paper: Software Engineering Lab
Paper Code: CS(FT)685C
Contact (Periods/Week): 3L
Contact: L-T-P =0-0-3
Credit Point: 2

Prerequisite:

For Software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools.

Course Objective(s)

- To learn software development skill through various stages of software life cycle. .
- To ensure the quality of software through software development with various protocol based environment.

Course Outcomes

CS(FT)685C.1 To handle software development models through rational method.
CS(FT)685C.2 To prepare SRS document, design document, test cases and software configuration management and risk management related document.
CS(FT)685C.3 To Develop function oriented and object oriented software design using tools like rational rose.
CS(FT)685C.4 To perform unit testing and integration testing
CS(FT)685C.5 To apply various white box and black box testing techniques

Course Content

Assignments to be given from the following

1. Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system) .DFD of standard application problems.

2. Project Schedule preparation. Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables.

3. Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepare Software Design Document using tools like Rational Rose.(For standard application problems)

4. Software Development and Debugging. Estimation of project size using Function Point(FP) for calculation.

5. Design Test Script/Test Plan(both Black box and White Box approach)

6. Compute Process and Product Metrics (e.g Defect Density, Defect Age, Productivity, Cost etc.) Cost Estimation models. COCOMO

Recommended books:

1. Software Engineering: Apractitioner's approach–Pressman(TMH)
2. Software Engineering- Pankaj Jalote(Wiley-India)

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(FT)685C.1	3	3	3	2	2	-	-	-	-	-	-	3
CS(FT)685C.2	3	2	3	-	-	-	-	-	-	-	-	2
CS(FT)685C.3	3	2	3	2	3	-	-	-	-	-	-	-
CS(FT)685C.4	3	3	-	-	-	-	-	-	-	-	-	-
CS(FT)685C.5	3	2	-	-	-	-	-	-	-	-	-	2

Paper Name: Group Discussion

Paper Code: HU681

Contact: L-T-P= 0-0-2

Credit: 1

Pre requisites: Soft Skills

Course Objective: To help the students get confident in communicating in the english language.

Course outcome(s):
HU681.1. Ability to demonstrate English speaking skills
HU681.2. Ability to integrate information on a subject under a specific theme.
HU681.3. Ability to interpret the ideas discussed in the group.
HU681.4. Ability to justify their thoughts.
HU681.5. Ability to collaborate with the team members to draw definite conclusion to subject topics.

Course Content: Current and significant topics.

CO PO MAPPING

CO	Statement	Program Outcomes											
		a	b	c	d	e	f	g	h	i	j	k	l
HU681.1	Ability to demonstrate English speaking skills	-	-	-	-	-	-	-	2	-	3	-	3
HU681.2	Ability to integrate information on a subject under a specific theme.	-	-	-	-	-	2	-	-	-	3	-	3
HU681.3	Ability to interpret the ideas discussed in the group.	-	-	-	-	-	2	-	-	2	3	-	3
HU681.4	Ability to justify their thoughts.	-	-	-	-	-	1	-	3	1	3	-	3
HU681.5	Ability to collaborate with the team members to draw definite conclusion to subject topics.	-	-	-	-	-	-	-	3	3	3	2	3
Overall CO (FT692) Mapping		-	-	-	-	-	1	1	2	1	3	1	3

4th Year: 7th SEMESTER

A.THEORY:

Sl. no.	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	HS	HU702	Values and Ethics in Profession	2	0	0	2	2
2	PC	FT701	Waste Management of Food Industries	2	2	0	4	3
3	PE	FT702 (A/B/C)	Elective–I (EnzymeTechnology/RenewableEnergyTechnology/ PlantMaintenance,Safety& Hygiene)	3	0	0	3	3
4	PE	FT703 (A/B/C)	Elective–II (Modeling & Simulation of Food Processes/Protein Technology/ Food Packaging Technology)	3	0	0	3	3
5	OE	EI(FT) 701 (A/B)	Process Instrumentation/ Process Control Systems	3	0	0	3	3
Total Theory							15	14

B.PRACTICAL&SESSIONAL:

Sl. no.	Field	Code	Subjects	Contact hours/week				Credit
				L	T	P	Total	
1	PC	FT791	Food Engineering lab	0	0	3	3	2
2	OE	EI (FT)791	Instrumentation Laboratory/Process Control Systems Laboratory	0	0	3	3	2
3	Sessional	FT792	Report and Seminar on Industrial Training	-	-	-	-	3
4	Sessional	FT793	Projectpart1	0	0	6	6	4
5	Sessional	FT794	Seminar	0	0	3	3	2
6	Sessional (**MC**)	**MC781**	Foreign Language	0	0	2	2	0
Total Practical and Sessional							17	13
Total 7th Semester							32	27

THEORY

Paper Name: Values and Ethics in Profession
Paper Code: HU702

Contact: L-T-P= 2-0-0

Credit: 2

Pre requisites: Basic knowledge of management, basics of communication, Knowledge about environment science

Course Objective: To create awareness on professional ethics and Human Values

Course Outcome: On Completion of this course student will be able to

CO.1	Understand the core values that shape the ethical behavior of an engineer and Exposed awareness on professional ethics and human values.
CO.2	Understand the basic perception of profession, professional ethics, various moral issues & uses of ethical theories
CO.3	Understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field
CO.4	Aware of responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer.
CO.5	Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives

Course contents:

Module: 1. Introduction: Definition of Ethics; Approaches to Ethics:
Psychological, Philosophical, Social.

Module: 2. **Psycho-social theories of moral development**: View of Kohlberg;
Morality and Ideology, Culture and Morality, Morality in everyday
Context.

Module: 3. **Ethical Concerns**: Work Ethics and Work Values, Business Ethics,
Human values in organizations: Values Crisis in contemporary society
Nature of values: Value Spectrum of a good life.

Module: 4. ***Ethics of Profession:***
Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.
Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Module: 5. **Self Development**: Character strengths and virtues, Emotional Intelligence, Social intelligence, Positive cognitive states and processes (Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).

Module: 6.Effects *of Technological Growth:*
Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics Appropriate Technology, Movement of Schumacher; Problems of man, machine, interaction.

Text / Reference Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

CO-PO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
Co-1	_	_	_	_	_	1	1	1	1	2	_	_
Co-2	_	_	_	_	_	1	1	3	1	2	_	_
Co-3	_	_	_	_	_	3	2	3	_	1	_	_
Co-4	_	_	_	_	_	3	2	1	_	_	_	_
Co-5	_	_	_	_	_	3	2	2	_	1	3	_

Paper Name: Waste Management of Food Industries

Paper Code: FT 701

Contact: L-T-P= 2-2-0

Credit: 3

Pre requisites: Basic Environmental Engineering, Unit Operations, Thermodynamics and Kinetics.

Course Objective: To help the student develop a detailed understanding on waste generated from food industry and its reusability in

Course outcome(s):

FT 701.1 - Ability to classify different industrial waste and different disposal methods.

FT 701.2 - Ability to identify different treatment methods for liquid and solid waste.

FT 701.3 - Ability to interpret data regarding different waste treatment method.

FT 701.4 - Ability to apply different methods in industry and domestic purpose.

FT 701.5 - Ability to describe the recovery of useful material from waste as byproducts.

Course Contents:

Module 1: 8L
Introduction: Types of Pollution, Waste disposal methods – physical, chemical and biological. Classification and characterization of food industrial wastes from fruit and vegetable processing industry, beverage industry, fish, meat and poultry industry, sugar industry and dairy industry;

Module 2: 8L
Treatment methods for liquid wastes from food process industries; Design of activated sludge process, Rotating biological contactors, Trickling filters, UASB, Numerical Problem.

Module 3: 8L
Treatment methods of solid wastes: Biological composting, drying and incineration; Design of solid waste management system: Landfill digester, Vermicomposting pit ,Biomanure, Numerical Problem.

Module 4: 8L
Biofilters and bioclarifiers, Biogas plant, Ion exchange treatment of waste water, Drinking water treatment, Recovery of useful materials from effluents by different methods.

Revision: 4L

Text and reference books:
1. Food Industry Wastes: Disposal and Recovery; Herzka A & Booth RG; 1981, Applied Science Pub Ltd.
2. Water & Wastewater Engineering; Fair GM, Geyer JC &Okun DA; 1986, John Wiley & Sons, Inc.
3. Wastewater Treatment; Bartlett RE; Applied Science Pub Ltd.
4. Symposium: Processing Agricultural & Municipal Wastes; Inglett GE; 1973, AVI.
5. Food Processing Waste Management; Green JH & Kramer A; 1979, AVI.
6. Environmental Biotechnology: Principles and Applications; Rittmann BE & McCarty PL; 2001, Mc-Grow-Hill International editions.
7. Environmental Biotechnology; Bhattacharyya B C & Banerjee R; Oxford University Press.

CO - PO Mapping:

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT 701.1	Ability to classify different industrial waste and different disposal methods	3	2	-	-	-	2	2	-	-	-	-	3
FT 701.2	Ability to identify different treatment methods for liquid and solid waste.	3	2	2	-	-	2	2	-	-	-	-	3
FT 701.3	Ability to interpret data regarding different waste treatment method.	3	3	3	3	-	2	2	-	-	-	-	3
FT 701.4	Ability to apply different methods in industry and domestic purpose.	3	2	-	-	-	3	3	-	-	-	-	3
FT 701.5	Ability to describe the recovery of useful material from waste as byproducts.	3	2	2	-	-	-	2	-	-	-	-	3

Overall CO (FT701) mapping	3	2	1	1	-	2	2	-	-	-	-	3

Paper Name: Enzyme Technology

Paper Code: FT 702A

Contact: L-T-P= 3-0-0

Credit: 3

Pre requisites: Chemistry of food, food microbiology, food biotechnology

Course Objective: To help student to gain knowledge about different enzyme production, purification and isolation process as well as the use of enzymes in food technology.

Course outcome(s):

FT702A.1. Ability to explain the enzyme kinetics and the effects of different parameters on enzymes.

FT702A.2. Ability to understand the production and purification processes of enzyme.

FT702A.3. Ability to have the knowledge of uses of enzyme in food processing industries.

FT702A.4. Ability to demonstrate the principles and uses of enzymes and whole cell in immobilized form.

FT702A.5. Ability to apply the concepts of recombinant DNA Technology.

Course Contents:

Module 1: 8L
Introduction to enzyme technology; Industrial enzymes – present status and opportunities with special reference to food industries; Catalytic properties of enzymes; Intracellular and extra-cellular enzymes.

Module 2: 8L
Enzyme production technology: Amylase production. Introduction of enzyme reactors and process design.Application of recombinant DNA technique to enzyme technology.

Module 3: 8L
Cell disintegration by physical, chemical and biological methods; Enzyme purification methods: Salting out, organic solvent precipitation, dialysis, reverse osmosis etc.

Module 4: 8L
Application of enzymes for production in biochemical and food processing industries; Application of immobilized enzymes and cells.Production of Commercial Enzymes.

Revision: 4L

Text books and references:

1. Methods of Enzymology
2. Biochemical Engg Fundamentals-Baily, Ollis. MGH
3. Bioprocess Engineering by Michael L. Shuler and FikretKargi
4. Prescott & Dunn's Industrial Microbiology Macmiller
5. Principles of Fermentation Technology-Wittaker and Stanby

CO - PO Mapping:

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT702A. 1	Ability to explain the enzyme kinetics and the effects of different parameters on enzymes.	3	2	2	2	-	-	-	-	-	-	-	3
FT702A. 2	Ability to understand the production and purification processes of enzyme.	3	3	3	2	2	1	2	-	-	-	-	3
FT702A. 3	Ability to have the knowledge of uses of enzyme in food processing industries	3	3	3	-	-	2	2	-	-	-	2	3
FT702A. 4	Ability to demonstrate the principles and uses of enzymes and whole cell in immobilized form.	3	3	3	1	2	-	1	-	-	-	3	3
FT702A. 5	Ability to apply the concepts of recombinant DNA Technology	3	3	3	-	3	2	1	-	-	-	-	3
Overall CO (FT702A) mapping		3	3	3	1	1	1	1	-	-	-	1	3

Paper Name: Renewable Energy Technology

Paper Code: FT 702B

Contact: L-T-P= 3-0-0

Credit: 3

Pre requisites: Basic Environmental Engineering, Food Process Engineering, Unit Operation.

Course Objective: To help the students develop an overview on the application of non conventional energy and realize its role in sustainable development.

Course outcome(s):

FT 702B.1. Ability to define the different biological fuels and biomass as a source of renewable energy

FT 702B.2. Ability to explain the phenomenon of thermal combustion of biomass and biogas generation.

FT 702B.3. Ability to describe the process of hydrogen production by photosynthetic bacteria.

FT 702B.4. Ability to classify the different technologies behind the conversion of biomass to clean fuels and petrochemical substitutes.

FT 702B.5. Ability to classify the different technologies associated with the application of solar, wind and nuclear energy.

Course Contents:

Module I (8L):

Biological fuel generation; Biomass as a renewable energy source; Types of biomass: forest, agricultural and animal residues; Industrial and domestic organic wastes; Conversion of biomass to clean fuels and petrochemical substitutes by physicochemical and/or fermentation processes.

Module II (8L):

Biogas from anaerobic digestion; Thermal energy from biomass combustion; Ethanol from biomass.

Module III (8L):

Hydrogen production by photosynthetic bacteria, biophotolysis of water and by fermentation; Microbial recovery of petroleum by biopolymers (Xanthum gum), biosurfactants.

Module IV (8L):

Solar energy; Solar collectors, solar pond, photovoltaic cells, chemical storage; Geothermal energy and wind energy; Use of geothermal energy; Operating principles of different types of wind energy mills; Nuclear energy; Nuclear reactions and power generation; Tidal wave energy.

Revision: 4L

Text/ Reference Books:

1. J.E.Smith – Biotechnology, 3rd edn. Cambridge Univ Press.
2. S.Sarkar – fuels and combustion, 2nd edn., University Press.

CO - PO Mapping:

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT702B.1	Ability to define the different biological fuels and biomass as a source of renewable energy	3	2	2	2	-	-	3	-	-	-	-	3
FT702B.2	Ability to explain the phenomenon of thermal combustion of biomass and biogas generation.	3	2	2	1	-	1	2	1	-	-	-	3
FT702B.3	Ability to describe the process of hydrogen production by photosynthetic bacteria	3	3	2	2	-	-	2	-	-	-	-	3
FT702B.4	Ability to classify the different technologies behind the conversion of biomass to clean fuels and petrochemical substitutes	3	3	2	1	-	3	3	2	-	-	-	3
FT702B.5	Ability to classify the different technologies associated with the application of solar, wind and nuclear energy	3	2	2	1	-	-	3	1	-	-	-	3
Overall CO (FT702B) mapping		3	3	2	1	-	1	3	1	-	-	-	3

Paper Name: Plant Maintenance, Safety & Hygiene

Paper Code: FT 702C

Contact: L-T-P= 3-0-0

Credit: 3

Pre requisites: Principles of Food Preservation, Food Process Engineering

Course Objective: To help the students understand the importance of maintaining safety and hygiene in different food industry.

Course outcome(s):

FT 702C.1. Ability to describe safety levels in different food industries.

FT 702C.2. Ability to understand different industrial parameters that affect the environment in food processing units.

FT 702C.3. Abilityto apply the HACCP protocols in food industries.

FT 702C.4. Ability to analyze the different adulterants in food to maintain safety during human consumption.

FT 702C.5. Ability to create an overall safe environment for food processing industries.

Course Contents:

Module I (8L):

Plant maintenance program; Role of maintenance staff and plant operators; Preventive maintenance; Guidelines for good maintenance & safety precautions; Lubrication & lubricants; Work place improvement through '5S'.

Module II (8L):

The objective of safety, health & environment; Cost of safety; Accident investigation report; Safety promotional activity; Environmental pollution and its control.

Module III (8L):

Indian Factories Act on safety; HACCP; Desirable safety features of some food processing equipment; Personal protective equipment; Safety from adulteration of food.

Module IV (8L):

Hygiene and sanitation requirement in food processing and fermentation industries; Cleaning, sanitizing & pest control in food processing; storage and service areas.

Revision: 4L

Text/ Reference Books:

1. Basic Concepts of Industrial Hygiene, Ronald M Scott, CRC Press.
2. Safety design criteria for industrial plants. Maurizio Cumo& Antonio Naviglia.CRC Press.
3. Industrial Hygiene & Toxicology by Josef Brozek-1948.
4. Food Hygiene, Microbiology & HACCP. S J Forsythe, P R Hayes. Springer.

CO - PO Mapping:

CO	Statement	Program Outcomes											
		a	b	c	d	e	f	g	h	i	j	k	l
FT702C.1	Ability to describe safety levels in different food industries	3	2	-	-	-	1	1	1	-	-	2	3
FT702C.2	Ability to understand different industrial parameters that affect the environment in food processing units.	3	2	-	-	-	2	3	-	-	-	2	3
FT702C.3	Ability to apply the HACCP protocols in food industries	2	-	-	-	-	3	3	1	-	-	2	3

FT702C.4	Ability to analyze the different adulterants in food to maintain safety during human consumption	3	2	1	1	-	2	-	3	-	-	2	3
FT702C.5	Ability to create an overall safe environment for food processing industries	2	-	-	-	-	3	3	3	2	-	2	3
Overall CO (FT702C) mapping		3	1	1	1	-	2	2	2	1	-	2	3

Paper Name: Modeling & Simulation of Food Processes

Paper Code: FT 703A

Contact: L-T-P= 3-0-0

Credit: 3

Pre requisites: Basic Engineering Mathematics and Food Processing Engineering

Course Objective: To help the students understand the basic theory behind the application of modeling and simulation in food processing industry.

Course outcome(s):

FT 703A.1. Ability to define the mathematical modeling and process analysis

FT 703A.2. Ability to explain batch processes in food industry

FT 703A.3. Ability to explain simultaneous heat and mass transfer in packed tower and immobilized enzyme system

FT 703A.4. Ability to identify the importance of modeling and simulation in fermentation processes.

FT 703A.5. Ability to identify the application of mathematical modeling in food industry.

Course Contents:

Module I (8L):

Introduction to mathematical modeling; Process analysis and simulation; Model building; Classification and uses of mathematical models; Formulation of mathematical model and fundamental laws.

Module II (8L):

Batch processes in food industry; Equilibration in batch processes; Steady state flow processes of non reacting systems; Mixing in flow processes.

Module III (8L):

Simultaneous heat and mass transfer in packed tower and immobilized enzyme system.

Module IV (8L):

Modeling, simulation and optimization of fermentation processes.

Revision: 4L

Text/ Reference Books:

1. Process modeling, simulation and control: William L Luyben, TMH
2. Process analysis &simulation :Himmelblau, Kenneth &Birchoff, John Wills.

CO - PO Mapping:

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT703A.1	Ability to define the mathematical modeling and process analysis	3	3	2	2	-	1	-	-	-	-	-	3
FT703A.2	Ability to explain batch processes in food industry	3	3	2	1	-	-	-	-	-	-	-	3
FT703A.3	Ability to explain simultaneous heat and mass transfer in packed tower and immobilized enzyme system	3	3	2	2	-	-	-	-	-	-	-	3
FT703A.4	Ability to identify the importance of modeling and simulation in fermentation processes.	3	3	2	2	-	1	2	-	-	-	-	3
FT703A.5	Ability to identify the application of mathematical modeling in food industry.	3	2	2	2	-	2	-	-	-	-	-	3
Overall CO (FT703A) mapping		3	3	2	2	-	1	1	-	-	-	-	3

Paper Name: Protein Technology

Paper Code: FT 703B

Contact: L-T-P= 3-0-0

Credit: 3

Pre requisites: Engineering Chemistry, Chemistry of Food

Course Objective: To help the students develop an advanced idea about protein utilization in food and its importance in our daily diet.

Course outcome(s):

FT703B.1 - Ability to define protein structure and properties and to analyze different sources of protein.
FT703B.2 - Ability to describe protein concentrate and isolate and their functions.
FT703B.3 - Ability to relate manufacturing of protein hydrolysates and to develop textured protein.
FT703B.4 - Ability to apply different technique to detect and estimate protein.
FT703B.5 - Ability to develop general idea about protein and to formulate various protein products for different protein based industry.

Course Contents:

Module I (8L):

Determination of protein structure; Nutritional and commercial importance of proteins; Physical, chemical and functional properties of proteins; Folding of proteins; Commercial sources of proteins; Creation of new proteins by bio-composite synthesis technique.

Module II (8L):

Process of making protein isolates and concentrates; Factors affecting quality of isolates and concentrates; Treatment to isolate and concentrate; Packaging of protein isolates and concentrates; Food and non food uses of isolates and concentrates.

Module III (8L):

Methods of manufacturing protein hydrolysates; Factors affecting quality of hydrolysates; Food uses of hydrolysates; Fibre spinning process of proteins; Textured protein gels and expanded products; Simulated milk products; Restructured protein; Nonconventional sources of protein.

Module IV (8L):

Centrifugation; Cell disruption; Protein precipitation and its recovery; Aqueous two-phase separation; Ion exchange chromatography; Gel filtration; Affinity chromatography; Electrophoresis; Cross filtration; Ultra filtration.

Revision: 4L

Text/ Reference Books:

1. Altschul, A.M and Wilcke, , H.L Ed 1978. new protein Foods. Vol III. Academic Press, New York
2. Bodwell, C.E.Ed. 1977. evaluation of proteins for Humans. AVI, Westport
3. Milner,M., Scrimshaw, N.S and Wang, D.I.C.Ed. 1978. Protein Resources and Technology. AVI, Westport
4. Salunkhe, O.K and Kadam, S.S Eds. 1999. Handbook of world legumes; Nutritional Chemistry, Processing Technology and
Utilization. Volume I to III, CRC Press, Florida
5. Salunkhe, D.K. Chavan, J.K.,Adsule, R.N Kadam, S.S 1992. World Oilseeds: Chemistry, Technology and Utilization, Van
Nostrand Reinhold, New York
6. Bioseparation Engineering: Principles, Practise and Economics, M.Ladish; Wiley Inter science
7. Proteolytic enzymes: a practical approach, Beynon, R.J and Bond, J.S; IRL Press, Oxford

8. Protein Biotechnology, Franks, F.; Humana Press

CO – PO MAPPING

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT703B.1	Ability to define protein structure and properties and to analyze different sources of protein.	3	-	-	-	-	-	-	-	-	-	-	3
FT703B.2	Ability to describe protein concentrate and isolate and their functions.	3	2	-	-	-	2	-	-	-	-	-	3
FT703B.3	Ability to relate manufacturing of protein hydrolysates and to develop textured protein.	3	2	-	-	-	2	-	-	-	-	-	3
FT703B.4	Ability to apply different technique to detect and estimate protein.	3	3	2	2	1	-	-	-	-	-	-	3
FT703B.5	Ability to develop general idea about protein and to formulate various protein products for different protein based industry.	3	2	2	1	1	1	1	-	-	-	-	3
Overall CO (FT703B) mapping		3	2	1	1	1	1	1	-	-	-	-	3

Paper Name: Food Packaging Technology

Paper Code: FT 703C

Contact: L-T-P= 3-0-0

Credit: 3

Pre requisites: Chemistry of Food, Food Process Engineering, Principles of Food Preservation

Course Objective: To help the students identify the importance of packaging in food industry and understand the recent developments in food packaging.

Course outcome(s):

FT 703C.1 Ability to define food packaging and explain its function.
FT 703C.2 Ability to differentiate between different packaging materials like metals, glass, plastics and papers and their methods of production.
FT 703C.3 Ability to recognize the potential of biocomposite materials for food packaging and define active and intelligent packaging.
FT 703C.4 Ability to discuss the role of different regulatory bodies in food packaging and disposal protocols for food packaging.
FT 703C.5 Ability to interpret the importance of hermetic seals in food packaging and discuss their application in different food manufacturing flow-sheets.

Course Contents:

Module I (8L):

Functions of packaging; Type of packaging materials; Selection of packaging material for different foods; Selective properties of
packaging film; Methods of packaging and packaging equipment

Module II (8L):

Mechanical strength of different packaging materials; Printing of packages; Barcodes & other marking; Interactions between
packaging material and foods; Environmental and cost consideration in selecting packaging materials.

Module III (8L):

Manufacture of packaging materials; Potential of biocomposite materials for food packaging; Packaging regulations; Packaging
and food preservation; Disposal of packaging materials.

Module IV (8L):

Testing of packaging; Rigid and semi rigid containers; Flexible containers; Sealing equipment; Labelling; Asceptic and shrink
packaging; Secondary and transport packaging.

Revision: 4L

Text/ Reference Books:

1. Food and Packaging Interactions by Joseph H. Hotchkiss, (ACS symposium series -365, April 5-10, 1987, American chemical society, Washington DC, 1988.)
2. Packaging foods with plastics by winter A. Jenkins & James P Harrington – Technomic publishing co. Inc, Lancaster. Basel.
3. Flexible food packaging (Question & Answers) by Arthur Hirsch VNB – Van Nostrand Reinhold, New York (An AVI Book), ISBN 0-442-00609-8.
4. Food Packaging and Preservation (theory & practice) by M.Mathlouthi-Elsevier Applied science publisher, London and New York.
5. Food Packaging Materials (Aspect of Analysis & Migration of contaminants) by N.T.crosby applied science publishers LTD. London.
6. Plastics in Packaging by A.S Athlye, TMGH, New Delhi.
7. Packaging (specifications, purchasing & Quality Control) 3rd edition by Edmond A Leonard- Marcel Dekker, INC- Newyork& Basel.
8. Plastics in packaging by forwarded by H.B Ajmera& M.R Subramanium – Indian institute of packaging. Published by A.P.Vaidya, Secretary IIP, E2, MIDC, Industrial Area (Andheri (East), Bombay-400093.
9. Food Packaging- Stanley Sacharois& Roger C. Griffin- The AVI Publishing company Inc. 1970.
10. Principles of packaging development- Griffin &Sacharow. (The AVI Publishing company, Inc. 1972).

CO – PO MAPPING

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT 703C.1	Ability to define food packaging and explain its function.	3	1	-	-	-	1	1	-	-	-	-	3
FT 703C.2	Ability to differentiate between different packaging materials like metals, glass, plastics and papers and their methods of production.	3	2	2	-	-	1	1	-	-	-	-	3
FT 703C.3	Ability to recognize the potential of biocomposite materials for food packaging and define active and intelligent packaging.	3	2	2	-	1	1	1	-	-	-	-	3
FT 703C.4	Ability to discuss the role of different regulatory bodies in food packaging and disposal protocols for food packaging.	3	1	1	-	-	2	3	-	-	-	-	3
FT 703C.5	Ability to interpret the importance of hermetic seals in food packaging and discuss their application in different food manufacturing flow-sheets.	3	2	2	2	1	2	1	-	-	-	-	3
Overall CO (FT 703C) mapping		3	2	1	1	1	1	1	-	-	-	-	3

Paper Name: PROCESS INSTRUMENTATION
Paper CODE: EI (FT)701 A
CONTACT: 3L
CREDITS: 3
TOTAL CONTACT HOURS: 35

Prerequisite: None

Course Objective:

1. To understand the importance of different industrial instruments.

2. To understand the working principle of different measuring instruments.

3. To measure different physical parameters like pressure, temperature, flow rate, level etc

4. To install the different instruments.

Course Outcome:

EI(FT)701A.1: Able to explain working principle of different measuring instruments.

EI(FT)701A.2: Able to find the specification of different instruments.

EI(FT)701A.3: Able to Measure different physical parameters like pressure, temperature, flow rate, level etc

EI(FT)701A.4: Able to apply the knowledge of measurement in different practical field.

Module I : Introduction to Process Instrumentation: [5L]

Operational aspect of instrument system, Principle of measurement, Static and dynamic characteristics of instrument, Error analysis and its calibration. Principle of operation of transducer and sensor.
Types & classification, applications of transducer elements.

Module II :Temperature& Pressure Measurement[10L]

Temperature measurement :Resistance thermometers, thermistors and thermocouples. Radiation and optical pyrometers.
Pressure Measurement**:** Pressure gauge, Elastic deformation elements, Basic concept of pneumatic pressure transmitter,. Low pressure measurement by McLeod Gage and PiraniGauge
Electrical strain gauges: Types ,Gauge Factor, strain gauge type load cell.

Module III : Flow & Level Measurement: [8L]

Flow measurement – orifice meter, venturimeter, rotameter turbine meter, ultrasonic flow meter, magnetic flow meters;
Level measurements- float actuated devices, electrical method, sonic methods.

Module IV: Moisture & Viscosity Measurement: [8L]

Moisture: Definition, Electrical methods of measurement, hygrometer,Moisture measurement cells for granular material, infrared transmission measurement of moisture, Viscosity Measurement.

Text Books:

1. D. Patranabis, 'Principles of industrial Instrumentation', TMH, New Delhi, 2nd Ed
2. Arun Kumar Ghosh: 'Introduction to Measurement & Instrumentation', PHI, New Delhi, 4th edition.
3. K.Krishnaswamy, S.Vijayachitra: 'Industrial Instrumentation',New age International Publishers, 2nd edition.
4. B. G. Liptak: 'Instrument Engineers Handbook', vol-I and vol-II, Chilton Book Co. Philadelphia
5. Ernest O. Doeblin, 'Measurement Systems – Application and Design', Tata-McGraw Hill
6. 7.S.K.Sen, 'Measurement Techniques in Industrial Instrumentation',New Age International.

CO-PO matrices of courses EI(FT)701A:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
ET701A.1	3	2	1	**1**	-	-	2	-	-	-	-	1
ET701A.2	**2**	**2**	3	-	-	-	-	**1**	-	-	-	-
ET701A.3	2	2	2	-	3	-	-	-	-	-	-	-
ET701A.4	1	2	2	**1**	1	-	-	-	-	-	**2**	3

Paper Name: PROCESS CONTROL SYSTEM
Paper Code: EI(FT) 701 B
CONTACT: 3L
CREDITS: 3
TOTAL CONTACT HOURS: 33

Prerequisite: Sensor & Transducer

Course Objective:

This course helps the student

1. To have a knowledge on basic process control loop & characteristics

2. To understand the different controller modes

3. To have a knowledge of final control element & different actuators

4. To apply the knowledge of Cascade, Ratio, Feed forward control to control a complex process

Course Outcome:

Student will be

EI(FT) 701 B.1: Demonstrate the fundamentals of control systems

EI(FT) 701 B.2: Calculate controller parameters of different controller

EI(FT) 701 B.3: Describe different advanced control strategy

EI(FT) 701 B.4: State the operation and use of final control element

Course Content:

Module I : Introduction to Control System [8L]

Control system, Open and closed loop system, transfer function of open loop and closed loop control systems; Block diagrams, Simplification of a control system using block diagram reduction.

Module II :Control actions & process controllers [15L]

Process control system – Basic block diagram , elements ,Process characteristics

Role of controllers in process industry controllers. Control actions: discontinuous & continuous modes; on off controllers: neutral zone, time proportional controller, proportional controllers, integral & derivative controllers; composite controllers; PI, PD, PID controllers

Module III : Final Control Element & Advanced control stratagies [10L]

Final control element, control valve,actuators

Feed forward control, ratio control, cascade control ,applications

Text Books:

1) Control Systems: Engineering, 5th Edition [I. J. Nagrath, M. Gopal]

2) D. Patranabis, Principles of Process Control, TMH , New Delhi, 2nd Ed.

3) D. P. Eckman, Automatic Process control, John Wiley, New York

4) Surekha Bhanot, Process Control Principal & Application , Oxford

5) G. Stephanopoulos, Chemical process Control, PHI

6) C. D. Johnson, Process Control Instrumentation Technology, PHI

CO-PO matrices of courses ET(FT)701B:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
EI(FT) 701 B.1	**1**	**2**	-	**3**	-	-	-	-	-	-	-	-
EI(FT) 701 B.2	3	2	2	**1**	**2**	-	-	-	-	-	-	-
EI(FT) 701 B.3	2	1	1	-	1	-	**1**	**1**	-	-	**2**	-
EI(FT) 701 B.4	1	1	-	-	-	-	-	-	-	-	**1**	-

PRACTICAL

Paper Name: Food Engineering lab

Paper Code: FT 791

Contact: L-T-P= 0-0-3

Credit: 2

Pre requisites: Food Process Engineering, Unit Operations Principles of Food Preservation

Course Objective: To help the students develop a practical idea about different operations related to food engineering.

Course outcome(s):

FT791.1. Ability to define the practical implication of the theoretical ideas regarding basic food engineering phenomenon.

FT791.2. Ability to interpret practical application of the extraction phenomenon related to food processing.

FT791.3. Ability to analyze and operate the driving principles of different types of driers like spray drier, tray drier, drum drier etc. and determine the working parameters required for a desired thermal processes.

FT791.4. Ability to explain the practical use of rheological study in a food based industry.

FT791.5. Ability to explain the different separation techniques that are used in food industries.

Course Contents:

1. Oil extraction from oils seeds
2. Drying efficiency – spray drier, tray drier, drum drier
3. Fruit juice concentration
4. Rheological Study for Fluids with different consistency
5. Separation using a Centrifuge

CO – PO MAPPING

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT791.1	Ability to define the practical implication of the theoretical ideas regarding basic food engineering phenomenon.	3	2	2	-	-	-	-	1	2	2	-	3

FT791.2	Ability to interpret practical application of the extraction phenomenon related to food processing.	3	2	2	2	-	-	-	1	2	2	-	3
FT791.3	Ability to analyze and operate the driving principles of different types of driers like spray drier, tray drier, drum drier etc. and determine the working parameters required for a desired thermal processes.	3	2	2	2	-	-	-	1	2	-	-	3
FT791.4	Ability to explain the practical use of rheological study in a food based industry.	3	2	2	2	-	-	-	1	2	2	-	3
FT791.5	Ability to explain the different separation techniques that are used in food industries.	3	2	2	2	-	-	-	1	2	2	-	3
Overall CO (FT791) mapping		3	2	2	2	-	-	-	1	2	2	-	3

Paper Name: Process Instrumentation Lab
Paper Code : EI(FT)791A
Contacts : 3P
Credits : 2

Course Outcomes:

EI(FT)781A.1: Able to understand the working principle of different instruments
EI(FT)781A.2: Able to examine the calibration of different instruments.
EI(FT)781A.3: Able to measure different industrial parameter like pressure, temperature, flow, level etc.
EI(FT)781A.4: Able to choose the suitable instrument for measuring different process arameter.

Experiments:

1. Calibration of Pressure Gauge using Dead Weight Tester
2. Study of Thermocouple characteristics and Measurement of Temperature.
3. Study of Thermistor characteristics and Measurement of Temperature.
4. Study of RTD characteristics and Measurement of Temperature.
5. Measurements of flow rate and velocity of fluid flow by head type flow meter.
6. Measurements of flow rate and velocity of fluid flow by Variable Area type flow meter
7. Measurement of level using capacitive type level instrument.
8. Measurement of moisture using moisture analyzer
9. Measurement of viscosity
10. Extramural Experiment

CO-PO matrices of courses EI(FT) 791A:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EI(FT) 791 A.1	**1**	**2**	1	-	-	-	-	-	-	-	-	-
EI(FT) 791 A.2	**2**	**3**	3	**1**	**2**	-	-	**1**	**1**	-	-	-
EI(FT) 791 A.3	1	2	1	-	-	-	-	-	-	-	-	-
EI(FT) 791 A.4	2	2	2	**1**	3	-	-	-	-	-	-	-

Paper Name: PROCESS CONTROL SYSTEM LAB
Paper CODE: EI(FT) 791 B
CONTACT: 3P
CREDITS: 2

COURSE OUTCOME:

After completion of the laboratory course students will be able to:

EI(FT)791B.1 Recognize & explain basic process control loop elements via hands on experiment.

EI(FT) 791 B.2 Control different process variable (flow, pressure, level & temperature) using different controller mode.

EI(FT)791B.3 Use various PLC functions and develop PLC programs to control a real time system.

EI(FT)791 B.4 Control & monitor different process variable through DCS.

Experiments :

1. Study of Flow, Level, Pressure, Temperature processes and construction of the P&I diagrams in accordance with ISA guidelines / standards

2. Study of a Temperature Control Loop having Furnace, suitable final control element, Temperature transmitter, conventional PID controller/Control System, and data logger/recorder

3.Study of a Pressure Control Loop having Pressure source, Pressure Transmitter, Motorized/Pneumatic control valve, and conventional PID controller/Control System

4. Study of a Flow Control Loop having suitable Flow meter, Motorized/ Pneumatic control valve, and conventional PID controller/Control System

5.Study of a Level Control Loop having Level Transmitter, Motorized/ Pneumatic control valve, and conventional PID controller/Control System

6.Study of a typical Air Duct Flow Monitoring and Control

CO-PO matrices of courses EI(FT) 781B:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
EI(FT) 791 B.1	**2**	**2**	1	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
EI(FT) 791 B.2	**2**	**2**	1	**-**	**-**	**-**	-	**-**	**-**	**-**	-	-
EI(FT) 791 B.3	2	2	1	**1**	2	**-**	**-**	-	**2**	-	**-**	-
EI(FT) 791 B.4	2	2	2	**3**	2	-	**-**	**-**	-	-	**1**	-

SESSIONAL

Paper Name: Report and Seminar on Industrial Training

Paper Code: FT 792

Contact: L-T-P= 0-0-0

Credit: 3

Pre requisites: Food Process Engineering, Chemistry of Food, Unit Operations, Principles of Food Preservation

Course Objective: To help the students develop a practical outlook towards Food Engineering and understand different industrial applications and to make them industry ready.

Course Outcome(s):

FT792.1. Ability to recognize the applicability of food technology in industrial processing.

FT 792.2. Ability to classify several processing steps in industrial food production and preservation.

FT 792.3. Ability to develop soft skills related to the industry.

FT 792.4. Ability to illustrate different data and manage documents related to the food industry.

FT 792.5. Ability to demonstrate proper safety and hygiene in the food industry.

Course Contents: Training done at the concerned food industry.

CO – PO MAPPING

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT792.1	Ability to recognize the applicability of food technology in industrial processing.	3	3	2	2	-	-	-	-	2	2	2	3
FT792.2	Ability to classify several processing steps in industrial food production and preservation.	3	2	2	2	-	-	-	-	2	2	2	3
FT792.3	Ability to develop soft skills related to the industry.	-	-	-	-	-	3	-	3	3	3	-	3
FT792.4	Ability to illustrate different data and manage documents related to the food industry.	3	2	2	2	-	-	-	1	2	2	2	3
FT792.5	Ability to demonstrate proper safety and hygiene in the food industry.	3	2	2	2	-	3	-	3	3	3	3	3
Overall CO (FT792) mapped		3	2	2	2	-	1	-	1	2	2	2	3

Paper Name: Project part 1

Paper Code: FT793

Contact: L-T-P= 0-0-6

Credit: 4

Pre requisites: Food Process Engineering, Chemistry of Food, Unit Operations, Principles of Food Preservation, Food Microbiology

Course Objective: To help the students develop an innovative and working model based on their theoretical and practical knowledge.

Course outcome(s):

FT793.1. Ability to design a working model related to food processing and production.

FT793.2. Ability to formulate different fortified or develop an innovative production technique.

FT793.3. Ability to collaborate with other team members for the success of the project.

FT793.4. Ability to analyze different process parameters related to their respective projects.

FT793.5. Ability to demonstrate proper safety and hygiene in the processing steps undertaken by the project team.

Course Contents: Innovative topics on the recent advancements in the field of food technology, biotechnology, environmental sciences, etc.

CO – PO MAPPING

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT793.1	Ability to design a working model related to food processing and production.	3	2	2	2	1	2	2	-	2	2	2	3
FT793.2	Ability to formulate different fortified or develop an innovative production technique.	3	3	3	2	1	-	-	-	2	2	2	3
FT793.3	Ability to collaborate with other team members for the success of the project.	-	-	-	-	-	2	-	3	3	3	2	3
FT793.4	Ability to analyze different process parameters related to their respective projects.	3	3	3	3	3	1	1	2	2	2	2	3
FT793.5	Ability to demonstrate proper safety and hygiene in the processing steps undertaken by the project team.	3	2	2	2	1	3	3	3	3	3	3	3
Overall CO (FT793) mapping		3	2	2	2	1	2	1	2	2	2	2	3

Paper Name: Seminar

Paper Code: FT 794

Contact: L-T-P= 0-0-3

Credit: 2

Pre requisites: Food Process Engineering, Chemistry of Food, Unit Operations, Principles of Food Preservation, Food Microbiology

Course Objective: To help the students develop their soft skills and acquire an ability to represent and investigate different aspects of food technology.

Course outcome(s):

FT 794.1. Ability to assemble different data and information related to the presentation topic.

FT 794.2. Ability to compare the data with current developments to gain more suitable information on the desired topic.

FT 794.3. Ability to create a presentation on the related topic.

FT 794.4. Ability to demonstrate the different aspects for the analyzed data in an innovative manner.

FT 794.5. Ability to collaborate with team members for the seminar presentation.

Course Contents: Current topics on the recent advancements in the field of food technology, biotechnology, environmental sciences, etc.

CO – PO MAPPING

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT794.1	Ability to assemble different data and information related to the presentation topic.	3	2	2	2	-	-	-	-	1	-	1	3
FT794.2	Ability to compare the data with current developments to gain more suitable information on the desired topic	3	3	3	2	-	-	-	-	-	-	1	3
FT794.3	Ability to create a presentation on the related topic.	-	-	-	-	-	-	-	2	3	3	1	3
FT794.4	Ability to demonstrate the different aspects for the analyzed data in an innovative manner.	3	2	-	-	-	-	-	1	3	3	-	3
FT794.5	Ability to collaborate with team members for the seminar presentation.	-	-	-	-	-	-	-	3	3	3	3	3
Overall CO (FT794) mapping		2	1	1	1	-	-	-	1	2	2	1	3

Paper Name: Foreign Language

Paper Code: MC781

Contact: L-T-P= 0-0-2

Credit = 0

Pre-requisites: Basic high school level reading, writing and communication skills in English.

Course Objective: To help the students become fluent in a foreign language.

Course outcomes: By the end of the course the students will be able to
CO1—Read basic French and interpret the meaning
CO2—Construct simple sentences in French
CO3—Interact with others and hold simple conversations in French

Course Content:

Unit 1

Vocabulaire

- L’ alphabet français (The Alphabets)
- Les nombres (cardinaux et ordinaux) (Numbers)
- Les mois de l’année (The Months of the Year)
- Les saisons (The Seasons)
- Les jours de la semaine (The Days of the Week)
- Les couleurs (The Colours)
- La famille (The Family)
- Les nationalités (The Nationalities)

Grammaire
- Les Verbes—*être, avoir* et *aller*
- Nouns—Gender and Number
- Les articles (définis, indéfinis, contracté et partitif)
- Les adjectifs—possessifs et demonstraifs

Français Intéractif (Listening and Speaking)
- Les salutations
- Les forms de politesse
- Présentez-vous (About Yourself)

Unit 2

Vocabulaire
- L’heure (the time)
- La maison (the house)
- Le corps (the body)
- Les vêtements (clothes)
- Les professions (professions)
- Les loisirs (pastimes)
- Le sport (Sports)

Grammaire
- Le Verbes—*voir, savoir, venir, aller, sortir, connaître, partir.*
- Les négations
- Le futur
- Les interrogatifs

Français Intéractif (Listening and Speaking)
- Décrivez les images
- La dictée
- Liséz le journal

Unit 3

Vocabulaire
- La nourriture (Food)
- Les repas (Meals)
- Les légumes (Vegetables)
- Les fruits (Fruits)

- Les fleurs (Flowers)
- Les animaux (Animals)
- Les oiseaux (Birds)

Grammaire
- Les adverbes
- Les adjectifs
- Les prépositions

Français Intéractif (Listening and Speaking)
- Ecoutez la radio/la télévision
- Dialogues—À la médecin, au café, a la gare

Unit 4

Vocabulaire
- Le jardin (The Garden)
- Le temps (the weather)
- Les voyages (Travel)
- La ville (the City)
- Les vacances (Holidays)

Grammaire
- Pronoms interrrogatifs
- Mood—subjonctif et l'impératif

Français Intéractif (Listening and Speaking)
- Se présenter (expressing ideas/opinions on general topics)
- Ecoutez le programme sur la radio/la télévision

Recommended Texts:

*Le Nouveau Sans Frontières-1 (*Paris: CLE International, 1999)
Dondo, *Modern French Course* (1930, Oxford:Oxford UP, 1999)
Dictionnaire Larousse

CO-PO Mapping of Course:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CO.1	2	-	-	3	-	3	2	2	3	3	-	**3**
CO.2	2	3	3	3	-	3	3	3	2	3	-	3
CO.3	1	3	3	3	-	2	2	2	2	3	-	2
CO.4	1	2	3	3	-	2	1	1	2	3	-	2
CO.5	3	3	2	3	-	2	3	2	2	3	-	2

4th Year: 8th SEMESTER

A. THEORY:

Sl. no.	Field	Code	Subjects	Contact				Credit points
				L	T	P	Total	
1	HS	HU 804	Principles of Management	2	1	0	3	3
2	PC	FT801	Project Engineering & Food Plant Layout	2	2	0	4	3
3	PE	FT802 (A/B/C)	Elective–III(PrinciplesofBiochemicalEngineering/EntrepreneurshipDevelopmentforFoodTechnologists/ FunctionalFoods&Nutraceuticals)	2	2	0	4	3
Total Theory							11	9

B. PRACTICAL&SESSIONAL:

Sl. no.	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	Sessional	FT891	Project part2	0	0	12	12	8
2	PC	FT892	Product Development & Quality Assurance Lab	0	0	4	4	3
3	Sessional	FT893	Grand Viva	-	-	-	-	3
Total Practical and Sessional							16	14
Total 8th semester							27	23

THEORY

Paper Name: Principles of Management
Paper Code: HU 804

Contact: L-T-P= 2-1-0
Credits: 3
Course Objectives:

1. To develop ability to critically analyze and evaluate a variety of management practices in the contemporary context
2. To understand and apply a variety of management and organizational theories in practice
3. To be able to mirror existing practices or to generate their own innovative management competencies required for today's complex and global workplace
4. To be able to critically reflect on ethical theories and social responsibility ideologies to create sustainable organizations

Course Content:

Unit	Details	Hour
01	Introduction to Management: definitions, managerial roles and functions; Science or Art perspectives- External environment-global, innovative and entrepreneurial perspectives of Management (3 Hrs.)– Managing people and organizations in the context of New Era- Managing for competitive advantage - the Challenges of Management	**4**
02	Early Contributions and Ethics in Management: Scientific Management- contributions of Taylor, Gilbreths, Human Relations approach-contributions of Mayo, McGregor's Theory, Ouchi's Theory Z .Systems Approach, the Contingency Approach, the Mckinsey 7-S Framework Corporate Social responsibility- Managerial Ethics.	**6**
03	Planning: Nature and importance of planning, -types of plans (3 Hrs.)- Steps in planning, Levels of planning - The Planning Process. – MBO Organising for decision making: Nature of organizing, organization levels and span of control in management Organisational design and structure –departmentation, line and staff concepts Leading and Controlling: Leading Vs Managing – Trait approach and Contingency approaches to leadership - Dimensions of Leadership (3 Hrs.) - Leadership Behavior and styles – Transactional and Transformational Leadership Basic control processcontrol as a feedback system – Feed Forward Control – Requirements for effective control – control techniques – Overall controls and preventive controls – Global controlling	**6**
3	Management of Physical Resources Plant: site selection procedures, factors affecting selection. Layout-types and relative merits and demerits, Maintenance-Objectives, different types of associated decisions, strategies for effective maintenance, computer applications. Material : Functions, objectives, planning and control including inventory models with or without storage costs, price break (excluding dynamic and probabilistic considerations). Different classes of inventory. Material Requirement Planning (MRP)	**6**
4	Quality management: Quality definition, quality planning, quality control and quality management, Total quality management, ISO 9000 systems, simple quality control techniques like control charts and acceptance sampling, Kaizen & Six Sigma	**4**
5.	Marketing management consumer behavior, market research, product design and development pricing and promotion.	**4**
	References 1. Harold Kooritz & Heinz Weihrich "Essentials of Management", Tata McGraw-Hill. 2. L.M. Prasad, Principles of Management , Sultan Chand & sons, New Delhi. 3. Sherlekar & sherlekar, Principles of Management, Himalaya Publishing House, New Delhi. 4. Stephen Robbins, Organizational Behavior, Pearson Education, New Delhi **5.** Production And Operations Management--K. ASWATHAPPA K. Shridhara	

	Bhat ,Himalayan publishing House	

CO-PO mapping for HU 804

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	_	_	_	_	_	1	1	1	1	2	_	_
CO-2	_	_	_	_	_	1	1	3	1	2	_	_
CO-3	_	_	_	_	_	3	2	-	_	1	_	3
CO-4	_	_	_	_	_		2	1	3	_	_	_

Paper Name: Project Engineering & Food Plant Layout

Paper Code: FT801

Contact: L-T-P= 2 – 2 – 0

Credit: 3

Pre requisites: Food Engineering, Food Processing

Course Objective: To help students develop a detailed theoretical outlook to project engineering and understand several parameters of a successful food plant layout.

Course outcome(s):

FT801. 1. Ability to identify the basis of project engineering and importance of feasibility study in a design project.

FT801. 2. Ability to recognize the basic concept of plant layout and design including the basic understanding of the equipment layout , ventilation and the choice of material used for construction.

FT801. 3. Ability to prepare flow sheets for material movement and utility consumption in a food plant.

FT801. 4. Ability to interpret the ISO requirements in food plant design and also apply PERT and CPM in project planning and monitoring.

FT801. 5. Ability to develop the basic scale – up operations in food processing industry.

Course Contents:

Module 1: 8L

Introduction to project engineering; Process design development: Optimum economic design, Feasibility Survey; Basic concepts of plant layout and design including basic understanding of equipment layout, ventilation; Design consideration for location of food plants.

Module 2: 8L

Miscellaneous aspects of plant layout and design like provision for waste disposal, and safety arrangements; Material of Construction for food processing equipment; Specifications of processing equipments and accessories

Module 3: 8L

Layout and designing aspects of pilot and semi-commercial food processing plants; Reference to design of bakery and biscuit, fruits, vegetable and beverage processing, and dairy industries; Hygienic Design of Food Plants; ISO, HACCP requirements in food plant; Role of FSSAI

Module 4: 8L

Preparation of flow sheets for material movement and utility consumption in food plants; Application of Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) in project planning and monitoring; Cost estimation for a Food Plant; Scale-up

Revision: 4L

Text and reference books:

1. Manufacturing Facilities Design and Material Handling by Fred E. Meyers, and Matthew P. Stephens, 3rd Edition, Pearson Prentice Hall, 2000
2. James M Moore, "Plant Layout and Design", Mcmillan& Co., (1959)
3. Bolz, Harold A George E., "Material Handling Handbook.
4. J M Apple, "Plant layout and Material Handling", John Willey & Sons, (1977)

CO PO Mapping:

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT801.1	Ability to identify the basis of project engineering and importance of feasibility study in a design project.	3	2	2	1	-	2	2	2	-	-	2	3
FT801.2	Ability to recognize the basic concept of plant layout and design including the basic understanding of the equipment layout , ventilation and the choice of material used for construction.	3	2	2	2	-	-	2	-	-	-	-	3
FT801.3	Ability to prepare flow sheets for material movement and utility consumption in a food plant.	3	2	2	-	-	-	2	-	-	-	2	3
FT801.4	Ability to interpret the ISO requirements in food plant design and also apply PERT and CPM in project planning and monitoring.	3	3	2	-	-	3	3	1	1		3	3
FT801.5	Ability to develop the basic scale – up operations in food processing industry.	3	2	2	2	-	-	-	-	-	-	-	3
Overall CO (FT801) mapping		3	2	2	2	-	3	2	2	1	-	2	3

Paper Name: Principles of Biochemical Engineering

Paper Code: FT802A

Contact: L-T-P= 2 – 2 – 0

Credit: 3

Pre requisites: Food Engineering, Food Processing

Course Objective: To help the students understand the basic principles of various biochemical processes and realize the importance of different design parameters in bioreactor operation.

Course outcome(s):

FT802A. 1. Ability to recognize the industrial implication of biochemical engineering.

FT802A. 2. Ability to interpret the kinetics of microbial reactions.

FT802A. 3. Ability to develop the design parameters for a bioreactor.

FT802A.4. Ability to illustrate the importance of downstream processing in bioprocess industries.

FT802A.5. Ability to evaluate the importance of design considerations in a fermentation plant design project and examine scale up operations.

Course Contents:

Module 1: 8L
Introduction to biochemical process industries; Industrial alcohols, antibiotics, acids, alcoholic beverages, vitamins, enzymes, single cell protein, dairy products

Module 2: 8L
Bioreactor design: Mechanisms and kinetics (Monod model), Fermentation - types of fermenters, chemostat, chemostat with recycle, turbidostat, PFR, fluidized bed reactor, air lift fermenter, Fed Batch reactions; Mass transfer in microbial reactors

Module 3: 8L
Bioproduct recovery: Downstream processing - separation process for cell mass and product, filtration, centrifuging, membrane processes (reverse osmosis, ultrafiltration, chromatographic separation); Extraction

Module 4: 8L
Scale-up of bioprocess; Bioprocess economics, Cost analysis of alcohol production plant, Fermentation plant design project, Bio-product regulation

Revision: 4L

Text and reference books:

1. Biochemical Engineering Fundamentals: J.E Bailey, D F Olli, MGH
2. Biochemical Engineering: Aiba S; Academia press, NY
3. Michael L. Shuler and FikretKargi: Bioprocess Engineering: Basic Concepts, 2nd Edition

CO PO Mapping

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT802A.1	Ability to recognize the industrial implication of biochemical engineering	3	2	2	-	-	2	1	-	-	-	-	3
FT802A.2	Ability to interpret the kinetics of microbial reactions.	3	2	2	1	-	-	1	-	-	-	-	3
FT802A.3	Ability to develop the design parameters for a bioreactor.	3	3	3	2	-	-	-	-	-	-	-	3
FT802A.4	Ability to illustrate the importance of downstream processing in bioprocess industries.	3	3	2	2	-	2	-	-	-	-	-	3
FT802A.5	Ability to evaluate the importance of design considerations in a fermentation plant design project and examine scale up operations.	3	3	3	3	-	-	-	-	-	-	-	3
Overall CO (FT802A) mapping		3	3	2	2	-	1	1	-	-	-	-	3

Paper Name: Entrepreneurship Development for Food Technologists

Paper Code: FT802B

Contact: L-T-P= 2-2-0

Credit: 3

Pre requisites: Food Process Engineering,Unit Operations in Food Technology, Food Processing Technology.

Course Objective: To help the students get themselves established as successful entrepreneurs.

Course outcome(s):

FT802B.1. Ability to design and construct a food processing industry.

FT802B.2. Ability to identify the different legal obligations and financial barriers related to the development a food industry.

FT802B.3. Ability use different technologies for food processing to optimize production.

FT802B.4. Ability to make several documentations related to the relevant food industry.

FT802B.5. Ability to establish proper safety and hygienic processing steps in the related food industry.

Course Contents:

Module I
Entrepreneur and entrepreneurial flair; Classification of small, medium and large scale manufacturing industries; Opportunities of food processing industries in West Bengal

Module II
Trade license and registration marks; Sources of finance; Selection of land and factory sheds

Module III
Agencies for promotion of food processing industries; Source of machine and equipment

Module IV
Preparation of project report; Market feasibility reports; Techno-economic feasibility report on fruit s and vegetable processing, bakery and confectionary, mushroom manufacture and soybean processing

Text books/ References:

1. Entrepreneurial Development by Sarwate (Everest Publication)

CO PO Mapping

CO	**Statement**	**Program Outcomes**											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT802B.1	Ability to design and construct a food processing industry.	3	3	3	-	-	1	-	-	2	-	3	3
FT802B.2	Ability to identify the different legal obligations and financial barriers related to the development a food industry.	-	-	-	-	-	2	-	2	-	-	1	3
FT802B.3	Ability use different technologies for food processing to optimize production.	3	3	3	1	-	-	-	-	-	-	2	3
FT802B.4	Ability to make several documentations related to the relevant food industry.	-	-	-	-	-	-	-	-	2	-	1	3
FT802B.5	Ability to establish proper safety and hygienic processing steps in the related food industry.	3	2	2	2	-	3	-	1	3	-	2	3
Overall CO (FT802B) mapping		2	2	2	1	-	1	-	1	1	-	2	3

Paper Name: Functional Foods &Nutraceuticals

Paper Code: FT802C

Contact: L-T-P= 2-2-0

Credit: 3

Pre requisites: Biochemistry, Chemistry of Food

Course Objective: To help the students develop a detailed understanding of functional properties of food and their utilization in modern food industry.

Course outcome(s):

FT802C.1. Ability to define Functional Foods &Nutraceuticals.

FT802C.2. Ability to formulate different fortification and enrichment techniques in foods with special references to modern industries.

FT802C.3. Ability to discuss the concepts of Probiotic, Nutraceutcals, Spiceuticals, Regulatory and labeling issues.

FT802C.4. Ability to recognize different purification and manufacturing steps in production of functional foods.

FT802C.5. Ability to explain different beneficial roles of nutraceuticals in our diet.

Course Contents:

Module 1:
Introduction: Relevant terminologies – Enrichment, value addition, fortification, supplementation, Sources, Significance, Fortification and Enrichment in different foods (MSG; Bakery and confectionary products e.g. bread, biscuit and cookies; Breakfast and ready to eat cereals; Infant formulas; Protein mixes; Vegetable Mixes; Dairy product e.g. ice cream; Beverages including diet beverages), Value addition in processed food products e.g. pasta, ice cream, pizza, wafers, rolls, buns, jam, jelly, sauce, pickles, waffles etc.

Module 2:
Types of functional foods: Concepts of Probiotic, Nutraceutcals, Spiceuticals, Regulatory and labeling issues, CODEX

Module 3:
Functional ingredients: Extraction / purification of lycopene, isoflavonoids, prebiotics and probiotic

s glucosamine, phytosterols, and their stability in processing conditions; Manufacturing of dietary supplements in the form of liquid, rehydration powder, tablet, pill, capsule or mix

Module 4:
Nutritional significance: Role of nutraceutical / functional foods in cardiovascular health, diabetes, obesity, immunity, age related muscular degeneration, stress management; Dosage levels; Adverse effects and toxicity of nutraceuticals

Text and reference books:

1. Functional Food Ingredients and Nutraceuticals: Processing Technologies, Second Edition (Functional Foods and Nutraceuticals) by John Shi; CRC Press
2. Handbook of Nutraceuticals and Functional Foods; Edited by Robert C. Wildman; CRC Press

CO PO Mapping

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT802C.1	Ability to define Functional Foods &Nutraceuticals.	3	2	-	-	-	1	1	-	-	-	-	3
FT802C.2	Ability to formulate different fortification and enrichment techniques in foods with special references to modern industries.	3	2	-	-	-	2	1	-	-	-	-	3
FT802C.3	Ability to discuss the concepts of Probiotic, Nutraceutcals, Spiceuticals, Regulatory and labeling issues.	3	2	-	-	-	2	2	-	-	-	-	3
FT802C.4	Ability to recognize different purification and manufacturing steps in production of functional foods.	3	2	2	1	-	1	1	-	-	-	-	3
FT802C.5	Ability to explain different beneficial roles of nutraceuticals in our diet.	3	2	-	-	-	1	2	2	-	-	-	3
Overall CO (FT802C) mapped		3	2	1	1	-	1	1	1	-	-	-	3

PRACTICAL

Paper Name: Product Development & Quality Assurance Lab

Paper Code: FT892

Contact: L-T-P= 0-0-4

Credit: 3

Pre requisites: Food Processing Technology, Food Microbiology, Principles of Food Preservations.

Course Objective: To help the students realize how to build products with sustainable competitive advantage with understanding of complete product development process.

Course outcome(s):

FT892.1. Ability to explain the different process controlling parameters that influence a food product development.

FT892.2. Ability to develop an innovative product or a processing flow and effectively vary the composition for the newly developed product and evaluate the results.

FT892.3. Ability to interpret governing parameters in the newly developed process flow while maintaining the palatability of the food in a consumer friendly manner.

FT892.4. Ability to recognize the importance of HACCP in the developmental process and establish quality assurance protocols.

FT892.5. Ability to identify the importance of shelf life study and perform varied tests to determine the nutritional quality of the newly developed product.

CO PO Mapping

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT892.1	Ability to explain the different process controlling parameters that influence a food product development.	3	2	2	2	-	-	-	-	1	-	-	3
FT892.2	Ability to develop an innovative product or a processing flow and effectively vary the composition for the newly developed product and evaluate the results.	3	2	2	-	-	1	-	-	-	-	-	3
FT892.3	Ability to interpret governing parameters in the newly developed process flow while maintaining the palatability of the food in a consumer friendly manner.	2	1	-	-	-	1	2	2	-	-	-	3
FT892.4	Ability to recognize the importance of HACCP in the developmental process and establish quality assurance protocols.	2	-	-	-	-	3	3	2	-	-	-	3
FT892.5	Ability to identify the importance of shelf life study and perform varied tests to determine the nutritional quality of the newly developed product.	2	2	-	-	-	-	2	-	-	-	-	3
Overall CO (FT892) mapping		2	1	1	1	-	1	1	1	1	-	-	3

SESSIONAL

Paper Name: Project part 2

Paper Code: FT891

Contact: L-T-P= 0-0-12

Credit: 8

Pre requisites: Food Process Engineering, Chemistry of Food, Unit Operations, Principles of Food Preservation, Food Microbiology

Course Objective: To help the students develop an innovative and working model based on their theoretical and practical knowledge.

Course outcome(s):

FT891.1. Ability to design a working model related to food processing and production.

FT891.2. Ability to formulate different fortified or develop an innovative production technique.

FT891.3. Ability to collaborate with other team members for the success of the project.

FT891.4. Ability to analyze different process parameters related to their respective projects.

FT891.5. Ability to demonstrate proper safety and hygiene in the processing steps undertaken by the project team.

Course Contents: Innovative topics on the recent advancements in the field of food technology, biotechnology, environmental sciences, etc.

CO – PO MAPPING

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT891.1	Ability to design a working model related to food processing and production.	3	2	2	2	1	2	2	-	2	2	2	3
FT891.2	Ability to formulate different fortified or develop an innovative production technique.	3	3	3	2	1	-	-	-	2	2	2	3
FT891.3	Ability to collaborate with other team members for the success of the project.	-	-	-	-	-	2	-	3	3	3	2	3
FT891.4	Ability to analyze different process parameters related to their respective projects.	3	3	3	3	3	1	1	2	2	2	2	3
FT891.5	Ability to demonstrate proper safety and hygiene in the processing steps undertaken by the project team.	3	2	2	2	1	3	3	3	3	3	3	3
Overall CO (FT891) mapped		3	2	2	2	1	2	1	2	2	2	2	3

Paper Name: Grand Viva

Paper Code: FT893

Credit: 3

Pre requisites: All Subjects of the B.Tech Course in Food Technology (1^{st} to 8^{th}Sem)

Course Objective: To judge the students on their overall understanding of the course.

Course outcome(s):

FT893.1. Ability to identify their skills in elaborating the basics concepts of food technology.

FT893.2. Ability to evaluate themselves on their understanding of the course after its completion.

FT893.3. Ability to prepare for industrial and academic interviews.

FT893.4. Ability to find errors in their understanding of the subject and rectify themselves.

FT893.5. Ability to solve real time problems and come up with innovative ideas.

Course Content: Viva to evaluate concepts from all Subjects of the B.Tech Course in Food Technology (1st to 8thSem)

CO PO Mapping

CO	Statement	Program Outcomes											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
FT893.1	Ability to identify their skills in elaborating the basics concepts of food technology.	3	3	2	1	-	-	-	2	1	3	-	3
FT893.2	Ability to evaluate themselves on their understanding of the course after its completion.	3	3	2	2	-	-	-	-	-	2	-	3
FT893.3	Ability to prepare for industrial and academic interviews.	3	3	2	1	-	2	-	3	1	3	2	3
FT893.4	Ability to find errors in their understanding of the subject and rectify themselves.	3	3	3	2	-	-	-	1	-	3	-	3
FT893.5	Ability to solve real time problems and come up with innovative ideas.	3	3	3	3	-	2	-	2	2	3	3	3
Overall CO (FT891) mapped		3	3	2	2	-	1	-	2	1	3	1	3