

B.Tech Food Engineering & Technology Syllabus Structure and Details (July 2020 onwards)

Course No.	Course Name	L	T	P	C	Course No.	Course Name	L	T	P	C
Semester I						Semester II					
UPH101	Engineering Physics	3	1	0	8	UCH201	Engineering Chemistry	3	1	0	8
UMA101	Engineering Mathematics-I	3	1	0	8	UMA201	Engineering Mathematics-II	3	1	0	8
UEE101	Basic Electrical Engineering	3	1	0	8	UCSE201	Programming for Problem Solving	4	1	0	10
UHSS101	English Communication	2	0	0	4	UCE201	Engineering Drawing and Computer Graphics	1	0	0	2
UME101	Engineering Workshop	1	0	0	2	UHSS201	Professional Ethics and Human Value	2	0	0	4
UPH171	Engineering Physics Lab	0	0	3	3	UCH271	Engineering Chemistry Lab	0	0	2	2
UEE171	Basic Electrical Engineering Lab	0	0	2	2	UCSE271	Programming for Problem Solving Lab	0	0	3	3
UHSS171	English Communication Practice	0	0	2	2	UCE271	Engineering Drawing and Computer Graphics Lab	0	0	4	4
UME171	Workshop Practice	0	0	4	4						
Contact Hours: 26		12	3	11	41	Contact Hours: 26		13	3	9	41
Semester III						Semester IV					
UFET301	Principles of Food Processing and Preservation	3	0	0	6	UFET404	Food Microbiology and Food Biotechnology	3	0	0	6
UFET302	Food Chemistry	3	0	0	6	UMA401	Numerical Methods & Computer Programming	3	0	0	6
UFET303	Biochemistry and Human Nutrition	3	0	0	6	UFET401	Food Product Technology-I (Fruits & Vegetables)	3	0	0	6
UFET304	Basic Microbiology	3	0	0	6	UFET402	Food Product Technology-II (Cereals & Legumes)	3	0	0	6
UME301	Basic Thermodynamics	3	0	0	6	UFET403	Fluid Mechanics	3	0	0	6
UME302	Engineering Mechanics	3	0	0	6	UHSS401	Engineering Economics	3	0	0	6
UFET371	Food Processing Lab	0	0	2	2	UFET471	Product Technology- I /II Lab	0	0	2	2
UFET372	Food Chemistry Lab	0	0	2	2	UFET474	Food Microbiology Lab	0	0	2	2
UFET373	Biochemistry and Human Nutrition Lab	0	0	2	2	UMA471	Numerical Methods & Computer Programming Lab	0	0	2	2
UHSS371	Language Lab	0	0	2	2						
Contact Hours: 26		18	0	8	44	Total Contact Hours 24		18	0	6	42
Semester V						Semester VI					
UHSS501	Industrial Management and Entrepreneurship	3	0	0	6	UHSS601	Professional Communication	2	0	0	4
UFET501	Food Product Technology-III (Milk and Milk Products)	3	0	0	6	UFET601	Food Packaging Technology	3	0	0	6
UFET502	Food Process Engineering	3	0	0	6	UFET602	Food Analysis, Quality Control and Management	3	0	0	6
UFET503	Food Process Equipment Design	3	0	0	6	UFET61*	Elective-I	3	0	0	6
UFET504	Fundamentals of Heat and Mass Transfer	3	0	0	6	UFET61*	Elective-II	3	0	0	6
UFET505	Food Industry Waste Management	3	0	0	6	UIE604	Process Control and Instrumentation	3	0	0	6
UFET571	Product Technology-III Lab	0	0	2	2	UFET671	Food Packaging Technology Lab	0	0	3	3
UFET572	Food Engineering Lab	0	0	2	2	UFET672	Food Analysis and Quality Control Lab	0	0	2	2
UFET573	Process Equipment Drawing	0	1	3	4	UFET681	Product Technology- IV/V Lab	0	0	3	3
UFET574	Transfer Process Engineering Lab	0	0	2	2	UIE674	Instrumentation Lab	0	0	2	2
Total Contact Hours 25		18	0	9	46	Total Contact Hours 27		17	0	10	44
Semester VII						Semester VIII					
UFET701	Food Hygiene and Plant Sanitation	3	0	0	6	UFET801	Plant Design and Project Engineering	3	0	0	6
UFET71*	Elective- I	3	0	0	6	UFET81*	Elective-I	3	0	0	6
UFET71*	Elective- II	3	0	0	6	UFET81*	Elective-II	3	0	0	6
UFET71*	Elective- III	3	0	0	6	UFET891	Major Project-II	0	0	12	12
UFET791	Major Project-I	0	0	10	10	UFET892	Project Defense	-	-	-	4
UFET792	Report and Presentation on Practical Training-II	-	-	-	3	UFET893	Comprehensive Viva Voce	-	-	-	4
UFET770	Seminar	0	0	3	3						
Contact Hours: 25		12	0	10	40	Total Contact Hours: 21		9	0	12	38
Total Mandatory Credits: 336											

Semester I

Paper code: UPH101

Paper name: Engineering Physics

Total contact hours: 40

Credit: 8

L-T-P: 3-1-0

1. Mathematical Physics:

Vector and Scalar field, grad, divergence, curl, Laplacian, line integral, surface integral, volume integral, physical examples in the context of electricity and magnetism, Stokes theorem, Gauss theorem (No proof). [5]

2. Electrodynamics:

Gauss Law of electrostatics, Biot-Savart Law, Ampere's Law, Displacement current, Equation of Continuity, Maxwell's equations in differential and integral form, Maxwell's wave equation in free space, propagation of EM wave in free space, transverse nature of EM wave. [6]

3. Heat and thermodynamics:

Thermodynamic system and state variables, Heat & Work, Zeroth Law, 1st and 2nd laws of thermodynamics, Isothermal and adiabatic changes, Carnot theorem, Carnot engine, entropy, pyrometer. [5]

4. Wave and Oscillations:

- Transverse wave on a string, reflection and transmission of waves at boundary, impedance matching, standing waves and their eigen frequencies, acoustics waves and speed of sound.
- Simple harmonic motion, Damped oscillation-its differential equation, energy decay in a damped oscillation, Forced vibration, Resonance, Sharpness of resonance and quality factor. [8]

5. Introduction to Quantum Mechanics:

Wave-Particle duality, Black body radiation, Photoelectric effect, Compton effect, Uncertainty principle, wave function, the Schrodinger time dependent and time independent equations, application of Schrodinger equation for free particle in one dimensional infinite potential box. [6]

6. Optics and Optoelectronics:

- Huygens' Principle, superposition of waves and interference of light, Young's double slit experiment, Newton's rings, Diffraction, Single slit diffraction, grating.
- LASER: Einstein's theory of matter radiation interaction and A and B coefficients, amplification of light by population inversion, properties of laser: monochromaticity, coherence, directionality and brightness, different types of laser: gas lasers (He-Ne) and solid state laser (Ruby), applications of laser in science, engineering and medicine.

- Light emitting diodes (LED): device structure, materials, characteristics and figures of merit. [10]

Books / References:

1. *Engineering Physics, Malik and Singh, Tata Mc Graw Hill*
2. *Engineering Physics, Naidu, Pearson*
3. *Engineering Physics, Gupta & Gaur, Dhanpat Rai*
4. *Quantum Mechanics, Ajay Ghatak S. Lokanathan, Trinity*
5. *Quantum Mechanics: A Text Book for undergraduates, Mahesh C Jain, TMH*
6. *Thermodynamics and kinetic theory of gases, W. Pauli, Dover Publications, 2010*
7. *Electromagnetic Theory, Prabir K. Basu & Hrishikesh Dhasmana, AneBooks*
8. *Introduction to Electrodynamics, David Griffiths*
9. *Electricity, magnetism and light, W. Saslow*
10. *Oscillations and waves in physics, Ian G. Main,*
11. *The physics of vibrations and waves, H.J. Pain,*
12. *Arthur Beiser, Concepts of Modern Physics (Sixth Edition), Tata McGraw-Hill Publication, New Delhi (1988).*

Paper Name: Engineering Physics Lab

Paper code: UPH171

Credit: 3

L-T-P: 0-0-3

List of experiments:

Experiment No 1: To determine the magnetic moment of a bar magnet and the horizontal component of the earth's magnetic field.

Experiment No 2: To study the Hall Effect in semiconductor (Germanium Crystal) and then to calculate the Hall coefficient.

Experiment No 3: To Verify Stefan-Boltzmann law of thermal radiation by electrical method.

Experiment No 4: To determine the coefficient of thermal conductivity of a bad conductor (glass) by using Lee's Disc apparatus.

Experiment No 5: To study the variation of time period of a bar pendulum about different axes and determine the value of acceleration due to gravity (g) at the place.

Experiment No 6: To determine the wavelength of sodium light by measuring the diameters of Newton's Rings.

Experiment No 7: To determine the wavelength of Laser light by using diffraction grating.

Experiment No 8: To determine the grating element by using sodium vapour lamp.

Experiment No 9: To determine the value of Planck's constant with the help of vacuum phototube.

Experiment No 10: To study the current flowing through an external circuit by a potentiometer and determine the internal resistance of a standard cell.

Paper code: UMA101
Paper name: Engineering Mathematics-I
Total contact hours: 40

Credit: 8
L-T-P: 3-1-0

Module 1: Calculus-I (15hours)

Successive derivative, Libnitz's Theorem, Tangent and Normal, Derivation of arc length (Cartesian and Polar coordinates), curvature, partial derivatives, homogeneous functions. Expansions of functions using Taylor's theorem

Beta and Gamma functions and their properties, applications of definite integrals.

Module 2: Sequences and Series (10 hours)

Convergence of sequence and series, tests for convergence (Comparison test, Ratio test, Cauchy's Root test), Fourier series, Change of intervals, Half range sine and cosine series.

Module 3: Multivariable Calculus (15 hours)

Differentiation of vector functions, scalar and vector field, gradient of a scalar function, directional derivatives, divergence, curl and their properties, integration of vector functions, line, surface and volume integral, Green's, Gauss's and Stoke's Theorems.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics

Paper code: UHSS101
Paper name: ENGLISH COMMUNICATION
Total contact hours: 39

Credit: 4
L-T-P: 2-0-0

Module 1: Vocabulary Building: 1.1 Word Formation 1.2 Root words from foreign languages and their use in English 1.3 Understanding prefixes and suffixes to form derivatives 1.4 Antonyms and Synonyms, Functional Vocabulary, Idioms and Phrasal Verbs	Contact hours: 3
Module 2: Basic Writing Skills 1.1 Sentence Structure 1.2 use of phrases and clauses in sentences 1.3 Importance of proper punctuation 1.4 Creating Coherence 1.5 Organizing Principles of paragraph in documents 1.6 techniques of writing precisely	Contact hours: 4

Module 3: Identifying Common Errors in Writing 1.1 Subject-verb Agreement 1.2 Noun-pronoun agreement 1.3 Effective Principles of Sentence Structure 1.4 Misplaced Modifiers 1.5 Articles 1.6 Prepositions 1.7 Redundancies 1.8 Cliches	Contact hours: 4
Module 4: Nature and Style of Sensible Writing 1.1 Describing 1.2 Defining 1.3 Classifying 1.4 Providing examples or evidence 1.5 Writing Introduction and Conclusio	Contact hours: 4
Module 5: Business Writing 1.5 Letter Writing, Memo, Report 1.6 Email 1.7 CV, Resume	Contact hours: 4
Module 6: Oral Communication (The Unit involves interactive practice sessions in language Lab) 6.1 IPA Symbols, pronunciation, Intonation, Stress and Rhythm 6.2 Listening Comprehension 6.3 Common Everyday Situations: Conversation and dialogues 6.4 Communication at work place 6.5 Interviews 6.6 Formal Presentations	Contact hours: 4
Module 7: Learning Language through Literature 7.1 Novel: R.K. Narayan <i>The Guide</i> 7.2 Poem: John Keats <i>Ode to a Nightingale</i> and <i>Ode to a Gracian Urn</i>	Contact hours: 4

BOOKS RECOMMENDED:

- (1) Practical English Usage, Michael Swan, OUP,1995
- (2) Remedial English Grammar, F.T. Wood, Macmillan, 2007
- (3) On Writing Well, William Zinsser, Harper Resource Book, 2001
- (4) Study Writing, Liz Hamp-Lyons and Ben Heasley, CUP, 2006
- (5) Communication Skills, Sanjay Kumar and PushpLata, OUP, 2011
- (6) Exercises in Spoken English, Parts-I-III, CIEFL, Hyderabad, OUP

Paper code: UHSS171;

Paper name: English Communication Practice

Total contact hours: 40

Credit: 2

L-T-P-C: 0-0-2-2

Module 1: Listening Practices 1.1 Enhancing listening skills 1.2 Different types of listening 1.3 How to be a good listener 1.4 Barriers to Effective Listening	Contact hours: 3
Module 2: Speaking Skills 2.1 The sounds of English 2.2 Benefits of Speaking 2.3 Self Development through Speaking Skills	Contact hours: 4
Module 3: Reading Skills 3.1 Definition 3.2 Kinds of reading 3.3 Critical Reading Practices 3.4 Reading Method 3.5 Reading Speed Skimming Scanning Active Reading	Contact hours: 4
Module 4: Writing Skills 4.1 Purpose 4.2 Importance of Style 4.3 Essay 4.4 Business Writing	Contact hours: 4
Module 5: Remedial English Grammar 5.1 Tense 5.2 Subject Verb agreement 5.3 Relative Clauses 5.4 Prepositions 5.5 Understanding voice changes	

BOOKS and Software RECOMMENDED:

- (1) Practical English Usage, Michael Swan, OUP, 1995
- (2) Remedial English Grammar, F.T. Wood, Macmillan, 2007
- (3) On Writing Well, William Zinsser, Harper Resource Book, 2001
- (4) Study Writing, Liz Hamp-Lyons and Ben Heasley, CUP, 2006
- (5) Communication Skills, Sanjay Kumar and PushpLata, OUP, 2011
- (6) Exercises in Spoken English, Parts-I-III, CIEFL, Hyderabad, OUP
- (7) Study Skills in English, Michael J. Wallace, CUP]
- (8) Sky Pronunciation
- (9) Tense Buster
- (10) Business Writing

Paper code: UME101

Paper name: Engineering Workshop

Total contact hours: 12

Credits: 2

L-T-P: 1-0-0

Module 1: Carpentry shop

(2 hrs)

- i. Introduction with the shop
- ii. Various structure of wood and types of wood
- iii. Different types of tools, machine and accessories used in Carpentry shop
- iv. Safety Precautions in workshop

Module 2: Fitting Shop

(2 hrs)

- i. Introduction with the fitting shop
- ii. Various marking, measuring, cutting, holding and striking tools
- iii. Different Operations like chipping, filing, marking drilling etc.
- iv. Working principle of drilling machine, lapping dies etc.

Module 3: Welding Shop (2 hrs)

- i. Introduction
- ii. Types of Welding, Arc Welding, Gas Welding, Gas Cutting
- iii. Welding of dissimilar materials, selection of welding rod material, size of rod and work piece
- iv. 3 Different types of flames
- v. Elementary symbolic Representation
- vi. Safety and precautions

Module 4: Machine Shop (2 hrs)

- i. Introduction
- ii. Study of Different types of Lathe machine, shaping machine, Drilling machine
- iii. Study of Different types of hand tools and machine tools and parts
- iv. Safety & precautions

Module 5 :Turning shop (2 hrs)

- i. Introduction
- ii. Various marking, measuring, cutting, holding, and string tools
- iii. Working principle of Drilling machine, tapping, dies, its uses
- iv. Safety precautions

Module 6: Electrical Shop (2 hrs)

- i. Introduction
- ii. Various terms and instruments used in electrical wiring
- iii. Study of different tools used in simple house wiring
- iv. Difference between ac and dc line

Suggested Text/Reference Books:

- (i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
- (ii) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
- (iii) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Paper code: UME171

Paper name: Workshop Practice

Total contact hours: 36

Credits: 4

L-T-P: 0-0-4

Module 1: Carpentry shop (6 hrs)

- Demo of different wood working tools and machines
- Demo of different wood working processes
- Simple joints like T joints, Cross halving joint, dovetail joint etc.
- One simple utility job.

Module 2: Fitting Shop (6 hrs)

- Demo of different fitting tools and machines and power tools
- Demo of different processes in fitting shop
- Squaring of a rectangular metal piece
- Making a V-block of metal piece
- One simple utility job.

Module 3: Welding Shop (6 hrs)

- Demo of different welding tools and machines
- Demo of Arc Welding, Gas Welding, Gas Cutter and rebuilding of broken parts with welding
- Any one Composite job involving lap joint welding process.

Module 4: Machine Shop (6 hrs)

- Demo of different machines and their operations
- Preferably prepare a simple job (e.g Turning operation etc)

Module 5 Turning shop (6 hrs)

- Demo of lathe machine, drilling machine

One job related to plane and taper turning , threading and knurling
One job related to drilling and tapping

Module 6 Electrical Shop

(6 hrs)

Demo of simple house wiring and use of tools
One job related to simple house wiring
Fittings of cut outs, fuses and other simple fittings etc.
Difference between Single phase wiring and three phase wiring

Paper code: UEE101

Paper name: Basic Electrical Engineering

Total contact hours: 40

Credit: 8

L-T-P: 3-1-0

Module 1:

Contact hours: 2

Introduction: Sources of energy; General structure of electrical power systems, Power transmission and distribution via overhead lines and underground cables.

Module 2:

Contact hours: 6

DC circuits: Definitions of active, passive, linear, non-linear circuits elements and networks, Kirchoff's laws, Nodal and mesh analysis, voltage and current sources, network theorems superposition. Thevenin's, Norton's, maximum power transfer, millman's, and reciprocity theorems, analysis of simple circuits with DC excitation.

Module 3:

Contact hours: 8

Single phase AC circuits: generation of single phase sinusoidal EMF, instantaneous, average and effective value, form and peak factor, examples of other alternating waveforms and average and effective value calculations, concept of phasor and phasor diagrams, lagging and leading of phasors, pure resistive, inductive and capacitive circuits, power factor, complex power, R-L, R-C and R-L-C series circuits, parallel AC circuits, series and parallel resonance.

Module 4:

Contact hours: 4

Three phase AC circuits: Generation of three phase EMF, delta and star connections, line and phase value of emf and current, solutions of simple 3-phase balance circuits with resistive and inductive loads, 3-phase power, comparison between 3-phase and 1-phase systems, applications of 3-phase systems.

Module 5:

Contact hours: 5

Magnetic circuits: Ampere's circuital law, B-H curve, definition of mmf, flux, flux-density and reluctance, comparison between electric and magnetic circuits, series, parallel and series-parallel circuits and their solutions, energy stored in magnetic circuit, lifting magnets, electromagnetic induction, self and mutual inductance, hysteresis and eddy current losses.

Module 6:

Contact hours: 5

Electrical machines: Introduction of electrical machines, classifications (DC and AC machines), transformers, technical specifications, reading of nameplate data, general applications (especially 1-phase and 3-phase induction motors).

Module 7:

Contact hours: 5

Electrical measuring instruments: Classification of instruments, essentials of indicating type instruments – deflecting torque, controlling torque, damping, types of indicating instruments, MC and MI type ammeters and voltmeters, extension of range, use of shunts and multiplier, errors and compensation.

Module 8:

Contact hours: 5

Electrical installations: Electrical wiring and type, fuse and its ratings, types of wires and cables, LT switch gears: MCB, ELCB, MCCB etc. Earthing and its importance. Electrochemical power sources: primary and secondary cells, classifications of secondary cells based on applications, Lead-acid cell, electrical characteristics of lead-acid cell, maintenance, charging methods of batteries.

Books / References:

(i) D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

(ii) D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

(iii) B.L. Thereja, A.K. Thereja, " A Textbook of Electrical Technology", S.Chand

Paper code: UEE171

Paper name: Basic Electrical Engineering Lab

Total contact hours: 18

Credit: 2

L-T-P: 0-0-2

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, rheostat and wattmeter.
2. Make a measured resistance from a given rheostat
3. Verification of Kirchhoff's laws
4. Verification of Superposition theorem
5. Verification of Thevenin's theorem
6. Verification of Maximum Power Transfer theorem
7. Measurement of voltage, current, power and power factor in single phase AC circuits.
8. Measurement of lamp's filament resistance.
9. Wiring

Semester II

Paper code: UCH201

Paper name: Engineering Chemistry

Total contact hours: 40

Credit: 8

L-T-P: 3-1-0

UNIT:1 Molecular Structure and Quantum Mechanics: Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures. Molecular orbital and quantum mechanics: Schrodinger equation, Eigen function, orthogonal and orthonormal. (6L)

UNIT:2 Electrochemistry: Electrochemical Cells – EMF of a cell, Electrodes, reference electrodes, application of Nernst equation and related problems. Principle of fuel cell, lead acid battery. Corrosion and material oxidation (4L)

UNIT:3 Reaction dynamics and Thermodynamics: Reaction laws: rate and order; molecularity; first and second order kinetics; (Arrhenious equation) catalysis. Laws and applications of thermodynamics, 1st law and 2nd law, Carnot cycle and related problems. (8L)

UNIT:4 Instrumental Methods of Analysis: Introduction to sophisticated instrumental techniques for characterization of compounds, materials, metals such as Powder X-ray diffraction, surface area, IR, UV,-Vis, NMR, SEM, TEM and GCMS (3L)

UNIT:5 Structure, Reactivity of Organic Molecules and Synthesis of Drug Molecule: Concept of electron displacement and their applications, types of intermediate organic species, brief study of some addition, elimination and substitution reaction, cyclization and ring openings. Benzyne reaction, Chichibabin reaction, Hoffman Exhaustive reactions, few important name reactions, to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule. (5L)

UNIT:6 Polymerization: Concepts, classifications and industrial applications; polymerization processes, degree of polymerization (addition and condensation polymerization); preparation, structure and use of some common polymers: plastic (PE, PP, PVC, Bakelite), rubber (natural rubber, SBR, NBR), fibre (nylon 6,6; polyester); conducting and semiconducting polymers. (4L)

UNIT:7 Industrial Chemistry: Solid liquid and gaseous fuels; constituents of coal, carbonization of coal, coal analysis, proximate and ultimate analysis, classification of coal, petroleum, gasoline. Octane number, cetane number, aviation fuel, natural gas, water gas. (4L)

UNIT:8 Materials Engineering: Concept of nano-chemistry, new forms of carbon, S.W.C.N.T., M.W.C.N.T., Liquid crystals. (4L)

UNIT:9 Biochemistry: Carbohydrates, lipids, amino acids, proteins, Nucleic acid– DNA and RNA, Vitamins and hormones – sources and application. (2L)

Paper name: Engineering Chemistry Lab
Paper code: UCH271

Credit: 2
L-T-P: 0-0-2

Experiment-1: Aim of the experiment:To determine the coefficient of viscosity of the glycerol by using Ostwald's viscometer.

Experiment-2: Aim of the experiment:To determine the surface tension of the given liquid with respect to water at room temperature by using Stalagnometer.

Experiment-3: Aim of the experiment:To identify acid radicals by dry and wet tests.

Experiment-4: Aim of the experiment:To identify basic radicals by dry and wet tests

Experiment-5: Aim of the experiment:Preparation of standard solution of Na_2CO_3

Experiment-6: Aim of the experiment:Preparation of standard solution of oxalic acid.

Experiment-7: Aim of the experiment:Determination of strength of H_2SO_4 by titrating with 0.1 N Na_2CO_3

Experiment-8: Aim of the experiment:Determination of strength of NaOH by titrating with 0.1 N HCL

Experiment-9: Aim of the experiment:Redox Titration KMnO_4 Vs $\text{H}_2\text{C}_2\text{O}_4$

Experiment-10: Aim of the experiment:Introduction to sophisticated instruments like FT-IR, UV-Visible and GC

Text/Reference Books:

1. S. Chawla, *A Text Book of Engineering Chemistry*, Dhanpat Rai Publishing Co.
2. Jain and Jain, *Engineering Chemistry*, Dhanpat Rai Publishing Co.
3. Atkins, *Physical Chemistry*, Oxford.
4. J. D. Lee, *Concise Inorganic Chemistry*, Blackwell Science.
5. V.R. Gowariker, N.V. Viswanathan, J. Sreedhar, *Polymer Science*, New Age International Publisher.
6. A.K. Chandra, *Introductory Quantum Chemistry*, 4th Edition, McGraw-Hill
7. S.K. Ghosh *Advanced General Organic Chemistry (A Modern Approach) (Set I & II)* NCBA Publisher, New Delhi, 2009
8. B. Viswanathan, P. S. Raghavan, *Practical Physical Chemistry*, Viva
9. Dr. S. Rattan, *Experiments in Applied Chemistry*, S. K. Kataria & Sons.

Paper code: UMA201

Paper name: Engineering Mathematics-II

Total contact hours: 40

Credit: 8

L-T-P: 3-1-0

Module –1: Matrices

(10 hours)

Inverse and rank of a matrix, rank-nullity theorem, System of linear equations, Symmetric, skewsymmetric and orthogonal matrices, Determinants, Eigenvalues and eigenvectors, diagonalisation of matrices, Cayley-Hamilton Theorem.

Module-2: First order ordinary differential equations

(10 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree, equations solvable for p, equations solvable for x and y, and Clairaut's form.

Module -3: Ordinary differential equations of higher orders

(8 hours)

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation, System of linear differential equations.

Module -4: Probability and Statistics

(12 hours)

Probability spaces, conditional probability, independence; Discrete and continuous random variables and their properties, Independent random variables; Expectation of Discrete and continuous random variables, Moments, mean and variance.

Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.

Reference /Text Books

1. D. Poole, *Linear Algebra: A Modern Introduction*, 2nd Edition, Brooks/Cole, 2005.
2. V. Krishnamurthy, V.P. Mainra and J.L. Arora, *An introduction to Linear Algebra*, Affiliated East-West press, Reprint 2005.

3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
8. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
9. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
10. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
11. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
12. G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.

Paper code: UCSE201

Paper name: Programming for Problem Solving

Total contact hours: 75

Credit: 10

L-T-P: 4-1-0

Module 1: Introduction to Programming

Contact hours: 10

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm.

Flowchart/ Pseudocode with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Module 2: Arithmetic expressions and precedence

Contact hours: 7

Module 3: Conditional Branching and Loops

Contact hours: 8

Writing and evaluation of conditionals and consequent branching

Iteration and loops

Module 4: Arrays

Contact hours: 7

Arrays (1-D, 2-D), Integer arrays and Strings

Module 5: Basic Algorithms

Contact hours: 8

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module 6: Function

Contact hours: 8

Functions (including using built in libraries), Parameter passing in functions, call by value,

Passing arrays to functions: idea of call by reference

Module 7: Recursion

Contact hours: 5

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Module 8: Structure**Contact hours: 6**

Structures, Defining structures and Array of Structures

Module 9: Pointers**Contact hours: 8**

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Module 10: File handling**Contact hours: 8****Books / References:**

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Paper code: UCSE271**Paper name: Programming for Problem Solving Lab****Total contact hours: 45****Credit: 3****L-T-P: 0-0-3**

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:**Lab1:** Familiarization with programming environment**Tutorial 2:** Variable types and type conversions:**Lab 2:** Simple computational problems using arithmetic expressions**Tutorial 3:** Branching and logical expressions:**Lab 3:** Problems involving if-then-else structures**Tutorial 4:** Loops, while and for loops:**Lab 4:** Iterative problems e.g., sum of series**Tutorial 5:** 1D Arrays: searching, sorting:**Lab 5:** 1D Array manipulation**Tutorial 6:** 2D arrays and Strings**Lab 6:** Matrix problems, String operations**Tutorial 7:** Functions, call by value:**Lab 7:** Simple functions**Tutorial 8 and 9:** Numerical methods (Root finding, numerical differentiation, numerical integration):**Lab 8 and 9:** Programming for solving Numerical methods problems**Tutorial 10:** Recursion, structure of recursive calls**Lab 10:** Recursive functions**Tutorial 11:** Pointers, structures and dynamic memory allocation**Lab 11:** Pointers and structures**Tutorial 12:** File handling:**Lab 12:** File operations**Paper code: UCE201****Paper name: Engineering Drawing and Computer Graphics****Total contact hours: 12****Credit: 2****L-T-P: 1-0-0****Module 1: Theory of Lettering and Plane Curves****Contact hours: 2**

Essentials of lettering, Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Module 2: Theory of Projection of Points, Lines and Plane Surfaces Contact hours: 2

Introduction to orthographic projection - principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

Module 3: Theory of Projection of Solids

Contact hours: 2

Introduction to the concepts and description of methods of drawing projections of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

Module 4: Theory of Projection of Sectioned Solids and Development of Surfaces

Contact hours: 2

Introduction to the concepts and description of sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinders and cones.

Module 5: Theory of Isometric and perspective projections

Contact hours: 2

Principles of isometric projection – Introduction to the concepts and description of isometric scale – Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones-combination of two solid objects in simple vertical positions – Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Module 6: Basics of AutoCAD

Contact hours: 2

Introduction to AutoCAD, Basics of AutoCAD: applicability and capability, DRAW tools, MODIFY tools, TEXT, DIMENSION, PROPERTIES.

Books / References:

1. *Bhatt N.D. and Panchal V.M., —Engineering Drawingll, Charotar Publishing House, 50th Edition, 2010.*
2. *Basant Agarwal and Agarwal C.M., —Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.*
3. *Venugopal K. and Prabhu Raja V., —Engineering Graphics, New Age International (P) Limited, 2008.*
4. *Natrajan K.V., —A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 2009.*
5. *Gopalakrishna K.R., —Engineering Drawing (Vol. I&II combined), Subhas Stores, Bangalore, 2007.*
6. *N S Parthasarathy And Vela Murali, —Engineering Graphics, Oxford University, Press, New Delhi, 2015.*
7. *Shah M.B., and Rana B.C., —Engineering Drawing, Pearson, 2nd Edition, 2009.*

Paper code: UCE271

Paper name: Engineering Drawing and Computer Graphics Lab

Total contact hours: 48

Credit: 4

L-T-P: 0-0-4

Module 1: Lettering and drawing plane curves

Contact hours: 8

Lettering, Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Module 2: Drawing projection of points, lines and plane surfaces

Contact hours: 8

Drawing orthographic projection - Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

Module 3: Drawing projection of solids

Contact hours: 8

Drawing projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

Module 4: Drawing projection of sectioned solids and development of surfaces

Contact hours: 8

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinders and cones.

Module 5: Drawing isometric and perspective projections

Contact hours: 8

Drawing isometric projections – isometric scale –Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions – Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Module 6: AutoCAD practice

Contact hours: 8

Familiarization of AutoCAD application software, Use of DRAW tools, MODIFY tools, TEXT, DIMENSION, PROPERTIES.

Paper code: UHSS201

Paper name: Professional ethics and human values

Total contact hours: 40

Credit: 4

L-T-P-C: 2-0-0-4

<p>Module 1: Engineering Ethics Senses of ‘engineering ethics’ – variety of moral issues – types of inquiry – moral dilemmas – moral autonomy – Kohlberg’s theory – Gilligan’s theory – consensus and controversy – professions and professionalism – professional ideals and virtues – theories about right action – self-interest – customs and religion – uses of ethical theories</p>	<p>Contact hours: 4</p>
<p>Module 2: Engineering as Social Experimentation Engineering as experimentation – engineers as responsible experimenters – codes of ethics – a balanced outlook on law – the challenger case study</p>	<p>Contact hours: 4</p>
<p>Module 3: Responsibility for safety Safety and risk – assessment of safety and risk – risk benefit analysis – reducing risk</p>	<p>Contact hours: 4</p>
<p>Module 4: Responsibilities and Rights Collegiality and loyalty – respect for authority – collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – intellectual property rights – discrimination</p>	<p>Contact hours: 4</p>
<p>Module 5: Global issues Multinational corporations – environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – sample code of conduct</p>	<p>Contact hours: 4</p>

TEXTBOOKS/REFERENCES:

1. Mike Martin and Roland Schinzinger, "*Ethics in Engineering*", McGraw Hill, New York, 1996.
2. Charles D Fleddermann, "*Engineering Ethics*", prentice Hall, New Mexico, 1999.
3. LauraSchlesinger, "*How Could You Do That: The Abdication of Character, Courage, and Conscience*", Harper Collins, New York, 1996.
4. Stephen Carter, "*Integrity*", Basic Books, New York, 1996.

Semester III

Paper code: UFET301

Paper name: PRINCIPLES OF FOOD PROCESSING AND PRESERVATION

Total contact hours: 40L

Credit: 06

L-T-P: 3-0-0

Module 1:

Introduction to food preservation – Objectives and needs of food preservation, Classifications of food on the basis of perishability, pH, moisture content, etc., Causes of quality deterioration and spoilage of perishable foods, wastage of foods, Principles of food preservation, Techniques of food preservation

Contact hours: 10L

Module 2:

Canning, Preservation principle of canning of food items, General process of canning of foods, Ascertaining canning, Concepts in thermal destruction of microorganisms- D, Z, F, values, Thermal process time calculations for canned foods, Spoilage in canned foods

10L

Contact hours:

Module 3:

Water activity of food and its significance in food preservation; Dehydration and drying of food items; IMF; Low temperature preservation: cold storage, cold chain, freezing (including cryogenic freezing)

Contact hours: 10L

Module 4:

Preservation by fermentation; Curing and pickling, Hurdle technology, Non-thermal (e.g. high pressure processing) and other minimal processing technologies, Ionization radiation; Use of preservative in foods: chemical preservative, bio-preservatives, antibiotics, lactic acid bacteria

Contact hours:10L

Books / References:

1. Technology of Food Preservation by Desrosier & Desrosier
2. Food Processing and Preservation by G. Subbulakshmi, Shobha A. Udipi
3. Food Science by N. N Potter
4. Preservation of fruits and vegetables by Girdhari Lal

Paper code: UFET302

Paper name: FOOD CHEMISTRY

Total contact hours: 50L

Credit: 06

L-T-P: 3-0-0

Module 1:

Water: Importance of water in foods, Physical properties of water, types of water, water activity and shelf life of food. Distribution of water in various foods and moisture determination **Contact hours:**

7L

Module 2:

Carbohydrates: Nomenclature and classification, structure, Physical and chemical properties of carbohydrates –monosaccharides, disaccharides and polysaccharides (cellulose, starch, fructans, galactans, hemi-cellulose, pectic substances, carrageenan); changes in carbohydrates during processing. Browning reactions: Enzymic and non-enzymic browning. **Contact hours:**

9L

Module 3:

Proteins: Classification, structure and properties of amino acids, structure of protein, physical and chemical properties of proteins. Changes in protein during processing, Proteins from plant and animal sources.

Contact hours: 7L

Module 4:

Lipids: Classification, structure, physical and chemical properties of fatty acids and fats. Lipids-simple & derived. Different types of fats, uses in food processing, food emulsions, fat replacers, importance of fats and oils in diet, introduction to hydrogenation and its importance, Changes during food processing.

Contact hours: 9L

Module 5:

Vitamins and Minerals: Sources and structures of minerals & vitamins; Effect of processing and storage of vitamins; Pro vitamins A & D; Vitamins as antioxidants, **Plant pigments and flavouring agents:** Importance, structure and properties of plant pigments- their chemical changes during food processing and storages.

Contact hours: 9L

Module 6:

Food additives: Definitions, uses and functions of Acid, Base, Buffer systems, Salts and chelating/sequestering agents, Masticatory substances. Low calorie and non-nutritive sweeteners, Polyols, Emulsifying and stabilizing agents, Anti-caking agents, thickeners, Firming agents. Flour bleaching agents and Bread improvers, Flavouring agents and related substances, Clarifying agents. Gases and Propellants. Tracers and other additives.

Contact hours:

9L

Books / References:

1. Food science Chemistry & Experimental Foods Dr.M.Swaminathan
2. Food chemistry by Lillian Hoagland Meyer
3. Food Chemistry by Fennema
4. Basic Food Chemistry by Lee
5. Principles of Biochemistry by Lehninger
6. Food Chemistry Belitz, Grosch

Paper code: UFET303

Paper name: BIOCHEMISTRY AND HUMAN NUTRITION

Total contact hours: 40L

Credit: 06

L-T-P: 3-0-0

Module 1:

Introduction to Biochemistry, usefulness of cells and organisms in biochemical studies. Proteins and protein structures; Essential amino acids. Metabolism of proteins (digestion and absorption); Nitrogen balance & nitrogen pool; Evaluation of quality of proteins

Contact hours: 10L

Module 2:

Enzymes; Definition, function, classification, nomenclature & structure; Co-enzymes and its function; Mechanism of enzyme action, enzyme kinetics & environmental effects; Enzyme inhibition.

Contact hours: 10L

Module 3:

Carbohydrates; Definition & classification; General chemistry of carbohydrates; Metabolic pathways for breakdown of carbohydrates: glycolytic pathway, pentose phosphate pathway, citric acid cycle, electron transport chain, ATP balance, gluconeogenesis; General chemistry of lipids; Essential fatty acids; Digestion & absorption of lipids.

Contact hours: 10L

Module 4:

Nutrition: 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

Contact hours: 10L

Books / References:

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. Hames, B. D. (Ed), Biochemistry, Viva Books
6. Fundamentals of Food and Nutrition by Sumati. R. Muldambi
7. Nutrition and dietetics by Rose
8. Nutrition and dietetics by Joshi

Paper code: UFET304

Paper name: BASIC MICROBIOLOGY

Total contact hours: 40L

Credit: 06

L-T-P: 3-0-0

Module 1:

History and Scope of Microbiology; Classification of Microorganisms-Bacteria, Fungi, Virus, Alga, Protozoa; sterilization techniques, disinfectant and antiseptic agents. Microscopy - types of microscopes and their applications-simple and compound, bright field, dark field, fluorescence, phase-contrast and electron microscopes.

Contact hours: 10L

Module 2:

Major groups of bacteria- Archaeobacteria, Actinomycetes, Chemoautotrophs, Eubacteria, Pseudomonads, cyanobacteria, Rickettsias, chlamydias and spirochetes; Bacterial cell- structure and functions of cellular components-cell wall composition of Gram positive and Gram negative bacteria, sub-cellular organizations, flagella, capsule and spores; Bacterial Staining; antimicrobial agents-antibiotics, chemotherapeutic drugs-antibacterial agents-mode of action; antibiotic .

Contact hours: 10L

Module 3:

Classification, morphology and characteristics of Virus, Fungi & Protozoa- structure of DNA -and RNA viruses, Viral replication, Bacteriophages- Lysogeny and Lytic cycle; Virus like agents satellites, viroids and

prions, antiviral and antifungal drugs; Classification of Helminthic parasites; Life cycle of malarial and filarial parasites.

Contact hours: 10L

Module 4:

Microbial culture continuous culture and synchronous culture; composition of culture media -solid and liquid media, chemically defined media, complex and differential media; Effect of pH, temperature and radiation on microbial growth, Microbial nutrition : Heterotrophs, autotrophs; uptake of nutrients, Enrichment culture technique. Transformation of elements: Carbon, Nitrogen, Phosphorous and Sulphur **Contact hours: 10L**

Books / References:

1. Prescott, Harley and Klein- Microbiology-5th edition; Publisher: McGraw Hill science 2002
2. Gerard J. Tortora, Berdell, R. Funke, Christine L. Case, , Microbiology: An Introduction. 8th edition Hardcover: 944 pages, Publisher: Benjamin Cummings. 2004.
3. Kenneth J. Ryan,C. George Ray, John C. Sherris, Sherris Medical Microbiology : An Introduction to Infectious Diseases, Hardcover: 992 pages, Publisher: McGraw-Hill Professional, 2003.

Paper code: UME301

Paper name: BASIC THERMODYNAMICS

Total contact hours: 40L

Credit: 06

L-T-P: 3-0-0

Module 1:

Fundamental Concepts and Definitions: Definition of thermodynamics, system, surrounding and universe, phase, concept of continuum, macroscopic & microscopic point of view. Density, specific volume, pressure, temperature. Thermodynamic equilibrium, property, state, path, process, cyclic process, Energy and its form, work and heat, Enthalpy.

Contact hours:

10L

Module 2:

Laws of thermodynamics: Zeroth law: Concepts of Temperature, zeroth law, First law: First law of thermodynamics. Concept of processes, flow processes and control volume, Flow work, steady flow energy equation, Mechanical work in a steady flow of process.

Contact hours: 10L

Module 3:

Second law: Essence of second law, Thermal reservoir, Heat engines. COP of heat pump and refrigerator. Statements of second law. Carnot cycle, Clausius inequality. Concept of Entropy.

Contact hours: 10L

Module 4:

Properties of steam and thermodynamics cycles: Properties of steam, use of property diagram, Steam-Tables, processes involving steam in closed and open systems. Rankine cycle. Introduction to I.C. Engines-two & four stroke S.I. and C.I. engines. Otto cycle, Diesel cycle.

Contact

hours: 10L

Books / References:

1. Van Wylen G.J. & Sonntag R.E. : Fundamentals of classical thermodynamics, John Wiley & Sons, Inc. NY.
2. Wark Wenneth : Thermodynamics (2nd edition), Mc Graw Hill book Co. NY.
3. Holman, J.P. : Thermodynamics, MC Graw Hill book Co. NY.
4. Yadav R. : Thermodynamics and Heat Engines, Vol I & II (SI Edition) Central Publishing House Allahabad.
5. Yadav R. : Steam & Gas Turbines.
6. Kshitish Chandra Pal : Heat Power, Orient Longman Limited, 17, Chittranjan Avenue, Calcutta.
7. S. Rao, B.B. Parulekar, 'Energy Technology', Khanna Pub., New Delhi.

Paper code: UME302

Paper name: ENGINEERING MECHANICS

Total contact hours: 44L

Credit: 06

L-T-P: 3-0-0

Module 1: Forces and Moments

Force, Moment and Couple, Resultant of forces, Forces in space. Equilibrium, FBD, General equations of equilibrium, Analysis of forces in perfect frames. Brief introduction to vector approach.

Contact hours: 12L

Module 2: Friction

Introduction to dry friction. Laws of friction, friction of simple machines- inclined planes, Screw Jacks.

Contact hours: 8L

Module 3: Basic Structural Analysis Contact hours: 6

Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams

Contact Hours: 6L

Module 4:

Center of gravity and moment of inertia

Center of gravity of axes, volume and composite bodies: Area moment of inertia and mass moment of Inertia for plane figures and bodies.

Contact hours: 8L

Module 5:

Kinetics of rigid bodies

Plane motion, force, mass, acceleration, work and energy. Impulse and momentum, rotational motion, centrifugal force, torque, angular motion and acceleration, angular momentum, Virtual work.

Contact hours: 10L

Books / References:

1. Engineering Mechanics: S Timoshenko & D H Young. McGraw Hill Int.
2. Engineering Mechanics: R S Khurmi. S Chand & Co.
3. Engineering Mechanics: R K Bansal. Laxmi Publication (P) Ltd
4. Engineering Mechanics: K L Kumar. McGraw Hill Publishing Co.
5. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
6. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
7. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.

Paper code: UFET371
Paper name: Food Processing Lab
Total contact hours: 20

Credit: 02
L-T-P: 0-0-2

List of Experiments:

- | | |
|----------------------------------------------------|-----------------|
| 1. Preparation of Apple/Pineapple Jam | Contact Hours:2 |
| 2. Preparation of Guava Jelly | Contact Hours:2 |
| 3. Preparation of Orange Squash | Contact Hours:2 |
| 4. Preparation of Tomato Ketchup | Contact Hours:2 |
| 5. Preparation of Dried Potato/Banana Chips | Contact Hours:2 |
| 6. Preparation of Mango Pickle | Contact Hours:2 |
| 7. Making of Ice cream | Contact Hours:2 |
| 8. Freeze drying of Seasonal Fruits and Vegetables | Contact Hours:2 |
| 9. Production of Milk/Potato powder by drum drier | Contact Hours:2 |
| 10. Preparation of Extruded Product | Contact Hours:2 |

Paper code: UFET372
Paper name: Food Chemistry Lab
Total contact hours: 20

Credit: 02
L-T-P: 0-0-2

List of Experiments:

- | | |
|---------------------------------------------------------------------------|-----------------|
| 1. Determination of moisture in food sample. | Contact Hours:2 |
| 2. Determination of protein in food sample. | Contact Hours:2 |
| 3. Determination of ash in food sample. | Contact Hours:2 |
| 4. Determination of crude Fat in food sample. | Contact Hours:2 |
| 5. Determination of titratable acidity of food and beverages. | Contact Hours:2 |
| 6. Determination of pH in food and beverages. | Contact Hours:2 |
| 7. Determination of total sugar of food samples. | Contact Hours:2 |
| 8. Determination non-reducing and reducing sugars of confectionary items. | Contact Hours:2 |
| 9. Determination of Vitamin C in food sample. | Contact Hours:2 |
| 10. Determination of Crude Fibre in food sample. | Contact Hours:2 |

Paper code: UFET373
Paper name: Biochemistry and Human Nutrition Lab
Total contact hours: 24

Credit: 02
L-T-P: 0-0-2

List of Experiments:

- | | |
|-------------------------------------------------------------------------------|------------------|
| 1. Separation of amino acids/sugars by Ascending Paper Chromatography | Contact Hours: 2 |
| 2. Separation of sugars/amino acids by Thin Layer Chromatography. | Contact Hours: 2 |
| 3. Separation and isolation of proteins/amino acids by Paper Electrophoresis. | Contact Hours: 2 |
| 4. Assay of Phosphatase activity | Contact Hours: 2 |
| 5, Assay of Protease activity | Contact Hours: 2 |
| 6. Effect of pH on enzymatic activity | Contact Hours: 2 |
| 7. Effect of Temperature on enzymatic activity | Contact Hours: 2 |
| 8. Separation and estimation of carbohydrate from plant tissue | Contact Hours: 2 |
| 9. Estimation of calcium in food sample | Contact Hours: 2 |

10. Estimation of iron in food products
11. Estimation of zinc in food sample
12. Estimation of tin in canned foods

Contact Hours: 2
 Contact Hours: 2
 Contact Hours: 2

Paper code: UHSS371
Paper name: Language Lab
Total contact hours:40

Credit: 2
L-T-P-C: 0-0-2-2

Module 1: Pronunciation Skills 1.1 Introduction of English Speech sounds 1.2 Vowel sounds, diphthongs and thriphongs 1.3 IPA Symbols 1.4 Transcription	Contact hours: 3
Module 2: Workshop on Business Writing 2.1 Vocabularies used in Business Writing 2.2 Successful Letters 2.3 Successful E-mails 2.4 Resume 2.5 Report Writing	Contact hours: 4
Module 3: Remedial Grammars 3.1 Tense and subject-verb agreement 3.2 Relative Clauses 3.3 Prepositions 3.4 Prepositions	Contact hours:4
Module 4: Public Speaking Skills and Presentation Skills	Contact hours: 4

BOOKS and Software RECOMMENDED:

- (1) Soft Skills, S. Hariharan, N.Sundararajan, S.P.Shanmugapriya MJP Publishers, Chennai
- (2) Communication Skills, Sanjay Kumar and PushpLata, OUP, 2011
- (3) Exercises in Spoken English, Parts-I-III, CIEFL, Hyderabad, OUP
- (4) Business Writing
- (5) Sky Pronunciation
- (6) Tense Buster

Semester IV



केन्द्रीय प्रौद्योगिकी संस्थान कोकराझार
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KOKRAJHAR, ASSAM-783370
Website: www.cit.ac.in

Department of Food Engineering & Technology
Detail Syllabus (UG)
SEMESTER IV

Paper Code: UFET401

Paper Name: FOOD PRODUCT TECHNOLOGY-I (FRUITS AND VEGETABLES)

Credits: 06

L-T-P: 3-0-0

Module I

Contact hours: 10

Current status of production and processing of fruits and vegetables. Structural, compositional and nutritional aspects. Post-harvest physiology, handling, losses and conservation of fruits and vegetables - physiological post harvest disorders - chilling injury and disease; prevention of post harvest diseases and infestation.

Module II

Contact hours: 10

Techniques of extension of shelf life of unmodified produce: hypobaric storage, pre-cooling and cold storage, Zero energy cool chamber; Commodity pretreatments - chemicals, wax coating, prepackaging, VHT and irradiation.

Module III

Contact hours: 10

Technology of Products: juices & pulps, concentrates & powders, squashes & cordials, nectars, fruit drinks & beverages carbonated RTS fruit beverages, IQF and frozen fruits and vegetables, Fermented products (Cider, wine, brandy).

Module IV

Contact hours: 9

Jam, Jelly & Marmalades; candied fruits, soup mixes; sauces & ketchups; puree & pastes; chutneys & pickles, dehydration of fruits and vegetables using various drying technologies; Fruit powders using spray drying; Canning.

Module V

Contact hours: 6

Processing of cashew nuts, coffee & cocoa beans, and tealeaves, Specialty fruit and vegetable products.

Suggested Readings

1. *Food science by B.Srilakshami;New Age International.*
2. *Fundamentals of Foods and Nutrition by R. Madambi & M.V. Rajgopal.*
3. *Foods :Facts and Principles by N Shakuntala manay;New Age International (P) Ltd.*
4. *Preservation of Fruits and Vegetable by Girdhari lal and Sidappa; CBS Publications*
5. *Food Science and Processing Technology, Vol., 2 by Mridula and Sreelata*
6. *Food Preservation by Sandeep Sareen*
7. *Fruit and Vegetable Preservation by Shrivastava and Kunal.*
8. *Post-Harvest Physiology & Handling of Fruits & Vegetables by Wills, Lee, Graham, McGlasson & Hall (AVI)*
9. *Literature from Spice Board of India, etc.*



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KOKRAJHAR, ASSAM-783370

Website: www.cit.ac.in

Subject Code: UFET402

Subject Name: FOOD PRODUCT TECHNOLOGY-II (CEREALS AND LEGUMES)

Credits: 06

L-T-P: 3-0-0

Module I

Contact hours: 9

Importance of cereals and legumes, Post-harvest quality and quantity losses. Recommended pre-processing practices for handling of cereals and pulses for their safe storage, including control of infestation, National and International quality and grading standards.

Module II

Contact hours: 9

Structure, types, composition, quality characteristics and physicochemical properties of wheat. Cleaning, tempering and conditioning, and milling processes for different wheat's. Turbogriding & Air Classification. Blending of flours. Milling equipments and milling products (Dalia, Atta, Semolina and flour). Flour grades and their suitability for baked goods. Quality characteristics and rheological properties of wheat milling products and its assessment. Byproduct utilization.

Module III

Contact hours: 9

Structure, types, composition, quality characteristics and physicochemical properties of rice. Milling and parboiling of paddy, Curing and ageing of paddy and rice. Criteria in and assessment of milling, cooking, nutritional and storage qualities of raw & parboiled rice. Processed rice products (flaked, expanded and puffed rice). By-product (husk and rice bran) utilization.

Module IV

Contact hours: 9

Structure, types and composition of corn. Dry and wet milling of corn. Starch and its conversion products. Processed corn products (popped corn, corn flakes etc.) Structure and composition of barley, bajra, jowar and other cereal grains and millets. Malting of barley. Pearling of millets. Parched and snack products.

Module V

Contact hours: 9

Structure, composition and properties of legumes. Cleaning, grading, pretreatments for difficult-to-mill (urad, arhar, moong, moth) and easy-to-mill (chana, masoor and pea) legumes, milling practices and actual milling of different legumes. Sweet and savory products from legumes in India.

Suggested Readings

1. *Cereals Technology* by Samuel A.Matz. CBS Publications.
2. *Technology of Cereals* by N.L.Kent.
3. *Food Facts and Principles* by Mannay;New age International (P) Ltd.
4. *Food Science* by Norman N.Potter;CBS Publications.
5. *Chemistry and Technology of Food and Food Products* by M.B. Jacobs
6. *Manuals on Rice and its Processing* by CFTRI.
7. *Cereals & Cereals Products-Chemistry & Technology* by DAV Dendy & B.J.Dobraszezsk, Aspen Publication.
8. *Development in Milling & Baking Technology* by AFST (I), CFTRI, Mysore, India.
9. *Food Industries of CEEDC, IIT, Madras.*
10. *Articles on Pulse Milling in India Food Industry & JFST,both Publications of AFST (I).*



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DEEMED TO BE UNIVERSITY, MHRD, GOVT. OF INDIA

KOKRAJHAR, ASSAM-783370

Website: www.cit.ac.in

Subject Code: UFET403

Subject Name: FLUID MECHANICS

Credits: 06

L-T-P: 3-0-0

Module I

Contact hours: 8

Properties of fluid. Fluid Statics: Pressure and its relationship with height, hydrostatic forces on submerged surfaces, Buoyancy and floatation. **Fluid kinematics:** Types and classification of fluid flow, flow rate and continuity equation, potential function and stream function, vortex flow.

Module II

Contact hours: 7

Fluid Dynamics: Euler's equation, Bernoulli's Theorem, Momentum of fluids in motion.

Module III

Contact hours: 7

Laminar viscous Flow: Reynolds number, Navier-stoke's equation, Hagen-Poiseuille equation, frictional loss. **Turbulent Flow:** Darcy-Weisbach equation, chezy's formula, shear stress in turbulent flow.

Module IV

Contact hours: 8

Flow through pipes: Pipe fittings and valves, loss of head due to sudden enlargement, contraction, at entrance and exit, due to obstruction, bend and various pipe fittings, flow through pipe in series and parallel, siphon, nozzles.

Module V

Contact hours: 8

Boundary layer flows: Introduction, Prandtl's boundary layer equation and Boundary layer separation. Flow around submerged bodies: Drag force, lift and drag coefficient, drag on flat plate circular cylinder and sphere.

Module VI

Contact hours: 7

Flow Measurements: Orifice and venturi meter, Pitot tube, Rotameter and other flow measuring instruments. **Hydraulic Pumps:** Positive displacement and centrifugal pumps.

Suggested Readings:

1. *Unit Operation of Chemical Engineering - Mc Cabe, Smith & Harriot*
2. *Transport Processes and Unit Operations - Geankoplis*
3. *Chemical Engineering (Vol. I & II) - Coulson, J. M. & Richardson, J. F.*
4. *Introduction to Chemical Engineering - Badger, W. L. & Bachero, J. T.*
5. *Chemical Engineering Handbook - Perry, A. S. and Wenzel, L. A.*



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DEEMED TO BE UNIVERSITY, MHRD, GOVT. OF INDIA
KOKRAJHAR, ASSAM-783370
Website: www.cit.ac.in

Subject Code: UFET404

Subject Name: FOOD MICROBIOLOGY AND FOOD BIOTECHNOLOGY

Credits: 06
L-T-P: 3-0-0

Module I

Contact hours: 10

Introduction – definition, historical development and significance of food microbiology; Factors affecting the growth of micro organisms in food - Intrinsic and Extrinsic parameters that affect microbial growth. Microbiology of vegetables, milk, meat and egg

Module II

Contact hours: 10

Fermentation and fermented foods: Biochemical pathways; Fermented vegetables, dairy, and meat products

Module III

Contact hours: 15

Food borne diseases: *Bacterial food borne diseases* (Staphyloccocal intoxicification, Botulism, Salmonellosis, Shigellosis, Enteropathogenic Escherichia Coli Diarrhoea, Clostridium Perfringens gastroenteritis, Bacillus cereus Gastroenteritics) Food Borne Viral Pathogens (Norwalk virus, Norovirus, Reovirus, Rotavirus, Astrovirus, Adenovirus, Parvovirus, Hepatitis A Virus) *Food Borne Animal Parasites* Protozoa, Giardiasis, Amebiasis, Toxoplasmosis, Sarcocystosis, Cryptosporidiosis. Cysticercosis/Taeniasis. Roundworm Trichinosis, Anisakiasis. *Mycotoxins*: Aflatoxicosis, Deoxyvalenol Mycotoxicosis, Ergotism

Module IV

Contact hours: 10

Basics of microbial genetics – Gene, DNA, RNA; Replication, transcription, transformation, transduction, conjugation; Regulation of gene expression; Application genetic / molecular biology techniques in food; GM foods.

Text Books / References :

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*; Bise
8. *Pelczar, M.I and Reid, R.D. (1993) Microbiology McGraw Hill Book Company, New York, 5th Edition.*
9. *Jay, James, M(2000) Modern Food Microbiology, 2nd Edition. CBS Publisher*
10. *Frazier, W.C. (1988) Food Microbiology, Mc Graw Hill Inc. 4th Edition.*
11. *Doyle, P. Bonehat, L.R. and Mantville, T.J-(1997): Food Microbiology, Fundamentals and Frontiers, ASM Press, Washington DC.*
12. *Comprehensive Biotechnology by Murray & Mooyoung, Academic press*



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Website: www.cit.ac.in

Subject Code: UHSS401

Subject Name: ENGINEERING ECONOMICS

Credits: 06

L-T-P: 3-0-0

Module I

Contact hours: 10

Definition of Economics, Consumer behaviour, Utility analysis and demand analysis, Kinds of Demand, Law of Demand and Law of Supply, Elasticity of Demand: Types and Measurement, Scope of Economics including economics of environment and e-commerce.

Module II

Contact hours: 10

Market forms-Perfect and Imperfect markets, Features of Perfect competition, Monopoly and Monopolistic competition. Price and output determination under Perfect Competition, Monopoly, Monopolistic and Oligopoly etc., Concept of Production function, Cost Analysis, Estimation of cost function-Profit and Break Even Analysis.

Module III

Contact hours: 9

National Income, GNP and NNP, Per-Capita Income, Source of Public Revenue-Tax Revenue and Non-Tax Revenue, Direct and Indirect Tax. Inflation and Deflation. Banking-Definition - Types of Banks. Concept of Investment Analysis

Module IV

Contact hours: 8

Features of Indian Economy, Planning in India, Objectives. Economic Reforms in India-Concept of Economic Liberalization, Privatization and Globalization. Unemployment Problem in India-Types, Causes and remedial measures.

Module V

Contact hours: 8

International Trade, Gains from International Trade, The World Trading Environment and Multinational Corporations, BPO etc., Function and Role of IMF, World Bank and WTO. Concept of Stock Exchange Market and Market for Securities.

Suggested Readings:

1. *M.L. Jhingan—Micro Economic Theory*
2. *Sumitra Paul-Managerial Economics*
3. *Joel Dean—Managerial Economics*



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Website: www.cit.ac.in

Paper Code: UFET471

Paper Name: Product Technology- I /II Lab

Total Contact Hours :24

List of experiments:

Credit: 02

L-T-P: 0-0-2

1. Determination of titratable acidity & pH of given non-alcoholic beverages. Contact Hours: 2
2. Determination of total soluble solid (TSS) and pH of Jam, Jelly and Sauces. Contact Hours: 4
3. Preparation of orange jelly and its physicochemical study. Contact Hours: 2
4. Preparation of apple jam and its physicochemical study. Contact Hours: 2
5. Preparation of tomato sauce and its physicochemical study. Contact Hours: 2
6. Determination of size and sphericity of given agricultural materials given. Contact Hours: 2
7. Determination of bulk density of given agricultural cereals. Contact Hours: 2
8. Determination of Dynamic Angle of Repose of given agricultural grains. Contact Hours: 2
9. Estimation of crushing efficiency of jaw crusher for agricultural grains. Contact Hours: 4
10. To study the operation of Hammer mill using agricultural grain. Contact Hours: 2



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KOKRAJHAR, ASSAM-783370

Website: www.cit.ac.in

Paper Code: UFET474

Paper Name: Food Microbiology Lab

Total Contact Hours: 24

List of experiments:

Credit: 02

L-T-P: 0-0-2

1. Sterilization of microbial media and necessary apparatus and utensils Contact Hours: 2
2. Preparation of microbiological culture media Contact Hours: 2
 - i) Agar media (Petri-dishes and in slants) e.g. nutrient agar, Potato Dextrose Agar
 - ii) Liquid broth e.g. nutrient broth, and preparation of dilution blank
3. Differential vs. generic / universal media vs. selective media Contact Hours: 2
4. Serial dilution preparation technique Contact Hours: 2
5. Pour plating method Contact Hours: 2
6. Spread plating method Contact Hours: 2
7. Determination of microbiological quality of a food /beverage/water Contact Hours: 6
 - i) MBRT of raw vs pasteurized milk
 - ii) Serial dilution and plating of manually extracted vs processed fruit juice
 - iii) Serial dilution and plating of tap water vs Aquaguard water
8. Streak plating technique for pure culture preparation Contact Hours: 2
 - i) Isolation of a bacterial culture from a food / food waste sample
9. Simple staining: Determination of bacterial cell morphology Contact Hours: 2
10. Gram staining: Determination of bacterial cell wall structure Contact Hours: 2