ANNA UNIVERSITY
CHENNAI - 600 025

UNIVERSITY DEPARTMENTS

REGULATIONS 2012
CURRICULA & SYLLABI FOR
I TO VIII SEMESTERS

B.TECH.
FOOD TECHNOLOGY
(FULL TIME)

ANNA UNIVERSITY, CHENNAI-600 025

UNIVERSITY DEPARTMENTS

R – 2012

B.TECH. FOOD TECHNOLOGY

I – VIII SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
HS8151	Technical English – I	3	1	0	4
MA8151	Mathematics – I	3	1	0	4
PH8151	Engineering Physics	3	0	0	3
CY8151	Engineering Chemistry	3	0	0	3
GE8151	Computing Techniques	3	0	0	3
GE8152	Engineering Graphics	2	0	3	4
PRACTICAL					
PH8161	Physics Laboratory	0	0	2	1
CY8161	Chemistry Laboratory	0	0	2	1
GE8161	Computer Practices Laboratory	0	0	3	2
GE8162	Engineering Practices Laboratory	0	0	3	2
	TOTAL	**17**	**2**	**13**	**27**

SEMESTER II

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
HS8251	Technical English - II	3	1	0	4
MA8251	Mathematics - II	3	1	0	4
PH8255	Physics of Materials	3	0	0	3

CY8254	Physical and Organic Chemistry	3	0	0	3
GE8251	Engineering Mechanics	3	1	0	4
PM8256	Food and Pharmaceutical Biochemistry	3	0	0	3
PRACTICALS					
FT8211	Bio-Organic Chemistry Lab	0	0	4	2
PM8262	Food and Pharmaceutical Biochemistry Lab	0	0	4	2
	TOTAL	**18**	**3**	**8**	**25**

SEMESTER III

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MA8356	Probability and Statistics	3	1	0	4
FT8301	Food Chemistry	3	0	0	3
FT8302	Food Microbiology	4	0	0	4
FT8303	Human Nutrition	3	0	0	3
FT8304	Introduction to Food Processing	3	0	0	3
PM8351	Fundamentals of Chemical Engineering	3	0	0	3
PRACTICALS					
FT8311	Food Chemistry Lab	0	0	4	2
FT8312	Food Microbiology Lab	0	0	4	2
	TOTAL	**19**	**1**	**8**	**24**

SEMESTER IV

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
GE8351	Environmental Science and Engineering	3	0	0	3
FT8401	Fluid Mechanics for Technologist	3	0	0	3
FT8402	Food Fermentation Processes	3	0	0	3
FT8403	Food Preservation Technology	3	0	0	3
FT8404	Mechanical Operations in Food Industry	3	0	0	3
IB8451	Analytical Methods and Instrumentation	3	0	0	3

PRACTICALS					
FT8411	Human Nutrition Lab	0	0	4	2
IB8461	Chemical Engineering Lab	0	0	4	2
	TOTAL	**18**	**0**	**8**	**22**

SEMESTER V

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
FT8501	Food Analysis	3	0	0	3
FT8502	Fundamentals of Heat and Mass Transfer	3	0	0	3
FT8551	Biochemical Engineering	3	0	0	3
PM8551	Cell and Molecular Biology	4	0	0	4
E1	Elective I	3	0	0	3
E2	Elective II	3	0	0	3
PRACTICALS					
FT8511	Bio Process Lab	0	0	4	2
FT8512	Food Analysis Lab	0	0	4	2
	TOTAL	**19**	**0**	**8**	**23**

SEMESTER VI

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MG8654	Total Quality Management	3	0	0	3
FT8601	Food Process Engineering	3	0	0	3
FT8602	Genetic Engineering and GM Foods	3	0	0	3
E3	Elective III	3	0	0	3
E4	Elective IV	3	0	0	3
PRACTICALS					
HS8561	Employability Skills	0	0	2	1
FT8611	Creativity, Innovation in New Food Product Design Lab	0	0	4	2

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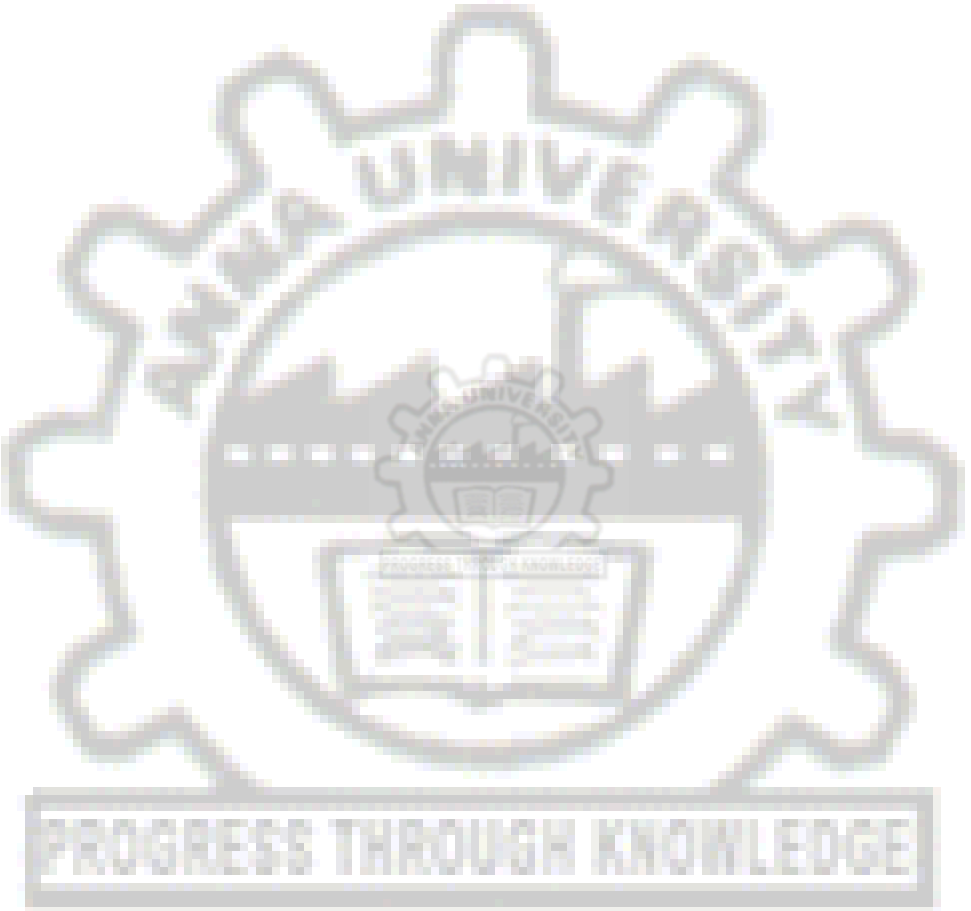

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FT8612	Food Processing Lab I	0	0	4	2
FT8661	Molecular Biology and Genetic Engineering Lab	0	0	4	2
	TOTAL	**15**	**0**	**14**	**22**

SEMESTER VII

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
FT8701	Food Packaging Technology	3	0	0	3
FT8702	Food Safety, Quality and Regulation	3	0	0	3
FT8703	Post Harvest Technology	3	0	0	3
E5	Elective V	3	0	0	3
E6	Elective VI	3	0	0	3
E7	Elective VII	3	0	0	3
PRACTICALS					
FT8711	Food Processing Lab II	0	0	4	2
FT8712	Food Product Development and Evaluation Lab	0	0	4	2
	TOTAL	**18**	**0**	**8**	**22**

SEMESTER VIII

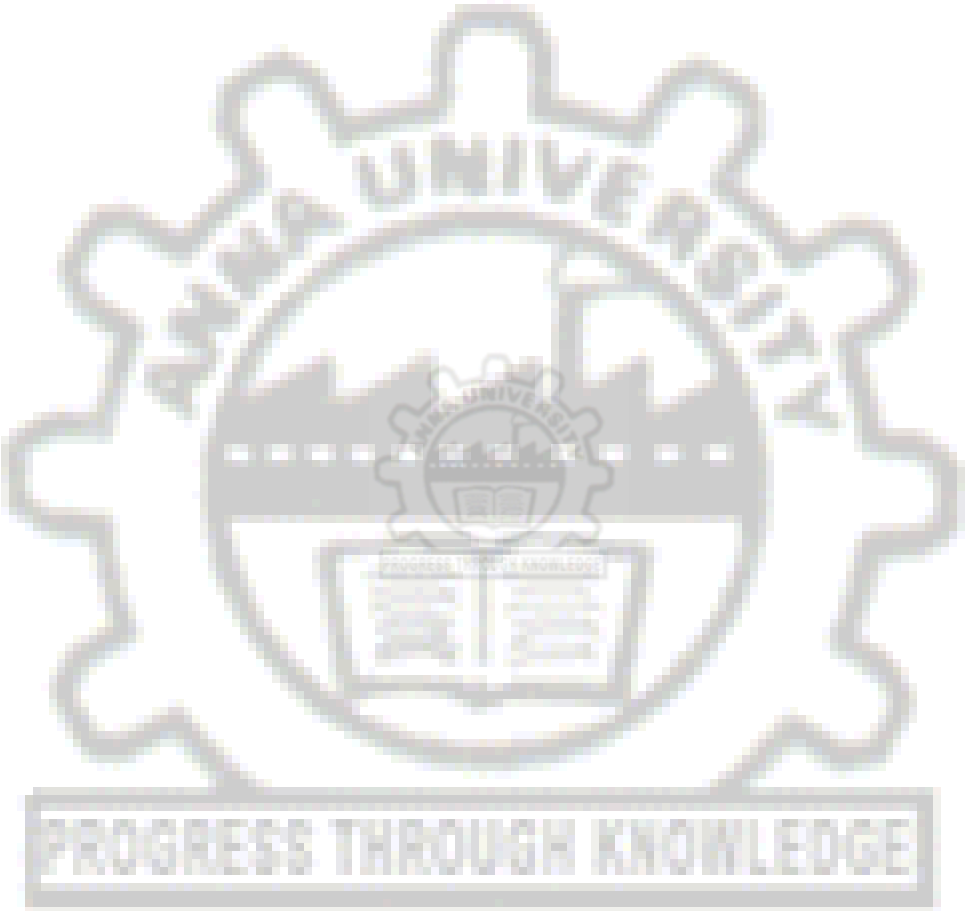
CODE NO	COURSE TITLE	L	T	P	C
PRACTICALS					
FT8811	Project Work	0	0	18	9
	TOTAL	**0**	**0**	**18**	**9**

LIST OF ELECTIVES FOR B.TECH. FOOD TECHNOLOGY

ELECTIVES (SEM V- VII)

CODE NO	COURSE TITLE	L	T	P	C
FT8001	Baking and Confectionery Technology	3	0	0	3
FT8002	Biology and Chemistry of Food Flavours	3	0	0	3
FT8003	Cereal Technology	3	0	0	3
FT8004	Dairy Product Technology	3	0	0	3
FT8005	Food Additives	3	0	0	3
FT8006	Food Allergy and Toxicology	3	1	0	4
FT8007	Fruit and Vegetable Technology	3	0	0	3
FT8008	Functional Foods and Nutraceuticals	3	0	0	3
FT8009	Genetically Modified Foods	3	0	0	3
FT8010	Instrumentation and Process Control	3	0	0	3
FT8011	Management of Food Waste	3	0	0	3
FT8012	Meat, Poultry and Fish Technology	3	0	0	3
FT8013	Pulse and Oil Seed Technology	3	0	0	3
FT8014	Refrigeration and Cold Chain	3	0	0	3
FT8015	Traditional Foods	3	0	0	3
FT8651	Process Economics and Industrial Management	3	0	0	3
GE8071	Fundamentals of Nano Science	3	0	0	3
IB8072	Biological Spectroscopy	3	0	0	3
IB8751	Bioinformatics and Computational Biology	3	0	0	3
IB8752	Downstream Processing	3	0	0	3
IB8753	Immunology	3	0	0	3
GE8072	Disaster Management	3	0	0	3
GE8073	Human Rights	3	0	0	3

TOTAL NO. OF CREDITS: 174



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HS8151 **TECHNICAL ENGLISH - I** **L T P C**

(Common to all branches of B.E / B.Tech programmes) **3 1 0 4**

OBJECTIVES

- To enable all students of engineering and technology develop their basic communication skills in English.
- To give special emphasis to the development of speaking skills amongst the students of engineering and technology.
- To ensure that students use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading for pleasure.

OUTCOME

- Development of basic communication skills in English.
- Development of speaking skills amongst the students of engineering and technology.
- Effective use of electronic media such as internet and supplement the learning materials used in the classroom.
- Development of reading habit for pleasure.

UNIT I **9+3**

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II **9+3**

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking & answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Lab descriptions (general/specific description of laboratory experiments) - Definitions - Recommendations;

Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association; E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III **9+3**

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause & effect / compare & contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV **9+3**

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations & acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

UNIT V **9+3**

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast & telecast from Radio & TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar & Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents, - Interpreting posters.

TOTAL: 60 PERIODS

Attested

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TEXT BOOKS

1. "Mindscapes: English for Technologists and Engineers". Orient Black Swan, 2012
2. Dhanavel, S.P. "English and Communication Skills for Students of Science and Engineering" Orient Black Swan, 2011.

REFERENCES

1. Pickett, Nell Ann, Ann A.Laster and Katherine E.Staples. "Technical English: Writing, Reading and Speaking". Longman, 2001.
2. Bailey, Stephen. " Academic Writing: A Practical Guide for Students" Rutledge, 2011.
3. Morgan, David and Nicholas Regan. "Take-Off : Technical English for Engineering. Reading" Garnet Publishing, 2008
4. Thorn, Michael and Alan Badrick "An Introduction to Technical English: Harlow" Prentice Hall, 1993.
5. Rizvi, M.Ashraf. "Effective Technical Communication" Tata McGraw-Hill, 2007.

EXTENSIVE READERS

1. Murthy, Sudha. "Wise & Otherwise." Penguin Books, 2006.
2. Gates, Bill and Collins Hemingway. "Business @ the Speed of Thought: Succeeding in the Digital Economy." Warner Business Books, 2000.

Website Resources

1. www.uefap.com
2. www.eslcafe.com
3. www.listen-to-english.com
4. www.owl.english.purdue.edu
5. www.chompchomp.com

MA8151 MATHEMATICS – I L T P C
3 1 0 4

OBJECTIVES:

1. To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
2. To make the student knowledgeable in the area of infinite series and their

convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.

3. To familiarize the student with functions of several variables. This is needed in many branches of engineering.
4. To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
5. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

OUTCOME:

- Obtain knowledge in the area of infinite series and their convergence.
- Familiarize in matrix algebra techniques.
- Familiarize concepts of improper integrals, Gamma, Beta and Error functions.
- Knowledge in mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES **9+3**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II INFINITE SERIES **9+3**

Sequences – Convergence of series – General properties – Series of positive terms –Tests of convergence (Comparison test, Integral test, Comparison of ratios and D'Alembert's ratio test) – Alternating series – Series of positive and negative terms –Absolute and conditional convergence – Power Series – Convergence of exponential, logarithmic and Binomial Series.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9+3**

Limits and Continuity – Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables –Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV IMPROPER INTEGRALS **9+3**

Improper integrals of the first and second kind and their convergence – Evaluation of integrals involving a parameter by Leibnitz rule – Beta and Gamma functions – Properties – Evaluation of integrals using Beta and Gamma functions – Error functions

UNIT V MULTIPLE INTEGRALS **9+3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of Solids – Change of variables in double and triple integrals – Area of a curved surface.

TOTAL : 60 PERIODS

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", 40th Edition Khanna Publishers,
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill, 2010.

REFERENCES

1. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", 3rd Edition, Narosa, 2007.
2. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", 7th Edition. Firewall Media An imprint of Lakshmi Publications, 2009.
3. Greenberg M.D., "Advanced Engineering Mathematics", 2nd Edition. Pearson Education, 2009.
4. O'Neil, V. Peter. "Advanced Engineering Mathematics", Cengage Learning, 2007.

PH8151 ENGINEERING PHYSICS **L T P C**
(Common to all branches of B.E / B.Tech programmes) **3 0 0 3**

OBJECTIVE:

To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

OUTCOME:

- Familiarize in properties of matter.
- Thorough knowledge in basic physics concepts relevant to different branches of Engineering and Technology.

UNIT I PROPERTIES OF MATTER **9**

Elasticity - Poisson's ratio and relationship between moduli (qualitative) - Stress-strain diagram - factors affecting elasticity - bending of beams - cantilever - bending moment - theory and experiment of Young's modulus determination - Uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

UNIT II ACOUSTICS AND ULTRASONICS **9**

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - rate of growth and decay of sound intensity - derivation of Sabine's formula - absorption coefficient and its determination - factors affecting acoustics of buildings : focussing, interference, echo, Echelon effect, resonance - noise and their remedies. Ultrasonics - production - magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating - industrial applications - NDT - Ultrasonic method: scan modes and practice.

UNIT III THERMAL PHYSICS **9**

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity - conductions in solids - Forbe's and Lees' disc methods - Rectilinear flow of heat through a rod - flow of heat through a compound materials - radical flow of heat through a spherical shell - thermal insulation of buildings – Laws of blackbody radiation: Kirchoffs law, Stephens law, Wiens law, Raleigh-Jean law and Planks law (derivation). Laws of thermodynamics - Otto and diesel engines and their efficiency - entropy - entropy of Carnot's cycle - reverse Carnot's cycle - refrigerator.

UNIT IV APPLIED OPTICS **9**

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its application - Lasers - Einstein's coefficients - CO_2, Nd:YAG and semiconductor lasers - homo junction and hetro junction - construction and working - applications - Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

UNIT V SOLID STATE PHYSICS **9**

Nature of bonding - growth of single crystals (qualitative) - crystal systems - crystal planes and directions - expressions for interplanar distance - coordination number and packing factor for simple structures: SC, BCC, FCC and HCP - structure and significance of NaCl, ZnS, diamond and graphite - crystal imperfections: point defects, dislocations and stacking faults - unit cell, Bravais space lattices - miller indices.

TOTAL: 45 PERIOD

TEXT BOOKS

1. Gaur R.K., and Gupta, S.L. "Engineering Physics". Dhanpat Raj Publications, 2003.
2. Palanisamy, P.K., "Engineering Physics". Scitech Publications, 2006.
3. Arumugam, M., "Engineering Physics". Anuradha Publications, 2000.

REFERENCE BOOKS

1. Sankar, B.N., Pillai.S.O., "Engineering Physics". New Age International, 2007.
2. Rajendran.V " Engineering Physics". Tata McGraw-Hill, 2009.

CY 8151 ENGINEERING CHEMISTRY L T P C
(Common to All Branches of Engineering and Technology) 3 0 0 3

OBJECTIVE:

- To introduce the basic chemistry concepts relevant to different branches of Engineering and Technology.

OUTCOME:

- Thorough knowledge in Chemical thermodynamics and polymer chemistry.
- Familiarize concepts in kinetics and catalysis.
- Thorough knowledge in photochemistry, spectroscopy, nanochemistry.
- Obtain knowledge in basic chemistry.

UNIT I CHEMICAL THERMODYNAMICS **9**

Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation – variation of chemical potential with temperature and pressure.

UNIT II POLYMER CHEMISTRY **9**

Introduction: Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerisation. Types and mechanism of polymerisation: Addition (Free Radical, cationic, anionic and living); condensation and copolymerisation. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerisation: Bulk, emulsion, solution and suspension.

UNIT III KINETICS AND CATALYSIS **9**

Introduction – reaction velocity, factors affecting reaction velocity, rate constant, order of reaction, molecularity, pseudo molecular reactions, zero, first, second and third order reactions, reactions of fractional orders, determination of order of reactions. Catalysis: Auto catalysis - Enzyme Catalysis: Michaelis-Menton equation; factors affecting enzyme catalysis. Heterogeneous Catalysis: Types of adsorption isotherms: Langmuir–Hinselwood and Rideal–Eley Mechanism.

UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY **9**

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Photoprocesses - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitisation. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. Width and intensities of spectral lines. Spectrophotometric estimation of iron. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram) and applications.

UNIT V NANOCHEMISTRY **9**

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: Nanocluster, nanorod, nanotube and nanowire. Synthesis:

Precipitation thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and Applications. Risk discussion and Future perspectives.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Kannan, P. and A. Ravikrishnan, "Engineering Chemistry". Sri Krishna Hitech Publishing, 2009.
2. Vairam, S. P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India, 2011

REFERENCES

1. Atkins, P.W. and de Paula Julio, "Physical Chemistry". 8th Edition. Oxford University Press, 2009.
2. Mukherjee, K.K. Rohtagi "Fundamental of Photochemistry" New Age International, 1986.
3. Ozin, O.A and A.C. Arsenault, "Nanochemistry: A Chemical Approach to Nanomaterials", RSC2005.
4. Gowariker, V.R., N.V.Viswanathan and Jayadev Sreedhar, "Polymer Science", New Age International, 2006

GE8151 COMPUTING TECHNIQUES L T P C
3 0 0 3

OBJECTIVE:

- To obtain basic knowledge in computer skills and programming language.

OUTCOME:

- Familiarize in fundamentals of computing and basic programming language.
- Thorough knowledge in arrays, strings, pointers.

UNIT I INTRODUCTION **8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS **10**

Problem formulation – Problem Solving - Introduction to ' C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS **9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV FUNCTIONS AND POINTERS **9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V STRUCTURES AND UNIONS **9**

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3. Yashavant P. Kanetkar. " Let Us C", BPB Publications, 2011.

REFERENCES

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
2. Byron S Gottfried, " Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007

GE8152 ENGINEERING GRAPHICS L T P C
2 0 3 4

OBJECTIVES

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

OUTCOME:

- Deep knowledge in graphic skills for communication of concepts.
- Familiarize in design of engineering products, national standards for technical drawing.

CONCEPTS AND CONVENTIONS (Not for Examination) 1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING 5+9

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, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 5+9

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 trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined

to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS **5 + 9**

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 and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES **5+9**

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. Development of lateral surfaces of solids with cut-outs and holes

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS **6 + 9**

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

COMPUTER AIDED DRAFTING (Demonstration Only) **3**

Introduction to drafting packages and demonstration of their use.

TOTAL : 75 PERIODS

TEXT BOOK

1. Bhatt, N.D. and V.M.Panchal, "Engineering Drawing", 59th Edition. Charotar Publishing House, 2010

REFERENCES

1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, 2007.
2. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production" Prentice Hall of India, 2005.
3. Shah M.B., and Rana B.C., "Engineering Drawing". 2nd Edition. Pearson, 2009.

4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International, 2008.
5. Natrajan K.V., “A Text book of Engineering Graphics”, Dhanalakshmi Publishers, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill, 2008.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

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

PH 8161	PHYSICS LABORATORY (Common to all branches of B.E. / B.Tech. Programmes)	L T P C 0 0 2 1

OBJECTIVES:

- To learn the basic concepts in physics relevant to different branches of Engineering and Technology.
- To study the concept of semiconductor and conductivity.
- To learn the properties of materials.

OUTCOME:

- Familiarize the properties of material and basic concepts in physics.

1.	Torsional pendulum	Determination of rigidity modulus of wire and moment of inertia of disc
2.	Non–uniform bending	Determination of young's modulus
3.	Lee's disc	Determination of thermal conductivity of a bad conductor
4.	Potentiometer	Determination of thermo e.m.f. of thermocouple
5.	Air wedge	Determination of thickness of a thin sheet of paper
6.	i. Optical fibre	Determination of Numerical Aperture and acceptance angle
	ii. Compact disc	Determination of width of the groove using laser
7.	Acoustic grating	Determination of velocity of ultrasonic waves in liquids
8.	Post office box	Determination of Band gap of a semiconductor
9.	Spectrometer	Determination of wavelength using grating
10.	Viscosity of liquids	Determination of co-efficient of viscosity of a liquid by Poiseuille's flow

TOTAL : 30 PERIODS

CY 8161 CHEMISTRY LABORATORY L T P C
(Common to all branches of Engineering and Technology) 0 0 2 1

OBJECTIVES:

- To study the properties of water and testing of various parameters.
- To study the concepts of alkalinity, pH, kinetics.

OUTCOME:

- Obtain the basic concepts in chemistry relevant to different branches of Engineering and Technology.
- Obtain knowledge in various properties of water.
- Familiarize concepts of alkalinity, pH

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.

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5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1,10- phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of poly vinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics – ester hydrolysis.
13. Corrosion experiment – weight loss method.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 30 PERIODS

REFERENCES

1. A text of quantitative inorganic analysis, A.L. Vogel, ELBS, London, 1995.
2. Experiments in Physical Chemistry, D.P. Shoemarker and C.W. Gardad, McGraw Hill, London, 2001.
3. American Public Health Association.

Attested

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GE8161 **COMPUTER PRACTICES LABORATORY** **L T P C**
0 0 3 2

OBJECTIVE:

- To enable the student to learn and use the major components of a computer system
- To make the students write programs and solve problems
- To learn to use office automation tools.

OUTCOME:

At the end of the lab session student will be able to use MS office and generate data, solve simple problems with C-Programming Language

LIST OF EXPERIMENTS:

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL: 45 PERIODS

GE8162 **ENGINEERING PRACTICES LABORATORY** **L T P C**

(Common to all Branches of B.E. / B.Tech. Programmes) **0 0 3 2**

OBJECTIVE

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

OUTCOMES:

- Ability to fabricate carpentry components and pipe connections including plumbing works.
- Ability to use welding equipments to join the structures.
- Ability to fabricate electrical and electronics circuits

GROUP – A (CIVIL & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICE **12**

Plumbing

- Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.
- Laying pipe connection to the suction side of a pump – inlet.
- Laying pipe connection to the delivery side of a pump – out let.
- Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.

Wood Work

- Sawing, planning and making common joints: T-Joint, Mortise and Tennon joint, Dovetail joint.

Study

- Study of joints in door panels, wooden furniture
- Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICE **9**

- Basic household wiring using switches, fuse, indicator – lamp etc.,
- Preparation of wiring diagrams

- Stair case light wiring
- Tube – light wiring
- Study of iron-box, fan with regulator, emergency lamp

GROUP – B (MECHANICAL AND ELECTRONICS) **15**

3. MECHANICAL ENGINEERING PRACTICE

Welding

- Arc welding of butt joints, lap joints, tee joints
- Gas welding Practice.
- Basic Machining
- Simple turning, drilling and tapping operations.
- Machine assembly Practice.
- Study and assembling the following:
- Centrifugal pump, mixies and air conditioners.
- Demonstration on
  - (a) Smithy operations like the production of hexagonal bolt.
  - (b) Foundry operation like mould preparation for grooved pulley.

4. ELECTRONIC ENGINEERING PRACTICE **9**

- Soldering simple electronic circuits and checking continuity.
- Assembling electronic components on a small PCB and testing.
- Study of Telephone, FM radio, low-voltage power supplies.

TOTAL: 45 PERIODS

HS8251	TECHNICAL ENGLISH - II	L T P C
	(For all branches of B.E / B.Tech programmes)	**3 1 0 4**

OBJECTIVES:

- To make the students acquire listening and speaking skills meant for both formal and informal contexts

- To help them develop their reading skills by exposing them to different types of reading strategies
- To equip them with writing skills needed for academic as well as workplace situations
- To make them acquire language skills at their own pace by using e-materials and language lab component

OUTCOMES:

Learners should be able to

- Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, and argue using appropriate communicative strategies.
- Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.

UNIT I **9 + 3**

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on something, weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; Grammar - Regular & irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II **9 + 3**

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his success, thanking one's friend / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercise on Grammar and vocabulary, Extensive reading activity (reading stories / novels from links), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

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UNIT III **9 + 3**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret etc.); Reading - Speed reading – reading passages with the time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading the articles from the journals - Format for the journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar & vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU materials – Attending a meeting and writing minutes.

UNIT IV **9 + 3**

Listening - Listening to a telephone conversation, Viewing a model interview (face-to-face, telephonic and video conferencing) and observing the practices; Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping the interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar & Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V **9 + 3**

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/ agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading Writing - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive

grammar and vocabulary exercises - Pictures for discussion; Language Lab - Different models of group discussion

TOTAL: 60 PERIODS

TEXT BOOKS

1. "Mindscapes: English for Technologists and Engineers". Orient Black Swan, 2012.
2. Dhanavel,S.P. "English and Communication Skills for Students of Science and Engineering". Orient Black Swan, 2011.

REFERENCES

1. Laws, Anne. "Presentations." Orient BlackSwan, 2000.
2. Lewis, Hedwig. "Body Language : A Guide for Professionals" Sage Publications, 1998.
3. Naterop, Jean B. and Rod Revell. "Telephoning in English". Cambridge University Press, 1987.
4. Rutherford, Andrea J. "Basic Communication Skills for Technology". Pearson Education, 2001.
5. Ur. Penny. "Teaching Listening Comprehension". Cambridge University Press, 1984.

EXTENSIVE READERS

1. Abdul Kalam, A P J. "Ignited Minds: Unleashing the Power within India". Penguin Books, 2002.
2 Parameswaran, Uma. "C.V.Raman: A Biography". Penguin Books, 2011.

WEB RESOURCES

1. www.esl-lab.com
2. www.englishgrammar.org
3. www.englishclub.com
4. www.mindtools.com
5. www.esl.about.com

MA8251 **MATHEMATICS - II** **L T P C**

(Common to all branches of B.E. / B.Tech. **3 1 0 4**

Programmes in II Semester)

OBJECTIVES

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of the electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

OUTCOMES:

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions.
- Students will be able to solve problems related to engineering applications by using these techniques.

UNIT I DIFFERENTIAL EQUATIONS **9+3**

Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT II VECTOR CALCULUS **9+3**

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral and volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTION **9+3**

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions w= z+ c, az, 1/z, z^2- Bilinear transformation.

UNIT IV COMPLEX INTEGRATION **9+3**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS **9+3**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems –Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 60 PERIODS

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", 40th Edition. Khanna Publishers, 2007.
2. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, 2010.

REFERENCES

1. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 2007.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, Delhi, 3rd Edition, 2007.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", 7th Edition.
4. Firewall Media (An imprint of Lakshmi Publications), 2009.
5. O'Neil, Peter. "Advanced Engineering Mathematics". Cengage Learning, 2007.

PH8255 **PHYSICS OF MATERIALS** **L T P C**

(Common to Chemical, Ceramic, Food, Leather, Industrial Biotechnology and Pharmaceutical and Rubber and Plastic) **3 0 0 3**

OBJECTIVE:

To learn the basic physics concepts involved in different materials like conducting conducting, and insulating, magnetic materials.

9

Outcome:

The course helps the students to get an indepth idea of properties of materials.

UNIT I PREPARATION AND PROCESSING OF MATERIALS

Phases - Phase rule – binary systems – tie line rule – lever rule – phase diagram – invariant reactions – diffusion Fick's law - Nucleation – homogeneous and heterogeneous nucleation – Free energy of formation of a critical nucleus – crystal growth – Czochralski, Bridgman, Solution methods - Thin films – preparation: PVD method - Sol-gel method – heat treatment and hardening processes.

UNIT II PROPERTIES OF CONDUCTING AND SUPERCONDUCTING MATERIALS 9

Classical free electron theory of metals –Fermi function - Schrödinger wave equation - Time independent and time dependent equations. Physical significance of wave function, particle in a box (in one dimension) – electrons in a metal - Density of energy states – effect of temperature on Fermi energy – carrier concentration in metals - Superconducting Phenomena, Properties of superconductors – Meissner effect and Isotope effect. Type I and Type II superconductors, High Tc superconductors – Magnetic levitation and SQUIDS.

UNIT III ELECTRONIC MATERIALS 9

Elemental and compound semiconductors - Origin of band gap in solids (qualitative) - Concept of effective mass of electron and hole – carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – carrier concentration in n-type and p-type semiconductors (derivation) – variation of Fermi level with temperature and impurity concentration – Compound semiconductors – Hall effect – Determination of Hall coefficient – LED and Solar cells.

UNIT IV INSULATING AND MAGNETIC MATERIALS 9

Dielectric, paraelectric and ferroelectric materials - Electronic, Ionic, Orientational and space charge polarization – Internal field and deduction of Clausius Mosotti equation – dielectric loss – different types of dielectric breakdown – classification of insulating materials and their applications - Introduction to magnetic materials - Domain theory of ferromagnetism, Hysteresis, Soft and Hard magnetic materials – Anti-ferromagnetic materials – Ferrites, Giant Magneto Resistance materials. Magnetic bubbles.

UNIT V CERAMIC AND NEW MATERIALS **9**

Introduction to Ceramics and its applications - Ceramic Fibres - Fibre reinforced Plastics – Fibre reinforced Metal – Metallic glasses – Shape memory alloys – Copper base alloys – Nickel – Titanium alloys – Relaxor- Ferroelectric materials – Electro and magneto rheological fluids - Sensors and Actuators – polymer semiconductos – photoconducting polymers – liquid crystals - Bio-sensors - Scintillation detectors (Position sensitive) –Bio materials – hydroxyapatite – PMMA – Silicone.

TOTAL : 45 PERIODS

REFERENCES

1. Raghavan. V. “Materials Science and Engineering”. Prentice Hall of India, 2002.
2. Kumar.J, Moorthy Babu. S and Vasudevan. S., “Engineering Physics” Vijay Nicole Imprints, 2006
3. Palanisamy.. P.K., “Materials Science”. Scitech., 2003.
4. Calister, W.D., “Materials Science and Engineering an Introduction”. John Wiley,2003.
5. Raghavan, V., “Physical Metallurgy”. Prentice Hall of India, 2002.

CY8254 **PHYSICAL AND ORGANIC CHEMISTRY** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the Structure and Reactivity of Organic Compounds.
- To study about Reaction Mechanisms and to study the concepts of chemical kinetics and catalysis

OUTCOME:

- Obtain knowledge in structure and reactivity of organic compounds.
- Familiarize the reaction mechanism and chemical kinetics.

UNIT I CHEMICAL KINETICS AND CATALYSIS **9**

Chemical Kinetics – Order – Molecularity – Rate of reaction – Activation energy – Polymerization kinetics – Catalysis – Surface science – Application of catalysis – Phase rule

- applications.

UNIT II ELECTRO CHEMISTRY / CORROSION **9**

Electro Chemistry – Electrochemical series – Transport numbers and ionic mobility –Buffer indicators - Redox reaction – Potentiometric, conductometric, polarographic studies – Galvanic cells – Electrolysis – Thermodynamic parameters**.**

UNIT III Structure and Reactivity in Organic Compounds **9**

Bonding in Organic Compounds- Structure-property relationships - Electronic effects like inductive, mesomeric, electromeric and hyper conjugation effects – Free radicals, carbo cations, carbanions, elementary ideas about stereo chemistry.

UNIT IV Details of Reaction Mechanisms **9**

Free radical substitutions, Electophilic addition, Aromatic Electrophilic substitutions, Nucleophilic additions, condensation reactions, nucleophilic substitutions in aliphatic and aromatic compounds, cyclo additions, rearrangements, uses of these reactions in polymer preparation.

UNIT V Organic substances of importance to polymer technology **9**

Amines, heterocyclic compounds – furan, thiophene, pyrrole, pyridine, quinoline, iso quinoline, imidazoles, thiazolesPreparation , properties and uses of simple monomers like ethylene, propylene, isobutylene, butadiene, styrene, methyl methacrylate , diisocyanates, glycols, polyols, epichlorohydrin, fluoro alkenes, acrylonitrile, vinyl chloride, vinyl acetate.

TOTAL : 45 PERIODS

REFERENCES

1. Glasstone, S., and D. Lewis. “Elements of Physical Chemistry”. Macmillan, 1995.
2. Maron and C.F. Pruton “Physical Chemistry” Macmillan, 1990.
3. Morrison and Boyd, “Organic Chemistry”. Prentice Hall,1992.
4. Finar I.L., “Textbook of Organic Chemistry”. ELBS,1996.

GE8251 **ENGINEERING MECHANICS** **L T P C**

OBJECTIVE:

To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering

OUTCOMES:

- Ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- Ability to analyse the forces in any structures.
- Ability to solve rigid body subjected to dynamic forces.

UNIT I BASICS AND STATICS OF PARTICLES 9 +3

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces — Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.

UNIT II EQUILIBRIUM OF RIGID BODIES 9 +3

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions.

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9 +3

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES **9 +3**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion -Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS **9+3**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 60 PERIODS (L:45 + T:15)

TEXT BOOKS

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill, 2004.
2. Vela Murali, "Engineering Mechanics", Oxford University Press, 2010

REFERENCES

1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education, 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education, 2006.
3. J.L.Meriam and L.G.Kraige, " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2,Third Edition, John Wiley & Sons,1993.
4. Rajasekaran, S and Sankarasubramanian, G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing, 2005.

PM8256 FOOD AND PHARMACEUTICAL BIOCHEMISTRY **L T P C**
3 0 0 3

OBJECTIVES

To develop understanding and provide scientific basics of the life processes at the molecular level and explain the structure, function and inter-relationships of bio-molecules and their deviation from normal and their consequences for interpreting and solving clinical problems.

OUTCOME:

Student learns the scientific basis of life processes, function of biomolecules and biochemistry concept of clinical diseases.

UNIT I BIOCHEMICAL ORGANIZATION AND BIOENERGETICS 10

Scope of clinical biochemistry, component of the cell, structure and biochemical functions, membrane structure and functions, transport through biological cell membrane, the concept of free energy, determination of change in free energy from equilibrium constant and reduction potential, bioenergetics and biological oxidation – general concept of oxidation and reduction, electron transport chain, oxidative phosphorylation, uncouplers and theories of biological oxidation and oxidative phosphorylation

UNIT II BIOMOLECULES 12

Carbohydrates – Classification, properties : starch, glycogen, dextrin, inulin, cellulose, metabolism of carbohydrates – gluconeogenesis, glycogenolysis, glycolysis. citric acid cycle and its biological significance, role of sugar in nucleotide biosynthesis and pentose phosphate pathway. Lipids – Classification, properties : sterols, essential fatty acids, eicosanoids, phospholipids, sphingolipids, metabolism of lipids, oxidation of fatty acids, α,β - oxidation and biosynthesis of ketone bodies, cholesterol, porphyrin biosynthesis, metabolism of bile pigments. Proteins and amino acids – Classification, properties, biosynthesis of amino acids and proteins, essential amino acids, metabolism of amino acids and proteins, Nitrogen balance. Nucleic acids –genetic code, nucleic acids, and structure of DNA and RNA, purine biosynthesis and pyrimidine biosynthesis.

UNIT III BIOENERGETICS 5

High energy compounds , electronegative potential of compounds , respiratory chain , ATP cycle , Calculation of ATP during oxidation of glucose and fatty acids.

UNIT IV MACROMOLECULES, VITAMINS, HORMONES, ENZYMES 10

Physical and chemical properties, structure of haemoglobin, immunoglobulins and nucleoprotein, classification and their properties, occurrence, functions, requirements, deficiency manifestations and role of vitamins as coenzyme, chemical nature and properties, hormones, Nomenclature, enzyme kinetics, classification and their properties, mechanism of action, enzyme induction and inhibition, coenzyme significance and enzymes of clinical importance

UNIT V BIOCHEMISTRY OF CLINICAL DISEASES **8**

Diabetes mellitus, atherosclerosis, fatty liver, and obesity, hormonal disorders, aging, inborn errors of metabolism and organ function tests

TOTAL : 45 PERIODS

TEXTBOOKS

1. Cox, M.M. and Nelson, David L. Lehininger, "Principles of Biochemistry". 5th Edition. W.H.Freeman , 2008
2. Murray, Robert K. etal., "Harper's Illustrated Biochemistry" 27th Edition. McGraw-Hill, 2006.
3. Satyanarayanan, U. "Biochemistry" Books and Allied. 2005
4. Voet, D.J. and J.G.Voet "Principles of Biochemistry" 3rd Edition. John wiley, 2008.
5. Rastogi, S.C. "Biochemistry" 2nd Edition. Tata Mc Graw-Hill, 2003

REFERENCES

1. Berg, J.M. "Biochemistry" 6th Edition. W.H. Freeman, 2007.
2. Devlin, Thomas M. " Textbook of Biochemistry : With Clinical Correlations". 6th Edition. John Wiley, 2006.
3. Segel, Irwin H. " Biochemical Calculations : How to solve Mathematical Problem in General Biochemistry" . 2nd Edition. John wiley, 2004.

FT8211 **BIO-ORGANIC CHEMISTRY LABORATORY** **L T P C**
0 0 4 2

OBJECTIVES:

- To synthesize and familiarize the organic compound, organic acid preparation and its purification.
- To synthesize the amino acids and study of its structure.

OUTCOME:

- Obtain the clear knowledge about organic compound preparation, purification and its structure.

1. Synthesis of aspirin
2. Hydrolysis of sucrose
3. Preparation of pyruvic acid from tartaric acid
4. Preparation of oleic acid from tartaric acid
5. Preparation of alpha d- glucopyranose pentaacetate
6. Preparation of 1,2,5,6 dicyclohexylnoine alpha d glucofuranose
7. Isolation of lycopene from tomato paste
8. Preparation of l-proline
9. Preparation of l-cysteine from hair
10. Preparation of s-ethyl hydroxybutonate from ethyl acetoacetate using yeast
11. Resolution of s-ethyl hydroxybutonate using 3,5 dinitrobenzoate.
12. Preparation of 5,10,15,20-tetrakisphenyl porphyrin.

TOTAL : 60 PERIODS

Equipment Needed for 20 Students

Colorimeter	2
Glassware, Chemicals, Media	as required

REFERENCES

1. Carey, Fracis A. “Organic Chemistry”. 7th Edition, Tata McGraw-Hill, 2009.
2. Page, M.I. and Andrew Williams “Organic and Bio-organic Mechanisms”. Pearson, 2010.

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PM8262	FOOD AND PHARMACEUTICAL BIOCHEMISTRY LABORATORY	L T P C 0 0 4 2

AIM

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

OBJECTIVE:

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

OUTCOME:

Experience in estimating qualitatively and quantitatively proteins, lipids, carbohydrates and metabolites. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs. Therapeutic and diagnostic applications of enzymes.

EXPERIMENTS

1. Preparation and measurement of pH of standard buffers (phosphate, carbonate, borate, TRIS etc.)
2. Qualitativeanalysisofcarbohydrates(monosaccharides,disaccharides,polysaccharides etc.)
3. Enzymatic hydrolysis of glycogen by α and β amylase
4. Qualitative analysis of proteins
5. Qualitative analysis of lipids (triglycerides, cholesterol, phospholipids etc.)
6. Quantitative analysis of proteins (Lowry's method, Bradford, UV)
7. Quantitative analysis of carbohydrates (Benedict's method etc.)
8. Quantitative analysis of lipids (Benedict's method etc.)
9. Quantitative estimation of blood glucose
10. Acid hydrolysis and action of salivary amylase on starch
11. Estimation of chloride, glucose, ammonia and creatinine in urine.
12. Quantitative analysis of urea in serum
13. Quantitative analysis of serum bilirubin
14. Quantitative estimation of serum cholesterol by Libermann Burchard's method
15. Isolation and assay of glycogen from the liver and skeletal muscle of mice

TOTAL : 60 PERIODS

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TEXT BOOKS

1. Plummer, D.T. "Introduction of Practical Biochemistry" 3rd Edition. Tata McGraw-Hill, 1987.
2. Wilson, Keith and John Walker "Principles and Techniques of Biochemistry and Molecular Biology ". 6th Edition. Cambridge University Press, 2006.
3. Segel, Irwin H. "Biochemical Calculations : How to solve Mathematical Problem in General Biochemistry" . 2nd Edition. John wiley, 2006.

MA8356 PROBABILITY AND STATISTICS L T P C
(Branch Specific Course) 3 1 0 4

OBJECTIVES

- To make the students acquire a sound knowledge in statistical techniques that model engineering problems.
- The Students will have a fundamental knowledge of the concepts of probability.

OUTCOME:

- Students acquire knowledge in fundamental probability and statistical Techniques,
- Familiarize in sampling distributions and statistical techniques used in engineering and management problems.

UNIT I RANDOM VARIABLES 9+3

Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTS OF SIGNIFICANCE 9+3

Sampling distributions - Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – $\chi 2$-test for goodness of fit – Independence of attributes – Non-parametric tests: Test for Randomness and Rank-

sum test (Wilcoxon test).

UNIT IV DESIGN OF EXPERIMENTS **9+3**

Completely randomized design – Randomized block design – Latin square design - 2^2 - factorial design - Taguchi's robust parameter design.

UNIT V STATISTICAL QUALITY CONTROL **9+3**

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

TOTAL : 60 PERIODS

TEXT BOOKS

1. Milton, J. S. and Arnold, J.C., "Introduction to Probability and Statistics". 4th Edition. Tata McGraw Hill, 2008.
2. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for Engineers". 8th Edition. Pearson Education,2011.

REFERENCES

1. Devore, J.L., "Probability and Statistics for Engineering and the Sciences".7th Edition. Thomson Brooks/Cole, 2008
2. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., "Probability and Statistics for Engineers and Scientists". 8th Edition. Pearson Education, 2007.
2. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists". 3rd Edition. Elsevier, 2004.
3. Spiegel, M.R., Schiller, J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill, 2004.

FT8301 **FOOD CHEMISTRY** **L T P C**
3 0 0 3

AIM

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

OBJECTIVES:

On completion of the course the students are expected to

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

OUTCOME:

- Better Understanding various food groups; the nutrient components, proximate composition, non-nutritive components in food.
- Effective use of food composition tables and databases.
- Understanding the interaction of food components in food products.

UNIT I CARBOHYDRATES **9**

Simple Sugars: mono and disaccharides, Hygroscopcity & solubility, optical rotation, mutarotation; sensory properties-sweetness index, caramelization, Maillard reaction; Glucose syrup, high fructose corn syrup, Dextrose Equivalent, Degree of polymerisation; Sugar alcohols; Oligosaccharides: structure, nomenclature, occurrence, uses in foods. Polysaccharides: Starch- amylose and amylopectin- properties, thickening & gelatinization, modified starches, resistant starch, Dextrins and dextrans, Starch hydrolysates – Malto dextrins and dextrins; Pectins, gums & seaweeds- gel formation & viscosity. Fiber - Cellulose & hemicellulose; Food sources, functional role and uses in foods.

UNIT II PROTEINS **9**

Review of protein structure & conformation; Properties & reactions of proteins in food systems: Dissociation, optical activity, solubility, hydration, swelling, foam formation & stabilization, gel formation, emulsifying effect, thickening & binding, amino acids in Maillard reaction, denaturation; Food enzymes ; Texturized proteins; Food sources, functional role and uses in foods.

UNIT III LIPIDS **9**

Review of structure, composition & nomenclature of fats. Non-glyceride components in fats & oils; Properties of fats & oils: crystal formation, polymorphism, melting points, plasticity,

isomerisation, unsaturation; Modification of fats: hydrogenation- cis and trans isomers, interesterification, acetylation, winterization; Hydrolytic rancidity & oxidative rancidity; radiolysis Shortening power of fats, tenderization, emulsification, frying - smoke point, auto oxidation, polymerization; Fat replacements; Food sources, functional role and uses in foods.

UNIT IV

A. WATER **2**

Chemistry, physical properties, free, bound & entrapped water, water activity. Drinking water, mineral water, water hardness, water quality for food processing

B. MINERALS & VITAMINS **1**

Mineral & vitamin content of foods- Food and Pharmaceutical grades; stability & degradation in foods.

C. COLOUR, FLAVOUR & AROMA COMPONENTS **6**

Naturally occurring colours, acids, other flavour & aroma components present in herbs, spices, coffee, tea, cocoa, fruits, vegetables & fermented products; Synthetic Colours and Naturally similar /artificial flavours, Threshold values, off flavours & food taints.

D. OTHER COMPONENTS **4**

Naturally occurring toxic substances, protease inhibitors, bioactive components: phytates, polyphenols, saponins, phytoestrogens etc.

UNIT V FOOD GROUPS & COMPOSITION **5**

Food groups, proximate composition, food composition tables- uses, food composition data bases.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Belitz H.-D, Grosch W and Schieberle P. Food Chemistry, 3rd Revised Edition, Springer-Verlag, 2004.
2. Meyer, Lillian Hoagland "Food Chemistry". CBS Publishers, 1987.
3. deMan, John M. "Principles of Food Chemistry". 3rd Edition, Springer, 1999.
4. Chopra, H.K. and P.S. Panesar. "Food Chemistry". Narosa, 2010.

REFERENCES

1. Vaclavik, V. A. and Christian E. W. "Essentials of Food Science". 2nd Edition, Kluwer-Academic, Springer, 2003.

2. Owusu-Apenten, Richard "Introduction to Food Chemistry" CRC Press, 2006.
3. Damodaran, Srinivasan, " Fennema's Food Chemistry " 4th Edition, CRC Press, 2008.
4. Gopalan C. Rama Sastri B. V. and Balasubramanian S. C. Nutritive Value of Indian Foods, NIN

FT8302 FOOD MICROBIOLOGY L T P C
4 0 0 4

AIM

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

OBJECTIVES

On completion of the course the students are expected to

- Be able to understand and identify the various microbes associated with foods and food groups.
- Be able to understand and identify the role of these microbes in food spoilage, food preservation.
- Understand the role of pathogens in food borne infections.
- Understand the methods used to detect pathogens in foods.

OUTCOME:

- Better understanding of various microbes associated with foods and food groups.
- Familiarize the role of microbes in food spoilage and food preservation.
- Obtain knowledge in methods to detect pathogens in food.

UNIT I MICROBES - STRUCTURE AND MULTIPLICATION 9

Basics of microbial existence; history of microbiology, classification and nomenclature of microorganisms, microscopic examination of microorganisms, light and electron microscopy; principles of different staining techniques like gram staining, acid fast, capsular staining, flagellar staining. Structural organization and multiplication of bacteria, viruses, algae and fungi; Nutritional requirements of bacteria; different media used for bacterial culture; growth curve and different methods to quantify bacterial growth; aerobic and anaerobic

bioenergetics and utilization of energy for biosynthesis of important molecules.

UNIT II ROLE OF MICROBES IN SPOILAGE OF FOODS AND THEIR CONTROL 9

Factors affecting spoilage of foods, Microbial flora associated with various food groups their spoilage potential. Microbiological spoilage problems associated with typical food products. Use of antimicrobial chemicals- organic acids, sugars, sodium chloride, nitrites, phosphates, sulphites, Benzoates, Sorbates / Propionates naturally occurring antimicrobials; Physical methods- Low and high temperatures, drying, radiation and high pressure; Tolerance of microbes to chemical and physical methods in various foods.

UNIT III MICROBES IN FOOD FERMENTATIONS 9

Microbes of importance in food fermentations, – Homo & hetero-fermentative bacteria, yeasts & fungi; Biochemistry of fermentations – pathways involved, Lactic acid bacteria fermentation and starter cultures, Alcoholic fermentations -Yeast fermentations - characteristics and strain selection, Fungal fermentations. Microbes associated with typical food fermentations- yoghurt, cheese, fermented milks, breads, idli, soy products, fermented vegetables and meats.

UNIT IV MICROBIAL AGENTS OF FOOD BORNE ILLNESS 9

Food borne infections and food poisoning, Microbial toxins - types, Gram Negative and Gram positive food borne pathogens – Salmonella, Coliforms, E. coli, Shigella, Vibrio cholerae, Staphylococcus aureus; Clostridium botulinum; Lysteria monocytogenes Toxigenic algae and fungi; Food borne viruses; helminths, nematodes and protozoa.

UNIT V MICROBIAL EXAMINATION OF FOODS 9

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. Vijaya Ramesh “Food Microbiology”. MJP Publishers, 2007
2. Jay, J.M. “Modern Food Microbiology”. 4th Edition. CBS Publishers, 2003
3. Adams, M.R and M.O. Moss. “Food Microbiology”. New Age International, 2002

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REFERENCES

1. Pawsey, R.K. "Case Studies in Food Microbiology for Food Safety and Quality". The Royal Society of Chemistry, 2001.
2. Forsythe, S.J. "The Microbiology of Safe Food". Blackwell Science, 2000.
3. Harrigan, W.F. "Laboratory Methods in Food Microbiology" 3rd Edition, Academic Press.

FT8303 HUMAN NUTRITION L T P C
3 0 0 3

AIM

The course aims to develop the knowledge of students in the basic area of Human Nutrition. This is necessary for effective understanding of food processing and technology subjects. This course will enable students to appreciate the relationship between food and the nutrients as well as function and contribution of nutrients to health of individuals.

OBJECTIVES

On completion of the course the students are expected to

- Be able to understand the physiological and metabolic functions of nutrients.
- Be able to understand methods of nutritional assessment, RDA and Dietary Recommendations & Guidelines.
-

OUTCOME:

- Better understanding in physiological and metabolic functions of nutrients.
- Familiarize nutritional assessment, RDA and Dietary Recommendations & Guidelines.
- Effective understanding of diet planning principles, exchange lists, food labels and nutrition facts for balanced nutrition and healthy diets.
- Understand and use effectively, diet planning principles, exchange lists, food labels and nutrition facts for balanced nutrition and healthy diets.

UNIT I AN OVERVIEW OF NUTRITION 9

Definition, six classes of nutrients, calculating energy values from food, using the RDA, nutritional status, nutritional requirement, malnutrition, nutritional assessment of individuals

and populations, dietary recommendations; research methods in nutrition;, balanced diet Planning a Healthy Diet: Diet planning principles, dietary guidelines; diet planning guides such as food groups, exchange lists, personal diet analysis; food labels: serving sizes, nutrition facts, daily values, descriptive terms, health claims. Digestion, Absorption and Transport**:** Anatomy and physiology of the digestive tract, mechanical and chemical digestion, absorption of nutrients.

UNIT II CARBOHYDRATES - SUGARS, STARCH AND FIBER **9**

Digestion and absorption of carbohydrates, lactose intolerance; Glycemic and Non-glycemic carbohydrates, blood glucose regulation, recommendations of sugar intake for health, health effects of fiber and starch intake, artificial sweeteners; Nutrition and Diabetes: Complications of diabetes mellitus, importance of blood sugar regulation, dietary recommendations for NIDDM and IDDM

UNIT III LIPIDS AND PROTEINS **9**

Food Sources, Lipid digestion, absorption and transport; Functions of the triglycerides; essential fatty acids- n-3 and n-6 fatty acids; trans fatty acids, Medium Chain Triglycerides, phospholipids and sterols; Health effects and recommended intakes of lipids. Digestion and absorption of proteins; Functions of proteins; amino acids; Protein quality, methods of assessing protein quality; Recommended intakes of proteins; protein and amino acid supplements; Protein Energy Malnutrition, Marasmus and Kwashiorkor; Chronic Energy Deficiency- short term and long term effects.

UNIT IV METABOLISM, ENERGY BALANCE AND BODY COMPOSITION **9**

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

UNIT V VITAMINS AND MINERALS **9**

Water Soluble Vitamins: B vitamins examined individually (Thiamine, Riboflavin, Niacin, Pyridoxine, Biotin, folate B12, choline, pantothenic acid, and carnitine) and in concert; B vitamin deficiencies, toxicities, and food sources; vitamin C roles and recommended intake, deficiency, toxicity and food sources. Fat Soluble Vitamins: A, D, E, and K; Function, recommended intakes, toxicities, food sources of vitamin A, D, E, and K; vitamin E as

antioxidant; beta carotene and vitamin A Water and Major Minerals: Water balance and recommended intakes; fluid/electrolyte balance, acid-base balance; function, recommended intakes, and regulation of sodium, potassium, and calcium. Trace Minerals: Food sources, function, recommended intakes, toxicities, deficiencies and transport of iron and zinc; importance of selenium, copper, fluoride, and chromium.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Mann, Jim and Stewart Truswell "Essentials of Human Nutrition". 3rd Edition. Oxford University Press, 2007.
2. Gibney, Michael J., et al., "Introduction to Human Nutrition". 2nd Edition. Blackwell,2009.
3. Gropper, Sareen S. and Jack L.Smith "Advanced Nutrition and Human Metabolism". 5th Edition. Wadsworth Publishing, 2008.

FT8304 INTRODUCTION TO FOOD PROCESSING L T P C
3 0 0 3

AIM

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

OBJECTIVES:

On completion of the course the students are expected to

- Be aware of the different methods applied to processing foods.
- Be able to understand the significance of food processing and the role of food and beverage industries in the supply of foods.

OUTCOME:

- Learning of different methods applied to processing foods.
- Better understanding of significance of food processing and the role of food and beverage industries in the supply of foods.

UNIT I PROCESSING OF FOOD AND ITS IMPORTANCE **9**

Source of food - food of plant, animal and microbial origin; different foods and groups of

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foods as raw materials for processing – cereals, pulses, grains, vegetables and fruits, milk and animal foods, sea weeds, algae, oil seeds & fats, sugars, tea, coffee, cocoa, spices and condiments, additives; need and significance of processing these foods

UNIT II METHODS OF FOOD HANDLING AND STORAGE **9**

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

UNIT III LARGE-SCALE FOOD PROCESSING **12**

Milling of grains and pulses; edible oil extraction; Pasteurisation of milk and yoghurt; canning and bottling of foods; drying – Traditional and modern methods of drying, Dehydration of fruits, vegetables, milk, animal products etc.; preservation by use of acid, sugar and salt; Pickling and curing with microorganisms, use of salt, and microbial fermentation; frying, baking, extrusion cooking, snack foods.

UNIT IV FOOD WASTES IN VARIOUS PROCESSES **6**

Waste disposal-solid and liquid waste; rodent and insect control; use of pesticides; ETP; selecting and installing necessary equipment.

UNIT V FOOD HYGIENE **9**

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

TOTAL: 45 PERIODS

TEXT BOOKS

1. Karnal, Marcus and D.B. Lund “Physical Principles of Food Preservation”. Rutledge, 2003.

2. VanGarde, S.J. and Woodburn. M “Food Preservation and Safety Principles and Practice”.. Surbhi Publications, 2001.
3. Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.
4. Khetarpaul, Neelam, “Food Processing and Preservation”, Daya Publications, 2005.

PM8351 FUNDAMENTALS OF CHEMICAL ENGINEERING L T P C
(Common for food & Pharmaceutical Technology) 3 0 0 3

AIM

- To understand the principles of Process calculations.
- To understand principles of fluid mechanics and its application.

OBJECTIVES

- To perform calculations pertaining to processes and operations.
- To apply fluid mechanics principles to applied problems.

OUTCOME

- Student understands the principles of Process calculations, understand principles of fluid mechanics and its application.

UNIT I BASIC PRINCIPLES OF STOICHIOMETRY **8**

Importance of material balance and energy balance in a process Industry-Dimensions, Units, conversion factors and their use –Data sources, Humidity and applications.

UNIT II MATERIAL BALANCES **10**

Material balance calculations for non reactive operations, once through operations, recycle operations, bypass operations. Material balance calculations for reactive processes, recycle, bypass processes – Application problems in unit operations and processes.

UNIT III ENERGY BALANCES **8**

Calculation of enthalpy changes, heat capacity, Latent heats, Data sources, Thermo chemical calculations. Heat of solution, Simultaneous material and energy balances.

UNIT IV FLUID MECHANICS **9**

Fluid – properties – compressible, incompressible fluids, Newtonian and Non Newtonian

Fluids, Fluid statics for compressible & incompressible fluids-Static pressure-application to pressure measurement, gravity settling, Fluid Flow phenomena – through pipes and other devices – pressure drop calculations. Pressure measuring devices.

UNIT V AGITATION FLOW THROUGH PACKINGS, FLUIDZATION, FLUID TRANSPORT **9**

Agitation – power requirement, Flow in packed columns, flow in fluidization columns, settling phenomena, Flow measurement, pumping of liquids and gases – equipments

TOTAL: 45 PERIODS

TEXT BOOKS

1. McCabe, W.L., J.C. Smith and P.Harriot "Unit Operations of Chemical Engineering", 7th Edition, Mc Graw Hill, 2007.
2. Bhatt, B.I. and S.M. Vora "Stoichiometry (SI Units)", 3rd Edition, Tata McGraw-Hill, 1996.

REFERENCES

1. Himmelblau, D.M. "Basic Principles and Calculations in Chemical Engineering", 6thEdition, PHI, 2006.
2. Geankoplis, C.J. "Transport Processes and Separation process Principles", 4th Edition, PHI, 2006.
3. Foust, A.S. et al., "Principles of Unit Operations", 2nd Edition, John Wiley & Sons, 1999.
4. Narayanan, K.V. and Lakshmi Kutty "Stoichiometry and Process Calculations", PHI, 2006
5. Coulson, J.M. and et al. "Coulson & Richardson's Chemical Engineering", 6th Edition, Vol. I & II, Butterworth – Heinman (an imprint of Elsevier), 2004.

FT8311 FOOD CHEMISTRY LAB **L T P C**
0 0 4 2

OBJECTIVE:

To study and understand the physical and chemical properties of foods

OUTCOME:

- Better understanding the physical and chemical properties of food.
- Familiarize in precipitation of casein and gellation of starch.

LAB EXPERIMENTS:

1. Estimation of Viscosity of foods
2. Properties of solutions- sugar & salt
3. Preparation of emulsions
4. Foaming properties of proteins
5. Solubility, specific gravity and Refractive index of oils
6. Oxidative rancidity of fats.
7. Effect of heat on proteins.
8. Iso-electric precipitation of casein, Effect of rennin on milk proteins
9. Gelling properties of starch
10. Study of gluten formation
11. Enzymatic Browning in foods

TOTAL: 60 PERIODS

REFERENCE

1. Weaver, C.M, and J.R. Daniel. "The Food Chemistry Laboratory – A Manual for Experimental Foods, Dietetics & Food Scientists." 2nd Edition, CRC Press, 2005.

EQUIPMENT

- Brookefield Viscometer
- Refractometer
- Spectrophotometer
- Reagents, Chemicals & Consumables

FT8312 FOOD MICROBIOLOGY LAB L T P C
0 0 4 2

OBJECTIVES

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

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OUTCOME:

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

LAB EXPERIMENTS:

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

EQUIPMENT

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

TOTAL: 60 PERIODS

REFERENCE

1. Harrigan, W.F. “Laboratory Methods in Food Microbiology” Academic Press, 2011

GE8351 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVE

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

OUTCOME

Student will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental Disasters.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

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

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

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UNIT II ENVIRONMENTAL POLLUTION **8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES **10**

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

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies.
– wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human

health – Case studies.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Masters, M. Gilbert "Introduction to Environmental Engineering and Science". 2nd Edition, PHI, 2004.
2. Joseph, Benny. "Environmental Studies". Tata McGraw-Hill, 2005.
3. Kaushik, Anubha and C.P. Kaushik . "Environmental Science and Engineering". 3rd Edition. New Age International, 2008

REFERENCE BOOKS

1. R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines,Compliances and Standards". Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia". Jaico Pub. 2001.
3. Sengar, S. Dharmendra. "Environmental law". PHI, 2007.
4. Rajagopalan, R. "Environmental Studies-From Crisis to Cure". Oxford University Press, 2005.

FT8401 FLUID MECHANICS FOR TECHNOLOGIST L T P C 3 0 0 3

OBJECTIVES

- To introduce the students to the mechanics of fluids through a thorough understanding of the properties of the fluids, behavior of fluids under static conditions.
- To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes and c) forces on vanes
- To be familiar with all the basic concepts of fluids and fluid flow phenomenon, conservation equations and their applications to simple problem.

OUTCOME

- Integrated understanding of the transport of mass, momentum and energy.
- Understanding conservation laws and dimensional analysis to fluid flow problems.
- Familiarizing in flow through closed conduits and hydraulic machines.

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UNIT I INTRODUCTION **9**

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface. Properties of velocity field - thermodynamic properties of a fluid - viscosity and other secondary properties - basic flow analysis techniques flow patterns.

UNIT II PRESSURE DISTRIBUTION IN A FLUID **9**

Pressure and pressure gradient - equilibrium of fluid element - hydrostatic pressure distributions - applications to manometry - Hydrostatic forces on planed and curved submerged surfaces - laws of buoyancy and stability; Considerations for bodies in floatation.

UNIT III INTEGRAL RELATIONS FOR A CONTROL VOLUME **9**

Basic laws of fluid mechanics, concept of system and control volume concept - The Reynold's transport theorem - continuity equation - the linear momentum equation - the angular momentum theorem - steady flow energy equation - friction less flow - Bernoulli equation - relation between the Bernoulli and steady flow energy equation.

UNIT IV DIMENSIONAL ANALYSIS AND SIMILITUDE **9**

The principle of dimensional homogeneity - the Pi-theorem - non-dimensional action of the basic equations -similitude - relationship between dimensional analysis and similitude - use of dimensional analysis for scale up studies.

UNIT V FLOW MEASUREMENT AND COMPRESSIBLE FLOW **9**

Constant and variable head meters - classification of pumps - performance curves, compressors and its efficiency; Adiabatic and isoentropic flow with the area changes, shock waves, operation of convergence and divergence nozzles, compressible duct flow with friction.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 1983.
2. Kumar, K.L., "Engineering Fluid Mechanics", 7th Edition. Eurasia Publishing, 1995.
3. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines". 5th Edition. Laxmi Publications, 1995.
4. Vasandani, V.P., "Hydraulic Machines - Theory and Design", Khanna Publishers, 1992.

FT8402 FOOD FERMENTATION PROCESSES L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge and skills related to process technologies and equipment used for the production of various fermented food products.

OUTCOME

- Understanding concepts, principles and procedures involved in the area of fermented food production.
- Familiarizing with different fermenter types and their design criteria.

UNIT I HISTORICAL PERSPECTIVE OF FOOD FERMENTATION 6

History of food fermentations; types of fermented foods and substrates/raw materials used, traditional fermented foods, biotransformation of raw materials

UNIT II FERMENTING ORGANISMS AND THEIR ROLE 9

Principles of food and industrial fermentations; microorganisms of importance in food fermentations, Biochemistry of fermentations/fermentation pathways. Lactic Acid Bacteria and starter cultures (Taxonomy, ecology, physiology, genetics and biotechnology, phage control) Brewers and Bakers yeasts, Yeast starter culture maintenance, Moulds used in food fermentations; Genetic manipulation of fermenting microbes, Strain specific traits

UNIT III FERMENTED FOOD PRODUCTS 12

Dairy fermentations Yeast fermentations - Wine and beer fermentations, bread making,

Mould fermentations – soy based fermented foods – miso, tempeh, soy sauces

Manufacture of cheese, yoghurt, wine, beer, bread, soy sauce; processes and equipment used for manufacture; bottling / packaging, aging, storage and shelf life of fermented foods; Prevention of spoilage of fermentations.

UNIT IV PRODUCTS OF MIXED FERMENTATIONS 9

Meats, sausages, fish sauces, sauerkraut, idli, Manufacture of different types of sausages,

fish sauces, sauerkraut, idli batter- processes and equipment used for manufacture; packaging, aging, storage and shelf life of the products; Prevention of spoilage of fermentations.

UNIT V OTHER PRODUCTS FROM FERMENTATION **9**

Fermentation production of flavor components, acids, alcohol, enzymes, pigments/colours

TOTAL : 45 PERIODS

TEXT BOOKS

1. Joshi, V. K. "Biotechnology: Food Fermentation" Volume 1. Educational Publishers & Distributors, 2004.
2. Hui Y. H *et al*. "Handbook of Food and Beverage Fermentation Technology". Marcel Dekker, 2004.
3. Wood, Brian J. B. "Microbiology of Fermented Foods" Volume 1 & 2. 2nd Edition. Blackie Academic & Professional, 1998.

REFERENCES

1. Farnworth, Edward R. "Handbook of Fermented Functional Foods" 2nd Edition. CRC Press, 2008.
2. Lea, Andrew G. H & John R. Piggott "Fermented Beverage Production" 2nd Edition. Kluwer Academic/ Plenum Publishers, 2010.

FT8403 FOOD PRESERVATION TECHNOLOGY **L T P C**
3 0 0 3

AIM

To expose the students to the principles and different methods of food preservation.

OBJECTIVES

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

OUTCOME

Understanding

- Changes occurring during various food processing techniques
- Changes during storage and preservation
- Effect of enzymes on spoilage reactions of foods

UNIT I FOOD AND ITS PRESERVATION 6

General principles of preservation, classification of methods used for preservation, need and importance of preservation at domestic and large scale, Causes of food spoilage; Nature of harvested crop, plant and animal – moisture, pH and water activity of foods.

UNIT II LOW TEMPERATURE METHODS 9

Principles of storage using low temperature; Product storage; Effect of cold storage on quality, storage of grains; Principles of refrigerated gas storage of foods, Gas packed refrigerated dough, Sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers. Principles of food freezing: Freezing of raw and processed foods, freeze concentration, freeze drying, IQF.

UNIT III CANNING, RETORT PROCESING, CONCENTRATION AND DRYING 12

Principles of canning and bottling of foods; Types and classification of foods used for canning; spoilage of canned and bottled foods, storage of canned foods; Influence of canning on the quality of food; retort pouch processing. Drying – Traditional and modern methods of drying, types of driers, influence of drying on pigments and enzymes; Dehydration of fruits, vegetables, milk, animal products etc.; osmotic methods. Principles of preservation by use of acid, sugar and salt; High solid - high acid foods; Pectin and gel formation; Invert sugar, jelly making, other food products, food concentrates. Pickling and curing with microorganisms, use of salt, and microbial fermentation.

UNIT IV NON-THERMAL METHODS 9

Chemical preservatives, preservation by ionizing radiations, ultrasonics, high pressure, fermentation, curing, pickling, smoking, membrane technology; Hurdle technology, application of infra-red microwaves; ohmic heating; control of water activity;

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UNIT V FOOD PACKAGING **9**

Basic packaging materials, types of packaging, packaging design, packaging for different types of foods, retort pouch packing, costs of packaging and recycling of materials.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Subbulakshmi, G., and Shobha A. Udipi “Food Processing and Preservation”.New Age Publications, 2006.
2. HUi, Y.H. “Handbook of Vegetable Preservation and Processing”. Marcel Dekker, 2003.

REFERENCES

1. Karnal, Marcus and D.B. Lund “Physical Principles of Food Preservation”. Rutledge,2003.
2. Gould, G.W. “New Methods in Food Preservation”. Springer,1995.

FT8404 MECHANICAL OPERATIONS IN FOOD INDUSTRY **L T P C**
3 0 0 3

OBJECTIVES

- To understand thoroughly the food processing UNIT operations, the equipment used to carry out the processes and also the calculations wherever necessary.

OUTCOME

- Students are exposed to different UNIT operations performed in various food processing industries so as to enable them to understand the basic processes.

UNIT I MIXING AND AGITATION **8**

Dimensional analysis; power for agitation; agitation of liquids; gas-liquid systems; gas-solid suspensions; agitator scale up.

UNIT II FILTRATION **8**

Constant pressure, constant volume batch filtration; continuous filtration; industrial filters; settling and sedimentation; centrifugation.

UNIT III HEAT TRANSFER EQUIPMENTS **15**

Applications of the principles of heat transfer to design equipment such as heat exchangers, condensers, jacketed kettles and coils, reboilers; Evaporation,
Refrigeration, Dropwise and filmwise condensation; Boiling; Unsteady state heat transfer; Heat transfer media.

UNIT IV CRYSTALLIZATION **7**

Characteristics of crystals like purity, size, shape, geometry, habit forms, size and factors affecting them, solubility curves and calculation of yields; Supersaturation theory and its limitations; Mier's supersolubility curve, nucleation mechanisms, crystal growth, study of various types of crystallizers, tanks, agitated batch, Swenson Walker, single vacuum, circulating magma and Krystal crystallizer; Caking of crystals and its prevention; Numerical problems on yields.

UNIT V DRYING **7**

Moisture content and mechanism of drying, rate of drying and time of drying, calculations, classification and types of dryers, dryers used in industries and special drying methods - tray, fluidized bed, spray, freeze, tunnel, Microwave, IR dryers; Mathematical problem on drying.

TOTAL : 45 PERIODS

TEXTBOOK

1. Toledo, Romeo T. "Fundamentals of Food Process Engineering" 2nd Edition. CBS Publishers, 2000.
2. Fellows P. J "Food Processing Technology" Woodhead Publishing, 1998.
3. Smith P. G "Introduction to Food Process Engineering". Springer, 2005.
4. Mujumdar, Arun S. "Dehydration of Products of Biological Origin". Oxford & IBH Publishing, 2004.

REFERENCES

1. Berk, Zeki. "Food Process Engineering and Technology". Elsevier, 2009.

IB8451 ANALYTICAL METHODS AND INSTRUMENTATION L T P C
3 0 0 3

AIM

To introduce students to the principles and methods of biological instruments.

OBJECTIVE

- To provide to the students the fundamentals of instrument knowledge and their applications in biology

OUTCOME

- Understanding the basic principles, instrumentation and applications of analytical techniques.

UNIT I OPTICAL SPECTROSCOPY **9**

Design of Experiments – Error Analysis – S/N ratio – Limit of Detection – UV –VIS Spectroscopy,
Applications, Instruments – single beam, double beam and Photo-diode array – applications – IR & Raman – Uses – Design – FT-IR, Raman.

UNIT II CHROMATOGRAPHY **9**

Distribution coefficients – solid-liquid, liquid-liquid and gas chromatography – theory of chromatography-normal phase & reverse phase chromatography – gel permeation – ion exchange & affinity chromatography – HPLC- Instrumentation & case studies.

UNIT III STRUCTURAL ELUCIDATION **9**

Nuclear Magnetic Resonance – Introduction-spin states – 1H, 13C NMR – Instrumentation-use in structural elucidation. Electron Paramagnetic Resonance-concept & instrumentation – use in metal containing proteins & membrane studies. X-Ray : X-ray spectroscopy –Auger – EELS Instrumentation & applications in Biology- X-ray diffraction- Instrumentation –small molecule & macromalecular crystallography.

UNIT IV MASS SPECTROMETRY **9**

Introduction – Instrumentation – CI, EI-Methods of Ionization- Methods for separation of Ions – Method for Detection. MALDI- TOF, ESI and FT-MS.

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UNIT V ELECTROCHEMICAL MEASUREMENTS **9**

Different types of electrochemical apparatus – Measuring Electrode potentials- Red-Ox proteins – Porous Silicon.

TOTAL : 45 PERIODS

TEXTBOOKS

1. Skoog, D.A. et al., "Principles of Instrumental Analysis". 6th Edition, Thomson/Brooks/ Cole, 2007.
2. Willard, Hobart H. et al., "Instrumental Methods of Analysis".7th Edition, CBS Publishers, 2008..
3. Braun, R.D. "Introduction to Instrumental Analysis". McGraw-Hill, 1987.

FT8411 HUMAN NUTRITION LAB **L T P C**
0 0 4 2

OBJECTIVES

- This course will enable the students to – be familiar with nutrient composition of foods
- To gain knowledge in quantitative methods in assessing nutritional status of individuals and groups

OUTCOME

- Understanding the food groups, constituents of food, energy from food
- Exposing to nutritional assessment, food constituents and their daily dietary allowances

EXPERIMENTS

1. Calculation and Computing of nutrient composition of foods
2. Comparison of Food Composition data bases
3. Clinical Signs - Need and importance, head to toe signs of normal health, identifying signs of PEM, Vitamin A deficiency ,nutritional anaemia and iodine deficiency,
4. Nutritional anthropometry - Standards for reference – WHO Growth Charts from birth to 18 years, Body Mass Index and reference value

5. Techniques of measuring height, weight, head, chest and arm circumference, waist to hip ratio, skin-fold thickness,
6. Calculation of percent Body fat using skin fold calipers
7. Normal weight, underweight and obesity classification based on percent body fat and BMI of individuals, Protein Energy Malnutrition in children, Chronic Energy deficiency in adults
8. Calculation of energy balance of individuals based on 3 day dietary recall.
9. Dietary survey of a group of individuals/community
10. Biochemical and Clinical tests/methods: urine, blood and serum tests for micro nutrients, cholesterol, sugar, total and differential count etc.

TOTAL : 60 PERIODS

IB8461 CHEMICAL ENGINEERING LAB L T P C
(Common for IBT, Food and Pharmaceutical Technology) 0 0 4 2

OBJECTIVES:

- To provide basic understanding of chemical engineering principles and operations
- Course will enable the students to apply the principles in other chemical engineering and biotechnology subjects offered in higher semesters

OUTCOMES:

Upon completion of this practical course the student will

- Have knowledge on the basic principles of chemical engineering
- Be able to apply the skill of material balance and energy balance in unit operations unit process of chemical engineering and biotechnology
- Be able to analyze the principles of chemical engineering and its applications in chemical, mechanical and biological perspectives
- Understand the design and working principles of fluid moving machinery and transport phenomena

List of Experiments:

1. Flow measurement a) Arifice meter b) Venturimeter, c) Rotameter
2. Pressure drop flow in pipes
3. Pressure drop in flow through packed column
4. Pressure drop in flow through fluidized beds
5. Chacteristics of centrifuge pump
6. Plate and frame filter Press

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7. Filteration in leaf filter
8. Heat transfer characteristics in heat exchanger
9. Simple and steam distillation
10. HETP in packed distillation
11. Ternary equilibrium in liquid-liquid extraction
12. Adsorption isotherm
13. Drying characteristics in a pan dryer

TOTAL : 60 PERIODS

TEXT BOOKS

1. McCabe, W.L., J.C. Smith and P.Harriot "Unit Operations of Chemical Engineering", 7th Edition, Mc Graw Hill, 2007.
2. Geankoplis, C.J. "Transport Processes and Separation process Principles", 4th Edition, PHI, 2006.

FT8501 FOOD ANALYSIS L T P C
3 0 0 3

AIM

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

OBJECTIVES

To understand the principles behind analytical techniques in food analysis

- To know the methods of selecting appropriate techniques in the analysis of food products.
- Appreciate the role of Food Analysis in food standards and regulation for the manufacture and the sale of food products and food quality control in food industries.
- To familiarize with the current state of Knowledge in food analysis.

OUTCOME

- Ability to apply knowledge in Identifying and determining the relative amounts of components in food sample.
- Knowledge on food standards, regulations and quality control.

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UNIT I INTRODUCTION **9**

Introduction, Food Regulations and Standards - Sampling methods - Sample preparation for analysis; Statistical evaluation of analytical data - Official Methods of Food Analysis. Moisture in foods - determination by different methods - ash content of foods, wet, dry ashing, microwave ashing methods; Significance of Sulphated Ash, water soluble ash and acid insoluble ash in foods; titratable Acidity in foods, determination of dietary fiber and crude fiber.

UNIT II LIPIDS, PROTEIN AND CARBOHYDRATE ANALYSIS **8**

Determination of Total fat in foods by different methods; Analysis of oils and fats for physical and chemical parameters, Quality standards, and adulterants; different methods of determination of protein and amino acids in foods; determination of total carbohydrates, starch, disaccharides and simple sugars in foods.

UNIT III SPECTROSCOPIC TECHNIQUES **9**

Basic Principles- Spectrophotometric analysis of food additives and food Components -IR Spectroscopy in online determination of components in foods; AAS and ICP-AES in mineral elements and toxic metals analysis; use of fluorimeter in vitamin assay- specfic use of Tintometer in vanaspathi analysis.

UNIT IV CHROMATOGRAPHIC TECHNIQUES **10**

Basic Principles, detection of adulterants in foods by paper chromatography and thin layer chromatography, column chromatography for purification analysis; analysis of food additives, sugars, phytochemicals and aflaotoxins, contaminants and other food components by HPLC, GC analysis of fatty acids, cis, trans Isomers - volatile oils, flavours and pesticides, contaminants and other volatile derivatives of food components; Significance MS detector in HPLC and GC.

UNIT V ELECTROPHORESIS, REFRACTOMETRY AND POLARIMETRY **9**

Basic Principles, application of electrophoresis in food analysis, refractive indices of oils and fats, total soluble solids in fruit juice and honey, specific rotation of sugars, estimation of simple sugars and disaccharides by polarimeter; Immunoassay techniques and its applications in foods.

TOTAL : 60 PERIODS

TEXT BOOKS

1. Nielson, S. Suzanne. “Food Analysis” 3rd Edition . Springer, 2003.

2. Pomeranz, Yeshajahu and Clifton E. Meloan “Food Analysis : Theory and Practice”, 3rd Edition, Springer, 2000.
3. Jacobs, Morris B. “ Chemical Analysis of Food and Food Products”. CBS Publishers,1999.

REFERENCES

1. Nollet, Leo M.L. “Handbook of Food Analysis” 2nd Edition, Vol. 1-3. Marcel Dekker, 2004.
2. Nollet, Leo M.L. “Food Analysis by HPLC”. 2nd Edition. Marcel Dekker, 2000.
3. Hurst, Jeffrey W. “Methods of Analysis for Functional Foods and Nutraceuticals” 2nd Edition, CRC Press, 2008.

FT8502 FUNDAMENTALS OF HEAT AND MASS TRANSFER L T P C

(Common for Food and Pharmaceutical Technology) 3 0 0 3

AIM

To understand the principles and applications of heat and mass transfer operations.

OBJECTIVES

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

OUTCOME

- Ability to acquire knowledge in
  - Mechanisms of heat transfer under steady and transient conditions.
  - Concepts of heat transfer through extended surfaces.
  - Thermal analysis and sizing of heat exchangers and
  - Basic concepts of mass transfer

UNIT I HEAT TRANSFER 11

Phenomena of heat transfer by conduction-concept of heat conduction resistances – application of heat conduction in series – heat transfer coefficient –heat convection phenomena- application for different situations –combined conduction and convection-overall heat transfer coefficient –application to design of heat exchangers- Principles of radiation heat transfer – Laws in radiation- View factor concepts – application.

UNIT II DIFFUSION & MASS TRANSFER COEFFICIENTS **8**

Diffusion in Mass Transfer – gas, liquid, solid diffusion and mass transfer-Diffusion in biological solutions-measurement of diffusion Coefficients – concept of mass transfer Coefficients - application for different situations.

UNIT III ABSORPTION **9**

Interphase mass transfer and overall mass transfer Coefficients – Absorption equipments-Hydraulics of Packed Absorbers-Process Design of Packed Absorbers-Concept of height of transfer units and number of transfer units in design.

UNIT IV DISTILLATION **9**

Vapour Liquid equilibrium and distillation-simple Distillation, Steam distillation, Flash distillation-Staged distillation Column-Design by McCabe-Thiele method-Enthalpy-Concentration diagrams and use in Distillation Column design.

UNIT V LIQUID EXTRACTION & LEACHING **8**

Principles of liquid-extraction-Equilibrium – staged extraction calculation – continuous extraction equipments; Principles of Leaching – equilibrium-staged leaching – Leaching equipments. Principles of adsorption - Design of packed adsorber.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Treybal, R.E. "Mass-Transfer Operations" 3rd Edition, McGraw-Hill, 1981.
2. Dutta, Binay, K. "Principles of Mass Transfer and Separation Process", PHI, 2007.
3. Nag, P.M. "Heat and Mass Transfer", 2nd Edition, Tata McGraw-Hill, 2007.
4. Geankoplis, C.J. "Transport Processes and Separation Process Principles" (Includes unit Operations) 4th Edition, PHI, 2003.

REFERENCES

1. Coulson, J.M. and et al. "Coulson & Richardson's Chemical Engineering", 6th Edition, Vol. I & II, Butterworth – Heinman (an imprint of Elsevier), 2004
2. McCabe, W.L., J.C. Smith and P.Harriot "Unit Operations of Chemical Engineering", 7th Edition, Mc Graw Hill, 2007.

Attested

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FT8551	BIOCHEMICAL ENGINEERING	LT P C
	(Common for Food and Pharmaceutical Technology)	3 0 0 3

AIM

To expose the students in Enzyme Studies and Overview of fermentation processes.

OBJECTIVE

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

Outcome

The student will be able to

- Understand the fundamentals of Enzyme kinetics, Inhibition kinetics and Immobilization
- Understand the concept of basic fermentation processes and its application during scale up operations.

UNIT I **9**

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

UNIT II **9**

Basic configuration of fermenter and ancillaries, main parameters to be monitored and controlled in fermentation processes.- Medium formulation for optimal growth and product formation- Medium optimization methods-Sterilization Concepts- Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid, media & air.

UNIT III **9**

Stoichiometry of cell growth and product formation, elemental balances, degrees of

reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients, energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT IV **9**

Modes of operation - batch, fed batch and continuous cultivation. Simple unstructured kinetic models for microbial growth, Monod model, growth of filamentous organisms, product formation kinetics - leudeking-piret models. Types of reactor- Air Lift Reactor,
Bubble Column Reactor, Immobilized enzyme reactors- packed bed, fluidized bed, membrane reactors.

UNIT V **9**

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. Shuler, M.L. and Kargi, F. “Bioprocess Engineering: Basic Concepts”, 2nd Edition, PHI, 2002.
2. Palmer, Trevor “Enzymes: Biochemistry, Biotechnology, Clinical Chemistry”, Affiliated East-West Press Pvt. Ltd., 2004.
3. Stanbury, P.F., A. Whitaker and S.J. Hall “Principles of Fermentation Technology”, 2nd Edition, Butterworth – Heinemann (an imprint of Elsevier), 1995.

REFERENCES

1. Doran, P.M. “Bioprocess Engineering Principles”, Academic Press, 1995.
2. Najafpour, D. Ghasem. “Biochemical Engineering & Biotechnology”. Elsevier, 2007.
3. Bryce, C.F.A and EL. Mansi. “Fermentation Microbiology & Biotechnology, 1999.
4. Blanch, H.W. and Clark, D.S. “Biochemical Engineering”, Marcel Decker Inc., 1997.
5. Moser, Anton. “Bioprocess Technology: Kinetics and Reactors”, Springer Verlag, 1988.

6. Bailey, J.E. and Ollis, D.F. "Biochemical Engineering Fundamentals" 2nd Edition, McGraw – Hill, 1988.
7. Lee, James M. "Biochemical Engineering", Prentice – Hall, 1992.
8. Wiseman, Alan "Handbook of Enzyme Biotechnology", 3rd Edition, Ellis Harwood Publications, 1999.
9. Hartmeier, Winfried "Immobilized Biocatalysts: An Introduction", Springer – Verlag,1986.

PM8551 CELL AND MOLECULAR BIOLOGY L T P C
4 0 0 4

OBJECTIVES

- To familiarize the students with the basic concepts and principles of nucleic acids in prokaryotic and eukaryotic organisms
- To understand the structure and machinery of nuclear functions responsible for cell functioning.

OUTCOME

- Familiarize fundamental mechanisms of gene expression and regulation at molecular level.

UNIT I CELL STRUCTURE AND FUNCTION OF THE ORGANELLES 12

Prokaryotic, Eukaryotic cells, Sub-cellular organelles and functions. Principles of membrane organization membrane proteins, cytoskeletal proteins. Extra cellular matrix, cell-cell junctions, various types of transport across cell membrane.

UNIT II CELL DIVISION, CANCER, APOPTOSIS AND IMMORTALIZATION OF CELLS 12

Cell cycle – Mitosis, Meiosis, Molecules controlling cell cycle, cancer, role of Ras and Raf in oncogenesis and apoptosis**.** Stem cells, immortalization of cells and its applications.

UNIT III CHEMISTRY OF NUCLEIC ACIDS & DNA REPLICATION 12

Introduction to nucleic acids: Nucleic acids as genetic material, Structure and

physicochemical properties of elements in DNA and RNA, Biological significance of differences in DNA and RNA. Primary structure of DNA: Chemical and structural qualities of 3', 5'-Phosphodiester bond. Secondary Structure of DNA: Watson & Crick model, Chargaff's rule, X–ray diffraction analysis of DNA, Forces stabilizes DNA structure, Conformational variants of double helical DNA, Hogsteen base pairing, Triple helix, Quadruple helix, Reversible denaturation and hyperchromic effect. Tertiary structure of DNA: DNA supercoiling.

Overview of Central dogma. Organization of prokaryotic and eukaryotic chromosomes. DNA replication: Meselson & Stahl experiment, bi–directional DNA replication, Okazaki fragments, Proteomics of DNA replication, Fidelity of DNA replication, Inhibitors of DNA replication, Overview of differences in prokaryotic and eukaryotic DNA replication, Telomere replication in eukaryotes.

UNIT IV TRANSCRIPTION **12**

Structure and function of mRNA, rRNA and tRNA. Characteristics of promoter and enhancer sequences. RNA synthesis: Initiation, elongation and termination of RNA synthesis, Proteomics of RNA synthesis, Fidelity of RNA synthesis, Inhibitors of transcription, Differences in prokaryotic and eukaryotic transcription. Basic concepts in RNA world: Ribozymes, RNA processing: 5'-Capping, Splicing-Alternative splicing, Poly 'A' tail addition and base modification.

UNIT V TRANSLATION **12**

Introduction to Genetic code: Elucidation of genetic code, Codon degeneracy, Wobble hypothesis and its importance, Prokaryotic and eukaryotic ribosomes. Steps in translation: Initiation, Elongation and termination of protein synthesis. Inhibitors of protein synthesis. Post-translational modifications and its importance.

TOTAL : 60 PERIODS

TEXT BOOKS

1. Friefelder, David, "Molecular Biology", 2nd Edition, Narosa Publishing House,1999.
2. Lewin Benjamin, "Genes IX" Jones and Bartlett, 2008.
3. Weaver, R.F. "Molecular Biology", 3rd Edition, McGraw Hill, 2005.

REFERENCES

1. Waston, J.D. "Molecular Biology of the Gene", 5th Edition, Pearson Education, 2004.
2. Walker, J.M. and R. Rapley "Molecular Biology and Biotechnology" 4th Edition, Panima, 2002.
3. Karp, Gerald. "Cell and Molecular Biology :Concepts and Experiments."2nd Edition,

John Wiley & Sons, 1999.
4. Lodish, Harvey et al., " Molecular Cell Biology," 6th Edition. W.H.Freeman, 2008.
5. Alberts, Bruce, "Molecular Biology of Cell", 5th Edition, Garland Science, 2008.
6. Cooper,G.M. "The Cell: A Molecular Approach, 4th Edition, ASM Press, 2007
7. Alberts, Bruce et al., "Essential Cell Biology", 2nd Edition, Garland Science, 2004

FT8511 BIOPROCESS LAB L T P C
0 0 4 2

AIM

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

OBJECTIVES:

- To study the sterilization principles and its role in bioreactor
- To design experiments to evaluate the performance of the bioreactor
- To develop enzyme immobilized processes.

OUTCOME:

- Obtain knowledge of sterilization and its role in bioreactor.
- Better understanding of bioreactor performance.
- Familiarize with thermal death kinetics and enzyme kinetics.

List of experiments:

1. Growth of bacteria – estimation of biomass, calculation of specific growth rate, yield coefficient
2. Medium optimization – Plackett Burman design, response surface methodology
3. Enzyme kinetics – Michaelis Menton parameter, effect of temperature and pH
4. Enzyme immobilization – gel entrapment,cross linking
5. Preparation of bioreactor, utilities for bioreactor operation
6. Thermal death kinetics
7. Batch sterilization design

8. Batch cultivation, estimation of kla – dynamic gassing method, exhaust gas analysis – carbon balancing, gas balancing
9. Fed batch cultivation, exhaust gas analysis – carbon balancing, gas balancing
10. Estimation of kla – sulphite oxidation method
11. Estimation of overall heat transfer coefficient

TOTAL : 60 PERIODS

REFERENCES

1. Bailey, J.E. and Ollis, D.F. "Biochemical Engineering Fundamentals" 2nd Edition, McGraw – Hill, 1988.
2. Lee, James M. "Biochemical Engineering", PHI, U.S.A.
3. Stanbury, P.F. et al. "Principles of Fermentation Technology", 2nd Edition, Butterworth – Heinemann / Elsevier, 1995.
4. El-Mansi, E.M.T. et al., "Fermentation Microbiology and Biotechnology", 2nd Edition, CRC / Taylor & Francis, 2007.
5. Peppler, H.J. and D. Perlman "Microbial Technology" (vol. I Microbial Processes and Vol. I Fermentation Technology)" 2nd Edition, Academic Press / Elsevier, 2004.

EQUIPMENT REQUIRED

- Shaker
- Laminar flow hood
- Spectrophotometer
- Laboratory scale reactor
- Table top centrifuge

FT8512 FOOD ANALYSIS LAB L T P C
0 0 4 2

OBJECTIVES

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

OUTCOME:

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

EXAMINATION OF TYPICAL FOOD PRODUCTS INCLUDING

a) Tea, Coffee and Cocoa
b) Milk and Milk Products
c) Edible oils and Fats
d) Cereal and Cereal products
e) Non alcoholic beverages and drinks
f) Spices and Condiments
g) Bakery, Confectionery products
h) Sugars and sweetening agents

LAB EXPERIMENTS

1. Determination of Moisture and Total solids in Honey and Fruit juices using refractometer.
2. PH, Conductivity, TDS, Chlorides and Alkalinity of Potable water.
3. Estimation of Acid Value and Peroxide value of Edible oils and Assessment of Rancidity.
4. Determination of Fat content of Biscuit and FFA of the Extracted Fat.
5. Determination of Melting point of vanaspathi and Test for Added Vitamin A
6. Estimation of Vitamin C in Fruit juices.
7. Estimation of Iron Content in Iron fortified food by Colorimeter /AAS.
8. Estimation of Benzoic acid in beverages.
9. Chromatographic separation of Food colors and estimation by spectrophotometer
10. Determination of sugars by polarimeter
11. Estimation of NVEE in chilly powder
12. Detection of Adulterants in oils and Fats
13. Detection of Adulterants in spices and spices powder
14. Microscopic examination of Coffee, tea and Chicory.

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TOTAL : 60 PERIODS

Attested

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REFERENCES

1. Raghuramulu, N. et al., “A Manual of Laboratory Techniques”. 2nd Edition. NIN, 2003.
2. Nielson, S. Suzanne. “Food Analysis” 3rd Edition . Springer, 2003.
3. Pomeranz, Yeshajahu and Clifton E. Meloan “Food Analysis : Theory and Practice”. 3rd Edition. Springer, 2000.

MG8654 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM

To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems

OUTCOME

- Ability to understand principles, practices and statistical techniques
- Ability to understand quality, systems, tools and techniques.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Basic concepts of TQM – TQM Framework - Contributions of Quality Gurus – Barriers to TQM – Cost of Quality.

UNIT II TQM PRINCIPLES 9

Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement – PDCA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II **9**

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures - BPR.

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits –Quality Council – Leadership, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward.

TOTAL : 45 PERIODS

TEXT BOOK

1. Besterfiled, Dale H. et al., "Total Quality Management", 4th Edition, Pearson Education Asia, 2006.

REFERENCES

1. Evans, James R. and William M. Lindsay, "The Management and Control of Quality". 6th Edition South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", 3rd Edition. Butterworth – Heinemann, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", PHI, 2006 .
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases". PHI, 2006.

FT8601 FOOD PROCESS ENGINEERING **L T P C**
3 0 0 3

AIM

The course aims to develop the knowledge of students in the area of vegetable and fruit processing and technology. This course will enable students to appreciate the application of scientific principles in the processing of these materials.

OBJECTIVES:

On completion of the course the students are expected to

- Be able to understand and identify the specific processing technologies used for Vegetables and fruits and the various products derived from these materials.

- Understand the application of scientific principles in the processing technologies specific to the materials.
- Grasp the changes in the composition of foods with respect to the type of processing technology used.

OUTCOME:

- Better understanding of specific processing technologies used for vegetables and fruits and its various products.
- Obtain knowledge in application of scientific principles in the processing technologies specific to the materials.
- Better knowing the changes in the composition of foods with respect to the type of processing technology used.

UNIT I BASIC COMPONENTS **9**

Construction and working of pipes, valves, pumps. Material of construction compatible with foods, basic principles in lay out.

UNIT II UNIT OPERATIONS IN FOOD INDUSTRY **9**

Basic principles of Grinding; prediction of Crushing efficiency; Laws of crushing, pulverization and ultrafine grinding, Classification of crushing equipment; Construction and working principle of mostly used equipments, viz., Jaw crushers, gyratory crushers etc.

UNIT III CONVEYORS AND SIEVES **9**

Classification of conveyors, selection of conveyors; conveying methods like belts, screw etc, Sieving and types of equipments

UNIT IV DRYING **9**

Basic principles, different methods of drying including, tunnel, sun, tray, spray drying and low temperature; design of dryer with mass and energy balance, drying time prediction.

UNIT V FREEZING AND EXTRUSION **9**

Principles of freezing and Chilling, freezing equipment and methods, freezing time and rate calculation; Principle, types and design of extruders.

TOTAL : 45 PERIODS

TEXTS BOOKS

1. Berk, Zeki "Food Process Engineering and Technology" Academic Press, 2009.
2. Smith, P.G. " Introduction to Food Process Engineering". Springer, 2004.
3. Toledo, Romeo T. "Fundamentals of Food Process Engineering". 3rd Edition, Springer, 2007.

REFERENCES

1. Rao, M.A. et al., "Engineering Properties of Foods". 3rd Edition. CRC/Taylor& Fransis, 2005.
2. Gopala Rao, Chandra "Essentials of Food Process Engineering". BS Publications, 2006.

FT8602 GENETIC ENGINEERING AND GM FOODS L T P C
3 0 0 3

OBJECTIVES:

Introduction to GM foods and their methods of production, advantages

- To study Genetically modified plants which are commercially available
- To study Transgenic animals and their engineering method
- To understand Genetically modified microorganisms and their applications in foods
- To know about Pharmaceutical applications of genetically engineered plants
- To understand Risk and safety assessment of the GM foods and their labeling

OUTCOME:

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

UNIT I BASICS OF RECOMBINANT DNA TECHNOLOGY 9

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

UNIT II DNA LIBRARIES **9**

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

UNIT III SEQUENCING AND AMPLIFICATION OF DNA **9**

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

UNIT IV TRANSGENIC TECHNOLOGY **9**

DNA microinjection, Retroviral vectors, Transgenic animals – Knock in and knock out animals, Transgenic plants – Ti plasmid.

UNIT V APPLICATIONS OF RDNA TECHNOLOGY IN FOODS **9**

Genetically engineered proteins: Bovine Somatotropin in Milk; Genetically engineered bacteria: Chymosin Lite beer; Tryptophan; Transgenic plants: Calgene Flavr Savr^{TM} tomato,Monsanto Round-UpTM Ready, Ciba Geigy BastaTM resistant crops; Edible vaccines:Cholera vaccine in potatoes; Transgenic Fish: Atlantic salmon.

TOTAL : 45 PERIODS

TEXTBOOKS

1. Rees, Andy "Genetically Modifies Food : A Short Guide for the Confused". Pluto Press, 2006.
2. Ahmed, Farid E. " Testing of Genetically Modified Organisms in Food". Food Products Press, 2004.

REFERENCES

1. Halford, Nigel G. "Genetically Modified Crops". Imperial College Press, 2003.

HS8561	EMPLOYABILITY SKILLS	L T P C
	(Lab / Practical Course)	0 0 2 1

(Common to all branches of Fifth or Sixth Semester B.E / B.Tech programmes)

OBJECTIVES

- To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
- To help them improve their soft skills, including report writing, necessary for the workplace situations

1. Making presentations – introducing oneself – introducing a topic – answering questions – individual presentation practice
2. Creating effective PPTs – presenting the visuals effectively
3. Using body language with awareness – gestures, facial expressions, etc.
4. Preparing job applications - writing covering letter and résumé
5. Applying for jobs online - email etiquette
6. Participating in group discussions – understanding group dynamics - brainstorming the topic
7. Training in soft skills - persuasive skills – sociability skills - questioning and clarifying skills – mock GD
8. Writing reports – collecting, analyzing and interpreting data – drafting the report
9. Attending job interviews – answering questions confidently
10. Interview etiquette – dress code – body language – mock interview

OUTCOMES:

At the end of the course learners should be able to

- Participate in conversations both formal and informal, attend phone calls and interviews successfully.
- Read different types of texts.
- Listen to, and understand foreign accents**.**

TOTAL : 30 PERIODS

Requirements for a class of 30 students

1. A PC or a lap top with one or two speakers
2. A Collar mike and a speaker

3. An LCD projector and a screen
4. CD's and DVD's on relevant topics
5. Individual chairs for conducting group discussions

REFERENCES

1. Dhanavel, S.P. "English and Soft Skills". Orient BlackSwan Ltd, 2010
2. Corneilssen, Joep. "How to Prepare for Group Discussion and Interview". Tata-McGraw-Hill, 2009.
3. D'Abreo, Desmond A. "Group Discussion and Team Building". Better Yourself Books, 2004.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh. "The ACE of Soft Skills". Pearson, 2010.
5. Gulati, Sarvesh. "Corporate Soft Skills". Rupa and Co., 2006.
6. Van Emden, Joan, and Lucinda Becker. "Presentation Skills for Students". Palgrave Macmillan, 2004.

EXTENSIVE READERS

1. Covey, Stephen R. "The 7 Habits of Highly Effective People". Free Press, 1989.
2. Bagchi, Subroto. "The Professional". Penguin Books, 2009.

WEB RESOURCES

1. www.humanresources.about.com
2. www.careerride.com

FT8611 CREATIVITY AND INNOVATION IN NEW FOOD PRODUCT DESIGN LAB **L T P C 0 0 4 2**

AIM

To study the various issues related to Creativity, Innovation and New Food Product Development.

OBJECTIVES

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

- To enable the students to understand the process of development of food products
- To develop ideas for new food products which are nutritious, cost effective and marketable

OUTCOME:

- Obtain knowledge to develop new product in food with creativity and innovation.
- Delivering good ideas for new products which are nutritious, cost effective and marketable

ACTIVITY

1. Market surveys to understand: Types of products, New products introduced in the market and Market trends for different products
2. Idea generation for new products: brain storming - different techniques
3. Assessing feasibility of the idea: Selection criteria - screening ideas for new products (evaluation techniques)
4. Product Concepts; factors to consider; concept methodology; Patent search - Patent laws - International code for patents - Intellectual property rights (IPR).
5. Product attributes and Concept testing using different approaches
6. Development of product specifications – design of prototype

TOTAL : 45 PERIODS

TEXT BOOKS

1. Brody, A.L. and J.B. Lord "Developing New Food Products for a Changing Market Place", 2nd Edition, CRC / Taylor & Francis, 2008.

REFERENCE BOOKS

1. Fuller, G. W. "New Food Product Development from Concept to Marketplace", CRC Press, Boca Raton
2. Lyon, D. H. "Guidelines for Sensory Analysis in Food Product Development and Quality Control", Chapman and Hall, 1992.
3. Robinson J, et al., "Design and Make It Food Technology", Nelson Thomes Ltd, 2001

FT8612 **FOOD PROCESSING LAB I** **L T P C**
0 0 4 2

OBJECTIVES

To develop skills related to

- Preservation of foods
- Use of various techniques and additives for food procssing and Preseravtion

OUTCOME

- Ability to select the specific preservation technology suitable for a specific food
- Ability to Process the different categories of food

EXPERIMENTS

1. Refrigeration and Freezing of vegetables and fruits
2. Drying of vegetables and fruits with and without additives - Drying rate studies including, constant rate and falling rate periods and the effects of various factors on them.
3. Osmotic drying of foods with salt and sugar.
4. Preparation of jams, jellies, syrups & squashes
5. Canning & bottling of vegetable and fruit products
6. Filtration and concentration of fruit juices
7. Production of extruded products.
8. Spray drying of juices/milk
9. Pasteusrisation of milk

TOTAL : 60 PERIODS

REFERENCES

1. Rahman, M.S. “Handbook of Food Preservation”, Marcel Dekker, 1999.
2. Ranganna, S. “Handbook of Canning and Aseptic Packaging” Vol. I, II & III, Tata McGraw – Hill, 2000.

FT8661	MOLECULAR BIOLOGY AND GENETIC ENGINEERING LAB	L T P C 0 0 4 2

OBJECTIVE

To provide an opportunity to experimentally verify the theoretical concepts of nucleic acids.
To make the student understand the basic tools in genetic engineering

OUTCOME
The students will perform various experiments to understand the role of Nucleic acids through different techniques.

LIST OF EXPERIMENTS

1. Isolation of total and plasmid DNA from bacteria.
2. Isolation of total DNA from plant and animal cells/tissues.
3. Restriction enzyme digestion of DNA.
4. Agarose gel electrophoresis of nucleic acids.
5. Elution of DNA from Agarose gels.
6. Polymerase Chain Reaction [PCR].
7. Ligation of DNA into expression vector.
8. Competent cell preparation, Transformation & Screening of recombinants.
9. Induction of recombinant protein expression
10. SDS-PAGE.
11. Western blotting.

TOTAL : 60 PERIODS

REFERENCES

1. Friefelder, David. “Molecular Biology”. 2nd Edition. Narosa 1987.
2. Ausubel, F.M. et al., “Short Protocols In Molecular Biology”. 4th Edition, John Wiley, 1999.
3. Sambrook, Joseph et al., “Molecular Cloning : A laboratory Manual”. 3rd Edition. Cold Spring Harbor, 2001.
4. Sambrook, Joseph et al., “The Condensed Protocols : From Molecular Cloning A Laboratory Manual”. Asian Books Pvt. Ltd., 2006.

FT8701 **FOOD PACKAGING TECHNOLOGY** **L T P C**
3 0 0 3

AIM

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

OBJECTIVES

To gain knowledge on

- The different types of materials and media used for packaging foods.
- Hazards and toxicity associated with packaging materials and laws, regulations and the monitoring agencies involved food safety, labeling of foods
- Methods of packaging, shelf life and food factors affecting packaging

OUTCOME

- Better Understandings of the various properties of food packaging materials

Ability to Select suitable packaging material for different food substances

UNIT I BASICS OF PACKAGING **6**

Packaging –Concepts, definition, Significance, classification. Packaging – Development, Retail/Unit; Packaging of foods –fresh and processed

UNIT II PACKAGING MEDIA & MATERIALS **12**

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

UNIT III PACKAGING SYSTEMS AND METHODS **12**

Vacuum packaging, gas flush packaging, CAP & MAP, aseptic & retort packaging, box in box. Food products-General classification and packaging types, varieties and trends Storage handling and distribution of packages-including pallets & containers

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UNIT IV PACKAGING DESIGN **7**

Food marketing and role of packaging; Packaging aesthetic and graphic design; Packaging –Laws and regulations

UNIT V ENVIRONMENTAL ISSUES IN PACKAGING **8**

Coding and marking including bar coding and Environmental, ecological & Economic issues, recycling and waste disposal.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Robertson, G.L. “Food Packaging : Principles and Practice”. 2nd Edition. Taylor & Francis, 2006.
2. Han, Jung H. “Innovations in Food Packaging”. Elsevier, 2005.
3. Ahvenainen, Raija. “Novel Food Packaging Techniques”. Wood Head Publishing, 2003.
4. Mathlouthi, M. “Food packaging and Preservation”. Aspen Publications, 1999.

FT8702 FOOD SAFETY, QUALITY AND REGULATION **L T P C 3 0 0 3**

AIM

To sensitize students about food safety and risks.

OBJECTIVES

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

OUTCOME

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

UNIT I INTRODUCTION **15**

Definition of food safety and concept of safe food; characterization of food hazards-physical, chemical and biological; adulteration, filth, plastics, pesticides, heavy metals; Changes due to food processing, trans fatty acids, pyrolytic and thermal decomposition products, urethane, mycotoxins, scrombotoxin, migration, cross - contamination, nitrates and related products, sulfites, phenolic antioxidants, non-nutritive sweeteners, colour additives, fat substitutes, chemical preservatives, veterinary drugs and antibiotics.

UNIT II MICROBIAL HAZARDS AND NATURAL SOURCE HAZARDS **8**

Allergens, goitrogens, lathyrogens, alkaloids, lectins, aflatoxins. Implementation of FSIS program for pathogen reduction; prevention of food-borne illness, dose-response, model risk assessment, management and communication; exposure assessment, monitoring; Structured model for microbial risk reduction, microbial biofilms, prevention of microbial hazards; Sanitation, antimicrobial plastics, intelligent packaging, headspace gas modification.

UNIT III MONITORING AND REGULATION **10**

HACCP, GMP; Surveillance networks, Consumer and food service operator education, function and roles of USFDA, USDA and EPA; Food Safety and Standards Act India 2006; Prevention of Food Adulteration Act, India, 1954; Responsibilities of the Food service operator, consumer protection, food audit.

UNIT IV SPECIAL FOODS SAFETY, HEALTH CLAIMS AND LABELLING **5**

Infant foods, formula foods, PKU, regulatory, industrial and international implications; fortified foods, sports nutrition, nutraceuticals, medical foods; Health claims; Labeling

UNIT V WORLD-WIDE FOOD SAFETY ISSUES **7**

GM Foods, safety and labeling; International Food Standards ISO 9000 and related

standards; Impact of food safety on global trade; Food safety in retail food businesses; international food service operators, institutional food service operators; application of the principals of modern hygiene .

TOTAL : 45 PERIODS

TEXT BOOKS

1. Fortin, N.D. “Food Regulation : Law, Science, Policy, and Practice”. John Wiley, 2009.
2. Lightbourne, Muriel “Food Security, Biological Diversity and Intellectual Property Rights” Ashgate, 2009.
3. Mehta, Rajesh and J. George “Food Safety Regulation Concerns and Trade : The Developing Country Perspective”. Macmillan, 2005.

FT8703 POST HARVEST TECHNOLOGY L T P C
3 0 0 3

AIM

The course aims to develop the knowledge of students in the area of post harvest processing of various foods and related technology. This course will enable students to appreciate the application of scientific principles in the processing of these materials.

OBJECTIVES

On completion of the course the students are expected to

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

OUTCOME

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

- Understandings of the application of scientific principles in the processing technologies specific to the materials.

UNIT I CEREALS AND PULSES **9**

Cereal Grains- Basic agricultural aspects, structure and composition; Storage, Insect control; Processing: Wheat - milling, (Atta and maida), quality aspects of flour, wheat proteins and their function; wheat based baked products – Bread, Biscuit, Cakes, Extruded products, malting and malt products; Rice- Milling, Parboiling, Quick cooking rice.

Pulses - Basic agricultural aspects, structure, composition, storage, insect control, processing- Milling/splitting, dhal milling, products – puffed, flakes, flour, soya milk, soy protein Isolate.

UNIT II VEGETABLES AND FRUITS **9**

Climatic and non climatic fruits, ripening process, phytonutrients in fruits and vegetables; Handling, transportation, controlled atmosphere ripening process, grading, cleaning, pretreatments, modified atmosphere packaging, chilling.

General pre-processing, different freezing methods and equipments, problems associated with specific fruits and vegetables;

Dehydration – General pre processing, different methods of drying, osmotic dehydration and other modern methods.

Canning - General pre-processing, specific or salient points in fruits and vegetables like – Blanching, exhausting, processing conditions. Fruit Juice / pulp/ Nectar/Drinks, concentrates Vegetable Purees/pastes.

UNIT III OIL SEEDS, NUTS AND SUGARS **9**

Basic agricultural aspects structure, composition, Storage, Insect control; processing: traditional and modern methods of oil extraction, refining, hydrogenation; oil blends.

Honey- Composition and Quality aspects; Sugars- Manufacture of table sugar, High Fructose corn syrup and Glucose syrup; Jaggery – sources, manufacture.

UNIT IV MILK AND MILK PRODUCTS **9**

Processing of Milk – Pasteurisation, homogenisation, sterilization, HTST and UHT processes; Processing and preservation of milk products - cream, sour cream, butter, ghee, skimmed

milk concentrate and skimmed milk powder, whey concentrate and whey powder, yoghurt, cheese and other products.

UNIT V MEAT, FISH & POULTRY **9**

Common and commercially important meats; pre and post slaughter handling, meat inspection and grading; animal welfare and safety in slaughter plant.

Structure and composition of meat, carcass chilling, ageing; storage of fresh meat - Modified atmosphere packaging, packaging of retail cuts; Processing and preservation - artificial tenderizing, chilling, freezing, curing, smoking, ready-to-eat meats and meat products; Kosher and Halal certification.

Marine and fresh water fish, shell fish - composition and nutrition; commercially important fish and shell fish; spoilage factors, ship board operations, storage and transport.

Processing and Preservation - chilling, freezing, canning, smoking, curing, salting and drying, fish meal and fish oils.

Types of poultry, production, classification & designation, grading.

Processing plant operations - slaughter, bleeding, scalding, defeathering, eviscerating, chilling, packaging; composition and nutrition, poultry meat products

Eggs- structure, composition, quality factors, storage, pasteurization, freezing and drying, egg substitutes.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Hamm, Wolf and Hamilton, R, J. “Edible Oil Processing”, Blackwell / Ane Books, 2004.
2. Morris, Peter C and Bryce, J.H. “Cereal Biotechnology”, CRC / Wood Head, 2000.
3. Arthey, David and Ashwat P.R. “Fruit Processing: Nutrition, Products, and Quality Management”, 2nd Edition, Springer, 2005.
4. Eckles, C.H., W.B. Combs and H. Macy “Milk and Milk Products”, 4th Edition, Tata McGraw-Hill, 1973.
5. Singh, I.S. “Post-Harvest Handling and Processing of Fruits and Vegetables” Westville Publishing, 2009.
6. Srivastava, A.P. et al., “Mechanisation of Vegetable Production and Post-Harvest Management”. Westville Publishing, 2009.

REFERENCES

1. Rajah, Kanes K. “Fats in Food Technology”, Blackwell / Ane Books, 2004.
2. Valpuesta, Victoriano “Fruit and Vegetable Biotechnology” CRC / Wood Head Publishing, 2002.
3. Mujumdar, A.S. “Dehydration of Products of Biological Orgin”, Oxfords IBH, 2004.
4. Alzamora, S.M., Tapia, M.S. and Lopez – Malo, A. “Minimally Processed Fruits and Vegetables: Fundamental Aspects and Applications”, Springer, 2005.
5. Salunkhe, D.K. and Kadam, S.S. “Handbook of Fruit Science and Technology: Production, Composition, Storage, and Processing”, Marcel Dekker, 2005.
6. “Agro – Food Processing: Technology Vision 2020 Fruits & Vegetables Current Status and Vision”, TIFAC, 1996.
7. Sofos, J.N. “Improving and Safety of Fresh Meat” Wood Head Publishing / CRC, 2005.

FT8711 **FOOD PROCESSING LAB II** **L T P C**
0 0 4 2

OBJECTIVES

To develop skills related to

- Preservation of foods
- Use of various techniques and additives for food processing

OUTCOME

Better knowledge of

- Properties of food material
- Drying technology for food products
- Various processing technologies

EXPERIMENTS

1. Retort processing of foods
2. Baking of cakes – plain cakes, sponge cakes, cup cake – quality characteristics; Effect of varying ingredients – emulsifiers, fat, sugar gums and processing conditions
3. Preparation of custard, puddings, mousse, flan, pie, tarts, doughnuts, biscuits
4. Baking of Bread - role of ingredients & processing

Attested

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5. Candies, toffees, fudges, pralines & brittles – Sugar crystallization & inhibition of crystal formation & soft centered sweets
6. Chocolates – role of ingredients and processing
7. Visit to a meat/sea food processing & preservation unit

TOTAL : 60 PERIODS

REFERENCES

1. Rahman, M.S. “Handbook of Food Preservation”, Marcel Dekker, 1999.
2. Ranganna, S. “Handbook of Canning and Aseptic Packaging” Vol. I, II & III, Tata McGraw – Hill, New Delhi, 2000
3. Pandey, H. et al., “Experiments in Food Process Engineering”. CBS Publishers, 2004.

FT8712 FOOD PRODUCT DEVELOPMENT AND EVALUATION LAB L T P C
0 0 4 2

OBJECTIVE

To introduce a basic knowledge about the process for developing food products with market perspective

OUTCOME

- Ability to Develop a new product through scientific approach
- Understanding the importance of packaging and nutritional labeling of food products.

Group projects to Develop Food Products at Laboratory scale

Project Identification: Products/Processes Review, Project Feasibility, Design and Product Specification

Project Planning: Identifying Objectives, Identifying Tools/Methods, Use of Information/ Communication Technology

Project Execution: Product Trials and Standardization, Product Quality Profiling – Sensory, Microbial, Nutrient, Shelf Life, Costing, Packaging and Labeling, Product Scale up feasibility

Project Presentation: Documentation and Report, Viva Voice

TOTAL : 60 PERIODS

TEXT BOOKS

1. Brody, A.L. and J.B. Lord "Developing New Food Products for a Changing Market Place", 2nd Edition, CRC / Taylor & Francis, 2008.
2. Side, Catherine "Food Product Development : Based on Experience". Iowa State Press, 2002.

REFERENCE BOOKS

1. Fuller, G. W. "New Food Product Development from Concept to Marketplace", 3rd Edition. CRC Press, 2011
2. Lyon, D. H. "Guidelines for Sensory Analysis in Food Product Development and Quality Control", Chapman and Hall, 1992.
3. MacFie, Hal "Consumer-led Food Product Development" Woodhead Pubishers, 2007.

FT8001 BAKING AND CONFECTIONERY TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES

This course will enable the student to

- Familiarize with the commercial methods of baking bread and recent advances
- Acquaint with the preparation of cakes and desserts
- Learn microbiological aspects of bakery products, sanitation and hygiene of baking industries.

OUTCOME

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

UNIT I COMMERCIAL BAKING AND CONFECTIONARY 9

Global status of bakery and confectionery industry; Raw materials and their quality parameters; chemical dough development, mechanical dough development, sheeting extrusion other rapid methods; Margarines/shortenings- production, types, applications.

UNIT II PRODUCTION OF BREAD 12

Variuos methods of production and effect of ingredients, formulations and process

parameters on quality; traditional bakery products; Multi grain bread and gluten free products; Rheological testing of dough- Farinograph, mixograph, extensograph, amylograph/ rapid visco analyser, Falling number; machinery used in baking industry. Microbiological aspects of different bakery products – prevention of bacterial rope and mold infection; Bakery hygiene and sanitation including control of rodents and pests. Bread faults – causes and remedies; Bread staling – theory, manifestation, retardation measures

UNIT III CAKES **9**

Cakes – flour specifications; ingredients, manufacturing process and quality evaluation; Basic methods of cake preparations, variety cakes and doughnuts, rusks, crakers, buns, muffins, pizza; Icings, glazers, creams, fondants, frostings; Cake recipe balancing, faults and remedies; Preparation of basic custards, pudding; Mousse.

UNIT IV CHOCOLATE AND CONFECTIONERY **9**

Confectionary manufacture- raw materials and processing; cocoa, sugar, special fats, dried milk products, emulsifiers; chocolate processing- compound coatings, candy bars, tempering, enrobing technology, chocolate shells.

Sugar confectionery – general technical aspects, manufacture of boiled sweets, lollipops, lozenges, gums and jellies, chewing gums, caramel, toffee, fudge. Indian Confectionery – Types , role of sugar in preparation, other ingredients and their role in preparation

UNIT V COSTING ECONOMICS & MARKETING **6**

Costing economics & Marketing of processes and products, including energy required and auditing; Project Preparation for Baking Unit and Layout; Bakery management and marketing

TOTAL : 45 PERIODS

TEXT BOOK

1. Matz, Samuel A. “Bakery Technology and Engineering” 3rd edition. CBS Publishers, 2008.

REFERENCES

1. Stanley Cauvain and Linda Young “Baked Products- Science, Technology and practice”. Blackwell Publishing, 2006.
2. Amendola, Joseph and Nicole Rees “The Baker’s Manual” 5th Edition. Wiley, 2003.

3. Hamed Faridi and, Jon M. Faubion “Dough Rheology and Baked Product Texture”. CBS Publishers, 1997.
4. Duncan, Manley “Biscuit, Cookie and Cracker Manufacturing Manuals”. Vol.1-6. Woodhead Publishing

FT8002 BIOLOGY AND CHEMISTRY OF FOOD FLAVOURS **L T P C**
3 0 0 3

OBJECTIVE

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

OUTCOME

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

UNIT I INTRODUCTION **9**

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

UNIT II FLAVOUR COMPOUNDS **9**

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

UNIT III THE CHEMICAL SENSES **9**

Anatomy of the chemical senses; neural development of the chemical senses; receptor mechanisms, neural coding; the control of eating.

UNIT IV FLAVOUR ANALYSIS **9**

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

UNIT V TEACHING FLAVOUR CONCEPTS **9**

Problem based learning; tongue and nose; Onion-Beverage-Maillard reaction-Thio-stench

TOTAL : 45 PERIODS

TEXT BOOKS

1. Fisher, Carolyn "Food Flavours : Biology and Chemistry". Royal Society of Chemistry, 1997
2. Heath, H.B. and G.Reineccius "Flavor Chemistry and Technology". CBS, 1996.
3. Ashurst, Philip R. " Food Flavorings". 3rd Edition. Aspen Publication, 1999.

REFERENCES

1. Reineccius, Gary "Flavor Chemistry and Technology". 2nd Edition. Taylor & Francis, 2006.
2. Hofman, Thomas, Chi-Tang-Ho and Wilhelm Pickenhagen "Challenges in Taste Chemistry and Biology ". ACS Publications, 2003.
3. Charalambous, G. "Food Flavors : Generation, Analysis and Process Influence". Elsevier, 1995.

FT8003 CEREAL TECHNOLOGY L T P C
3 0 0 3

AIM

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

OBJECTIVES

On completion of the course the students are expected to

- Be able to understand and identify the specific processing technologies used for cereals
- Understand the application of scientific principles in the processing technologies specific to the materials.

OUTCOME

Better Knowledge of fundamentals of cereals and pulses processing, equipments, products.

UNIT I PRODUCTION, STRUCTURE AND COMPOSITION **6**

Status, major growing areas and production of cereals and millets in India and the world, structure and chemical composition of cereals and millets; nutrient content and anti-nutritional factors.

UNIT II WHEAT AND RICE **15**

Storage, Insect control, Processing: Wheat – classification, wheat grain quality and milling, (Atta and maida), quality aspects of flour, wheat proteins and their function, rheology of flour; wheat based baked products – Bread, Biscuit, Cakes, Extruded products, Pizza, Chapatis, malting and malt products; instant flour mixes.

Varieties of rice grown in India and other countries; Storage, Insect control; Processing: Rice - Milling, and sorting; Parboiling, Polishing; Quick cooking rice, factors affecting quality of rice, Traditional Indian Products- Puffed Rice, flaked rice, Idli/Dosa/vada mixes and other instant products. Bran, germ and novel products from wheat / rice.

UNIT III OTHER CEREALS **9**

Corn - Wet and dry milling, Corn Products – Corn flakes, Corn starch, canned corn products, puffed product; HFCS; Oats- Milling, Oat Products – Steel cut, rolled oats, quick cooking; Rye bread; Traditional and Fermented cereal products

UNIT IV MILLETS **6**

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

UNIT V BAKED AND EXTRUDED PRODUCTS **6**

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. Matz, Samuel A. " The Chemistry and Technology of Cereals as Food and Feed" 2nd Edition, CBS, 1996.
2. Delcour, Jan A. and R. Carl Hoseney. "Principles of Cereal Science and Technology". 3rd Edition. American Association of Cereal Chemists, 2010.
3. Kulp, Karel "Handbook of Cereal Science and Technology". 2nd Edition,CRC Press, 2000.
4. Morris, Peter C. and James H Bryce "Cereal Biotechnology". CRC / Woodhead, 2000

FT8004 DAIRY PRODUCT TECHNOLOGY L T P C
3 0 0 3

AIM

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

OBJECTIVES

On completion of the course the students are expected to

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

OUTCOME

- Better understandings of the specific processing technologies used for milk and the various products derived from milk.
- Knowledge of application of scientific principles in the processing technologies specific to the materials.

Attested

DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.

UNIT I PROCESSING OF MILK **9**

Technology of milk and dairy products; Pasteurisation, sterilization, HTST and UHT processes.

UNIT II MILK PRODUCTS **9**

Manufacture of condensed milk, milk powder, cheese, ice-cream, butter, ghee, malted products, evaporated and dried products.

UNIT III MILK SUBSTITUTES **9**

Substitutes for milk and milk products. Casein , lactose and other by-products.

UNIT IV TECHNOLOGY OF BABY FOODS **9**

Weaning foods, therapeutic foods; Fortification and enrichment; Traditional dairy products. Milk confections.

UNIT V QUALITY PARAMETERS **9**

Judging and grading of milk; National and international standards of milk and milk products, in plant sanitation and hygiene.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Lampert, Lincoln M. “Modern Dairy Products: Composition, Food Value, Processing, Chemistry, Bacteriology, Testing, Imitation Dairy Products”. Chemical Publishing Company, 1998.
2. Selia, dos Reis Coimbra and Jose A. Teixeir “Engineering Aspects of Milk and Dairy Products” , CRC Press, 2009.

FT8005 **FOOD ADDITIVES** **L T P C**
3 0 0 3

AIM

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

OBJECTIVES

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

OUTCOME

- Better Understandings of functions of different food additives in improving the shelf life, quality, texture and other physical and sensory characteristics of foods.
- Knowledge of Regulations and the monitoring agencies involved in controlling the safer use of additives in foods

UNIT I FOOD ADDITIVES **9**

Definition; their function in food processing and preservation; Preservatives – definition; natural preservatives; chemical preservatives; acidulants and low pH – organic acids and esters; sulphur dioxide and its salts; nitrites; antibiotics; surface preservation; Permitted preservatives in foods – Antioxidants; natural and chemical antioxidants; mechanism of antioxidant function; primary and secondary antioxidants; sequestrants; selection and application of antioxidants in foods; evaluation of antioxidant effectiveness – permitted antioxidants in foods.

UNIT II FOOD COLORS **9**

Natural and synthetic colors; fake colors; inorganic pigments; application of colors in food industry; restriction on the use of colors in foods. Flavoring agents – concept of flavors in foods; natural flavors; nature identical flavors; artificial flavoring substances; restrictions on the use of flavoring agents in foods.

UNIT III EMULSIFIERS AND STABILIZERS **9**

Definition; properties; HLB value; function of emulsifiers and stabilizers in foods; permitted emulsifiers and stabilizers used in foods; polyols – physical and chemical properties of polyols, application in food industry, permitted polyols in foods.

UNIT IV SWEETENERS **9**

Natural and chemical sweeteners; nutritive and non-nutritive sweeteners; chemical structure & sweetness; saccharine, acesulfame K, aspartame, sucrolose; restriction on the use of sweeteners in foods; Food acids – their function and application in foods; permitted food acids; nutritive additives; enrichment of foods.

UNIT V FOOD SAFETY **9**

Food – Safety in the use of food additives in foods; regulations and monitoring agencies; toxicological evaluation of additives; interaction of additives with food ingredients.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Brennen, Alfred Larry. "Food Additives". 2nd Edition, CRC, .
2. Clydesdale, Fergus M. "Food Additives- Toxicology Regulation and Properties". CRC Press.
3. Mahindrulu, S.N. "Food Additives- Characteristics Detection and Estimation". TATA McGraw Hill.

FT8006 FOOD ALLERGY AND TOXICOLOGY **L T P C**
3 1 0 4

OBJECTIVES

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

OUTCOME

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

UNIT I INTRODUCTION **12**

Definition and need for understanding food toxicology; Hazards - Microbiological, nutritional and environmental.

Basics of immune resources - humoral and cell media resources. Allergen and mechanism of allergic resources.

UNIT II FOOD ALLERGY AND SENSITIVITY **12**

Chemistry of food allergens, celiac disease, food disorders associated with metabolism, lactose intolerance, and asthma

UNIT III PRINCIPLES OF TOXICOLOGY **12**

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

UNIT IV DETERMINATION OF TOXICANTS IN FOOD SAMPLING **12**

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

UNIT V TOXICANTS FORMED DURING FOOD PROCESSING **12**

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

TOTAL : 45 PERIODS

TEXTBOOKS

1. Helferich, William and Carl K.Winter “Food Toxicology” CRC Press, 2001.
2. Alluwalia, Vikas “Food Hygiene and Toxicology” Paragon International Publishers, 2007
3. Shibamoto, Taka yuki and Leonard F.Bjeldanzes “Introduction to Food Toxicology” 2nd Edition. Academic Press, 2009.

4. Maleki, Soheila J. A.Wesley Burks, and Ricki M.Helm “Food Allergy” ASM Press, 2006.

REFERENCES

1. Labbe, Ronald G. and Santos Garcia “Guide to Food Borne Pathogens” John Wiley & Sons, 2001.
2. Cliver, Dean O. and Hans P.Riemann “Food Borne Diseases” 2nd Edition., Academic Press/Elsevier, 2002.
3. Riemann, Hans P. and Dean O. Cliver “Food Borne Infections and Intoxications” 3rd Edition., Academic Press/Elsevier, 2006

FT8007 FRUIT AND VEGETABLE TECHNOLOGY L T P C
3 0 0 3

AIM

The course aims to develop the knowledge of students in the area of vegetable and fruit processing and technology. This course will enable students to appreciate the application of scientific principles in the processing of these materials.

OBJECTIVES

On completion of the course the students are expected to

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

OUTCOME

- Thorough Knowledge of the specific processing technologies used for vegetables and fruits and the various products derived from these materials.
- Better Understandings of the application of scientific principles in the processing technologies specific to the materials.
- Understand the changes in the composition of foods with respect to the type of processing technology used.

UNIT I BASIC AGRICULTURAL ASPECTS OF VEGETABLES AND FRUITS 8

Ability to identify all commercially important fruits and vegetables with their names in important Indian languages, important regions, season, basic aspects of cultivation, harvest (Good Agricultural practices) permitted pesticides and stages of application, yield

UNIT II FRESH FRUITS AND VEGETABLES 8

Climatic and non climatic fruits, ripening process, phytonutrients in fruits and vegetables; Handling, transportation, controlled atmosphere ripening process, grading, cleaning, pretreatments, modified atmosphere packaging, chilling.

UNIT III FREEZING & DEHYDRATION OF FRUITS AND VEGETABLES 12

General pre processing, different freezing methods and equipments, problems associated with specific fruits and vegetables; Dehydration – General pre processing, different methods of drying including sun, tray, spray drying and low temperature, osmotic dehydration and other modern methods; Indian Food Regulation and Quality assurance.

UNIT IV CANNING, PUREES AND JUICES 12

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

UNIT V FRUIT AND VEGETABLE PRODUCTS 5

Ready to eat vegetable products, Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys, Fruit Bar, Soup powders, Candied Fruits, Natural colors, Fruit and Vegetable Fibres- General and specific processing, different packing including aseptic. Indian Food Regulation and Quality assurance

TOTAL : 45 PERIODS

TEXTBOOKS

1. Fellows, P J. “Food Processing Technology : Principles and Practice”. 2nd Edition, CRC/ Woodhead, 1997.

2. Salunke,D. K and S. S Kadam “Hand Book of Fruit Science and Technology : Production, Composition, Storage and Processing”. Marcel Dekker, 1995.
3. Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.
4. Desrosier, N.W. and Desrosier, J.N. “The Technology of Food Preservation”, 4th Edition. CBS,1987.
5. Khetarpaul, Neelam, “Food Processing and Preservation”, Daya Publications, 2005.

FT8008 FUNCTIONAL FOODS AND NUTRACEUTICALS L T P C
3 0 0 3

OBJECTIVES

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

OUTCOME

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

UNIT I INTRODUCTION AND SIGNIFICANCE **6**

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

UNIT II ANALYSIS OF PHYTOCHEMICALS **12**

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

UNIT III ASSESSMENT OF ANTIOXIDANT ACTIVITY **12**

In vitro and In vivo methods for the assessment of antioxidant activity, Comparison of different In Vitro methods to evaluate the antioxidant, Prediction of the antioxidant activity of

natural phenolics from electrotopological state indices, Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources

UNIT IV ROLE IN HEALTH AND DISEASE **12**

Nutraceuticals and Functional foods in Gastrointestinal disorder, Cancer, CVD, Diabetic Mellitus, HIV and Dental disease; Importance and function of probiotic, prebiotic and synbiotic and their applications, Functional foods and immune competence; role and use in obesity and nervous system disorders.

UNIT V SAFETY ISSUES **6**

Health Claims, regulations and safety issues- International and national.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Bisset, Normal Grainger and Max Wich H "Herbal Drugs and Phytopharmaceuticals", 2nd Edition, CRC, 2001.
2. Wildman, Robert "Handbook of Nutraceuticals and Functional Foods". CRC, 2006.
3. Webb, P P. "Dietary Supplements and Functional Foods". Blackwell, 2006.
4. Ikan, Raphael "Natural Products: A Laboratory Guide", 2nd Edition, Academic Press / Elsevier, 2005.
5. Tipnis, H.P. "Bioavailability and Bioequivalence : An Update" New Age International,

REFERENCES

1. Shi, John, Fereidoon Shahidi and Chi-Tang Ho "Asian Functional Foods". CRC/Taylor & Francis, 2007 .
2. Watson, Robald Ross "Functional Foods and Nutraceuticals in Cancer Prevention". Blackwell Publishing, 2007.
3. Gibson, G.R. and C.M.Willams. "Functional Foods : Concept to Product". Woodhead, 2000
4. Hanson, James R. "Natural Products: The Secondary Metabolites", Royal Society of Chemistry, 2003.

FT8009 **GENETICALLY MODIFIED FOODS** **L T P C**
3 0 0 3

AIM

To familiarize the students with the concepts of Genetic Engineering involved in foods

OBJECTIVES

To introduce the Technology involved in Genetic modification of plant and animal food products

OUTCOME
Better understandings of concepts involved in Transgenic foods and Animal cloning.

UNIT I GENETIC ENGINEERING AND FOODS I **9**

Genetically engineered proteins, Bovine Somatotropin in Milk; Genetically engineered bacteria, Chymosin Lite beer; Tryptophan,Transgenic plants, Calgene Flavr SavrTM tomato; Methionine-enriched oil

UNIT II GENETIC ENGINEERING AND FOODS II **9**

Frost-resistance Drought and Salinity resistance, Herbicide Resistance , Monsanto Round-Up TM Ready ,Ciba Geigy BastaTM resistant crops Insect Resistance: *Bacillus* thuringiensis toxin ,Ciba Geigy, B.t. maize ,Monsanto Golden Harvest Seeds, Fungal Resistance Bintje potatoes,Virus Resistance.

UNIT III PLANT PHARMACEUTICALS **9**

Beta -carotene in rice, transgenic “heart-healthy” canola oil; Edible vaccines, Hepatitis B vaccine in maize, Cholera vaccine in potatoes

UNIT IV TRANSGENIC ANIMALS **9**

Growth hormone gene in pigs, *alpha*-lactalbumin and lactoferrin in milk, Transgenic Fish, Atlantic salmon

UNIT V ANIMAL CLONING **9**

Biotechnology: Benefits, Risks and Public Perceptions; the Environment, the Third World, the Western World, Europe's Mistrust.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Rees, Andy "Genetically Modifies Food : A Short Guide for the Confused". Pluto Press, 2006.
2. Ahmed, Farid E. "Testing of Genetically Modified Organisms in Food". Food Products Press, 2004.

REFERENCE

1. Halford, Nigel G. "Genetically Modified Crops". Imperial College Press, 2003.

FT8010 INSTRUMENTATION AND PROCESS CONTROL L T P C
3 0 0 3

AIM

To familiarize the students with concepts of process dynamics and control leading to control system design

OBJECTIVE

To introduce dynamic response of open and closed loop systems, control loop components and stability of control systems along with instrumentation.

OUTCOME

Better understandings on concepts of process dynamics and control leading to control system design.

UNIT I INSTRUMENTATION **6**

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

UNIT II OPEN LOOP SYSTEMS **11**

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

UNIT III CLOSED LOOP SYSTEMS **10**

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

UNIT IV FREQUENCY RESPONSE **9**

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

UNIT V ADVANCED CONTROL SYSTEMS **9**

Introduction to advanced control systems, cascade control, feed forward control, Smith predictor controller, control of distillation towers and heat exchangers, introduction to computer control of chemical processes.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Stephanopoulos, G., "Chemical Process Control", PHI, 2003.
2. Coughnowr, D., "Process Systems Analysis and Control ", 2nd Edition., McGraw Hill,1991.

REFERENCES

1. Marlin, T. E., "Process Control ", 2nd Edition, McGraw Hill, 2000.
2. Smith, C. A. and Corripio, A. B., "Principles and Practice of Automatic Process Control", 2nd Edition., John Wiley,1997.

FT8011 **MANAGEMENT OF FOOD WASTE** **L T P C**
3 0 0 3

OBJECTIVES

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

Outcome

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

UNIT I CLASSIFICATION & CHARACTERIZATION OF FOOD INDUSTRY WASTE 8

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

UNIT II WASTE FROM MEAT, DAIRY AND VEGETABLE PROCESSING INDUSTRY 9

Classification, analysis and disposal of waste from meat; Bioremediation and utilization of dairy waste. Treatment of water from fruit and vegetable processing industry

UNIT III TREATMENT METHODS OF WASTE FROM FOOD INDUSTRY 9

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

UNIT IV RECYCLING AND UTILIZATION OF WASTE PRODUCT FROM FOOD INDUSTRY 10

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

UNIT V REGULATORY ISSUES WITH FOOD INDUSTRY WASTE 9

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. Herzka, A. and Booth, R.G. “Food Industry and Trade: Recycling Waste”. Applied Science Publishers, 1981.
2. Tegge, G., Green, J. H., and A. Kramer. “Food Processing Waste Management;: AVI Publishing, 1979 .

REFERENCES

1. Vasso Oreopoulou and Winfried Russ. “Utilization of by-products and Treatment of Waste in the Food Industry”. Springer, 2007.
2. Ioannis S. Arvanitoyannis. “Waste Management for the Food Industries”. Academic Press, 2008.

FT8012 MEAT, POULTRY AND FISH TECHNOLOGY L T P C
3 0 0 3

AIM

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

OBJECTIVES

On completion of the course the students are expected to

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

OUTCOME

Thorough understandings and Knowledge of

Processing technologies involved in Fish, meat, poultry industries

Preservation technologies involved in Fish, meat, poultry industries

Safety issues, Regulation and Quality assurance in animal products.

UNIT I MEAT & MEAT PROCESSING **12**

Common and commercially important meats; pre and post slaughter handling, meat inspection and grading; animal welfare and safety in slaughter plant.

Structure and composition of meat, carcass chilling, ageing; storage of fresh meat- Modified atmosphere packaging, packaging of retail cuts; Processing and preservation- artificial tenderizing, chilling, freezing, curing, smoking, sausage manufacture, ready-to-eat meats and meat products;

Kosher and Halal certification, safety issues, regulation and quality assurance.

UNIT II POULTRY **9**

Types of poultry, production, classification & designation, grading, Processing plant operations-slaughter, bleeding, scalding, defeathering, eviscerating, chilling, packaging; composition and nutrition, poultry meat products; safety issues, regulation and quality assurance.

UNIT III EGGS **6**

Eggs- structure, composition, quality factors, storage, pasteurization, freezing and drying, egg substitutes; regulation and Quality assurance.

UNIT IV FISH & FISH PROCESSING **9**

Marine and fresh water fish, shell fish- composition and nutrition commercially important fish and shell fish, names in important Indian languages, important regions, season; spoilage factors, ship board operations, storage and transport.

Processing and Preservation-chilling, freezing, canning, smoking, curing, salting and drying, fish meal and fish oils; ready-to-eat fish and other sea food products; safety issues, Indian regulation and quality assurance.

UNIT V EXTRUDED FOOD PRODUCTS **9**

Principle, types and design of extruders, factors affecting extrusion performance, types of extruded foods - pasta , meat substitutes, textured plant and milk proteins, specialty foods; uses and advantages of extrusion technology; packaging of extruded products; regulation and quality assurance.

TOTAL : 45 PERIODS

TEXT BOOK

1. Eckles, C.H., W.B. Combs and H. Macy "Milk and Milk Products", 4th Edition, Tata McGraw-Hill, 1973.

REFERENCE

1. Sofos, J.N. "Improving and Safety of Fresh Meat" Wood Head Publishing / CRC, 2005.

FT8013 PULSE AND OIL SEED TECHNOLOGY **L T P C**
3 0 0 3

AIM

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

OBJECTIVES

On completion of the course the students are expected to

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

OUTCOME

Knowledge in

- processing technologies used for pulses and oil seeds and the various products derived from these materials.
- application of scientific principles in the processing technologies specific to the materials.
- changes in the composition of foods with respect to the type of processing technology used.

UNIT I PULSES AND LEGUMES **9**

Basic agricultural aspects, structure, composition, storage, insect control, processing of pulses – Pre-treatment of pulses for milling, Milling/splitting, dhal milling, methods to improve recovery.

UNIT II PULSE PRODUCTS PROCESSING **9**

Legume-based products - puffed, flakes, flours, traditional flour based Indian sweets and savouries; fermented products.

UNIT III SOYA PROCESSING **9**

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

UNIT IV OIL SEEDS AND NUTS **9**

Basic agricultural aspects structure, composition, Storage, Insect control; types of oilseeds used for edible oil processing: coconut, groundnut, sesame, sunflower seed, safflower seed, canola, mustard, palm kernel.

Nuts – types, structure, nutrient and phytochemical composition; raw and processed nuts.

UNIT V OIL SEED PROCESSING **9**

Traditional and modern methods of oil extraction, refining, bleaching, deodorizing, hydrogenation; interesterification and esterification; salad oils, shortenings, hard butters,

margarine, spreads and dressings for foods, toppings, oil blends; applications of different oils and fats in food processing & products; oil seed meals; associated toxins.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Lawson, Harry "Food Oils and Fats : Technology, Utilization, and Nutrition". CBS Publishers, 1997.
2. Hamm, Wolf and Richard J Hamilton "Edible Oil Processing" Blackwell Publishing, 2004
3. Gunstone, Frank D. "The Chemistry of Oils and Fats : Sources, Composition, Properties and Uses" Blackwell Publishing, 2004.

REFERENCES

1. Rajah, Kanes K. "Fats in Food Technology", Blackwell / Ane Books, 2004.
2. Sivasankar, B. "Food Processing & Preservation", Prentice Hall of India, 2002.

FT8014 REFRIGERATION AND COLD CHAIN L T P C
3 0 0 3

OBJECTIVE

- To understand the underlying principles of operation in different refrigeration & Air conditioning systems and components.
- To provide knowledge on basic design aspects of Refrigeration & Air conditioning systems.

OUTCOME

- To include the students with the knowledge of refrigeration and air conditioning.

UNIT I MEANING AND IMPORTANCE OF COLD CHAIN, CHART 9

What is cold chain? Need for the chain for chilled / frozen food item, various links of the chain; importance of shelf- life; just – in-time deliveries; Temperature limits;-in various countries-
Europe, US, Australia etc; Chilling and freezing;- Chilling injury, cook-chilling systems; cold –

shortening; PPP and TTT concepts; Temperature monitoring; -Critical temperatures; Temperature –time indicators(TTI); Time –temperature –correlation-the kinetic approach, effective temperature; Transportation regulations; Role of packaging in cold chain – MAS, MAP, CAS, CAP etc; Thaw indicators.

UNIT II MICRO ORGANISMS AND THE COLD CHAIN **9**

Micro organisms and their growth phases; response of micro organisms; Inactivation mechanism during Chilling and freezing; Rapid freezing and slow thawing;Categories (groups) of Organisms in respect of their ability to survivor under Cold / Chilling environment; Cold shock proteins and cold shock response. Thawing techniques, microbial quality of thawed foods.

UNIT III PRINCIPLES AND METHODS OF REFRIGERATION **9**

Concepts of systems and surrounding; meaning of refrigeration; Types of refrigeration; vapour compression-the refrigerating cycle, capacity, COP etc; Power consumption , efficiency factors;
Refrigeration cycle as a series of thermodynamics processes refrigeration cycle; COP, capacity
– in vapour absorption refrigeration; comparative study between the above types of refrigeration; Types of refrigerants –their advantages / disadvantages; Refrigeration load demands and their calculation; closed cycle air refrigeration (CCAR); Cryogenic refrigeration; Freezing time – their prediction models, etc. Types freezer; - Blast freezer, Cryogenic tunnel freezer, spiral freezer, fluidized – bed freezer, Tumbling & rotary tunnel freezer, etc; Choosing the right freezer.

UNIT IV SHELF – LIFE OF FOOD PRODUCTS **9**

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

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

UNIT V HAZARD ANALYSIS CRITICAL CONTROL POINTS (HACCP) 9

Definition; Purpose; origins of HACCP; Developing the HACCP plan; Preliminary steps- the five –step process-HACCP team assembly, Defining the product and its usage; Constructing the flow diagrams; On-Site confirmation of flow diagram, etc. The 7-point HACCP system: - conducting a hazard analysis; Identifying CCPs; Establishing limits for each CCP; Estabilishing monitoring procedure for critical limits; Corrective actions to be established; Procedures-setting for verification;

Establish documentation and record maintaining. Top-Management Commitment & involvement; Tranining of personnel; Implementation and integrating HACCP system with ISO, TQM, etc.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Evans, Judith "Frozen Food Science and Technology". Wiley-Blackwell , 2008.
2. Kennedy, Chris J. "Managing Frozen Foods ". CRC Press, 2000.

FT8015 TRADITIONAL FOODS L T P C
3 0 0 3

AIM

To help students understand the diversity of foods, food habits and patterns in India with focus on traditional foods.

OBJECTIVES

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

Outcome

- Detailed Understanding of historical and traditional perspective of foods and food habits
- Knowledge in Methods and production process of Traditional foods.
- Aware of Health benefits of Traditional foods.

UNIT I HISTORICAL AND CULTURAL PERSPECTIVES **9**

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

UNIT II TRADITIONAL METHODS OF FOOD PROCESSING **9**

Traditional methods of milling grains – rice, wheat and corn – equipments and processes as compared to modern methods. Equipments and processes for edible oil extraction, paneer, butter and ghee manufacture – comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation – sun-drying, osmotic drying, brining, pickling and smoking.

UNIT III TRADITIONAL FOOD PATTERNS **9**

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

UNIT IV COMMERCIAL PRODUCTION OF TRADITIONAL FOODS **12**

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

UNIT V HEALTH ASPECTS OF TRADIONAL FOODS **6**

Comparison of traditional foods with typical fast foods / junk foods – cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments /illnesses.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Sen, Colleen Taylor “Food Culture in India” Greenwood Press, 2005.
2. Davidar, Ruth N. “Indian Food Science: A Health and Nutrition Guide to Traditional Recipes: East West Books, 2001.

FT8651 PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT L T P C
3 0 0 3

AIM

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

OBJECTIVES

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

OUTCOME

Thorough knowledge of principles of cost estimation, feasibility analysis, management, organization and quality control

UNIT I PRINCIPLES OF PRODUCTION MANAGEMENT AND ORGANISATION 15

Planning, organization, staffing, coordination, directing, controlling, communicating, organization as a process and a structure; types of organizations; Method study; work measurement techniques; basic procedure; motion study; motion economy; Principles of time study; elements of production control; forecasting; planning; routing; scheduling; dispatching; costs and costs control, inventory and inventory control.

UNIT II ENGINEERING ECONOMICS FOR PROCESS ENGINEERS - INTEREST, INVESTMENT COSTS AND COST ESTIMATION 10

Time Value of money; capital costs and depreciation, estimation of capital cost,

manufacturing costs and working capital, invested capital and profitability.

UNIT III PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENT 8

Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

UNIT IV ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE 4

Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.

UNIT V ECONOMIC BALANCE AND QUALITY AND QUALITY CONTROL 8

Essentials of economic balance – Economic balance approach, economic balance for insulation, evaporation, heat transfer. Elements of quality control, role of control charts in production and quality control.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Peters, M. S. and Timmerhaus, C. D., "Plant Design and Economics for Chemical Engineers", 5th Edition. McGraw Hill, 2002
2. Holand, F.A., Watson, F.A. and Wilkinson, J.K., "Introduction to Process Economics", 2nd Edition. John Wiley, 1983.
3. Narang, G.B.S. and Kumar, V., "Production and Costing", Khanna Publishers, 1988.

REFERENCES

1. Allen, L.A., "Management and Organization", McGraw-Hill.
2. Perry, R. H. and Green, D., "Chemical Engineer's Handbook", 7th Edition. McGraw-Hill.

GE8071 FUNDAMENTALS OF NANO SCIENCE L T P C
3 0 0 3

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

OUTCOMES:
Upon completing this course, the students

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

UNIT I INTRODUCTION **10**

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

UNIT II PREPARATION METHODS **10**

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES **5**

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT IV PREPARATION ENVIRONMENTS **10**

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

UNIT V CHARECTERISATION TECHNIQUES **10**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

TOTAL : 45 PERIODS

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., Nanomaterials: Synthesis, Properties and Applications, (Institute of Physics Publishing, Bristol and Philadelphia, 1996)

2. N John Dinardo, Nanoscale charecterisation of surfaces & Interfaces, Second edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

1. G Timp (Editor), Nanotechnology, AIP press/Springer, 1999
2. Akhlesh Lakhtakia (Editor) The Hand Book of Nano Technology, "Nanometer Structure", Theory, Modeling and Simulations. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

IB8072 BIOLOGICAL SPECTROSCOPY L T P C
3 0 0 3

OBJECTIVES:

- To deliver the knowledge of spectroscopic techniques and its functions
- To provide the technical information of spectroscopy for biological applications

OUTCOMES:

Upon completion of this course, the student would be able
understand

Basics of optical rotary dispersion methods and nuclear magnetic resonance

- Principles and applications of mass spectrometry and X-ray diffraction
- About the microscopic techniques and applications
- And apply the spectroscopic techniques for various biological applications

UNIT I OPTICAL ROTATORY DISPERSION 5

Polarized light – optical rotation – circular dichroism – circular dichroism of nucleic acids and proteins.

UNIT II NUCLEAR MAGNETIC RESONANCE 10

Chemical shifts – spin – spin coupling – relaxation mechanisms – nuclear overhauser effect – multidimensional NMR spectroscopy – detemination of macromolecular structure by nmr – magnetic resonance imaging.

UNIT III MASS SPECTROMETRY **10**

Ion sources sample introduction – mass analyzers and ion detectors – biomolecule mass sepctrometry – peptide and protein analysis – carbohydrates and small molecules – specific applications.

UNIT IV X-RAY DIFFRACTION **10**

Scattering by x- rays – diffraction by a crystal – measuring diffraction pattern – Bragg reflection
– unit cell – phase problem – anomalous diffraction – detemination of crystal structure – electron and neutron diffraction.

UNIT V SPECIAL TOPICS AND APPLICATIONS **10**

Electron microscopy – transmission and scanning electron microscopy – scanning tunneling and atomic force microscopy – combinatorial chemistry and high throughput screening methods.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Banwell, Colin N. and Elaine M. McCash "Fundamentals of Molecular Spectroscopy",4th Edition. TataMcGraw-Hill, 1995.
2. Hammes, Gordon G. "Spectroscopy for the Biological Sciences". Wiley Interscience, 2005.
3. Pavia,Donald L., Gary M. Lampman and George S.Kriz "Introduction to Spectroscopy". 3rd Edition. Thompson/Brooks/Cole, 2001.
4. Aruldas, G. "Molecular Structure and Spectroscopy". 2nd Edition. PHI, 2007.
5. Siuzdak, Gary "Mass Spectrometry for Biotechnology". Academic Press, 2005.

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IB8751 BIOINFORMATICS AND COMPUTATIONAL BIOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To improve the programming skills of the student
- To let the students know the recent evolution in biological science.

OUTCOMES:

Upon completion of this course, students will be able to

- Develop bioinformatics tools with programming skills.
- Apply computational based solutions for biological perspectives.
- Pursue higher education in this field.
- Practice life-long learning of applied biological science.

UNIT I INTRODUCTION 9

Basic UNIX commands – telnet – ftp – protocols – hardware – topology -search engines – search algorithms.

UNIT II DATABASES 9

Data management – data life cycle – database technology – interfaces and implementation – biological databases and their uses

UNIT III PATTERN MATCHING & MACHINE LEARNING 9

Pairwise sequence alignment – local vs. global alignment – multiple sequence alignment – dot matrix analysis – substitution matrices – dynamic programming – bayesian methods – tools – BLAST – FASTA- machine learning – neural networks – statistical methods – Hidden Markov models.

UNIT IV PHYLOGENY 9

Introduction; mutations; irrelevant mutations; controls; mutations as a measure of time; distances; reconstruction; distances between species; estimating time intervals from distances.

UNIT V ADVANCED TOPICS IN BIOINFORMATICS 9

Biomolecular and cellular computing – micro array analysis – systems biology.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Bergeron,B. “Bioinformatics Computing”. PHI, 2002.
2. Westhead, D.R., Parish, J.H., Twyman, R.M., “Instant Notes In Bioinformatics”. BIOS Scientific Publishers, 2000.
3. Gibas, C. and Jambeck,P. “Developing Bioinformatics Skills”, O’Reilly, 1999.

REFERENCES

1. Baxevanis, A.D. “Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins”, John Wiley, 1998.
2. Gusfield, Dan “Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology”. Cambridge University Press, 1997.
3. Lesk, A.M. “Introduction to Bioinformatics”, Oxford University Press, 2003.
4. Attwood, T.K. “Introduction to Bioinformatics” Addison Wesley Longman, 1999.
5. Gautham, N. “Bioinformatics: Databases and Algorithms”, Narosa, 2006.

IB8752 DOWNSTREAM PROCESSING L T P C
3 0 0 3

OBJECTIVES:

To enable the students to

- Understand the methods to obtain pure proteins, enzymes and in general about product development R & D
- Have depth knowledge and hands on experience with on Downstream processes

OUTCOMES:

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

- Define the fundamentals of downstream processing for product recovery
- Understand the requirements for successful operations of downstream processing
- Describe the components of downstream equipment and explain the purpose of each
- Apply principles of various unit operations used in downstream processing and enhance problem solving techniques required in multi-factorial manufacturing environment in a structured and logical fashion

UNIT I DOWNSTREAM PROCESSING **10**

Introduction to downstream processing, principles, characteristics of biomolecules and bioprocesses. Cell disruption for product release – mechanical, enzymatic and chemical methods. Pretreatment and stabilisation of bioproducts.

UNIT II PHYSICAL METHODS OF SEPARATION **6**

Unit operations for solid-liquid separation - filtration and centrifugation.

UNIT III ISOLATION OF PRODUCTS **12**

Adsorption, liquid-liquid extraction, aqueous two-phase extraction, membrane separation – ultrafiltration and reverse osmosis, dialysis, precipitation of proteins by different methods.

UNIT IV PRODUCT PURIFICATION **12**

Chromatography – principles, instruments and practice, adsorption, reverse phase, ion-exchange, size exclusion, hydrophobic interaction, bioaffinity and pseudo affinity chromatographic techniques.

UNIT V FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS **5**

Crystallization, drying and lyophilization in final product formulation.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Belter, P.A., E.L. Cussler and Wei-Houhu “Bioseparations – Downstream Processing for Biotechnology”, John Wiley, 1988.
2. Sivasankar, B. “Bioseparations : Principles and Techniques”. PHI, 2005.
3. Asenjo, Juan A. “Separation Processes in Biotechnology”. CRC / Taylor & Francis, 1990.

REFERENCES

1. Jenkins, R.O. “Product Recovery in Bioprocess Technology”. BIOTOL Series, Butterworth-Heinemann, 1992.
2. Janson, J.C. and Ryden, L. “Protein Purification : Principles, High Resolution Methods and Applications”. VCH, 1989.
3. Scopes, R.K. “Protein Purification : Principles and Practice”. 3rd Edition. Narosa, 1994.

IB8753 **IMMUNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

- To discuss the structure, functions and integration of immune system.
- To explain the antigen-antibody interactions and how the immune system is protecting the body from foreign pathogens/germs.
- To explain various techniques of monoclonal and engineered antibodies (important therapeutic molecules) production, for treating most of the human diseases.

OUTCOMES:

- The students after completing the course would be aware of immune system structure and functions.
- The students would be aware of immunity to various pathogens
- The students would be aware of how to produce the therapeutic/diagnostic molecules.
- The students would be aware of tumour, allergy and hypersensivity reactions.

UNIT I INTRODUCTION **6**

Cells of immune system; innate and acquired immunity; primary and secondary lymphoid organs; antigens: chemical and molecular nature; haptens; adjuvants; types of immune responses; theory of clonal selection.

UNIT II CELLULAR RESPONSES **12**

Development, maturation, activation and differentiation of T-cells and B-cells; TCR; antibodies: structure and functions; antibodies: genes and generation of diversity; antigen-antibody
reactions; monoclonal antibodies: principles and applications; antigen presenting cells; major histocompatibility complex; antigen processing and presentation; regulation of T-cell and B-cell responses.

UNIT III INFECTION AND IMMUNITY **16**

Injury and inflammation; immune responses to infections: immunity to viruses, bacteria, fungi and parasites; cytokines; complement; immunosuppression, tolerance; allergy and hypersensitivity; AIDS and Immunodeficiencies; resistance and immunisation; Vaccines.

UNIT IV TRANSPLANTATION AND TUMUR IMMUNOLOGY **8**

Transplantation: genetics of transplantation; laws of transplantation; tumor immunology.

UNIT V AUTO - IMMUNITY **3**

Autoimmunity, Autoimmune disorders and diagnosis.

TOTAL : 45 PERIODS

TEXTBOOKS

1. Male, David. etal., "Immunology". 7th Edition. Mosby Publication, 2006.
2. Kindt, Thomas J. etal., "Kuby Immunology". 6th Edition. W.H Freeman & Co., 2007.
3. Khan, Fahim Halim. "The elements of Immunology". Pearson Education, 2009.
4. Chakravarty, Ashim K. "Immunology and Immunotechnology". Oxford University Press, 2006.

REFERENCE

1. Coico, Richard, et al., "Immunology : A Short Course". 5th Edition. Wiley-Liss, 2003.

GE8072 DISASTER MANAGEMENT **L T P C**
3 0 0 3

OBJECTIVES:

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

UNIT I INTRODUCTION TO DISASTERS **9**

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

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of-community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

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

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

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

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

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

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

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

TEXTBOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423

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Anna University, Chennai-600 025.

2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

GE8073 HUMAN RIGHTS L T P C
3 0 0 3

OBJECTIVES :

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

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

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

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO’s, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

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

REFERENCES:

1. Kapoor S.K., “Human Rights under International law and Indian Laws”, Central Law Agency, Allahabad, 2014.
2. Chandra U., “Human Rights”, Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.