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OBJECTIVES:

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

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 and 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) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); 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 and effect / compare and 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 and 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 and telecast from Radio and 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 and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

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

OUTCOMES:
Learners should be able to

- speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents

TEXTBOOKS:

REFERENCES:

EXTENSIVE Reading (Not for Examination)

WEBSITES:

TEACHING METHODS:
- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.
EVALUATION PATTERN:

Internal assessment: 20%
3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like
- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.
- Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

End Semester Examination: 80%

MA6151 MATHEMATICS – I

OBJECTIVES:
- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- 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.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES

UNIT II SEQUENCES AND SERIES

UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.
UNIT IV  DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES  9+3

UNIT V  MULTIPLE INTEGRALS  9+3

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

OUTCOME:
• This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

TEXT BOOKS:

REFERENCES:

PH6151  ENGINEERING PHYSICS – I  L T P C
3  0  0  3

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

UNIT I  CRYSTAL PHYSICS  9
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II  PROPERTIES OF MATTER AND THERMAL PHYSICS  9
UNIT III QUANTUM PHYSICS

UNIT IV ACOUSTICS AND ULTRASONICS

UNIT V PHOTONICS AND FIBRE OPTICS

OUTCOME:
- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXT BOOKS:
1. Arumugam M. Engineering Physics. Anuradha publishers, 2010

REFERENCES:
1. Searls and Zemansky. University Physics, 2009
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011

TOTAL: 45 PERIODS

CY6151 ENGINEERING CHEMISTRY - I LT P C
3 0 0 3

OBJECTIVES:
- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.

To acquaint the students with the basics of nano materials, their properties and applications.

**UNIT I  POLYMER CHEMISTRY**
9
Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

**UNIT II  CHEMICAL THERMODYNAMICS**
9
Terminology of thermodynamics - 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 (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van’t Hoff isotherm and isochore (problems).

**UNIT III  PHOTOCHEMISTRY AND SPECTROSCOPY**
9

**UNIT IV  PHASE RULE AND ALLOYS**
9

**UNIT V  NANOCHEMISTRY**
9
Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

**OUTCOME:**
- The knowledge gained on polymer chemistry, thermodynamics, spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

**TEXT BOOKS:**
REFERENCES:

GE6151 COMPUTER PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:
The students should be made to:
- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION

UNIT II C PROGRAMMING BASICS

UNIT III ARRAYS AND STRINGS

UNIT IV FUNCTIONS AND POINTERS

UNIT V STRUCTURES AND UNIONS
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
OUTCOMES:
At the end of the course, the student should be able to:
• Design C Programs for problems.
• Write and execute C programs for simple applications.

TEXTBOOKS:

REFERENCES:

GE6152 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.

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
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 traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.
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.

COMPUTER AIDED DRAFTING (Demonstration Only)  3
Introduction to drafting packages and demonstration of their use.

TOTAL: 75 PERIODS

OUTCOMES:
On Completion of the course the student will be able to
- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

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

GE6161 COMPUTER PRACTICES LABORATORY LT P C

OBJECTIVES:
The student should be made to:
• Be familiar with the use of Office software.
• Be exposed to presentation and visualization tools.
• Be exposed to problem solving techniques and flow charts.
• Be familiar with programming in C.
• Learn to use Arrays, strings, functions, structures and unions.

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 – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Apply good programming design methods for program development.
• Design and implement C programs for simple applications.
• Develop recursive programs.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:
Standalone desktops with C compiler 30 Nos.
(or)
Server with C compiler supporting 30 terminals or more.

GE6162 ENGINEERING PRACTICES LABORATORY LT P C
OBJECTIVES:

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

GROUP A (CIVIL & MECHANICAL)

I  CIVIL ENGINEERING PRACTICE

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:

   Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:

   Wood work, joints by sawing, planing and cutting.

II  MECHANICAL ENGINEERING PRACTICE

Welding:

(a) Preparation of arc welding of butt joints, lap joints and tee joints.
(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays, funnels, etc.
(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example –
   Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.
GROUP B (ELECTRICAL & ELECTRONICS)

III  ELECTRICAL ENGINEERING PRACTICE

10

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

IV  ELECTRONICS ENGINEERING PRACTICE

13

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

TOTAL: 45 PERIODS

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.

REFERENCES:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

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

**MECHANICAL**

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

**ELECTRICAL**

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

**ELECTRONICS**

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

**GE6163 PHYSICS AND CHEMISTRY LABORATORY – I**

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

**LIST OF EXPERIMENTS**
(Any FIVE Experiments)

1. (a) Determination of Wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of Young’s modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster’s Bridge
OUTCOME:
- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee’s Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster’s bridge set up
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY- I

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

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of DO content of water sample by Winkler’s method.
2. Determination of chloride content of water sample by argentometric method.
3. Determination of strength of given hydrochloric acid using pH meter.
4. Determination of strength of acids in a mixture using conductivity meter.
5. Estimation of iron content of the water sample using spectrophotometer.
   (1,10- phanthroline / thiocyanate method).
7. Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

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

REFERENCES:
1. Iodine flask - 30 Nos
2. pH meter - 5 Nos
3. Conductivity meter - 5 Nos
4. Spectrophotometer - 5 Nos
5. Ostwald Viscometer - 10 Nos

Common Apparatus: Pipette, Burette, conical flask, porcelain tile, dropper (each 30 Nos.)

HS6251 TECHNICAL ENGLISH II

OBJECTIVES:
- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

UNIT I

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like 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 and 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

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 / her success, thanking one’s friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students’ dialogues.

UNIT III

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning; Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for 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 and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

UNIT IV
9+3
Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, - Role play and mock interview for grasping 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 and 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 – Checklist - 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; Language Lab - Different models of group discussion.

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

OUTCOMES:
Learners should be able to
• speak convincingly, express their opinions clearly, initiate a discussion, negotiate, 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.
• listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

TEXTBOOKS:

REFERENCES:

EXTENSIVE Reading (Not for Examination)

Websites
2. http://owl.english.purdue.edu

TEACHING METHODS:
- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

EVALUATION PATTERN:

Internal assessment: 20%
- 3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like
  - Project
  - Assignment
  - Report
  - Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

End Semester Examination: 80%
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 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.

UNIT I VECTOR CALCULUS 9+3
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green’s theorem in a plane, Gauss divergence theorem and Stokes’ theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelipeds.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 9+3
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy’s and Legendre’s linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III LAPLACE TRANSFORM 9+3

UNIT IV ANALYTIC FUNCTIONS 9+3
Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w = z+k, kz, 1/z, z², e^z and bilinear transformation.

UNIT V COMPLEX INTEGRATION 9+3
Complex integration – Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula – Taylor’s and Laurent’s series expansions – Singular points – Residues – Cauchy’s residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

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

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.
TEXT BOOKS:

REFERENCES:

PH6251 ENGINEERING PHYSICS – II L T P C
3 0 0 3

OBJECTIVES:
• To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I  CONDUCTING MATERIALS 9

UNIT II  SEMICONDUCTING MATERIALS 9

UNIT III  MAGNETIC AND SUPERCONDUCTING MATERIALS 9
Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV  DIELECTRIC MATERIALS 9
UNIT V  ADVANCED ENGINEERING MATERIALS  9

TOTAL: 45 PERIODS

OUTCOMES:
- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

TEXT BOOKS:

REFERENCES:

CY6251  ENGINEERING CHEMISTRY - II  L T P C
3  0  0  3

OBJECTIVES:
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

UNIT I  WATER TECHNOLOGY  9
Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming-desalination of brackish water –reverse osmosis.

UNIT II  ELECTROCHEMISTRY AND CORROSION  9

UNIT III  ENERGY SOURCES  9
Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion-
differences between nuclear fission and fusion - nuclear chain reactions - nuclear reactor power generator - classification of nuclear reactor - light water reactor - breeder reactor - solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery - lithium battery- fuel cell $\text{H}_2 - \text{O}_2$ fuel cell - applications.

UNIT IV ENGINEERING MATERIALS

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement - manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement - properties and uses. Glass - manufacture, types, properties and uses.

UNIT V FUELS AND COMBUSTION


TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

GE6253 ENGINEERING MECHANICS

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

UNIT I BASICS AND STATICS OF PARTICLES

UNIT II EQUILIBRIUM OF RIGID BODIES 12
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 12

UNIT IV DYNAMICS OF PARTICLES 12

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12
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

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.

TEXT BOOKS:

REFERENCES:
GE6252 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L T P C
4 0 0 4

OBJECTIVES:

- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS

12
Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS

12

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS

12

UNIT IV DIGITAL ELECTRONICS

12
Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING

12
Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 PERIODS

OUTCOMES:

- ability to identify the electrical components explain the characteristics of electrical machines.
- ability to identify electronics components and use of them to design circuits.

TEXT BOOKS:

REFERENCES:

GE6262 PHYSICS AND CHEMISTRY LABORATORY – II

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

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of Young’s modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid – Poiseuille’s method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

OUTCOMES:
- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. Spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.
   a. (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY - II

OBJECTIVES:
- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of alkalinity in water sample
2. Determination of total, temporary & permanent hardness of water by EDTA method
3. Estimation of copper content of the given solution by EDTA method
4. Estimation of iron content of the given solution using potentiometer
5. Estimation of sodium present in water using flame photometer
6. Corrosion experiment – weight loss method
7. Conductometric precipitation titration using BaCl₂ and Na₂SO₄
OUTCOMES:
- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

REFERENCES:

- Laboratory classes on alternate weeks for Physics and Chemistry.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Potentiometer - 5 Nos
2. Flame photo meter - 5 Nos
3. Weighing Balance - 5 Nos
4. Conductivity meter - 5 Nos

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (30 Nos each)

GE6261 COMPUTER AIDED DRAFTING AND MODELING LABORATORY

LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building ( Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

NOTE: PLOTTING OF DRAWINGS MUST BE MADE FOR EACH EXERCISE AND ATTACHED TO THE RECORDS WRITTEN BY STUDENTS.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:
1. Pentium IV computer or better hardware, with suitable graphics facility - 30 No.
2. Licensed software for Drafting and Modeling – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 No.

MA6351  TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS  

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OBJECTIVES
To facilitate the understanding of the mathematical principles on transforms and partial differential equations and to cultivate the art of formulating physical problems in the language of mathematics.

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

UNIT II  FOURIER SERIES  

UNIT III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  
Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV  FOURIER TRANSFORMS  

UNIT V  Z - TRANSFORMS AND DIFFERENCE EQUATIONS  

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

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

TEXT BOOKS:

REFERENCES:

FD6301 PRINCIPLES OF CHEMICAL ENGINEERING  L T P C
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.

UNIT I BASIC PRINCIPLES OF STOICHIOMETRY 9
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 UNIT OPERATIONS 9
Introduction to size reduction - Size Separation – Drying - Evaporation, Distillation – Basic concept and equipment used in the operations.

UNIT III UNIT PROCESS 9

UNIT IV FLUID MECHANICS 9

UNIT V AGITATION FLOW THROUGH PACKINGS, FLUIDZATION, FLUID TRANSPORT


TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

FD6302 FOOD PROCESS CALCULATIONS

OBJECTIVE
To make them understand different types of laws of chemistry of materials and also prepare the students to accurately calculate the stoichiometric relations between the materials involved in the unit operation process.

UNIT – I

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

UNIT – II

Fundamental Calculations and Humidity: Use of partial pressure and pure component volume ingas calculations, applications of real gas relationship in gas calculation. Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity - Use of humidity in condensation and drying - Humidity chart, dew point.

UNIT – III
Material Balance: Stoichiometric principles, Application of material balance to unit operations like distillation, evaporation, crystallization, drying, extraction, Leaching.

Combustion: Determination of Composition by Orsat analysis of products of combustion of solid, liquid and gas fuels - Calculation of excess air.

UNIT – IV 9+3


UNIT – V 9+3

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

TOTAL : 60 PERIODS

(Use of Psychometric chart is permitted in the examination)

TEXT BOOKS

REFERENCES

FD6303 FOOD MICROBIOLOGY L T P C 3 0 0 3

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.

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 FOOD BORNE ILLNESS

Factors affecting spoilage of foods, Microbial flora associated with various food groupstheir spoilage potential. Microbiological spoilage problems associated with typical food products.

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 III  MICROBES IN FOOD FERMENTATIONS

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

UNIT IV  MICROBIAL AGENTS OF FOOD BORNE ILLNESS

Food borne infections and food poisoning, Microbial toxins - 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

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; 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

REFERENCES
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 isentropic flow with the area changes, shock waves, operation of convergence and divergence nozzles, compressible duct flow with friction.

TOTAL : 45 PERIODS

TEXT BOOKS

FD6305 FOOD CHEMISTRY L T P C
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.

**UNIT I CARBOHYDRATES**

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**

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**

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 WATER**

A. **WATER**

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

B. **MINERALS & VITAMINS**

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

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

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**

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

**UNIT V FOOD GROUPS & COMPOSITION**

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

**TOTAL : 45 PERIODS**

**TEXT BOOKS**

REFERENCES

FD6311 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.

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

FD6312 FOOD CHEMISTRY LAB

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.

EXPERIMENTS
1. Preparation and measurement of pH of standard buffers (phosphate, carbonate, borate, TRIS etc.)
2. Qualitative analysis of carbohydrates
3. Quantitative analysis of carbohydrates (Benedict, DNS method)
4. Enzymatic hydrolysis of glycogen by α and β amylase
5. Quantitative analysis of proteins (Lowry, Bradford, UV method)
6. Qualitative analysis of lipids (triglycerides, cholesterol, phospholipids etc.)
7. Estimation of Viscosity and refractive index of foods
8. Specific gravity and Oxidative rancidity of fat and oils
9. Enzymatic Browning in foods
10. Iso-electric precipitation of casein, Effect of rennin on milk proteins
11. Gelling properties of starch
12. Acid hydrolysis and action of salivary amylase on starch
13. Enzymatic hydrolysis of sucrose and measurement of optical rotation.

TOTAL: 60 PERIODS

REFERENCES

MA6468 PROBABILITY AND STATISTICS

AIM
This course aims at providing the required skill to apply the statistical tools in engineering problems.
OBJECTIVES
The students will have a fundamental knowledge of the concepts of probability.
Have knowledge of standard distributions which can describe real life
phenomenon. Have the notion of sampling distributions and statistical
techniques used in 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 TESTING OF HYPOTHESIS 9 + 3
Sampling distributions - Tests for single mean, proportion, Difference of means (large
and small samples) – Tests for single variance and equality of variances – χ²-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 - 2² -
factorial design.

UNIT V STATISTICAL QUALITY CONTROL 9 + 3
Control charts for measurements (=and R charts) – Control charts for attributes (p, c
and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
1. Devore, J.L., “Probability and Statistics for Engineering and the Sciences”, 7th
2. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., “Probability and Statistics for

FD6401 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.
OBJECTIVE

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

PREREQUISITE

Basic knowledge in chemistry, physics and food chemistry.

UNIT I

INTRODUCTION

Introduction, food regulations and standards; sampling methods, and sample preparation for analysis; statistical evaluation of analytical data. General methods of food analysis - Moisture determination by different methods; ash analysis - different methods; titrable acidity in foods; determination of crude fiber and dietary fiber.

UNIT II

LIPIDS, PROTEINS AND CARBOHYDRATE ANALYSIS

Analysis of oils and fats for physical and chemical parameters and quality standards, protein analysis by different techniques; analysis of carbohydrates by different techniques.

UNIT III

SPECTROSCOPIC TECHNIQUES

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

UNIT IV

CHROMATOGRAPHIC TECHNIQUES

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

UNIT V

ELECTROPHORESIS, REFRACTOMETRY AND POLARIMETRY

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

TOTAL: 45 PERIODS

TEXT BOOKS


REFERENCES

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.

UNIT I HEAT TRANSFER

UNIT II DIFFUSION & MASS TRANSFER COEFFICIENTS
Diffusion in Mass Transfer – gas, liq, 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
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
Vapour Liquid equilibrium and distillation-simple Distillation, Steam distillation, Flash distillation-Staged distillation Column-Design by Mc Cabe-Thiele method-Enthalpy-Concentration diagrams and use in Distillation Column design.

UNIT V LIQUID EXTRACTION & LEACHING

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
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.

UNIT I PROCESSING OF FOOD AND ITS IMPORTANCE 9
Source of food - food of plant, animal and microbial origin; different foods and groups of foods as raw materials for processing – cereals, pulses, grains, vegetables and fruits, milk and animal foods, sea weeds, algae, oil seeds & fats, sugars, tea, coffee, cocoa, spices and condiments, additives; need and significance of processing these foods

UNIT II METHODS OF FOOD HANDLING AND STORAGE 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
UNIT I  THERMODYNAMIC LAW AND PROPERTIES OF FLUIDS  9
First Law of thermodynamics, a generalized balance equation and conserved quantities. Volumetric properties of fluids exhibiting non ideal behavior; residual properties; estimation of thermodynamic properties using equations of state; calculations involving actual property exchanges; Maxwell’s relations and applications.

UNIT II  SOLUTION THERMODYNAMICS  9
Partial molar properties; concepts of chemical potential and fugacity; ideal and non-ideal solutions; concepts and applications of excess properties of mixtures; activity coefficient; composition models; Gibbs Duhem equation.

UNIT III  PHASE EQUILIBRIA  9
Criteria for phase equilibria; VLE calculations for binary and multi component systems; liquid liquid equilibria and solid-solid equilibria.

UNIT IV  CHEMICAL REACTION EQUILIBRIA  9
Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; calculation of equilibrium conversion and yields for single and multiple reactions.

UNIT V  THERMODYNAMIC DESCRIPTION OF MICROBIAL GROWTH AND PRODUCT FORMATION  9
Thermodynamics of microbial growth stoichiometry thermodynamics of maintenance, Calculation of the Operational Stoichiometry of a growth process at Different growth rates, Including Heat using the Herbert –Pirt Relation for Electron Donor, thermodynamics and stoichiometry of Product Formation

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE
size enlargement.

UNIT II FLUID – SOLID SEPARATION 9
Separation of solids & suspension from gas medium-screening- settling- Principles and equipments-classification-clarification.

UNIT III FILTRATION 9

UNIT IV MEMBRANE SEPARATION 9

UNIT V DRYING & CRYSTALLISATION 9

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE

FD6411 FOOD ANALYSIS LAB L T P C
0 0 4 2

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

TOTAL : 60 PERIODS

LAB EXPERIMENTS
1. Precision and validity in an experiment using absorption spectroscopy.
2. Validating Lambert-Beer’s law using KMnO₄
3. UV spectra of nucleic acids.
4. Determination of moisture in spices powder by distillation method and Hot air oven method.
5. pH, conductivity, TDS and hardness of water.
6. Determination of Peroxide Value, Acid value and free fatty acid in edible oils.
7. Isolation and identification of synthetic food colors in sweets, confectionery, beverages by Chromatography and Spectrophotometry.
8. Determination of total fat in liquid milk.
10. Determination of protein content in ice cream.
11. Detection of adulterants in edible oil and ghee.
12. Detection of oil soluble color in spices powder by TLC.
13. Chromatography analysis using column chromatography.

TEXTBOOKS

FD6412 CHEMICAL ENGINEERING LAB
(Common for IBT, Food and Pharmaceutical Technology)

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. Characteristics of centrifuge pump
6. Flat and frame filter press
7. Filtration 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

FD6501 MILLING TECHNOLOGY FOR FOOD MATERIALS
UNIT I GRAIN PROPERTIES
Importance of grains and cereals - definitions, Grain structure, Physico-chemical properties of grains and its nutritional value. Storage of cereal grains in relation to maintaining grain quality – types of storage structures.

UNIT II MILLING OF RICE

UNIT III MILLING PROCESS OF WHEAT 9


UNIT IV MILLING OF PULSES 9

UNIT V MILLING OF OIL SEEDS 9
Oil seed processing - natural sources of oil. Physio-chemical properties, mechanical extraction - Oil processing machinery, solvent extraction, factors influencing extraction, types of solvents. Refining of oil, hydrogenation, winterization, changes during storage. Oil seed flour concentrates and isolate.

TOTAL: 45 PERIODS

TEXT BOOKS
1. Chakraverty, A. —Post Harvest Technology of Cereals, Pulses and Oil Seeds, Third Edition,

REFERENCES

BT6604 CHEMICAL REACTION ENGINEERING LTPC 4 0 0 4

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

UNIT I SCOPE OF CHEMICAL KINETICS & CHEMICAL REACTION ENGINEERING 12
Broad outline of chemical reactors; rate equations; concentration and temperature dependence; development of rate equations for different homogeneous reactions. Industrial scale reactors.

UNIT II IDEAL REACTORS 12
Isothermal batch, flow, semi-batch reactors; performance equations for single reactors; multiple reactor systems; multiple reactions.
UNIT III  IDEAL FLOW AND NON IDEAL FLOW  12
RTD in non-ideal flow; non-ideal flow models; reactor performance with non-ideal flow.

UNIT IV  GAS-SOLID, GAS-LIQUID REACTIONS  12
Resistances and rate equations; heterogeneous catalysis; reactions steps; resistances and rate equations.

UNIT V  FIXED BED AND FLUID BED REACTORS  12
G/L reactions on solid catalysis; trickle bed, slurry reactors; three phase-fluidized beds; reactors for fluid-fluid reactions; tank reactors.

TOTAL : 60 PERIODS

OUTCOMES:
Upon completion of this course, the student would be able
- To design and conduct an experimental investigation in order to determine rate equations.
- To demonstrate an ability to solve material and energy balances in order to analyze the performance of a reactor.
- To demonstrate an experimental data using standard statistical methods to establish quantitative results.
- To design a reactor for bio based products to achieve production and yield specifications.

TEXT BOOKS:

REFERENCE:

FD6502  REFRIGERATION AND COLD CHAIN  L T P C  3 0 0 3

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 show 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, COPetc; 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 aisk-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; Establishing monitoring procedure for critical limits; Corrective actions to be established; Procedures-setting for verification; Establish documentation and record maintaining.
Top-Management Commitment & involvement; Training of personnel; Implementation and integrating HACCP system with ISO, TQM, etc.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

FD6503  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

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 BOOK

REFERENCES
2. Clydesdale, Fergus M. “Food Additives- Toxicology Regulation and Properties”. CRC Press,
AIM
To expose the students to the principles and different methods of food processing and preservation.

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

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

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

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

UNIT IV NON-THERMAL METHODS 9
(SUPER CRITICAL) Chemical preservatives, preservation by ionizing radiations, ultrasonics, high pressure, fermentation, curing, pickling, smoking, membrane technology. Hurdle technology,

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

TOTAL : 45 PERIODS

TEXT BOOKS
REFERENCES

FD6511 FOOD PROCESSING AND PRESERVATION LAB 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 and Preservation

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. Canning & bottling of vegetable and fruit products
5. Filtration and concentration of fruit juices
6. Production of extruded products.
7. Spray drying of juices/milk
8. Pasteurization of milk
9. Retort processing of foods
10. Baking of cakes – plain cakes, sponge cakes, cup cake – quality characteristics; Effect of varying ingredients – emulsifiers, fat, sugar gums and processing conditions
11. Preparation of custard, puddings, mousse, flan, pie, tarts, doughnuts, biscuits
12. Baking of Bread - role of ingredients & processing
13. Candies, toffees, fudges, pralines & brittles – Sugar crystallization & inhibition of crystal formation & soft centered sweets
14. Chocolates – role of ingredients and processing

TOTAL : 60 PERIODS

REFERENCES

FD6512 FOOD PRODUCTION ANALYSIS LAB L T P C 0 0 4 2

Analysis of food products for food additives, contaminants, nutrients and compliance to standards.

LAB EXPERIMENTS
1. Studying the expansion characteristics of snack foods on frying.
2. Rancidity test for fried foods to assess primary and secondary oxidative products.
3. Determination of Vitamin C in fruit juices.
4. Estimation of synthetic Food color in sweets, confectioneries and beverages.
5. Determination of Iron content in foods.
6. Determination of Iodine content in iodized salt.
7. Detection of Annatto color in table butter.
8. Determination of Lead in spices powder.
11. Detection of anti oxidant in foods.
12. Detection of certain emulsifiers and stabilizers in foods.

TOTAL : 60 PERIODS

FD6601 BIOCHEMICAL ENGINEERING

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

UNIT II KINETICS OF ENZYME ACTION

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

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

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

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
FD6602 BAKING AND CONFECTIONERY TECHNOLOGY

UNIT I INTRODUCTION TO BAKING

UNIT II EQUIPMENTS
Introduction to utensils and equipments used in bakery industry with their purpose. Bulk handling of ingredients—Dough mixing and mixers, Dividing, rounding, sheeting, and laminating—Fermentation enclosures and brew equipment—Ovens and Slicers. Rheology of dough—Farinograph, Amylograph, Alveograph, and Extensiograph.

UNIT III BREAD MAKING PROCESS

UNIT IV BAKERY PRODUCTS

UNIT V CONFECTIONERY PRODUCTS

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
GE6351 ENVIRONMENTAL SCIENCE AND ENGINEERING

AIM
The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participate.

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.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY
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 – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

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

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

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES BOOKS:
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.

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
- General and specific processing, different packing including aseptic
Purees/paste 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

TEXT BOOKS
2. Gopala Rao, Chandra. “Essentials of Food Process Engineering”. B.S. Publications,
GE6757

TOTAL QUALITY MANAGEMENT

L T P C

3 0 0 3

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

UNIT I
INTRODUCTION
9

UNIT II
TQM PRINCIPLES
9
Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

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

UNIT IV
TQM TOOLS AND TECHNIQUES II
9

UNIT V
QUALITY SYSTEMS
9

TOTAL: 45 PERIODS

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

TEXTBOOK:

REFERENCES:
GE6674 COMMUNICATION AND SOFT SKILLS- LABORATORY BASED  L T P C
0 0 4 2

OBJECTIVES:

To enable learners to,

- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

UNIT I LISTENING AND SPEAKING SKILLS 12
Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.

UNIT II READING AND WRITING SKILLS 12
Reading different genres of tests ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS 12
International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service(Language related)- Verbal Ability.

UNIT IV INTERVIEW SKILLS 12
Different types of Interview format- answering questions- offering information- mock interviews-body language(paralinguistic features)- articulation of sounds- intonation.

UNIT V SOFT SKILLS 12
Motivation- emotional intelligence-Multiple intelligences- emotional intelligence-managing changes-time management-stress management-leadership straits-team work- career planning - intercultural communication- creative and critical thinking

TOTAL: 60 PERIODS

Teaching Methods:

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for graining proficiency and better participation in the class.
### Lab Infrastructure:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description of Equipment (minimum configuration)</th>
<th>Qty Required</th>
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<tbody>
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<tr>
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<td>- PIV System</td>
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<td>- OS: Win 2000 server</td>
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<td>- JRE 1.3</td>
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<td>DVD recorder/player</td>
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<td>9</td>
<td>LCD Projector with MP3/CD/DVD provision for Audio/video facility</td>
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### Evaluation:

**Internal: 20 marks**

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

**External: 80 marks**

- Online Test - 35 marks
- Interview - 15 marks
- Presentation - 15 marks
- Group Discussion - 15 marks

**Note on Internal and External Evaluation:**

1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking – example for role play:
   - a. Marketing engineer convincing a customer to buy his product.
b. Telephonic conversation- fixing an official appointment / placing an order / enquiring
and so on.
3. Presentation – should be extempore on simple topics.
4. Discussion – topics of different kinds; general topics, and case studies.

OUTCOMES:

At the end of the course, learners should be able to

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews.

REFERENCES:

2. Graded Examinations in Spoken English and Spoken English for Work
downloadable materials from Trinity College, London.
University Press.
4. Interactive Multimedia Programs on Managing Time and Stress.

Web Sources:

http://www.slideshare.net/rohitjsh/presentation-on-group-discussion
http://www.washington.edu/doit/TeamN/present_tips.html
http://www.oxforddictionaries.com/words/writing-job-applications
http://www.kent.ac.uk/careers/cv/coveringletters.htm
http://www.mindtools.com/pages/article/newCDV_34.htm

FD6612 BIO PROCESS 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 in industrial scale.

OBJECTIVE
To sterilize the bioreactor
To operate the bioreactor
To design experiments to evaluate the performance of the bioreactor
To develop enzyme immobilized processes.

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

TOTAL : 60 PERIODS

REFERENCES
2. Lee, James M. “Biochemical Engineering”, PHI, U.S.A.

BAKING AND CONFECTIONERY
LABORATORY LAB
FD6613
L T P C 0 0 4 2
1. Study of ingredients (major and minor): characteristics of flour, yeast, shortening, sugar, egg and salts.
2. Experiment on leavening action of baking powder, sodium- bicarbonate and ammonium-bi-carbonate.
3. Determination sedimentation value of flour
4. Estimation of gluten content (atta, and maida)
5. Estimation of water absorption power (atta, and maida)
6. Determination dough rising capacity of yeast
7. Studies of dough characteristics farinographic and extensographic
8. Preparation of biscuits-different types.
9. Preparation of bread-different types.
11. Preparation of sugar boiled confectionary.

REFERENCES / MANUALS/SOFTWARE:

TOTAL : 60 PERIODS

FD6701 GENETIC ENGINEERING AND GENETICALLY MODIFIED FOOD
L T P C 3 0 0 3
UNIT I BASICS OF RECOMBINANT DNA TECHNOLOGY
Manipulation of DNA and RNA – Restriction and Modification enzymes, Design of linkers and adaptors. Characteristics of cloning and expression vectors based on
plasmid and bacteriophage, Vectors for insect, yeast and mammalian system, Prokaryotic and eukaryotic host systems, Introduction of recombinant DNA in to host cells and selection methods.

UNIT II DNA LIBRARIES 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 (Remove company names) 9
Genetically engineered proteins: Bovine Somatotropin in Milk; Genetically engineered bacteria:Chymosin Lite beer; Tryptophan; Transgenic plants: Calgene Flavr SavrTM tomato, Monsanto Round-UpTM Ready, Ciba Geigy BastaTM resistant crops; Edible vaccines:Cholera vaccine in potatoes; Transgenic Fish: Atlantic salmon.

TOTAL : 45 PERIODS

TEXTBOOKS

REFERENCE
in fish. Handling and transportation of fish. Bacteriology of fish, Chilling of fish, Freezing
and Individual quick freezing. Canning and smoking operations, Salting and drying of fish, pickling. Radiation
processing of fish and fish products. Seafood quality Assurance, Advances in fishery by products technology.

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

UNIT V EGG PROCESSING 9

TOTAL: 45 PERIODS

TEXT BOOKS

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

UNIT IV MILK POWDER PROCESSING AND MILK SUBSTITUTES


UNIT V STORAGE SANITATION AND EFFLUENT TREATMENT

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

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCE:

FD6704 CREATIVITY, INNOVATION AND NEW PRODUCT DEVELOPMENT LT P C

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

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

UNIT I INTRODUCTION
The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brain storming - different techniques

UNIT II PROJECT SELECTION AND EVALUATION
Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques)

UNIT III NEW PRODUCT PLANNING
Design of proto type - testing - quality standards - marketing research - introducing new products
UNIT IV NEW PRODUCT DEVELOPMENT

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

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

GE6075 PROFESSIONAL ETHICS IN ENGINEERING LT P C
3 0 0 3

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

UNIT I HUMAN VALUES

UNIT II ENGINEERING ETHICS

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

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS

UNIT V GLOBAL ISSUES
Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert
Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility

TOTAL : 45 PERIODS

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

TEXTBOOKS:

REFERENCES:

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

FD6711 SKILLS FOR FOOD PRODUCT DESIGN AND DEVELOPMENT

OVERVIEW (THEORY)
Organization and assignment of team, Definition of roles; Product Concepts; factors to consider; concept methodology; consumer testing; Product attributes; Concept testing approaches; Development of product specifications; Prototype development; role of ingredients and processing in defining attributes; scale up; Process flow sheet development; factors to consider in process development; process optimization; Factors to consider beyond formulation and processing - shelf life requirements; product performance testing; market positioning, Packaging and labeling, costing; Marketing: developing test market strategies

3. GROUP PROJECTS TO DEVELOP FOOD PRODUCTS AT LABORATORY SCALE

(PRACTICAL)
**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 Voce

**TOTAL**: 45 PERIODS

**TEXTBOOKS**

**REFERENCES**

**FD6712**  
**DAIRY PROCESS TECHNOLOGY LAB**  
**L T P C**  
**0 0 6 3**

**Properties of milk**
1. Determination of viscosity, density and specific gravity of milk
2. Determination of redox potential, acidity and pH of milk

**Analysis of milk**
3. Platform test - Methylene Blue Reduction Test, clot on boiling test
4. Determination of protein in milk by formol titration (pynes method)
5. Determination of lactose content of milk by polarimeter
6. Estimation of milk fat by Gerber method or Milko tester
7. Phosphatase test
8. Determination of adulterant and preservatives of milk

**Milk products and Quality Analysis**
10. Preparation and analysis of Yoghurt
11. Preparation and analysis of Cottage cheese
12. Preparation and analysis of Ice-cream/ Cream
13. Preparation and analysis of Butter/ Ghee
OBJECTIVE
To study various food laws, importance and functions of food safety management systems, to impart knowledge on food laws and safety in food processing.

UNIT I  HISTORICAL PERSPECTIVES INCLUDING NECESSITY OF FOOD LAWS
Establishment of US Pure Food Law in early 1900s and of Food & Drug Administration to enforce safety of food products; Urbanisation of population and necessity of processed and preserved foods and the necessity of ensuring quality of food to prevent adulteration. Prevention of Food Adulteration Act 1954 & Rules 1955 established in India to enforce safety and purity of food products; Various aspects of defining adulteration, taking samples of food for analysis by public analyst, prosecution for adulteration and punishment; Standards of various food products; FPO; Infant Milk Substitute Act; Laws relating to vegetable oils; Use of permitted additives like colours, preservatives, emulsifiers, stabilisers, antioxidants etc. Food Safety & Standards Act 2006 and the provisions therein; Integrated Food Law - Multi departmental - multilevel to single window control system, consumer protection Act.

UNIT II  FOOD SAFETY IN PROCESSING
Building and equipment design; microbiological quality of water, air; Safety in food procurement, storage, handling and manufacture; Food safety in retail food businesses; international food service operators, institutional food service operators; application of the principals of modern hygiene; Food handlers, habits, clothes, illness;

UNIT III  KEY SAFETY PRINCIPLES
Training & Education for safe methods of handling food; cleaning and sanitization of processing plants; principles of cleaning and sterilization; sterilization & disinfection; different methods used - detergents, heat, chemicals; selecting and installing equipment; Cleaning of equipment and premises. Safety limits of sanitizers; pest control; management and disposal of waste.

UNIT IV  FOOD SAFETY MANAGEMENT SYSTEM
Food safety and quality management systems - Physical, chemical and Microbial hazards and their control in food industry; Good laboratory practice (GLP); Quality systems standards including ISO; - ISO 9000; total quality management (TQM); hazard analysis of critical control points (HACCP); good manufacturing practices (GMP);

UNIT V  MANAGEMENT
Good Manufacturing Practice and HACCP; Surveillance networks, Consumer and food service operator education; GM Foods, safety and labeling; International Food Standards ISO 9000 and related standards; Impact of food safety on global trade.

TOTAL : 45 PERIODS

TEXT BOOKS
AIM
The project work aims to train the students on systematic analysis of a problem and to enable them to bring out a solution it.

OBJECTIVE
The objective of the project is to make use of the knowledge gained by the student at various stages of the degree course.
Each student is required to submit a report on the project assigned to him/her by the department. The report should be based on the literature collected from the many sources and the actual analysis done by the student on the given project.

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

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

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

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

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

TOTAL : 45 PERIODS

TEXT BOOKS
Francis, 2006.

REFERENCES

FD6002 BIOLOGICALLY ACTIVE PHYTOCHEMICALS IN FOOD L T P C 3 0 0 3

UNIT I BIOSYNTHESIS AND SIGNIFICANCE 9
Phytochemicals in food, the plants as chemical factories, synthesis of isotopically Labeled Phytoestrogens

UNIT II ANALYSIS OF PHYTOCHEMICALS 9
Qualitative and quantitative methods: phytoestrogens in plants; isoflavones; falavnols, polyphenols, tannins, saponins, lignans Multiresidue method for penicillins and cephalosporins in Bovine muscle.

UNIT III ASSESSMENT OF ANTIOXIDANT ACTIVITY 9
In vitro and In vivo methods for the assessment of antioxidant activity, Comparison of different methods to evaluate the antioxidant , Prediction of the antioxidant activity of natural phenolics from electrotopological state indices

UNIT IV CARATENOIDS 9
Factors affecting bioavailability , chemical and characterasition of cell histochemical wall polysaccharides in almond seed in relation to lipid bioavailability.

UNIT V OPTIMISING PHYTOCHEMICAL 9
Optimising phytochemical release by process technology, Variation of Antioxidant Activity during technological treatments , new food grade peptidases from plant sources .

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

FD6003 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.
- 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
Six classes of nutrients, calculating energy values from food, using the RDA, nutritional assessment of individuals and populations, dietary recommendations; research methods in nutrition; 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.

UNIT II CARBOHYDRATES: SUGARS, STARCH AND FIBER
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
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. Hyperlipidemia, atherosclerosis and cardiovascular disease.

UNIT IV METABOLISM, ENERGY BALANCE AND BODY COMPOSITION
Review of catabolic and anabolic pathways of glucose, fats and amino acids; 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
Water Soluble Vitamins: B vitamins examined individually (Thiamine, Riboflavin, Niacin, Pyridoxine, Biotin, folate and B12, choline, pantothenic acid, 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 the 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

REFERENCES

FD6004 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.

OBJECTIVE
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.

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

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

UNIT IV ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE

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

UNIT V ECONOMIC BALANCE AND QUALITY AND QUALITY CONTROL

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

REFERENCES

FD6005 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

UNIT I INTRODUCTION AND SIGNIFICANCE
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
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
In vitro and In vivo methods for the assessment of antioxidant activity, Comparison of different In Vitro methods to evaluate the antioxidant, Prediction of the antioxidant activity of natural phenolics from electrotopological state indices, Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources
UNIT IV  ROLE IN HEALTH AND DISEASE  12
Nutraceuticals and Functional foods in Gastrointestinal disorder, Cancer, CVD, Diabetic Mellitus, HIV and Dental disease; Importance and function of probiotic, prebiotic and symbiotic and their applications, Functional foods and immune competence; role and use in obesity and nervous system disorders.

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

TOTAL : 45 PERIODS

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

REFERENCES
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

REFERENCES

FD6007  
ENTREPRENEURSHIP  

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

UNIT II
Develop a Business Plan

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

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

UNIT V
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.

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

UNIT II  TRADITIONAL METHODS OF FOOD PROCESSING  9

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

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

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

TOTAL : 45 PERIODS

TEXT BOOKS

FD6009 CEREAL, PULSE & OIL SEED TECHNOLOGY

AIM
The course aims to develop the knowledge of students in the area of Cereal, 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 cereals, 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.

UNIT I CEREALS
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, rheology of flour; wheat based baked products – Bread, Biscuit, Cakes, Extruded products, Pizza, Chapatis, malting and malt products; Rice-Milling, Parboiling, Quick cooking rice, Traditional Indian Products- Puffed Rice, flaked rice, Idli/Dosa/vada mixes and other savouries; Corn- Wet and dry milling, Corn Products – Corn flakes, Corn starch, canned corn products, puffed product; Oats-Milling, Oat Products – Steel cut, rolled oats, quick cooking; Traditional and Fermented cereal products

UNIT II OTHER CEREALS AND MILLETS
Sorghum, Pearl Millet, Finger millet, Foxtail Kodo Millet - Basic agricultural millet, aspects, structure and composition; storage, insect control; processing - pearling, Milling, Malting, Malt based foods, flaked and fermented products; Traditional and Nutritional products based on finger millet.

UNIT III SUGARS
Honey- Composition and Quality aspects; Sugars- Manufacture of table sugar, High Fructose corn syrup and Glucose syrup; Jaggery – sources, manufacture, uses in traditional food products; stages of sugar saccharine products

UNIT IV PULSES AND LEGUMES
Basic agricultural aspects, structure, composition, storage, insect control, processing-
Milling/splitting, dhal milling, products – puffed, flakes, flour, legume-based traditional
products, flour based Indian sweets and savouries, soya milk, soy protein Isolate, soya
paneer

UNIT V  OIL SEEDS AND NUTS  6
Basic agricultural aspects structure, composition, Storage, Insect control; processing:
traditional and modern methods of oil extraction, refining, bleaching, deodorizing,
hydrogenation; oil blends; applications of different oils and fats in food processing &
products.

TOTAL : 45 PERIODS

TEXTS BOOKS

REFERENCES

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 Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

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

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

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

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context,
- Disaster damage assessment and management.

TEXTBOOK:

REFERENCES
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005
FD6010  FOOD PROCESS EQUIPMENT DESIGN  L T P C  3 0 0 3

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

UNIT I  INTRODUCTION  9
Material of construction: Introduction to material selection; Material properties; Environmental effects on material selection; Mechanical properties & strength of materials.

UNIT II  CONSTRUCTION REQUIREMENTS  9
Design basis: Design code; Design pressure, stress & factor of safety; Corrosion allowance; Weld joint efficiency factor; Design loadings; Criteria of failure.

UNIT III  DESIGN OF PIPES AND PRESSURE VESSELS  9
Design of pipe and pipe fittings. Process vessels under internal and external pressure; Design of attachments and closures;

UNIT IV  DESIGN OF SUPPORTS  9
Design of flange connections & threaded fasteners; Design of supports; Bracket or Lug supports, Leg Supports, Skirt Supports

UNIT V  DESIGN OF PROCESS EQUIPMENTS  9

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

FD6011  FOOD PACKAGING  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

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

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

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

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

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

TOTAL : 45 PERIODS

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

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

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

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

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

TOTAL : 45 PERIODS

REFERENCES
1. Handbook of food toxicology by S. S. Deshpande
2. The food safety information handbook by Cynthia A. Robert, 2009
3. Nutritional and safety aspects of food processing by Tannenbaum SR
4. Microbiological safety of food by Hobbs BC, 1973
5. Food Safety Handbook by Ronald H. Schmidt, Gary E. Rodrick

GE6084 HUMAN RIGHTS L T P C 3 0 0 3

OBJECTIVES :
• To sensitize the Engineering students to various aspects of Human Rights.

UNIT I

UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.
UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

TOTAL : 45 PERIODS

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

REFERENCES: