PROFESSIONAL COMMUNICATION
HU-101

Unit – I : Technical Communication   **8**

Nature; Origin and Scope; Feature and General Writing; Significance; Style: Objective Style as Contrary to Literary Composition.
Forms of Technical Communication:
Reports: Types, Significance, Structure & Style of Report;
Writing of Reports: Project, Thesis, Dissertation Writing;
Technical Paper & Scientific Article Writing: Elements, Methods & Technical Objectives;
Technical Proposal: Nature, Divisions, Kinds, Uses.

Unit-II : Pre-Requisites of Technical Written Communication   **9**
Vocabulary Building : Homophones (Words Similar in sound but different in Meanings); Word-formation; One-Word substitute; New & Select Vocabulary Building (about 500 words)
Functional Grammar : Patterns and Correct usage (Parts of speech); Syntax Concord; Prepositions; Articles.
Requisites of Good Sentence and Paragraph Writing: Requisites of Good Sentence Writing; Paragraph Writing; Unity, Coherence and Emphasis; Development of Paragraph: Inductive Order, Deductive Order, Spatial, Linear, Chronological Orders etc. with Emphasis on Argumentative & Expository Writing.
Unit : III : Business Correspondence: Principles; Features; Sales and Credit Letters: Letters of Enquiry, Quotation, Order, Claim, Complaint and Adjustment letters, Bio-Data Making, Resumes/Job Application Processing.   **7**
Unit-IV : Language Learning Through Thematic and Value based Critical Reading (Non-Detailed Text Study) :
A Study of following Value-Oriented Essays:

A.L.Basham	:	The Heritage of India
S. Radhakrishnan	:	*The Gandhian Outlook*
Francis Bacon	:	*Of Studies*
J.B. Priestley	:	Making Writing Simple
Virginia Wooef	:	How should one Read a Book
R.K. Narayan	:	*A Bookish Topic*
C.E.M. Joad	:	The Civilization of Today

Study of following Short Stories for making the Students acquaint with the styles of great Writers of World:

O.H. Henry	:	The Gift of the Magi
R.N. Tagore	:	The Renunciation
Katherine Mansfield	:	*The Fly*
A.P. Chekhor	:	*The Lament*
M.R. Anand	:	The Barber's Trade Union
Ruskin Bond	:	The Eyes Are Not Here
D.H. Lawrence	:	The Rocking Horse Winner

Ist YEAR

Ernest Hemingway   :   The Capital of the World
Unit-V : Dimensions of Spoken English: Using English Language Laboratory :
          6
Stress, Intonation, Rhythm, Phonemes, Allophones, Phonetic Transcription, Listening, Reading & Comprehension of Speech and Reproduction of Response.
Texts Books/ References

Singh R.P. (ed)	:	An Anthology of English Essay; OUP, New Delhi
Singh R.P. (ed)	:	An Anthology of English Short Stories; OUP, New Delhi.
Hornby A.S.	:	Guide to Patterns & Usage in English; OUP, New Delhi
Clark S. & Pointon	:	Word for Word; OUP, New Delhi
Ruther Ford A.	:	Basic Communication Skills; Person Education, New Delhi.
Singh R.P.	:	Functional Skills in Language & Literature; OUP, New Delhi
Bansal R.K. & Harrison	:	Phonetics in English; Orient Longman, New Delhi
Sethi & Dhamija	:	A Course in Phonetics & Spoken English; Prentice Hall, New Delhi.
Blum Rosen	:	Word Power; Cambridge University Press, New Delhi
Seely John	:	Writing Report; OUP, New Delhi

Suggested Readings :

Arora V.N. etal	:	Improve Your Writing; OUP Delhi
Mohan K. & Sharma R.C.	:	Business Correspondence of Report Writing; TMH, New Delhi.
Clive Upton etal	:	Oxford Dictionary of Pronunciation for Current English; OUP New Delhi.
		A Dictionary of Modern English Usages; OUP, New Delhi
Michael Swan	:	Practical English Usages; OUP, New Delhi
John Alveyblrideh	:	American English Pronouncing Dictionary; OUP New Delhi.
Jons Daniel	:	English Pronouncing Dictionary; Cambridge University Press.

          I st YEAR

MATHEMATICS-I
MA-101

Unit - I : Matrices   9
Elementary row and column transformation, Rank of matrix, Linear dependence, Consistency of linear system of equations, Characteristic equation, Caley-Hamition Theorom, Eigen values and eigen vectors, Diagonalisation, Complex and unitary materices .

Unit - II : Differential Catculus-I   8
Leibnitz theorem, Partial differentiation, Eulers theorem, Curve tracing, Change of variables, Expansion of function of several variables

Unit - III : Differntial Caluculus-II   7
Jacobian, , Approximation of errors, Exterma of functions of several variables, Lagranges method of multipliers (Simple applications).

Unit - IV : Multiple Integrals   7
Double and triple integral, Change of order, Change of variables, Beta and Gamma functions, Application to area, volume, Dirichlet integral and applications.

Unit - V : Vector Calculus   7
Point functions, Gradient, divergence and curl of a vector and their physical interpretations, Line, Surface and Volume integrals, Greens, Stokes and Gauss divergence theorem.

CHEMISTRY
CY-101

L T P
3 1 0

Unit – I

1. **Molecular theory of diatomic heteromolecules, Bond theory of bonding in metals, Hydrogen bonding.**

2. **Solid state Chemistry:**

   Radius Ratio Rule, Space lattice (only cubes), Type of unit cell, Bragg's Law, Calculation of Density of unit cell.

   One & Two Dimensional solids, graphite as two dimensional solid and its conducting properties. Fullerene & its applications.

Unit-II

1. Basic principles of spectroscopic methods. The use of UV, Visible, IR, ^{1}H NMR, for the determination of structure of simple organic compounds.

2. Characteristics and classification of polymers.

3. Structures of the following polymers, viz, Natural and synthetic rubbers, Polyamide and Polyester fibres, polymethylmethacrylate, poly acrylonitrile and polystyrene. A brief account of conducting polymers (polypyrrole & polytiphene) & their applications.

I st YEAR

Unit-III

1. Stability of reaction intermediates, e.g. Carbanion, Carbocation and free radicals. Types of organic reactions, & Mechanism of nucleophilic substitution reaction.

2. Mechanism of the following reactions.

   (i) Aldol condensation. (ii) Cannizzaro reaction (iii) Beckmann rearrangement (iv) Hofmann rearrangement, and

   (v) Diels-Alder reaction

3. E-Z Nomenclature. Optical Isomerism of organic Compounds containing one chiral center. Examples of optically active compounds without chirality. Conformations of butane.

Unit-IV

1. Order & Molecularity of reactions. First & Second order reactions. Energy of activation.

2. Phase Rule: Its application to one component system (Water).

3. Equilibrium Potential, electrochemical cells (galvanic & concentration cells), Electrochemical theory of corrosion & protection of corrosion.

Unit-V

1. Hardness of water, softening of water by Lenny-S process & Reverse osmosis. Treatment of boiler feed water by Calgon process, Zeolites and ion-exchange resins.

2. Classification of fuels, Coal, Biomass & Biogas. Determination of gross and net calorific values using Bomb Calorimeter.

3. Environmental pollution : Types of pollution & pollutants, Air Pollution. Formation and depletion of ozone, smog and Acid rain.

References :

1. Organic Chemistry (Morrison & Boy)
2. Inorganic Chemistry (I.D. Lee)
3. Physical Chemistry (Barrow)
4. Environmental chemistry (Manahan)

MECHANICAL ENGINEERING
ME-101

Ist YEAR

A. THERMODYNAMICS
Unit – I : Fundamental Concepts and Definitions

Definition of thermodynamics, system, surrounding and universe, phase, concept of continuum, macroscopic & microscopic point of view. Density, specific volume, pressure, temperature. Thermodynamic equilibrium, property, state, path, process, cyclic process, Energy and its form, work and heat, Enthalpy.　　3

Laws of thermodynamics

Zeroth law: Concepts of Temperature, zeroth law.　　1

First law: First law of thermodynamics. Concept of processes, flow processes and control volume, Flow work, steady flow energy equation, Mechanical work in a steady flow of process.　　2

Second law: Essence of second law, Thermal reservoir, Heat engines. COP of heat pump and refrigerator. Statements of second law. Carnot cycle, Clausius inequality. Concept of Entropy.　　3

Unit – II : Properties of steam and thermodynamics cycles:

Properties of steam, use of property diagram, Steam-Tables, processes involving steam in closed and open systems. Rankine cycle.　　4

Introduction to I.C. Engines-two & four stoke S.I. and C.I. engines. Otto cycle, Diesel cycle.　　3

B. MECHANICS AND STRENGTH OF MATERIALS
Unit-III : Force system and Analysis

Basic concept: Laws of motion. Transfer of force to parallel position. Resultant of planer force system. Free Body Diagrams, Equilibrium and its equation.　　4

Friction: Introduction, Laws of Coulomb friction, Equilibrium of bodies involving dry fiction-Belt Friction.　　2

Unit-IV : Structure Analysis

Beams: Introduction, Shear force and Bending Moment, shear force and Bending Moment Diagram for statically determinate beams.　　4

Trusses: Introduction, Simple Trusses, Determination of Forces in simple trusses members, methods of joints and method of section.　　3

Unit-V : Stress and Strain Analysis

Simple stress and strain: Introduction, Normal shear stresses, stress-strain diagrams for ductile and brittle materials, Elastic constants, one dimensional loading of members of varying cross sections, strain Energy.　　**3**

Compound stress and strains: Introduction, state of plane stress, Principal stress and strain, Mohr's stress circle.　　**2**

Pure Bending of Beams: Introduction, Simple Bending theory, Stress in Beams of different cross sections.　　**2**

Torsion: Introduction, Torsion of Shafts of circular section, Torque and Twist, Shear stress due to Torque.　　**2**

Reference:

I st YEAR

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

INFORMATION TECHNOLOGY

CE--101

L T P
3 1 0

Unit – I : Fundamental Concept of Information
Information Concept and Processing:

Definition of information, Data Vs Information, Introduction to Information representation in Digital Media, Text, image, graphics, Animation, Audio, Video etc., Need, Value and Quality of information, Concept of Information Entropy, Shannon's Principles, Entropy of Information, use of Entropy in Coding, Static & Dynamic codes, Category and Level of Information in Business Organization.

Information Representation:

Information Content, Entropy, Data Compression, Shannon Fano, Huffman Coding, Extended Huffman Codes, Arithmetic Coding, LZ78, LZW coding, Introduction to JPEG, MPEG, MHEG and other IT Industry Standards.

Unit-II : Concepts in Computer & Programming
Computer Appreciation:

Definition of Electronic Computer, History, Generations, Characteristic and Application of Computers, Classification of Computers, RAM/ROM, Computer Hardware, CPU, Various I/O devices, Peripherals, Storage Media, Software Definition, Role and Categories, Firmware and Humanwer.

Programming Language Classification & Program Methodology:

Computer Languages, Generation of Languages, Translators-Interpreters, Compiler/Interpreters, Compilers, Flow, Charts, Dataflow Diagram, Assemblers, Introduction to 4GLs, Software Development Methodology, Life Cycles, Software Coding, Testing, maintenance, ISO, CMM standards for IT industry.

UNIT : III : Digital Devices and Basic Network Concepts
Digital Fundamentals:

Various codes, decimal, binary, hexa decimal conversion, floating numbers gates, flip flops, adder, multiplexes, need for Data Transmission over distances, Types of Data Transmission, Media for Data Transmission, Modulation, AM, FM, Digital Modulation, Multiplexing of Signals

Data Communication & Networks:

I st YEAR

Computer Networks, Networking of computers- Introduction of LAN and WAN. Network Topologies, Basic Concepts in Computer Networks, Client-server Architecture, ISDN, ATM, Token based protocol, CSMA/CD, Mobile Communication.

UNIT-IV : Internet and Web Technologies

Internet & World Wide Web:

Hypertext Markup Language, DHTML, WWW, Gopher, FTP, Telnet, Web Browsers, Net Surfing, Search Engines, Email, ISP, EDI, E-Commerce, Public Key Private Key, Safety of Business Transaction on web.

Web Technologies:

Elementary Concepts of E-Commerce, Basic Infrastructures for E-Commerce, Electronic Token, Security Threats, Electronic Payment Systems, Digital Signatures, Network, Security, Firewall, Introduction to Web Technologies.

UNIT-V : Concepts in Operating System, Office Tools and Data Management

Introductory concepts in operating system & Data Management:

Elementary Concepts in Operating System, textual Vs GUI Interface, Introduction to DOS, MS Windows, MS office Tools, MS WORD, MS EXCEL, MS Power Point, Tools for Data Management, Basics of Database management system, Introduction to basic Commands of Dbase, Foxpro, SQL Etc.

IT Industry Trends, Careers and Applications in India:

Scientific, Business, Educational and Entertainment Application, Industry Automation, Weather Forecasting, Awareness of Ongoing IT projects in India NICNET, BRNET etc. Application of IT to other Areas E Commerce, electronic governance, Multimedia, Entertainment.

References:

1. D S Yadav, "Foundations of IT", New Age, Delhi
2. Curtin, "Information Technology : Breaking News", TMH
3. Rajaraman, "Introduction to Computers", PHI
4. Nelson, "Data Compression", BPB.
5. Peter Nortans "Introduction to Computers", TMH.
6. Leon & leon "Fundamental of information Technology", Vikas

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CHEMISTRY PRACTICALS
CY-151
LIST OF EXPERIMENTS

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0 0 2

1. Determination of alkalinity in the given water sample.

2. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.

3. Determination of available chlorine in bleaching powder.

4. Determination of chloride content in the given water sample by Mohr's method.

5. Determination of iron content in the given ore by using external indictor

6. pH-metric titration.

7. Determination of Equivalent weight of Iron by the chemical displacement method. The equivalent weight of copper is 63.5

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Ist YEAR

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(Note : the procedure to be followed in carrying the above experiment is given as annexure)

8. Viscosity of an addition polymer like polyster by Viscometer.

9. Determination of iron concentration in sample of water by colorimetric method. The method involves the use of KCNS as colour developing agent and the measurements are carried out at λ_{max} 480 nm.

    Note : The general procedure of estimation is given on pp653-8 of the textbook of Quantitative Chemical Analysis by A.I. Vogel 6th Edition, Publisher : Pearson education Ltd. 2000)

10. Element detection & functional group identification in organic compounds

Annexure

In this experiment we will determine the equivalent weight of Iron, which displaces one equivalent of copper (63.5 g) from a solution containing copper ions.

Procedure: Clean a sample of iron (strip measuring 3.5cm×1.5cm) with a sand paper and weigh it accurately. Place it in a clean beaker (250ml) and pour into it 100ml of $CuSo_4$ solution of known strength (~ N/10) Allow the strip to stand in the beacker for about 30 minutes. Carefully withdraw the strip of iron (from the beaker) with a forceps and place it on a porcelain plate contained in a desiccafor (using $cacl_2$ as a desiccant). The quantity of copper sulphate remaining in solution – after the chemical displacement, is estimated by lodometric titration method. The dried strip of iron (containing the deposited copper) is then carefully weighed.

Observations:

Weight of iron strip = ……………g

Wt. Of iron strip + copper = ………………g

(after drying)

wt. of copper deposited on iron strip $\Rightarrow$

Initial conc. of cu- final conc. of cu. (determined by titration)

The weight of iron, which goes into solution(as Fe So $_4$)

$\Rightarrow$ (Initial weight of iron strip + weight of deposited copper) - weight of iron strip along with copper (after drying)

$$\frac{\text{Eq.wt. of copper } (63.5)}{\text{Eq. Wt. of Iron}} = \frac{\text{Wt. of Copper Deposited}}{\text{Wt. of Fe}_{(s)} \text{ (going into solution)}}$$

The Eq. Wt. of Fe = ?

The % error involved in the experiment =………………

MECHANICAL ENGINEERING LAB
ME-151

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I st YEAR

List of Practicals

1. Study of boiler models - Babcock Wilcox, Lancashire and Locomotive.

2. Study of Steam engine and steam turbine models.

3. Study of 2-stroke and 4-stroke I.C.E. models.

4. Study of Fiat engine and/ or Diesel engine prototype.

5. Study of a vapour compression Refrigeration unit tutor/refrigerator.

6. Study of a window type air conditioner.

7. To conduct the tensile test on a UTM and determine ultimate Tensile strength, percentage elongation for a steel specimen.

8. To conduct the compression test and determine the ultimate compressive strength for a specimen.

9. To conduct the Impact test (Izod / charpy) on the Impact testing machine and to find the impact strength.

11. To determine the hardness of the given specimen using Brinell / Rockwell / Vicker testing machine.

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ENGINEERING GRAPHICS   **L T P**
CE 151   **0 0 2**

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1. **Introduction**
   Graphics as a tool to communicate ideas, Lettering and' dimensioning, Construction of geometrical figures like pentagon and hexagon.
   <div align="center">2</div>

2. **Orthographic Projection**
   Principles of orthographic projections, Principal and auxiliary planes, First and Third angle projections. 1
   Projection of points. Pictorial view.
   <div align="center">1</div>
   Projection of lines parallel to both the planes. Parallel to one and inclined to other, Inclined to both the planes. Application to practical problems.
   <div align="center">3</div>
   Projection of solid in simple position, Axis or slant edge inclined to one and parallel to other plane, Solids lying on a face or generator on a plane.
   <div align="center">2</div>
   Sectioning of solids lying in various positions, True shape of the section.
   <div align="center">2</div>

<div align="center">**I st YEAR**</div>

Development of lateral surfaces, sheet metal drawing.
          1

3.   Isometric Projection

Principles of isometric projection, Isometric projection using box and offset methods.   2

References:

1.   Bhatt. N.D.: Elementary Engineering Drawing, Charothar Publishing.
2.   Laxmi Narayan V & Vaish W. : A Text Book of Practical Geometry on Geometrical

drawing.

COMPUTER PROGRAMMING LAB
CE-151

L T P
0 0 2

List of Practicals

1.   Practice of all internal and External DOS Commands
2.   Write simple batch program
3.   Giving exposure to Windows environment
4.   File and program management in windows
5.   Practice of all UNIX commands
6.   Write simple shell script
7.   Introduction to text editing and word processing

8.   Exposure to advance feature supported by some editors
9.   Net Surfing
10.   Creation and usage of E-mail account
11.   Write small program using C language
12.   Handling of data structure in C
13.   Familarizing mail account using PINE, deleting, creating folder/ mail-messages, adding signature, creating directory of addresses.
     Note : List may be modified according to new software available.

I st YEAR

ENVIRONMENTAL STUDIES
ES – 201

L T P
3 1 0

Unit-I : The Multidisciplinary nature of environmental studies   2
Definition, scope and importance, Need for public awareness

Natural Resources   6

Renewable and non-renewable resources

Natural resources and associated problems.

(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food resources: World food problem, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

(f) Land resources: Land as 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.

Unit-2 : Ecosystems   6

- 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 following ecosystem:
  (a) Forest ecosystem (b) Grassland Ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit-3 : Biodiversity and its conservation   7

Introduction- Definition : genetic, species and ecosystem diversity, Biogeographical classification of India,Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels,

India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ Ex-situ conservation of biodiversity.

Unit-4 : Environmental Pollution　　　　　　　　　　　　　　8
Definition

- Causes, effects and control measures of-
    - (a) Air Pollution. (b) Water Pollution. (c) Soil Pollution (d) Marine Pollution. (e) Noise Pollution. (f)Thermal Pollution. (g) Nuclear hazards.
- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Diaster management: floods, earthquake, cyclone and landslides.

Unit-5: Social Issues and the Environment　　　　　　　　5

From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Case Studies, Environmental ethics: Issues and possible solutions, Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Human Population and the Environment　　　　　　　　4

Population growth, variation among nations, Population explosion- Family Welfare Programme, Environment and human health, Human Rights, Value Education., HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.

Suggested Field work

Visit to local area to document environmental assets- river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban/Rural /Industrial / Agricultural, Study of common plants, insects, birds, Study of simple ecosystems-pond, river, hill slopes etc

References
1. Agrawal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad- 380 013, India Email : mapin@icenet.net (R)
3. Brunner R.C., 1989, hazardous Waste Incineration, McGraw Hill Inc. 480p.
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P, Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyolopedia, Jaico Publ. House, Mubmbi, 1196p.
6. De. A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)

8.   Gleick, H.P. 1993 Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press. 473p.

9.   Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)

10. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.

11. Jadhav, H. & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.

12. Mckinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.

13. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TM)

14. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)

15. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p.

16. Rai N,B, & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.

17. Sharma B.K., 2001. Environmental Chemistry. Goel Publ. House Meerut.

18. Survey of the Environment, The Hindu (M)

19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)

20. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol I and II, Environment Media (R)

21. Trivedi R.K. and P.k. Goel, Introduction to air pollution, Techno-Science Publication (TB)

22. Wagner K.D., 1998. Environment Management. W.B. Saunders Co. Philadelphia, USA 499p.

(M)   Magazine   (R)   Reference (TB)   Textbook

PHYSICS
PH-201

L T P
3 1 0

Unit – I : Relativistic Mechanics

Inertial and Non-inertial Frames, Michelson-Morley Experiment, Postulates of Special Theory of Relativity, Galilean and Lorentz Transformation, Length Contraction and Time Dilation, Addition of Velocities, Mass Energy Equivalence and Variation of Mass with Velocity.

6

Unit – II : Interference

Coherent Sources, Conditions of Interference, Fresnel's Biprism Experiment, Displacement of Fringes, Interference in Thin Films – Wedge Shaped Film, Newton's Rings.

4

Diffraction : Single and n-Slit Diffraction, Diffraction Grating, Raleigh's Criterion of Resolution, Resolving Power of Telescope, Microscope and Grating.   **5**

Unit – III : Polarization

Phenomenon of Double Refraction, Ordinary and Extra-ordinary Rays, Nicol Prism, Production and Analysis of Plane, Circularly and Elliptically Polarized Light, Fresnel Theory, Optical Activity, Specific Rotation, Polarimeter.   **5**

Laser : Principle of Laser Action, Einstein's Coefficients, Construction and Working of He-Ne and Ruby Laser.   **3**

Unit – IV : Electromagnetics

Ampere's Law and Displacement Current, Maxwell's Equations in Integral and Differential Forms, Electromagnetic Wave Propagation in Free Space and Conducting Media, Poynting Theorem.   **5**

Magnetic Properties of Materials

Basic Concept of Para- , Dia and Ferro-Magnetism, Langevin's Theory of Diamagnetism, Phenomenon of Hysterisis and Its Applications   **4**

Unit – V : X-Rays

Diffraction of X-Rays, Bragg's Law, Practical Applications of X-Rays, Compton Effect.   **3**

Wave Mechanics : Wave Particle Duality, de Broglie Concept of Matter Waves, Heisenberg Uncertainty Principle, Schrödinger Wave Equation and Its Applications: Particle in a Box and One Dimensional Harmonic Oscillator.   **5**

References:

1. Robert Resmick : Introduction to Special Theory of Relativity
2. Aurthur Beiser : Perspectives of Modern Physics
3. A.K. Ghatak : Optics
4. Wehr Richords & Adiav : Physics of Atoms
5. O.Svelto : Lasers
6. D.J. Griffith : Electrodynamics

MATHEMATICS II
MA-201

Unit - I : Differential Equations   **8**

Ordinary differential equations of first order, Exact differential equations, Linear differential equations of first order, Linear differential equations of nth order with constant coefficients, Complementary functions and particular integrals, Simultaneous linear differential equations, Solutions of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications to engineering problems (without derivation).

Unit - II : Series Solutions and Special Functions   **8**

Series solutions of ODE of 2nd order with variable coefficients with special emphasis to differential equations of Legendre, and Bessel . Legendre polynomials, Bessels functions and their properties.

Unit - III : Laplace Transform   7

Laplace transform, Existence theorem, Laplace transform of derivatives and integrals, Inverse Laplace transform, Unit step function. Dirac delta function, Laplace transform of periodic functions, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

Unit - IV : Fourier Series and Partial Differential Equations   8

Periodic functions, Trignometric series, Fourier series of period 2π, Eulers formulae, Functions having arbitrary period, Change of interval, Even and odd functions, Half range sine and cosine series.

Introduction of partial differential equations, Linear partial differential equations with constant coefficients of 2nd order and their classifications - parabolic, elliptic and hyperbolic with illustrative examples.

Unit - V : Applications of Partial Differential Equations   7

Method of separation of variables for solving partial differential equations,Wave equation up to two-dimensions, Laplace equation in two-dimensions, Heat conduction equations up to two-dimensions, Equations of transmission Lines.

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ELECTRICAL ENGINEERING
EE-201

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Unit-I

1.   **Steady State Analysis of A.C. Circuits :**

Sinusoidal and phasor representation of voltage and current: single phase a.c. circuit-behaviour of resistance, inductance and capacitance and their combination in series & parallel and power factor, series parallel resonance-band width and quality factor : magnetic circuit.   8

Unit-II

2.   **D.C. Network Theory :**

Circuit theory concepts-Mesh and node analysis.

Network Theorems- Super-position theorem. Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Star Delta transformation.

3.   **Measuring Instruments:**

Construction and principle of operation of voltage and current measuring instruments; introduction to power and energy meters.
        8

Unit-III

4.   **Three Phase A.C. Circuits :**

Star-Delta connections, line and phase voltage/current relations, three phase power and its measurement.

5.   **Transformer :**

Principle of operation, types of construction, phasor diagram, equivalent circuit, efficiency and voltage regulation of single phase transformer, O.C. and S.C. tests.   9

Unit-IV

6.   D.C. Machines

Principle of electromechanical energy conversion, types of d.c. machines, E.M.F. equation, Magnetization and load characteristics, losses and efficiency, speed control d.c. motors, applications.

7.   Three phase Synchronous Machines :

Principle of operation and application of synchronous motor.   8

Unit-V

8.   Three phase induction Motor

Principle of operation, types and methods of starting, slip-torque characteristics, applications.

9.   Single phase Induction Motor :

Principle of operation, methods of starting.   7

References :

1.   V. Del Toro. " Principles of electrical Engineering, "Prentice hall International.
2.   W.H. Hayt & J.E. Kennedy," Engineering circuit Analysis, "Mc Graw Hill.
3.   I.J. Nagrath, "Basic Electrical Engineering," Tata Mc. Graw Hill.
4.   A.e. Fitgerald, D.E., Higginbotham and A Grabel, "Basic Electrical Engineering " Mc Graw Hill.
5.   H. Cotton, "Advanced Electrical Technology" Wheeler Publishing.

ELECTRONICS ENGINEERING
EC-201

Unit – I
Semiconductor materials and properties

Group-IV materials, Covalent bond, electron-hole concepts	1
Basic concepts of energy bands in materials, concept of forbidden gap	2
Intrinsic and extrinsic semiconductors, donors and acceptors impurities	1

Junction diode

p-n junction	1
depletion layer	1
v-i characteristics, diode resistance, capacitance	1
diode ratings (average current, repetitive peak current, non-repetitive current, peak-inverse voltage).	1

Unit-II

Diode Applications

rectifiers (half wave and full wave)	1
calculation of transformer utilisation factor and diode ratings,	1
filter (C-filter), calculation of ripple factor and load regulation	2
clipping circuits, clamping circuits, voltage multipliers	2

Breakdown diodes

breakdown mechanisms (zener and avalanche)	1
breakdown characteristics, zener resistance, zener diode ratings	1
zener diode application as shunt regulator	2

Unit-III

Bipolar Junction Transistor

Basic construction, transistor action	1
CB, CE and CC configurations, input/output characteristics	2
Biasing of transistors-fixed bias, emitter bias, potential divider bias, comparison of biasing circuits	2

Transistor Amplifier

Graphical analysis of CE amplifier, concept of voltage gain, current gain	2
h-parameter model (low frequency), computation of A_i, A_v, R_i, R_o of single transistor CE and CC amplifier configurations.	2

Unit-IV

Field Effect Transistor

JFET: Basic construction, transistor action, concept of pinch off, maximum drain saturation current, input and transfer characteristics, characteristic equation CG, CS and CD configurations, fixed-, self-biasing	3
MOSFET: depletion and enhancement type MOSFET-construction, operation and characteristics.	2
Computation of A_v, R_i, R_o, of single FET amplifiers using all the three configurations	1

Unit-V

Switching theory and logic design

Number systems, conversion of bases	5
Boolean algebra, logic gates, concept of universal gate, canonical forms.	2
Minimisation using K-map	1

Operational Amplifiers

Concept of ideal operational amplifiers, ideal op-amp parameters, inverting, non-inverting and unity gain amplifiers, adders, difference amplifiers, integrators	2

Books and reference:

1. Boylestad and Nashelsky, 'Electronic Devices and circuits' PHI, 6e, 2001.
2. A Mottershead, 'Electronic devices and circuits', PHI, 2000.
3. Morris Mano, 'Digital Computer Design', PHI, 2003.

PHYSICS PRACTICALS
PH-251

L   T   P
2   1   0

List of Experiments (Any Ten)
1. To determine the wavelength of monochromatic light by Newton's ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the specific rotation of cane sugar solution using half shade polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To determine the specific resistance of the material of given wire using Carey Foster's bridge.
7. To determine the variation of magnetic field along the axis of a current carrying coil and then to estimate the radius of the coil.
8. To verify Stefan's Law by electrical method.
9. To calibrate the given ammeter and voltmeter.
10. To study the Hall effect and determine Hall coefficient, carnier density and mobility of a given semiconductor material using Hall-effect set up.
11. To determine energy bank gap of a given semiconductor material.
12. To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
13. To draw hysteresis curve of a given sample of ferromagnetic material and from this to determine magnetic susceptibility and permeability of the given specimen.
14. To determine the balistic constant of a ballistic galvanometer.
15. To determine the viscosity of a liquid.

Note : Additional experiments may be added based on contents of syllabus.

COMMUNICATION LAB (ENGLISH)

HU-251

(i) Orientation to Speech Sounds through International Phonetic Alphabets (I.P.S.) : British Received Pronunciation.

(ii) Speech Drills with Emphasis on Articulatory Phonetics, Place and Manner.

LIST OF PRACTICALS

Stress in Speech: Based on Accentual Patterns.

Intonation-Pattern-Practice: Rising, Falling and Level-Tones.

Rhythm in Speech-Practices On Strong and Weak-form Words.

Individual Conferencing / Speaking along with Quizzes.

Conversational Skills for Interview/ Seminars / Workshops with Emphasis on Kinesis along with Promotion of Phonetic-Script-Skills.

Group-Discussion: Practices based on Accurate & Current Grammatical Patterns.

Official / Public Speaking : Practices based on Mechanics of Articulation.

Theme Presentation-Practices Based on Linguistic Patterns.

Developing Argumentative Skills/ Role-Play Presentations with Proper Rhythmic Stress.

Testing comprehension : Reading and Listening Exercises with the use of Audio-Visual Aids.

Audience-based, Effective Speech Production (Elocution)

ELECTRICAL ENGINEERING LAB
EE -251

L T P
0 0 2

List of Practicals

A minimum of 10 experiments from the following :

1. Verification of Network Theorems.

2. Study of diode characteristcs.

3. To study a half wave and full wave rectifier circuit with and without capacitor filter and determine the ripple factor.

4. Determination of Common base and common emitter characteristics of a transistor.

5. Study of phenomenon of resonance in RLC series circuit.

6. Measurement of power in a three phase circuit by two wattmeter method.

7. Measurement of efficiency of a single phase transformer by load test.

8. Determination of parameters and losses in a single phase transformer by OC and SC test.

9. DC generator characteriestics.

10. Speed control of dc shunt motor.

11. Study running and reversing of a three phase induction motor.

12. Study of a single phase energy meter.

13. To study the various logic gate (TTL).

    Additional experiments may be added based on contents of syllabi.

<div align="center">

WORKSHOP PRACTICE
WS-251

</div>

L T P
0 0 2

1. **Carpentry Shop:** 1. Study of tools and operation and carpentry joints. 2. Simple exercise using jack plain. 3. To prepare half-lap corner joint, mortise and tennon joints. 4. Simple exercise on woodworking lathe.

2. **fitting Bench Working Shop :** 1. Study of tools and operations 2. Simple exercises involving filling work. 3. Making perfect male-female joint 4. Simple exercise involving drilling/tapping/dieing.

3. **Black Smithy Shop :** 1. Study of tools and operations 2. Simple exercises based on black smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging.

4. **Welding Shop :** 1. Study of tools and operations . 2. Simple butt joint. 3. Lap joint. 4. oxy acetylene welding.

5. **Sheet metal shop :** 1.Study of tools and operations. 2. Making funnel complete with soldering.   3. Fabrication of tool box, tray, electrical panel box etc.

6. **Machine Shop :** 1. Study of tools and operations. 2. Plane turning. 3. Step turning. 4. Taper turning , 5. Threading. 6. Single point cutting tool grinding.

MATHEMATICS III

MA- 301

Unit - I : Integral Transforms   **8**
Fourier integral, Fourier complex transform, Fourier sine and cosine transforms and applications to simple heat transfer equations.

Z – transform and its application to solve difference equations.

Unit - II : Functions of a Complex Variable - I   **9**
Analytic functions, C-R equations and harmonic functions, Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic functions, Liouvilles theorem, Fundamental theorem of algebra.

Unit - III : Functions of a Complex Variable - II   **8**
Representation of a function by power series, Taylor's and Laurent's series, Singularities, zeroes and poles, Residue theorem, evaluation of real integrals of type $\int_o^{2\pi} f(\cos\theta, \sin\theta) d\theta$ and $\int_{-\infty}^{+\infty} f(x) dx$, Conformal mapping and bilinear transformations.

Unit - IV : Statistics and Probability   **8**
Moments, Moment generating functions, Skewness, Kurtosis,Correlation and Regression, Binomial distribution, Poisson distribution, Normal distribution.

Unit - V : Curve Fitting and Solution of Equations   **5**
Method of least squares and curve fitting of straight line and parabola, Solution of cubic and bi-quadratic equations.

CHEMISTRY-I
CY-301

                                         L : T: P
                                         3 : 1: 0

Unit –I
IUPAC nomenclature: E-Z,R-S bicyclic alkanes , hetrocycles aliphatic and aromatic compounds: Application of Grignard reagent, lithium aluminum hydride.   7

Unit-II
Stereoisomerism: Geometrical isomerism with and without chirality, concept of aromaticity directive influence of substitute.Criteria & techniques of purity of compounds. Melting point ,Boiling point , recrystallisation , various distillations.   7

Unit-III
Reactions , Synthesis & mechanism: Hydrocarbons including cyclic , alcohol, phenols , aldehyde& ketones, carboxylic acids & their derivatives, halides , nitro, amino & diazo compounds.   10

Unit-IV

Conformational analysis: Various terms , conformation analysis of ethane , cyclohexane & 1,2 disubstituted cyclohexane Heterocyclic: Classification, preparation and properties of pyridine.   10

Unit-V

Bimolecules: Structures & reactions of mono & disaccharides, proteins & natural polymers.   6

FLUID FLOW AND SOLID HANDLING
CH-301

L:T: P
3 : 1: 0

Unit-I

Solids and Their Handling

Properties of solids ,screening, industrial screening equipment. Determination of particle size, screen analysis, size reduction of solids,stages of reduction , operating variables, intermediate and fine size reduction, power requirement and mechanism.

Power driven machines: Crushers, grinders, and conveyors.   8

Unit –II

Filtration: Theory, continuous and batch equipments. Flow of solids through fluids, classification and sedimentation.   8

Unit – III

Fluid flow:

Properties of fluids

Fluid statics: Euler'sequation, Hydrostatic Law and Pressure Measurement

Transport of fluids, energy relationships, pipe fittings, minor losses in pipe flow   8

Unit IV

Flow measurements: Orifice meter. Nozzle and venturi meters, rotameter and pitot tube.   8

Unit V

Pumping and compressing: reciprocating pumps, rotarypumps, centrifugal pumps and blowers. Introduction to fluidization.   8

1. To Determine size distribution of sample cruoled in a dodge crusher
2. To Determine efficiency of crusting of a roll crusher.
3. To determine surface area volume of a sample using screen analysis.
4. To Determine constants of filtration in case of rotary filter.
5. To Determine terminal velocity in case of hinderel setting in sedimentation.
6. To Calibrate orificemeter
7. To Calibrate vanturimeter.
8. To Calibrate rotameter.
9. To Verify Bernoulli equation.

COMPOSITIOIN, QUALITY AND SAFETY OF FOODS

FT-301

L : T: P

3   1   0

Unit-I   *L (1 – 9)* T (1 – 3)

Composition: Chemical constituents of foods: Desirable and Potentially undesirable food constituents and their importance. Recommended Dietary Allowances (RDA).

Composition of foods – General and specific for different foods of plant and animal origin.

Unit-II   L (10 – 18)   T (4 – 6)

Carbohydrates: Classes, Nomenclature and structure. Dietary utilization and disturbances

Lipids: Definition, Classification and structure: Fatty acids composition of natural lipids of plants and animal origin, Essential fatty acids. Role and use of natural lipids and tailor made fats in foods.

Unit-III   L (19 – 27)   T (7 – 9)

Protein: Physico-chemical properties of amino acids, peptides and proteins, structure - function relationship of proteins, Essential Amino acids.

 Nutritional attributes of food and their implications.

Unit- IV   L (28 – 36)   T (10 – 12)

 Quality: Basic concepts. Nutritional and sensory attributes and their assessments, causes of undesirable changes leading to quality deterioration in foods and their implications. Determination of probable cause(s) of observed quality change in foods.

Unit-V   L (37 – 45)   T (13 – 15)

Safety: Operational sense of food safety, Potential Food derived health hazard- Microbial contamination, Nutritional Imbalance. Pesticide residues, Environmental Contamination. Naturally occurring compounds and permitted food additives. Testing food for its safety.

Book References:

Author	Title
C. Gopalan	Nutritive value of Indian Foods
L.H. Mayer	Food Chemistry
Kramner & Twigg	Quality control for Food Industry
H.D. Graham	Safety of Foods

MECHANICS OF SOLIDS
ME-301

L : T: P
3 : 1: 0

Unit-I

Simple stress and strain ; Normal stress and strain; Elastic materials- Hook's Law; Modulus of elasticity- Young's modulus; Tensile test, Stress-Strain curves for important engineering materials; Ductile and Brittle materials; Poisson's ratio and its application to

a two-dimensional stress system; Shear stress and strain; Modulus of rigidity; Allowable working stress, Factor of safety.   8

Unit-II

Stress concentration factor; Toughness; Creep and fatigue; Compound bars subjected to external loads; Simple bending theory; Shear force and Bending moment diagram for beams carrying concentrated and distributed loads; Points of contraflexure; Neutral axis; Section modulus; Second moment of area.   8

Unit-III

Slope and defection of beams; Direct integration method; Macaulay's method; Energy method; Simple torsion theory; Polar record moment of area shear stress and strain in shafts; Torsion of hollow shafts; Torsion of thin walled tubes.   8

Unit-IV

Strain energy under uniaxial tension and compression; Biaxial state of stresses; Stresses on oblique planes; Principal stresses and strains; Mohr's stress circle; Bulk modulus; Volumetric strain.   8

Unit-V

Pressure vessels; Thin and thick cylinders; Hoop and longitudinal stresses; Lame' theory; Buckling of columns: Euler's theory.   6

FLUID MECHANICS LAB
CH-351

L : T: P
0 : 0 : 3

1. To determine experimentally the metacentric height of a ship model.
2. To verify the momentum equation experimentally.
3. To determine the coefficient of discharge of an orifice (or a mouth piece) of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice (or the mouth piece.).
4. To plot the flow net for a given model using the concept of electrical analogy.
5. To measure surface tension of a liquid.
6. To calibrate an orifice meter and study the variation of the coefficient of discharge with the Reynolds number.
7. To verify Dacy's law and to find out the coefficient of permeability of the given medium.
8. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
9. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
10. to study the variation of friction factor, 'f' for turbulent flow in smooth and rough commercial pipes.
11. To determine the loss coefficients for the pipe fittings.
12. To study the flow behaviour in a pipe bend and to calibrate the pipe bend for discharge measurement.

13. To study the boundary layer velocity profile and to determine boundary layer thickness and displacement thickness. Also to determine the exponent in the power law of velocity distribution.

CHEMISTRY-I LAB
CY-351

L : T: P
0 : 0 : 3

1. Identification of liquid organic compounds.
2. Identification of two organic compounds (one water soluble and one water insoluble) in a mixture.
3. Minor estimation of phenol, glucose & aniline.
4. Preparation of p- Nitroacetanilide from Acetanilide.
5. Paper chromatography of organic compounds
6. Thin layer chromatography: Determination of Rf value & Separation of compounds.

ANALYSIS OF FOOD CONSTITUENTS LAB
FT-351

L : T: P

0   0   6

S. No. Name of the practical

1. Sampling requirements, procedures and methods.
2. Determination of moisture content of foods by oven drying and distillation methods.
3. Determination of Total and Acid insoluble ash content in foods.
4. Determination of Crude fat content by solvent extraction methods in foods.
5. Determination of crude Protein by Kjeldhal Lowry methods.
6. Determination of reducing and total sugar content in foods.
7. Determination of crude fibre content in foods.
8. Determination of specific mineral contents in foods such as Calcium, Iron, Phosphorus, Chloride etc.
9. Determination of specific vitamin content of food such as ascorbic acid, carotenes etc.
10. Determination of specific Natural and/ or added Colouring Matters in foods.
11. Determination of specific added food Preservatives in foods.
12. Chromatographic Separation and identification of sugars and amino acids.

References:

1. BIS and AOAC Methods of Food analysis.

2. "Hand Book of analysis and quality control for fruit and Vegetable Products". IInd edition. Tata McGraw-Hill Publishing Company Ltd. New Delhi.

NUMERICAL METHODS AND COMPUTER PROGRAMMING
MA-401

L : T: P
3 : 1: 0

Unit-I

C Language and C^{++} Language : Overview , structure of C and C^{++} programs , charter set, key words, identifiers , constants, variables , data types, declarations, operators, expressions, control structures, arrays, functions, pointers, etc. Simple programs.   10

Unit-II

Alogrithms and flow charts. Introduction to numerical methods, Interpolation and extrapolation, solution of differential equations and partial differential equations and algebra equations . Numerical integration , solution of simultaneous linear equations.   8

Unit-III

Elements of BASIC/PASCAL/C/C++ oriented programming.   8

Unit-IV

Control and input – output statements , subscripted variables, functions and subroutines.   8

Unit-V

Writing simple computer programs in BASIC/PASCAL/C/C++. Selected examples from electrical/mechanical/civil/chemical engineering.   8

CHEMISTRY-II
CY-401

L : T: P
3 : 1: 0

Unit-I

Chemical Kinetics : Kinetics of parallel side,opposite, consecutive and chain reactions, fast reactions fundamental aspect of kinetics of reactions in solution.

Unit-II

Catalysis : Acid basis catalysis, Enzyme catalysis, heterogeneous reactions.   6

Unit-III

Surface chemistry: adsorption, adsorption isotherms , surface tension and its determination .

Colloids chemistry : General preparation properties and classification hydrophilic and lypophobic sols. Electrical and technique properties of solutions.   7

Unit-IV

Thermodynamic: Application of I st and II nd law of thermodynamics to chemical processes. Thermodynamic functions, F.A.S.K. their determination relations and physical significance

Unit-V

Colligative properties : Lowering of B>P. elevation in B.P . depression in F.P. Osmotic pressure and relation with molecular weight.

Electro chemistry : Cells their classification liquid junction potential , E.M.F. and thermodynamic functions relations. Application of E.M.F. measurements activity coefficient concept.

HEAT TRANSFER OPERATIONS
CH-401

L : T: P
3 : 1: 0

Unit-I

Introduction to heat transfer and general concepts of heat transfer by conduction , convection and radiation.

Conduction: Basic concepts of conduction in solids, liquids and gases , steady state temperature fields and one dimensional conduction without heat generation e.g. through plane walls, cylindrical and spherical surfaces , composite layers etc. Insulation materials , critical and optimum insulation thickness. Extended surfaces, fines and their practical applications . Introduction to unsteady state heat transfer.   8

Unit-II

Convection: Fundamentals of convection , basic concept of convection and definitions . Natural and forced convection, hydrodynamic and thermal boundary layers, laminar and turbulent heat transfer inside and outside tubes . Dimensional analysis, determination of individuals and overall heat transfer coefficients and their temperature dependence, heat transfer in molten metals.   8

Unit-III

Heat transfer with phase change : Condensation of pure and mixed vapors, film wise and drop wise condensation ,loading in condensers and basic calculation on condensers, heat transfer in boiling liquids, boiling heat transfer coefficients.   8

INDUSTRIAL FUELS AND PROCESS CALCULATIONS
CH - 402

L : T: P
3 : 1 : 0

Unit –I
Fuels: Origin, chemical composition, classification, storage, and general uses of industrial fuels.   8

Unit II

Types of solid fuels , proximate and ultimate analysis of coal, calorific values of fuels, specification of fuel oil. Types of gaseous fuels, control of combustion. Types of liquid fuels, petroleum and its distillation products, coal tar and its distillation products, modified and synthetic fuels, fuels for cryogenic engines.   8

Unit - III

Process calculations: Systems of units. Stoichometry and composition relations. Material balances, the use of ideal gas laws and vapour pressures, solubility and heat capacity data.   8

Unit-IV

Humidityand solvent recovery. Material balance for various unit operations like absorption, distillation, crystallization etc.   8

Unit-V

Thermochemistry and energy balances. Material and energy balances for typical processes.   8

BASIC AND FOOD MICROBIOLOGY
FT-401

L : T: P
3 : 1 : 0

Unit-I   **L (1 – 8)   T (1 – 4)**

General characteristics of microorganism: Classification, morphology, physiology, growth, nutrition and reproduction; Pure culture techniques and maintenance of cultures, control of microorganism.

Unit-II   **L (9 – 14)   T (5 – 7)**

Incidence of microorganism in foods, source of contamination. Principle underlying spoilage and preservation of foods.

Unit-III   **L (15 – 24)   T (8 –12)**

Contamination, spoilage and preservation of cereal products, sugar products, fruit and vegetable products, meat products, fish and sea foods egg and poultry products milk and milk products and other foods, Microbiological standard of foods.

Unit-IV   **L (25 – 30)   T (13 – 15)**

Food poisoning and food borne infections, food plant sanitation, inspection and control, personnel hygiene, HACCP in food industry.
Beneficial microorganisms and their utilization in food fermentation.

Book references:

Author	*Title*
M.J.Pelczar	Microbiology
James M. Jay	Modern Food Microbiology
Adams & M.O..Moss	Food Microbiology
W.C.Frazier	Food Microbiology

NMCP LAB
MA-451

L : T: P
0 : 0 : 3

Develop programs in C and C++ languages for any TEN of the following:

1.Solution of a single nonlinear algebraic equation by Newton Raphson method.
2.Solution of a single nonlinear algebraic equation by Regula Falsi method.
3.Solution of two simultaneous nonlinear algebraic equation by Newton Raphson method.
4.Solution of linear simultaneous equations by Gauss Jordan method.
5.Solution of linear simultaneous equations by Gauss Elimination method.
6.Solution of linear simultaneous equations by Gauss Seidel and Successive over Relaxation method.
7.Implementation of interpolation formulae.
8.Implementation of least squares approximation of a function.
9.Implementation of numerical differentiation formulae.
10.Implementation of numerical integration formulae.

11.Solutions of single first order ordinary differential equation by 4th order Runge Kutta method.

12 Solutions of second order ordinary differential equation by 4th order Runge Kutta method.

13. Solutions of simultaneous first order ordinary differential equation by 4th order Runge Kutta method.

14. Solution of boundary value problems by finite difference techniques.

CHEMISTRY- II LAB
CY-451

L : T: P
3 : 1 : 0

1. To verify Freundlich adsorption Isotherm.
2. To find out the percentage composition of given solution by viscosity measurement with the help of Ostwalds viscometer.
3. To verify Participation or Distribution Law.
4. To determine the rate constant (K) for the hydrolysis of Ethyl Acetate catalyzed by HCl acid.
5. To determine the molecular weight of the given compounds by elevation of boiling point.
6. To determine the molecular weight of the given compounds by depression of freezing point.
7. To determine pH of a solution using pH mater.

BASIC AND FOOD MICROBIOLOGY LAB
FT-451

L : T: P
0 : 0 : 6

S. No.	Name of the practical
1.	Microscope its parts and utility in identification and differentiation of bacteria, yeast and mold.
2.	Familiarization with common techniques for handling pure culture serial dilution, Inoculation, slide preparation incubation, counting etc.
3.	Micrometry and determination of size of deferent different microbes.
4.	Simple and differential staining of microorganisms and their examination.
5.	Direct total, viable, and non-viable count of microorganisms in milk.
6.	Preparation and sterilization of media and glass ware for microbial counts.
7-8.	Determination of Standard Plate Count (SPC) in natural and/or processed foods.
9-10.	Microbiological examination of some selected natural and processed foods.
11-12	Microbiological examination of potable water: Total and coliform count.

13.   Enumeration of coliform organism in some selected processed foods.

Book Reference:
Author   **Title**
H. W. Selley Jr. and Paul J. Van.   Microbes in action

INDUSTRIAL ECONOMICS AND PRINCIPLES OF MANAGEMENT
HU-501

L : T: P
3 : 1: 0

Industrial Economics:

Unit –I

Introduction : Nature and Significance of economics. Meaning of Science, Engineering and Technology and their relationship with economic development.   4

Unit-II

Basic Concept: The concept of demand and supply. Elasticity of Demand and Supply. Indifference curve analysis, Price effect, Income effect and Substitution .

Unit -III

Money and Banking: Functions of Money. Value of Money, Inflation and Measures to control it. Brief idea of functions of banking system , viz.,Commercial and Central Banking.

Management:

Unit -IV

Introduction: Definition ,Nature and Significance of Management. Evaluation of Management thought Contribution of Max Weber, Taylor and Fay

Unit – V

Human Behaviour: Factors of Individual Behaviour, Perception,Learning and Personility development, Interpersonal Relationship and Group Behaviour. 10

MASS TRANSFER OPERATIONS – I
CH- 501

L : T: P
3 : 1: 0

Unit-I

Basic Principles of mass transfer: Molecular diffusion in fluids, mass transfer coeeficients, Interphase mass transfer.

Humidification Operations: Vapour pressure, enthalpy, absolute humidity, dew point, etc., Unsaturated vapour gas mixtures.   8

Unit-II

Gas absorption: Countercurrent, co-current, multistage continuous contact operations.   8

Unit-III

Distillation : Entrainment, pressure drops , flooding , transfer coefficients and relative volatility. Macabe Thiele and Ponchon method for binary component distillation of azeotropes. Flash vaporization and Multicomponent distillation.   8

Unit-IV

Liquid extraction: Concurrent and countercurrent operations in single and multistage solvent extraction, triangular diagrams.   8

Unit-V

Drying: Batch and freeze drying, rotary driers. Surface vs diffusion controlled operations.

Leaching: Design of equipment fot above operations.   8

FOOD ADDITIVES
FT-501

L : T: P

3 : 1: 0

Unit-I   L (1 – 8)   T (1 – 4)

Definitions, uses and functions of:Acid, Base, Buffer systems, Salts and chelating/sequestering agents, Masticatory substances. Low calorie and non nutritive sweeteners, Polyols

Unit-II   L (9 – 16)   T (5 – 8)

Antioxidants, Emulsifying and stabilizing agents, Anti-caking agents, thickeners, Firming agents. Flour bleaching agents and Bread improvers.

Unit-III   L (17 – 22)   T (9 –12)

Anti microbial agents / Class I and Class II preservatives as per PFA Act.

Unit-IV   L (23 – 30)   T (13 – 15)

Colorants, Flavoring agents and related substances, Clarifying agents. Gases and Propellants. Tracers and other additives.

Book References:

Author	Title
O.R.Fennema	Food Chemistry
N.S.Manay	Food Acts and Principles
PFA Rules 1955	PFA Act 1954

FOOD CHEMISTRY

FT– 502

L : T: P

3 : 1: 0

Unit-I   L (1 – 9)   T (1 – 3)

(a) Water in Foods: Structure. Properties, Interactions, Water activity, and stability.

(b) Carbohydrates: Functions, Reactions and properties of simple and complex carbohydrate, Selection of Natural or Modified carbohydrates for incorporation into processed food.

Unit-II **L (10 – 18)** **T (4 – 6)**

Lipids: Consistency of commercial fats Lipolysis, Auto oxidation, Thermal Decomposition and effect of ionizing radiation, Refining of oils, Modification of oils and fats, Role of food lipids in flavor, Nutritional aspects of natural ands modified fats.

Unit-III **L (19 – 27)** **T (7 – 9)**

Proteins: Nutritive and supplementary value of food protein, Chemical reactions and interactions of amino acids and proteins, De-naturation and it implications, Functional properties of food proteins, Modification of food proteins in processing and storage and its implications.

Unit-IV **L (28 – 36)** **T (10 – 12)**

Vitamins, Minerals, Pigments and Flavours: Chemistry and stability of water and fat-soluble vitamins, Chemical properties of minerals and their bioavailability, Enrichment and fortification. Natural pigments in foods and their retention in processed foods. Flavoring constituents in foods, Development of process and reaction flavour volatiles.

Unit-V **L (37 – 45)** **T (13 – 15)**

Characteristics of muscle tissues, Milk, Egg and edible plant tissues, Integrated approach to food chemistry.

Book references:
Author **Title**
O.R. Fennema Food chemistry

FOOD BIOCHEMISTRY AND BIOTECHNOLOGY

FT– 503

L : T: P
3 : 1: 0

Unit-I **L (1 – 9) T (1 – 3)**

Nomenclature, Classification and specificity of enzymes and cofactors, Enzyme Kinetics: Factors affecting the rate of enzyme catalyzed reaction, regulation and control of enzyme action.

Unit-II **L (19 – 27) T (7 – 9)**

Metabolic Pathways: Carbohydrates, proteins and fats; catabolism and anabolism

Unit-III   **L (10 – 18) T (4 – 6)**

Digestion absorption, Assimilation and Transport of nutrients in human beings.

Unit-IV   **L (28– 36) T (10 – 12)**

Post harvest and Postmortem biochemical changes in foods: Changes in composition, color, texture, flavor and its implications on quality of foods.

Unit-V   **L (37 – 45) T (13 – 15)**

Application of enzymes in food processing: Endogenous enzymes and their role in modification of foods, enzyme added to foods during processing sources, conversions and specific applications.

Book References:

Author	Title
O.R.Fennema	Food Chemistry
A.L.Lehninger	Principle of biochemistry
Lubert Stryen	Biochemistry
N.A.M.Eskin	Biochemistry of Foods
S.A.Joshi	Nutrition and Dietetics
J.H.Weil	General Biochemistry

FOOD CHEMISTRY LAB

FT– 551

L : T: P
0 : 0: 6

S. No. Name of practical

1. Analysis of water for potable and food purposes
2. Moisture content in foods in relation to their stability
3. Non-enzymatic browning reactions and its determinations
4. Determination of rate/ extent of hydrolysis of sucrose/starch
5. Determination of free fatty acid content in fats and oils
6. Detection and estimation of oxidative rancidity in fats/oils
7. Determination of heat stability of vitamin c
8. Study of some reactions of proteins
9. Study of some processing changes in proteins
10. Study of some functional properties of proteins
11. Detection / Estimation of some additives in foods
12. Detection/Estimation of adulterants in some foods

Book References:

1. The chemical analysis of foods and food products, by Morris B. Jacobs, III Edition, CBS Publishers and distributors New Delhi.

2.   ISI hand book of food analysis

1.   Hand book of analysis and quality control for fruit and vegetable products, by S. Ranganna, II Ed., Tata McGraw Hill Publishing Co. New Delhi.

4.   Official Method of analysis of AOAC

FOOD BIOCHEMISTRY AND BIOTECHNOLOGY LAB
FT– 552

L : T: P
0 : 0 : 6

S.No. Name of Practical

1.Determination of enzyme activity and specific activity (Enzyme assay)

2. Determination of effect of temperature on enzyme activity

3. Determination of effect of pH on enzyme activity

4. Determination of effect of substrate concentration on enzyme activity and estimation of Km.

5.Estimation of enzymatic browning in a food

6. Estimation of enhancement in an enzyme activity during ripening of a fruit

7. Estimation of enhancement in an enzyme activity during sprouting of a grain

8. Detection/ estimation of catalase and peroxidase activity in vegetable

9-13.   Application of enzymes:

Amylase in hydrolysis of starch.

Invertase in hydrolysis of sucrose.

Protease in hydrolysis of protein

Lipase in hydrolysis of fat.

Cellulase and hemicellulase for dehulling of a grain,etc.

Book references:

1.   An introduction to practical biochemistry by D.T.Plummer, III Ed. Tata McGraw Hill Publishing Co. New Delhi

2.   Principles of Enzymology for Food Science by J.R.Whitaker, Marcel Dekker Inc

3.   Methods in Enzymology by S.P.Colwick and N.O. Kaplan, Acadmic Press

CHEMICAL ENGINEERING THERMODYNAMICS
CH-602

L : T: P
3 : 1: 0

Unit-I
Basic Concept
The firstlaw and conservation of energy. Applications to steady , nonsteady flow and other engineering problems. The second law. Applications to engineering problems relating to equilibrium , maximum and minimum work.   8

Unit-II
Properties of Pure Substances
Changes in thermodynamic properties and their inter-relationships. The ideal gas. Fugacity and Fugacity coefficients for real gases.   8

Unit-III
Multicomponent System
Partial molal properties. Mathematical models for the chemical potential. Ideal and non-ideal solutions. Activity and activity coefficients. The Gibbs Duhem equations. Excess properties of mixtures.   8

Unit-IV
Phase Equilibria
Criteria for equilibrium between different phases in Multicomponent nonreacting systems. Applications to systems of engineering interest, particularly to vapour – liquid equilibria and solubility.   8

Unit-V
Chemical Equilibrium
The equilibrium constant and the variation of yield in chemical reactions with pressure, temperature and composition.   8

MASS TRANSFER OPERATIONS –II
CH-601

L : T: P
3 : 1: 0

Unit –I
Diffusion
Molecular and turbulent diffusion , diffusion coefficient. Fick's law of diffusion, measurement and estimation of diffusivity. Diffusion in multicomponent gas mixtures. Diffusion in solids: Molecular, Knud sen and surface diffusion.
Inter phase mass transfer: Mass transfer coefficients, diffusion between phases, equilibrium solubility of gases in liquids. Mass transfer theories. Mass transfer in fluidized beds.   8

Unit –II
Adsorption and Stripping
Equipments, gas-liquid equilibria, Henry's law, selection of solvent, absorption in tray column, graphical and analytical methods. Adsorption in packed columns. HTU, NTU & HETP concepts, design equations for packed column.   7

Unit –III

Humidification and Dehumidification

Vapour liquid equilibrium and enthalpy for a pure substance , vapour pressure – temperature curve, vapour gas mixtures, definition and derivations of relationships related with humidity, fundamental concept of humidification . Dehumidification and water cooling, wet bulb temperature, adiabatic and non-adiabatic operation, evaporative cooling, classification and design of cooling towers.   7

Unit –IV

Drying

Solid-gas equilibria, definitions of moisture contents, types of batch and continuous dryers, rate of batch drying , time of drying, mechanism of batch drying, continuous drying.   4

Unit –V

Crystallization

Equilibrium yield of crystallization , heat and mass transfer rates in crystallization, theories of crystallization. Classification and design of crystallizers.   4

FOOD PRESERVATION & PROCESSING PRINCIPLES
FT - 601

L : T: P
3 : 1: 0

Unit-I   L (1 – 9)   T (1 – 3)

Basic considerations: Aims and objectives of preservation & processing of foods, Characteristics of tissues and non-tissues foods, Degree of perishability of unmodified foods, Causes of quality deterioration and spoilage of perishable foods, intermediate moisture foods, wastage of foods.

Unit-II   L (1

Preservation of foods by low temperatures:

(A)   Chilling temperatures: Consideration relating to storage of foods at chilling temperatures, Applications and procedures, Controlled and Modified atmosphere storage of foods, Post storage Handling of foods.

(B)   Freezing temperatures: Freezing process, Slow and fast freezing of foods and its consequence, other occurrences associated with freezing of foods. Technological aspects of pre freezing, Actual freezing, Frozen storage and thawing of foods.

Unit-III   L (19 – 27)   T (7 – 9)

Preservation of foods by high temperatures: Basic concepts in thermal destruction of microorganisms D,Z,F values. Heat resistance and thermophic microorganisms. Cooking, Blanching, Pasteurization and Sterilization of foods. Assessing adequacy of thermal processing of foods, General process of caning of foods, Spoilage in canned foods.

Unit-IV   L (28 – 36)   T (10 – 12)

Preservation by water removal:

(a)   Principles, Technological aspects and application of evaporative concentration process; Freeze concentration and membrane process for food concentrations.

(b)   Principles, Technological aspects and application of drying and dehydration of foods, Cabinet, tunnel, belt, bin, drum, spray, vacuum, foam mat, fluidized-bed and freeze drying of foods.

Unit-V   **L (37 – 45)   T (13 – 15)**

Principles, Technological aspects and application of sugar and salt, Antimicrobial agents, Biological agents, non ionizing and ionizing radiations in preservation of foods. Hurdle technology.

Book References	Author
O.R.Fennema	Principles of Food science
V.Kyzlink Principle of Food Preservation	
James M.Jay	Modern Food Microbiology

MACHINE DESIGN
ME- 601

L : T: P
3 : 1: 0

Unit-I
Introduction to the methodology of Engineering design; Design circle for a product/ system; Important considerations in design; Formulation of design concepts; Miscellaneous considerations like wear, environmental, human and aesthetic aspects; Ergonomics considerations.   8

Unit-II
Estimation of design load under static and dynamic conditions; Design for safety; Stress concentration and its effect and its prevention; Consideration of creep, fatigue and thermal stresses in design.   8

Unit-III
Material selection in design; Important engineering materials- Their classification and properties; Elementary idea of rubber, plastic ceramics and composites; Advantages over conventional metals and alloys.   8

Unit IV
Design of power transmission systems- belt, pulley and shafts; Design of riveted and welded joints; Design of keys, couplings, lever and brackets.   8

Unit-V
Design of pressure vessels- thick and thin cylinders, pipe and joints; Elementary ideas and importance of computer aided design; Basics of computer graphics - general introduction to AutoCAD.   8

CEREALS, PULSES AND OILSEED PRODUCTS
FT – 602

L : T: P
3 : 1: 0

Unit-I   L (1 – 9)   T (1 – 3)

Composition, Structure and Processing characteristic of Cereal grains, Legumes and oilseeds, Post harvest, Post processing practices for their safe storage. Parboiling and Milling of paddy, Quality characteristics, Curing and aging of rice, Processed rice products.

Unit-II   L (1

Wheat and its quality characteristics for milling into flour and semolina, Flour milling, Turbo grinding and air classification, Flour grades and their suitability for baking purposes, Assessment of flour quality and characteristics, Milling of Durum wheat, Macaroni products.

Unit-III   L (19 –27)   T (7 – 9)

Ingredients, Technology and quality parameters for baked products: Bread, Biscuits and cakes; Breakfast cereals.

Unit-IV   L (28 – 36)   T (10 – 12)

Dry and Wet milling of corn, Starches and its conversion products, Malting of barley, Pearling of Millets, Milling of legume-pulses by traditional and improved processes.

Unit-V   L (37 – 45)   T (13 – 15)

Processing of oil seeds for direct use and consumption, Oil and protein products. Processing of extracted oil refining, hydrogenation, interestrification. Processing of deoiled cake into protein concentrates and isolates, Textured protein, Functional protein preparations. Peanut butter, Margarine and Spread.

Book references:

Author	Title
C.F.T.R.I. Mysore	Manuals on Rice and its Processing
N.N.Potter	Food Science
S.A.Matz	Cereal Technology
S.A.Matz	Bakery Technology

CHEMICAL ENGINEERING OPERATION LAB

CH-651

L : T: P
0 : 0 : 3

1.   Studies on Jaw Crushers, Hammer mill, Ball Mill, Crushing Rolls
2.   Screen Analysis
3.   Pressure Drop studies in pipe fittings
4.   Studies on Rotameter, Orifice meter, venturi meter and V – Notch.
5.   Studies on sedimentation and filtration.

6.   Studies on Heat Exchangers viz. Concentric pipe heat exchanger, Shell and tube heat exchanger.
7.   Studies on Single effect/ Multiple effect evaporators.
8.   Studies on Bubble cap/ tray/ fractional column.
9.   Studies on Absorption/ Humidification/ Dehumidification columns.
10.   Studies on extraction column.

FOOD PRESERVATION AND PROCESSING LAB
FT-651

L : T: P
0 : 0 : 6

S. No. Name of practical

1.   Extension of shelf life/ preservation of foods by use of low temperature.
2.   Processing and preservation of Peas by use of high temperature.
3.   Preservation and processing of certain vegetables by drying and dehydration (water removal)
4.   Osmotic concentration/dehydration of certain fruits and vegetables using concentrated sugar and salts solutions (reduction in water activity)
5.   Preparation of Jam/Jelly and its preservation by sugar.
6.   Preparation of tomato puree/ketchup and its preservation by chemical preservatives.
7.   Preparation of fruit juice/pulp and its preservation by chemical preservatives/thermal processing.
8.   Preparation of cordials and squash as per FPO specification.
9.   Preparation of Bread/test baking.
10.   Pre-treatment and milling of legume-pulses / dehulling of oil seeds.
11-14. Preparation of certain baked products – Buns, Biscuits, Cookies, Cakes Pizza etc.

Book References:

Author	Title
G.Lal, G.S.Siddappa & G.L.Tondan	Preservation of Fruits and Vegetables
S.C.Dubey	Basic Baking: Science and Craft
E.J.Pyler	Baking Science and Technology

FT-652 SEMINAR

L : T: P
0 : 0 : 3

The student will be required to prepare and deliver a seminar as well as submit a written report on the topic assigned to him/her

FRUITS, VEGETABLES AND PLANTATION PRODUCTS

FT - 701

L : T: P
3 : 1: 0

Unit-I   L (1 – 9)   T (1 – 3)

Structural, Compositional and Nutritional aspects of fruits and vegetables. Physiological development: Growth, Maturation, Ripening and Senescence. Post harvest handling including controlled and modified storage. Techniques of processing and preservation of fruits and vegetables by refrigeration and freezing, canning and bottling, drying and dehydration.

Unit-II   L (10 – 18)   T (4 – 6)

Technology of fruits and vegetable products: Juices and pulps, Concentrates and powders, Squashes and cordials. Beverage: Still and carbonated. James, Jellies and Marmalades. Preserves, candies and crystallized fruits. Tomato products: Puree, Paste, Ketchup, Sauce and soup. Chutneys, pickles and other products.

Unit-III   L (19 – 25)   T (7 – 9)

Spices: Composition, Structure and characteristics. Preservation and processing of major and minor spices of India; whole spice, Spice powder, Paste and extracts, Spice oils and oleoresins.

Unit-IV   L (26 – 36) T (10 – 12)

Composition, Structure and characteristics of cashew nut and other dry fruits. Composition, Production and processing of Tealeaves: Black tea, Green tea and Oolong tea. Instant tea. Production and processing of coffee cherries by wet and dry methods to obtain coffee beans, grinding, storage and preparation of brew, Soluble /Instant coffee, Use of chicory in coffee, decaffeinated coffee.

Unit-V   L (37 – 45) T(13 – 15)

Production, processing and chemical composition of cocoa beans. Cocoa Processes: Cleaning, roasting, alkalization, cracking and fanning, Nib grinding for cocoa liquor, cocoa butter and cocoa powder. Manufacturing process for chocolate: Ingredients, Mixing, Refining, Conching, Tempering, Moulding etc. to obtain chocolate slabs, chocolate bars. Enrobed and other confectionary products.

Book References:

Author	Title
G. Lal, G.S. Siddappa and G.L. Tondan & G.L. Tandon B.L. Amla	Preservation of fruits & vegetables. Food Industry.
B. Shrilakshimi	Food Science.
Bernard. W. Minifie	Chocolate, Cocoa and Confectionary: Science and Technology.
R.H.H. Wills et.al.	An introduction to the Post-harvest physiology and handling of fruits and vegetables.

FOOD QUALITY AND FOOD LAWS
FT - 702

L : T: P
3 : 1: 0

Unit-I   **L (1 – 9)   T (1 – 3)**

Ways of describing of Food Quality, Quality control and Quality Assurance functions. Total Quality Control (TQC) and the role of management/ TQM.. Statistical quality control. Quality costs., Analysis and Interpretation of sensory scores. Application of sensory evaluation in Quality Management of foods.

Unit-II   **L (19 – 27)   T (7 – 9)**

Instrumental measurements of sensory attribute of foods: Appearance, color, volume, density and specific gravity, Rheological and textural characteristics . Texture profile analysis. Correlation between instrumental and Sensory analysis of food quality attributes**.**

Unit-III   **L (28 – 36) T (10 – 12)**

Nutritional Quality of foods and its assessments: Food proteins (Digestibility, Biological value, NPU, PER), Modifications of foods constituents due to processing and storage and their nutritional implications.

Unit-IV   **L (37 – 45) T (13 – 15)**

Food standards and Specifications: Compulsory and voluntary trade and Company standards. Consumer, company, In-process and finished product specifications. Relevant Food laws : PFA, FPO, SWMA, MPO, AgMark, and BIS Standards.

Book References:

Author	Title
J.M.DeMan	Rheology and Texture in Food Quality
Y.Pomeranz	Food Analysis : Theory and practice
	IS: 6273 (Part-1& Part-2)
M.A. Amerine	Principles of Sensory Analysis of Food

INSTRUMENTATION AND PROCESS CONTROL
CH-701

L : T: P
3 : 1: 0

Unit-I

Elements of measurement , fumctions and general classifications of measuring instruments. Indicating and recording type of instruments. Elements of measuring instruments,static and dynamic characteristics of measuring instruments.   6

Unit-II

Principle of operation, construction and application of important industrial instruments for the measurement of temperature, flow, liquid level and composition.   10

Unit-III

Dynamic behavior of first order, second order and two or more first order systems in series.   10

Unit-IV
Block and physical diagrams of control system. Open and closed loop control systems. Characteristics of measuring elements, controllers and final control elements. Mods of control actions.   (08 lectures)

Unit-V
Response of closed loop control systems for various kind of control actions and measurement lag.   6

CHEMICAL REACTION ENGINEERING
CH-702

L : T: P
3 : 1: 0

Unit-I
Chemical Reactions : Rate of chemical reactions, variable affecting the reaction rate, order of reaction , reaction rate constant , elementary and non-elementary reaction mechanism. Arrhenius equation, Collision theory and theory of absolute reaction rates, predictability of reaction rate.   8

Unit-II

Kinetics of homogeneous chemical reactions, rate equations for simple and complex reactions, irreversible reaction, parallel reactions,consecutive reactions, auto catalytic reactions   and   homogeneous   catalytic reactions.   8

Unit-III
Interpretation of reactor data in constant volume and variable volume batch reactions, integral and differential method of following kinetic data.   6

Unit-IV
Classification of chemical reactions, Interpretation of reactor data in flow reactions. Reactor designs for homogeneous, batch, semi-batch, plug flow and continuous stirred tank. Electrochemical reactors. Isothermal as well as non-isothermal operation, space velocity and residence time in flow reactors. Size comparison of single reactors like batch, plug flow and CSIR for first and second order single reactions. Multiple reactor systems, Plug flow reactions in series and for parallel equal sized CSTR's in series.   10

Unit-V
Catalysts: Preparation, activity and the factors which influence it. The effect of physical properties such as surface area and pore size etc. on catalyst activity, methods of determination   of   their   physical   properties,   catalyst   poisoning,   Biocatalysis. Heterogeneous   catalytic reactions, principles, absorption isotherms, kinetics of solid catalysed fluid reactions, rate-controlling steps.Use of computers in designing, modeling, optimization and simulation of chemical process.   8

NUTRITIONAL ASPECTS OF NATURAL & PROCESSED FOODS
OE-40

L : T: P
3 : 1: 0

Unit-I　　　　　　　　　　　　　　　　　**L (1 – 9)**　**T (1 – 3)**

Food and its functions, Role of nutrients, Effects of deficient or excess intake of the individual essential nutrients. Recommended Dietary Intakes (RDI) and its uses. Factors affecting nutritional requirement of an individual.

Unit-II　　　　　　　　　　　　　　　　　**L (10 –18)**　**T (4 – 6)**

Composition of Foods: General and Specific for different foods of plant and animal origin. General causes. of loss, of nutrients. Nutritional changes during processing & storage and their implications. Potentially undesirable constituents in foods. Restoration, Enrichment, Fortification and Supplementation of foods.

Unit-III　　　　　　　　　　　　　　　　**L (19 – 27)**　**T (7 – 9)**

Digestion, Absorption and Metabolism of food in human body.

Unit-IV　　　　　　　　　　　　　　　　**L (28 – 36) T (10 – 12)**

Balanced diets for normal individuals. Therapeutic diets for people suffering from various ailments and disorders. Functional foods.

Unit-V　　　　　　　　　　　　　　　　　**L (37 – 45) T (13 – 15)**

Assessment of calorific value and nutritional quality of natural and processed foods by chemical and biological means. Sensory qualities and acceptability of foods.

References:
1.　'Dietetics' by B. Srilakshmi, H' edn., New Age International (P)Ltd.New Delhi.
2.　'Nutrition and Dietetics' by Shubhangini A. Joshi, Tata McGrawHill Co.Ltd
3.　'Nutritive Value of Indian Foods' by C. Gopalan, B.V. Ramasastri and S.C.Balasubramanian; NIN, Hyc
4.　'Food Chemistry' by O.R. Fennema, 2' edn. Marcel Dekkar Inc.
5.　'Basic Nutrition in Health & Disease' by P. S. Howe, W.B. Saunders Company London.

FOOD QUALITY EVALUATION LAB
FT-751

L : T: P
0 : 0: 3

1.　Sensitivity tests (Threshold/Dilution) to measure individual ability for sensory analysis.
2-3.　Difference tests to evaluate qualitative and' quantitative differences and/or preference between test products.
4-5.　Assessment of quality of wheat flour (Water Absorption Power, Gluten Content, Sedimentation Value etc.).
6.　Evaluation of quality of Bakery Products: Bread, Biscuits, Cakes etc.
7-8.　Evaluation of quality of Dairy Products: Over ran and fat content in IceCream, Specific gravity of Milks etc.

9-10. Assessment of quality of Fruit & Vegetable Products: Tomato Products, Jam, Jelly, Marmalades, Squashes& Cordials, Canned Products.

11-12. Assessment of Quality of Beverages: Tea & Coffee, Carbonated and RTS Beverages.

Book References:

Author	Title
BIS Specifications	
Morris B. Jacobs	The Chemical Analysis of Foods & Food Products
S. Rangann	Hand Book of Analysis and Quality Control for Fruit & Vegetable Products
	Official Method of Analysis of AOAC

FT-752: PROJECT

L : T: P
3 : 1: 0

The student (s) will be required to search literature pertaining to design of an

equipment / processing of a food commodity / production of food product, comprehend it

and prepare a report for assessment.

FT-753 : INDUSTRIAL TRAINING

L : T: P
0 : 0 : 3

The student(s) will be required to undertake training in the food industry after III B. Tech.VI semester for a specified period and submit its report after completion for evaluation and oral examination in the VII semester of his studies in Final B.Tech.

ELECTIVE
FT-011 : SPECIALITY FOODS

L : T: P
3 : 1 : 0

Unit-I

Infant and baby foods, Adolescent / Teen-age foods, Geriatric foods, Foods for pregnant ladies and nursing mothers. Functional foods and Probiotics.

Unit-II

Foods / Diets in metabolic disorders and disturbances.

Unit-III

Foods and Diets recommended and restricted in Gastrointestinal disorders; Fever and Infection; Liver, gallbladder and pancreatic disturbances.

Unit-IV

Foods and Diets recommended and restricted in blood, circulatory and Cardiac diseases; urinary and Musculoskeletal diseases. Allergies.

Unit-V

Beneficial Effects of Spices, gamma-linolenic acid, Spirulina, antioxidants and other food constituents. New Developments.

Book References:

Author	Title
Benzamin T. Burton	Human Nutrition
Shubhangini A. Joshi	Nutrition and Dietetics
B. Srilakshmi	Dietetics
Arnold E. Bender	Nutrition and Dietetic foods
AFST(I) & CFTRI	Proceedings of IFCON 98
Periodicals by AFST(I), CFTRI	Indian Food Industry
P. S. Howe, W.B. Saunders	Basic Nutrition in Health & Disease

FOOD PROCESSING WASTE MANAGEMENT
FT-013

L : T: P
0 : 0 : 3

Unit-I

Basic considerations: Standards for emission or discharge of environmental pollutants from food processing Industries as per the updated provision of Environment (Protection) Act, 1986. Elements of importance in the efficient management of food processing wastes.

Unit-II

Characterization and utilization of by-products from Cereal Pulses, Oilseeds, Fruits and vegetables, Plantation products, Fermented foods, Milk, Fish, Meat, Egg and poultry processing industries.

Unit-III

Characterization of food Industry effluents, Physical an chemical parameters, Oxygen demands and their interrelationships, Residues (solids), Fats, Oils and grease, Forms of Nitrogen, Sulphur and Phosphorus, Anions and cations, Surfactants, Colour, Odour, Taste, Toxicity. Unit concept of treatment of food industry effluent, Screening, Sedimentation Floatation as pre - and primary reactants.

Unit-IV

Biological oxidations: Objects, Organisms, Reactions, Oxygen requirements, Aeration devices Systems: Lagoons, Activated sludge process, Oxidation ditches, Rotating biological cont caters and their Variations and advanced modifications.

Unit-V

Advanced wastewater treatment systems. Physical separations, Micro-strainers, Filters, Ultra filtration and reverse osmosis. Physico-chemical separations: activated carbon adsorption, Ion-exchange electro-dialysis and magnetic separation. Chemical oxidations and treatment Coagulation and flocculation. Disinfection. Handling disposal of sludge.

Book References:

Author	Title
J.H. Green	Food Processing Waste Management
	Environment (Protection) Act
AFST(I) & CFTRI	Proceedings of the Symposium on By-
products From food	
	Industries: Utilization and Disposal

TECHNOLOGY OF ANIMAL FOODS
FT-801

L : T: P
3 : 1 : 0

Unit-I

Fluid Milk: Composition of milk and factor affecting it. Physico-chemical characteristics of milk and milk constituents. Production and collection , cooling and transportation of milk. Packaging storage and distribution of pasteurized milk.: Whole, Standardized, Toned, Double toned and skim milk. Test for milk quality and Adulteration. UHT processed milk, flavoured, Sterilized milk. Cleaning and sanitization of dairy equipments.

Unit-II

Definition, Classification, Composition and physico-chemical properties of cream. Production processes and quality control. Butter: Definition, Classification, Composition and methods of manufacture, Packaging and storage. Butter oil/Ghee. Ice cream: Definition, Classification and Composition, Constituents and their role. Preparation of mixes and freezing of Ice cream, Overrun, Judging, Grading, and defects of Ice cream.

Unit-III

Evaporated and Condensed milk: Method of manufacture, Packaging and storage. Defects, Causes, and prevention. Roller and Spray Drying of milk solids. Instantization. Flow ability, Dustiness, Reconstituability, Dispersability, Wet ability, Sink ability and

appearance of milk powders. Manufacture of casein, Whey protein, Lactose from milk or use in formulated foods.

Unit-IV
Ante-mortem examination of meat animals, Scienctific slaughtering, Post mortem changes, Tendering and curing of meat, Beef Mutton, Pork Sausages and other meat products. Catch, Handling and transportation of fish. Fish spoilage, Processing, Preservation of fish, Shell fish and other sea foods.

Unit-V
Poultry processing, Canning of poultry products. Physical, Chemical Nutritional and Functional characteristics of Egg. Causes of deterioration of quality of egg, Preservation and Processing of Egg. Manufacturing of egg white, Egg yolk and Whole Egg solids/powder.

Book References:

Author	Title
H.V.Athortone	Chemistry and testing of dairy products
N.Warner	Principles of dairy processing
Sukumar De	Outlines of dairy technology
R.A.Lawrie	Meat Science.
G.J.Mountney	Poultry Products Technology
B.Srilakshmi	Food Science

TRADITIONAL AND FERMENTED FOODS
FT- 802

L : T: P
3 : 1 : 0

Unit-I
Indian traditional sweet, savory and snack food products: Sweetmeats, Namkins, Papads Idli and Dosa.

Unit-II
Preparation and Maintenance of Bacterial, Yeast and Mold cultures for food fermentations. Lactic acid bacteria-activities and health-promoting effects. Mushrooms: Cultivation and preservation.

Unit-III
Fermented Dairy Products: Cheeses, Curd and Yoghurt, Butter milk and the fermented milks. Spoilages and defects of fermented dairy products and their control. Fermented meat and fish products.

Unit-IV
Fermentative Production of Beer, Wines, Cider and Vinegar. Fermented Vegetables (Pickles).

Unit-V
Production of Baker's Yeast, Microbial Proteins and fats, Food enzymes, and Food additives. Oriental fermented foods.

Book References:

Author	Title
K.H. Steinkrus	Handbook of Indigenous Fermented Foods
Sukumar De	Outlines of Dairy Technology
Prescott & Dunn	Industrial Microbiology
L.E. Casida	Industrial Microbiology
W.C. Frazier and D.C. Westhoff	Food Microbiology

FOOD PACKAGING
FT- 803

L : T: P
3 : 1 : 0

Unit-I
Basic Concepts: Concept of packaging, Functions of a Food Package, Package development factors and Food package development. Aseptic Packaging. Newer trends.

Unit-II
Cellulosic and Polymeric packaging materials and forms: Food grade polymeric packaging materials, Rigid plastic packages. Films: Oriented, Co-extruded, Laminates and Metallised; Cellophane, Olefins, Polyamides, Polyesters, PVC, PVDC, PVA, Inomers, Copolymers, Polycarbonates, Phenoxy, Acrylic and Polyurethane. Their mechanical sealing and barrier properties.

Unit-III
Glass and Metal containers:
Glass: Composition, Properties, Bottle making and Closures for glass containers.
Metal: Bulk containers, Tin-plate containers, Tin free steel containers, Aluminium containers, Latest development in metal cans and protective lacquers.

Unit-IV
Food product characteristics and package requirement, Selection of materials, Forms, Machinery and methods for fresh produce (Fruits, Vegetables, Egg, Meat and Fish), Edible oils and Fats, Spice and spice products, Processed products (Fruit & Vegetable, Cereal & Pulse, Dairy, Confectionary & Snacks, Meat & Marine products).

Unit-V
Package printing, Packaging Laws and Regulations, Evaluation of food packaging materials and package performance.

Book References:

Author	Title
M. Mahadeviah and R.V. Gowramma	Food Packaging Materials
S. Saclarow and R.C. Griffin	Principles of Food Packaging
Trends in Food Science & Technology	Proceedings of IFCON-1988

INDUSTRIAL   SAFETY AND HAZARD MANAGEMENT
CH-801

L : T: P
3 : 1: 0

Unit I
Industrial safety, Industrial hygiene and safety aspects related to toxicity, noise, pressure, temperature, vibrations, radiation etc. Explosions including dust , vapor, cloud and mist explosion.   06

Unit II
Elements of safety, safety aspects related to site, plant layout, process development and design stages, identification of hazards and its estimation, risk, risk analysis and assessment methods; fault free method, event free method, scope of risk assessment, controlling toxic chemicals and flammable materials.   10

Unit III
Toxic substances and degree of toxicity, its estimation, their entry routes into human system, their doses and responses, control techniques for toxic substances exposure, use of respirators, ventilation systems.   08

Unit IV
Prevention of losses, pressure relief, provision for fire fighting, release of hazardous materials from tanks, pipes through holes and cracks , relief systems : types and location of relief's.   08

Unit V
Handling, transportation and storage of of flammable liquids, gases, and toxic materials and wastes, regulation and legislation, government role, risk management routines, emergency preparedness, disster planning and management.

08

PROJECT
FT-851

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The student (s) will be required to prepare a detailed project report on fabrication of an equipment / establishment of a plant for processing of a food commodity for production of food product(s) with complete lay-out and economic analysis for assessment.