

PHYSICS
TAS-101/ TAS-201
(Revised w.e.f. 2004-05)

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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 Hysteresis 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 Resnick : Introduction to Special Theory of Relativity
2. Aurthur Beiser : Perspectives of Modern Physics
3. A.K. Ghatak : Optics
4. Wehr Richards & Adiaiv : Physics of Atoms
5. O.Svelto : Lasers
6. D.J. Griffith : Electrodynamics

CHEMISTRY

TAS-102/TAS-202

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[Revised w.e.f. 2004-2005]

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, ¹H 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 & polythiophene) & their applications.

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 & Boyd)
2. Inorganic Chemistry (I.D. Lee)
3. Physical Chemistry (Barrow)
4. Environmental chemistry (Manahan)

PROFESSIONAL COMMUNICATION

TAS-103

[Effective from the session : 2004-05]

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.

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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	:	<i>The Gandhian Outlook</i>
Francis Bacon	:	<i>Of Studies</i>
J.B. Priestley	:	Making Writing Simple
Virginia Woelf	:	How should one Read a Book
R.K. Narayan	:	<i>A Bookish Topic</i>
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	:	<i>The Fly</i>
A.P. Chekhov	:	<i>The Lament</i>
M.R. Anand	:	The Barber's Trade Union
Ruskin Bond	:	The Eyes Are Not Here
D.H. Lawrence	:	The Rocking Horse Winner
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
Rutherford 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.

MATHEMATICS-I

TAS-104

Unit - I : Matrices	9
Elementary row and column transformation, Rank of matrix, Linear dependence, Consistency of linear system of equations, Characteristic equation, Caley-Hamilton Theorem, Eigen values and eigen vectors, Diagonalisation, Complex and unitary matrices .	
Unit - II : Differential Calculus-I	8
Leibnitz theorem, Partial differentiation, Eulers theorem, Curve tracing, Change of variables, Expansion of function of several variables	
Unit - III : Differential Calculus-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.	

ELECTRICAL ENGINEERING

TEE-101/TEE-201

(Revised : with effect from session 2002-2003)

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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. Fitzgerald, D.E., Higginbotham and A Grabel, "Basic Electrical Engineering " Mc Graw Hill.
5. H. Cotton, "Advanced Electrical Technology" Wheeler Publishing.

MECHANICAL ENGINEERING

TME-101/201

[Effective from the session : 2004-05]

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 stroke 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 friction-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:

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

ELECTRONICS ENGINEERING

TEC-101/ TEC-201

[Effective from the session : 2004-05]

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.	

INFORMATION TECHNOLOGY

TIT-101/TIT-201

[Effective from the Session : 2004-05]

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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:

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
7. Kanter, "Managing Information System"
8. Lehngart, "Internet 101", Addison Wesley
9. CIS tems "Internet, An Introduction", Tata McGraw Hill.

ENVIRONMENTAL STUDIES

TES - 201

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Unit-I :

The Multidisciplinary nature of environmental studies

2

Definition, scope and importance, Need for public awareness

Natural Resources

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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.
- Disaster 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, Clarendon Press Oxford (TB)
5. Cunningham, W.P, Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 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

MATHEMATICS II

TAS-204

- 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, Trigonometric 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.

PHYSICS PRACTICALS

TAS-151/TAS-251

(Revised w.e.f. 2004-05)

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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, carrier density and mobility of a given semiconductor material using Hall-effect set up.
11. To determine energy band 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 ballistic constant of a ballistic galvanometer.
15. To determine the viscosity of a liquid.

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

CHEMISTRY PRACTICALS

TAS-152/TAS-252

LIST OF EXPERIMENTS

[Revised w.e.f. 2004-2005]

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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 indicator
6. pH-metric titration.
7. Determination of Equivalent weight of Iron by the chemical displacement method. The equivalent weight of copper is 63.5

(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 CuSO₄ 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 cacl₂ as a desiccant). The quantity of copper sulphate remaining in

solution – after the chemical displacement, is estimated by iodometric 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 So₄)

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

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

The Eq. Wt. of Fe = ?

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

ELECTRICAL ENGINEERING LAB

TEE-151 / TEE 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 characteristics.
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 characteristics.
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.

MECHANICAL ENGINEERING LAB

TME-151 / TME 251

L T P
0 0 2

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.

COMPUTER PROGRAMMING LAB

TCS 151 / TCS 251

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. Familiarizing 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.

WORKSHOP PRACTICE

TWS-151/251

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 tenon 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.

ENGINEERING GRAPHICS TCE 151

L T P
0 0 2

1. Introduction	
Graphics as a tool to communicate ideas, Lettering and' dimensioning, Construction of geometrical figures like pentagon and hexagon.	2
2. Orthographic Projection	
Principles of orthographic projections, Principal and auxiliary planes, First and Third angle projections.	1
Projection of points. Pictorial view.	1
Projection of lines parallel to both the planes. Parallel to one and inclined to other, Inclined to both the planes. Application to practical problems.	3
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.	2
Sectioning of solids lying in various positions, True shape of the section.	2
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, Charohtar Publishing.
2. Laxmi Narayan V & Vaish W. : A Text Book of Practical Geometry on Geometrical drawing.

TAS-253 : COMMUNICATION LAB (ENGLISH)

- (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)

TAS 301: MATHEMATICS III

L : T: P
3 : 1: 0

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, Liouville's 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 $\int_0^{2\pi} f(\cos\theta, \sin\theta) d\theta$ 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.	

TCY-301: CHEMISTRY-I

L : T: P
3 : 1: 0

Unit -I	
IUPAC nomenclature: E-Z,R-S bicyclic alkanes , heterocycles 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	
Biomolecules: Structures & reactions of mono & disaccharides, proteins & natural polymers.	
	6

TCH-307: FLUID FLOW AND SOLID HANDLING

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's equation, 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
	18

Unit V

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

1. To Determine size distribution of sample crushed in a dodge crusher
2. To Determine efficiency of crushing 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 hindered settling in sedimentation.
6. To Calibrate orificemeter
7. To Calibrate venturimeter.
8. To Calibrate rotameter.
9. To Verify Bernoulli equation.

TBE-301 MICROBIOLOGY

L : T: P
3 1 0

Unit-I

Microbiology & its scope, microscopy. classification, morphology & physiology of bacteria, yeast, molds, algae and virus.

Unit-II

Microbial growth kinetics, growth curve, diauxic growth factors influencing growth, continuous and synchronous culture, microbial nutrition and reproduction.

Unit-III

Pure culture techniques – microbial culture media, isolation, identification and maintenance of cultures, characteristics of pure culture, enumeration techniques.

Unit-IV

Physical and chemical methods of control of microorganisms, immune response, antigen-antibody interaction. Microbial defense mechanisms under adverse conditions.

Unit-V

Microbial ecology, incidences of microorganisms in soil, water, air, food and sewage, food spoilage organisms, food borne infections and poisoning organisms.

References:

1. "Microbiology" by M.J. Pelczar, Jr. E.C.S. Chan and N.R. Krieg, 5th Ed. , TMH Book Company.
2. "Foundation in Microbiology", Kathleen Talaro & Arthur Talaro, W.C.B. Wm. C. Brown Publishers (1994).

ME-307 MECHANICS OF SOLIDS

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 deflection of beams; Direct integration method; Macaulay's method; Energy method; Simple torsion theory; Polar second 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; Lamé's theory; Buckling of columns: Euler's theory. 6

CH-357 FLUID MECHANICS LAB

L : T: P
0 : 0 : 3

CY-351 CHEMISTRY -I LAB

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 R_f value & Separation of compounds.

BE-351 MICROBIOLOGY LAB

L : T: P
0 0 6

1-2. Microscopy : Use & care of microscope, examination of prepared slides and wet mounts of bacteria, yeast, molds. Microbial Identification & examination of food samples. Other biomaterials of bacteria, yeast and molds.

3. Micrometry: Measurement of microbial cells.

4. Staining techniques: Simple staining, Gram staining, Endospore staining, Capsule staining.

5-7. Enumeration techniques: Microscopic count using haemocytometer, Viable cell count (By pour plate method) Turbidity measurement as direct expression of growth.

8-9. Culture techniques: Culture media preparation, Cultivation of microorganisms.

10. Isolation of microorganisms by streak plate method.

11. Isolation by serial dilution method, maintenance & preservation.

12. Influence of antimicrobial agent on growth effect of UV radiation & heat on microbial growth.

13. Microbiological examination of water: Coliform & Salmonella counts.

14. Microbiological assay of a growth factor.

References:

1. "Microbes in action". A laboratory manual of Microbiology, H.W. Seeley Jr. and Paul J. Van Demark, D.B. Taraporevala Sons & Co. Pvt. Ltd.
2. "Methods in Microbiology", Ed. J.R. Norris and D.W. Ribbons, Vol. 3 A, Academic Press, London & New York.

TAS-401: COMPUTER BASED NUMERICAL METHODS

L T P
3 1 0

Unit 1

Problem solving on computer. Algorithms and flow charts.

Introduction to numerical computing, approximations and errors in numerical computations. Truncation and round off errors, propagation of errors.

Root finding: bisection method, regula falsi method, iteration method, Newton Raphson method, Secant method, systems of nonlinear equations. 08

Unit 2

Matrix algebra, Solution of simultaneous linear algebraic equations: Gauss elimination, Gauss Jordan method, LU decomposition, Jacobi method, Gauss Seidel method, SOR method, convergence of iterative methods. Tridiagonal systems and Thomas algorithm, Condition of a system and stability issues. 06

Unit 3

Interpolation and Extrapolation: Newton's forward and backward interpolation formula, Lagrange interpolation formula. Divided differences and Newton's general formula. Numerical differentiation, Numerical integration : Trapezoidal and Simpson's rules. Newton-Cotes integration formulas, Romberg integration, Gaussian Quadrature. 10

Unit 4

Numerical solution of O.D.E.: Taylor series method, Euler's method, Runge Kutta methods. Multistep methods: Milne's method, Adams method, accuracy, Convergence criteria, stiffness, systems of equations. 08

Unit 5

Boundary Value problems: Finite difference method, solving eigenvalue problems, polynomial method, power method. Numerical solution of Partial Differential equations. Elliptic, Parabolic and hyperbolic PDEs. 08

Books Recommended

E. Balagurusamy: Numerical Methods, Tata McGraw hill.

Reference Books

1. **Sastry, S. S.** "Introductory Methods of Numerical Analysis", 3rd ed. Prentice- Hall of India, New Delhi (2002).
2. "Schaum's Outlines: Numerical Analysis", 2nd ed. Tata Mc Graw Hill Publishing Co. Limited (1968)
3. **Kandasamy, P. Thialagawathy, K. & Gumawathy, K.** "Numerical Methods", S. Chand & Company Ltd., New Delhi (1999).
4. **Balaguruswamy, E.** "Numerical Methods. Tata Mc Graw Hill Publishing Company Limited, New Delhi (2001).
5. **V. K. Singh** "Numerical and Statistical Methods in Computer" (2005), Paragon International Publishers, New Delhi.
6. **Jain, Iyengar and Jain,** "Numerical Methods for Scientific and Engineering Computation" (2003), New Age International, New Delhi.
7. **Grewal B.S.,** "Numerical Methods in Engineering and Science", Khanna Publishers, Delhi.

TCY-401: CHEMISTRY-II

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 lyophobic sols. Electrical and technique properties of solutions. 7

Unit-IV

Thermodynamic: Application of Ist and IInd 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.

TCH-401: HEAT TRANSFER OPERATIONS

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, fins 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

TCH - 407 : INDUSTRIAL FUELS AND PROCESS CALCULATIONS

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. Stoichiometry and composition relations. Material balances, the use of ideal gas laws and vapour pressures, solubility and heat capacity data. 8

Unit-IV

Humidity and 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

TBE-401 : BIOCHEMISTRY

L : T : P
3 : 1 : 0

Unit I

Structure and function of biomolecules; carbohydrates, proteins, lipids and nucleic acids. Biochemical separation methods. Vitamins, enzymes and coenzymes.

Unit-II

Biological membranes and transport across them. Bioenergetics. Major anabolic and catabolic pathways of carbohydrate metabolism and their regulation; glycolysis, TCA cycle, pentose phosphate pathway, galactose metabolism, electron transport and oxidative phosphorylation, gluconeogenesis. Typical metabolic pathways of microbes; Entner-Duodoroff pathway, glyoxilate cycle, phosphoketolate pathway.

Unit-III

Lipid metabolism; transport and oxidation of fatty acids in animal tissues, glycerol metabolism, biosynthesis of fatty acids and triacylglycerol.

Protein metabolism; out lines of amino acid metabolism and their significance.

Unit-IV

Nuclic acid metabolism; mechanism and biosynthesis of DNA and RNA, reverse transcription. Protein biosynthesis, inhibitors of protein synthesis, transport of proteins and signal peptides.

References:

1. "Principles of Biochemistry", A.L. Lehninger, D.L. Neston, N.M. Cox, CBS Publishers & Distributors.
2. "Biochemistry", Lubert Stryer, W.H. Freeman & Co. , New York.
3. "General Biochemistry", J.H. Weil, New Age International (PLD).

NUMERICAL TECHNIQUES LAB TAS 451

L T P
0 0 3

Use of following Techniques in C/C++ Language

1. Solution of single non-linear algebraic equations by Newton Raphson method.
2. Solution of single non-linear equations by Regulafalsi method.
3. Solution of system of linear simultaneous by Gauss Elimination method.
4. Solution of system of linear simultaneous equation by gauss seidel method and successive over relaxation method.

5. Solution of single first order ordinary differential equations by fourth order Runge-Kutta method.
6. Solution of Heat equations (Parabolic equations) by finite difference method.
7. Solution of Laplace equations (elliptic equation) by finite difference method.
8. Solution of wave equations (Hyperbolic equation) by finite difference method.
9. Finding Newton's interpolatory polynomial for n points.
10. Finding Newton's interpolatory polynomial based on finite difference table for n points.
11. Simpson's 3/8-rule.

TCY-451 : CHEMISTRY- II LAB

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.

TBE-451 : BIOCHEMISTRY LAB

L : T: P
3 : 1 : 0

- 1 Estimation of carbohydrates.
2. Estimation of proteins.
3. Estimation of nucleic acids:
4. Isoelectric precipitation.
5. Separation of amino acids by paper chromatography.
6. Separation of sugars by paper chromatography.
7. Extraction of Lipids.
8. Thin layer Chromatography.
9. Gel Electrophoresis.
- 10-11. Assay of enzyme activity and enzyme kinetics.
12. Identification and estimation of an intermediate of EMP pathway.
13. Cell fractionation.

References:

1. "An Introduction to Practical Biochemistry", david T. Plummer, tata McGraw-Hill Publishing Co. Ltd., New Delhi.

THU-501: INDUSTRIAL ECONOMICS AND PRINCIPLES OF MANAGEMENT

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 Personality development, Interpersonal Relationship and Group Behaviour. 10

TCH- : MASS TRANSFER OPERATIONS – I

L : T: P

3 : 1: 0

Unit-I

Basic Principles of mass transfer: Molecular diffusion in fluids, mass transfer coefficients, 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. McCabe 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 for above operations. 8

TBE-501 : BIOPROCESS PRINCIPLES

L : T: P

3 : 1: 0

1. Thermodynamic principles. Coordination of microbial metabolism with reference to carbohydrates, lipids and proteins etc. Metabolic pathway synthesis of small molecules, key crossroads and branch points in metabolism.
2. Regulation of the synthesis of enzymes, control of metabolic pathway by regulatory enzymes. Control of protein synthesis by induction and repression. Regulation of a few major metabolic pathways especially those relevant to bioprocesses industries.
3. End-products of metabolism: Primary and secondary metabolites, such as enzymes, amino acids, organic acids, solvents, nucleotides and antibiotics. Anaerobic metabolic end products and partial oxidation and its end products.
4. Stoichiometry of cell growth and product formation. Overall growth stoichiometry, elemental material balance for growth, heat generation and yield concepts etc.
5. Application of gene cloning in redirecting cellular metabolism for over-production of a desired metabolite; Metabolic pathway synthesis.

References:

1. Principles of Biotechnology by A. L. Lehninger, CBS Publishers and Distributors.
2. 'Biochemical Engineering Fundamentals' by J.E. Bailey and D.F. Ollis, McGraw-Hill Book Co.

TBE – 502 : MOLECULAR BIOLOGY & GENETIC ENGINEERING

L : T: P

3 : 1: 0

1. Development of Molecular Biology. Nucleic acids forms, structure and functions. Gene: Its concept and inheritance.
2. Regulation of transcription and translation. Protein structure, folding and refolding.
3. Controlling of Prokaryotic Gene Expression, control circuit of operon. Tryptophan operon. Repressor Blokage.
4. r-DNA Technology : Principles, construction and properties of vectors and restriction enzyme properties and uses.
5. Gene cloning and expression of genes. Restriction mapping and -DNA sequencing.

References:

1. "Molecular Biology of the Gene", J.D. Watson, Melnopak, California.
2. "Genes", 8th Ed., Benjamin Lewis (2000) John Wiley & Sons, New York.
3. "Biochemistry", A.L. Lehninger, Worth Publication, New York.
4. "Recombinant DNA Technology", Dhillon J.R., John Wiley & Sons, New York.
5. "Genetics", P.K. Gupta, Rastogi Publication, Meerut.

TBE-503 : FERMENTATION BIOTECHNOLOGY-I

L : T: P

3 : 1: 0

1. Introduction and scope of microbial processes. Alcoholic fermentation and resent developments. Glycerol fermentation.
2. Malting and brewing: beer production, wine manufacturing and other distilled liquors.
3. Microbial production of organic acids and fermentation processes.
4. Biomass as a fermentation product: Baker's yeast, Bioinsecticides, Biofertilizers.
5. Amino acids: Lysine and glutamic acid. Commercial enzymes: Solid and submerged fermentation, recovery etc.

References:

1. "Industrial Microbiology", S.C. Prescott and C.G. Dunn, McGraw-Hill Book Company, Inc. New York.
2. "Industrial Microbiology", L.E. Casida Jr. Wiley Eastern Ltd.
3. "Microbial Technology", Vol.II, H.J. Peppler and D. Perlman, Academic Press, New York.

TBE - 551 : MOLECULAR BIOLOGY AND GENETICS LAB

0 0 6

1. Screening and selection of mutants by exposure of microbial cells to physical agents.
2. Mutation using chemical agents.
3. Estimation of DNA and RNA in microbial cells.
4. Induction and repression of β -galactosidase in yeast.
5. Development of recombinant strains.

References:

1. "An Introduction to Practical Biochemistry", david T. Plummer, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
2. "Methods in Microbiology", Ed. J.R. Norris and D.W. Ribbons, Vol. 3 A, Academic Press, London & New York.
3. "Methods in Yeast Genetics", A Laboratory Mannul of Cold Spring Harbour Laboratory, (1974 F. Sherman, G.R. Fink & C.W. Lawrence, Cold Spring Harbour, New York.

TBE-552 : FERMENTATION LAB

0 0 6

1. Analysis of molasses.
2. Preparation of malt and determination of diastatic power.
3. Determination of fermentation efficiency of yeast for batch production of ethanol.
4. Effect of substrate concentration on biomass yield for baker's yeast production and its characterization.
5. Fermentation efficiency for vinegar production.

6. Citric acid production by (a) solid state and (b) submerged fermentation.
7. Microbial production of enzymes by (a) solid state and (b) submerged fermentation.
8. Analysis of finished products (rectified spirit, beer etc.).

References:

1. "Industrial Microbiology", S.C. Prescott and C.G. Dunn, McGraw-Hill Book Company, Inc. New York.
2. Official methods of analysis of AOAC.
3. BIS booklets for various products.
4. "An Introduction to Practical Biochemistry", David T. Plummer, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

CH- : CHEMICAL ENGINEERING THERMODYNAMICS

L : T: P
3 : 1: 0

Unit-I

Basic Concept

The first law 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

TCH-607 : MASS TRANSFER OPERATIONS –II

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, Knudsen 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

TBE - 601 : FERMENTATION BIOTECHNOLOGY-II

L : T: P

3 : 1: 0

1. Antibiotics: Penicillin, streptomycin, tetracyclines, new antibiotics.
2. Biotransformations, Vaccines.
3. Biopolymers, Biosurfactants.
4. Recombinant derived products and applications: proteins, hormones, interferons and fine chemicals.
5. Introduction to drug discovery, Biotechnology based drugs, Bioethics. Intellectual Property Rights (IPR) and Protection (IPP).

References:

1. "Industrial Microbiology", S.C. Prescott and C.G. Dunn, McGraw-Hill Book Company, Inc. New York.
2. "Industrial Microbiology", L.E. Casida Jr. Wiley Eastern Ltd.
3. "Microbial Technology", Vol.II, H.J. Peppler and D. Perlman, Academic Press, New York.

TME- : MACHINE DESIGN

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

TBE – 602 BIOTECHNOLOGY OF WASTE TREATMENT

L : T: P

3 : 1: 0

1. Bioprocess kinetics applied to waste treatment. Operation and design features of trickling filters and rotating biological contractor (RBC).
2. Theory of activated sludge process, design, operation and control, BOD reduction and biomass relationship, modifications, stabilization ponds, operational and design aspects.
3. Anaerobic treatment systems. Sludge digestion theory, digester design, high rate digestion, heat transfer in digester.
4. New developments, fixed film reactors, UASB. Nitrification - denitrification, Phosphorous removal.
5. Treatment and disposal of waste of the industries e.g. distilling and brewing, antibiotics and sugar etc.

References:

1. "Waste Water Engineering: Treatment, Disposal and Reuse", Metcalf & Eddy, Inc.; Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. "Water supply and Pollution control", Warren Viessman Jr. and Mark J. Hammer; Harper & Row Publishers; New York.
3. "Environmental Engineering", Howard & Peavy, Donald R. Rawe and George Tehobanoglousd, McGraw-Hill International Editions.
4. "Waste Water Treatment", Rao & Dutta.

CH-655 : CHEMICAL ENGINEERING OPERATION LAB

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.

BE-651 WASTE WATER ANALYSIS AND TREATMENT LAB

L : T: P
0 : 0 : 6

1. Estimation of dissolved oxygen in water sample.
2. Determination of Biochemical Oxygen Demand (BOD) in wastewater sample.
3. Determination of Chemical Oxygen Demand (COD) in wastewater sample.
4. Determination of Solids: Volatile, fixed and total.
5. Evaluation of the effect of process, variables on the performance of activated sludge process.
6. Evaluation of performance of anaerobic digester.
7. Estimation of inorganic ions in water.

BE-652 SEMINAR

L : T: P
0 : 0 : 3

TBE - 701 BIOPROCESS ENGINEERING - I

L : T: P
3 : 1: 0

1. Definition and scope of Biochemical Engineering. Commercial aspects of Biochemical processes. Different biochemical unit operations and processes.
2. Sterilization of media: Principles, design of batch and continuous sterilization processes.
3. Sterilization of air: Principles, methods of air sterilization, design of air filters.
4. Aeration and agitation: Oxygen transfer in microbial systems, oxygen demands, mass transfer theories, measurements of volumetric mass transfer coefficient, power requirements in gassed and ungassed bioreactors, rheology of fermentation fluids.
5. Kinetics of microbial growth, substrate utilization and product formation in batch reactors.

References:

1. "Biochemical Engineering", Shuichi Aiba, Arthur E. Humphrey, Nancy F. Millis; University of Tokyo Press.
2. "Biochemical Engineering Fundamentals" by J.E. Bailey and D.F. Ollis, McGraw-Hill Book Co.
3. "Basic Biotechnology", J. Bu'lock, B. Kristiansen, Academic Press.
4. "Principle of Fermentation Technology", P.F. Stanbury and A. Whitaker; Pergamon Press.

TBE-702 ENZYME ENGINEERING

L : T: P
3 : 1: 0

1. Introduction - and scope, mechanism of enzymatic catalysis, allosteric enzymes.
2. Enzyme kinetics. Production of industrial enzymes.
3. Immobilization of enzymes and cells. Methods of immobilization.
4. Kinetics of the immobilized enzymes. External and internal diffusional characteristics of immobilized systems.
5. Enzymes reactor performance, operational strategies, carrier life and cycle time. Industrial application.

References:

1. "Biochemical Engineering Fundamentals" by J.E. Bailey and D.F. Ollis, McGraw-Hill Book Co., New York.
2. "Immobilized Enzymes" by Trevan.

TCH- : INSTRUMENTATION AND PROCESS CONTROL

L : T: P
3 : 1: 0

Unit-I

Elements of measurement , functions 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

TCH-707: CHEMICAL REACTION ENGINEERING

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

OE-41 : BIOTECHNOLOGY*

L : T: P

3 : 1: 0

1. Introduction: Development and prospects of biotechnology. Characteristics of living organisms, classification, morphology and physiology of microorganisms.
2. Growth, reproduction and nutritional aspects of micro-organisms. Culture isolation, maintenance. Physical and chemical control of micro-organisms.
3. General requirements of the microbial processes. Batch fermentation, growth and product formation kinetics. Sterilization of media and air. Aeration and agitation. Down stream processing.
4. Production of alcohol, glycerol, organic acids, baker's yeast, enzymes.
5. Antibiotics, biofertilizers, biopesticides. Concepts of biological waste treatments. New developments in biotechnology.

* For the students of branches other than Biochemical Engineering.

References:

1. "Principle of Fermentation Technology", P.F. Stanbury and A. Whitaker; Pergamon Press.
2. "Basic Biotechnology", J. Bu'lock, B. Kristiansen, Academic Press.
3. "Biochemical Engineering Fundamentals" by J.E. Bailey and D.F. Ollis, McGraw-Hill Book Co., New York.

TBE – 751: BIOPROCESS ENGINEERING LAB

L : T: P

0 : 1: 0

1. Determination of kinetic parameters for batch cultivation of yeast under stationary and shake flask conditions.
2. Growth kinetic studies of yeast in a bench top lab fermentor under controlled conditions.
3. Determination of volumetric oxygen transfer coefficient ($K_L a$), effect of aeration and agitation speed etc.
4. Comparison of filtration efficiency of fibrous and PVA air filter.
5. Determination of specific thermal death rate constant (K_d) and activation energy for microbial strains.
6. Studies on settling characteristics of various microbial cultures.
7. Preparation of immobilized enzymes & cells and evaluation of kinetic parameters.
8. Enzyme concentration by ultrafiltration.

References:

1. "Biochemical Engineering Fundamentals" by J.E. Bailey and D.F. Ollis, McGraw-Hill Book Co., New York.
2. "Principle of Fermentation Technology", P.F. Stanbury and A. Whitaker; Pergamon Press.
3. "Immobilized Cells and Organelles" Vol.I; B. Mattiason, CRC Press, Florida.
4. "Methods in Enzymology", S.P. Colwick and N.O. Kaplan, Academic Press.

TBE-752 : INDUSTRIAL TRAINING

TBE-753 : PROJECT (TERM WORK)

L : T: P

0 : 0: 3

TBE - 011 : ENVIRONMENTAL MANAGEMENT

L : T: P
3 : 1: 0

1. Basic aspects of environmental management: Principle and common approaches. Biosafety: Introduction and guidelines.
2. Solid waste management: Types of solid wastes, collection and disposal methods.
3. Sources, types and distribution of air pollutants, factor affecting dispersion of pollutants in air. Methods for abatement of air pollution. Effects of air pollution. Eco-friendly processes.
4. Primary and secondary standards, Air pollution indices: Definitions and significance. Govt. legislations for prevention and control of air and water pollution.

References:

1. "Environmental Engineering", Howard & Peavy, Donald R. Rawe and George Tchobanoglous, McGraw-Hill International Editions.
2. "Waste Water Engineering: Treatment, Disposal and Reuse", Metcalf & Eddy, Inc.; Tata McGraw-Hill Publishing Company Ltd., New Delhi.

TBE-012 : BIOINFORMATICS

Unit 1: Definitions of informatics, chronological history Molecular Biology's Central dogma; Gene structure and Information content, protein structure and function, Molecular Biology tools.

Unit 2: Database concept, Biological Databases; (Different types of data books spl. Biochemical pathway databases). Sequence Analysis, Pairwise Alignment and Database Searching. Multiple sequence Alignments, Trees and Profiles.

Unit 3: Genomics and Gene Recognition; From Sequencing Genes to Genomes Sequence Assembly, Annotation and Analyzing whole Genome sequences, Functional Genomics.

Unit 4: Predicting protein structure and function from sequences, Determine the structures of Proteins, Predicting the structures of proteins, from 3D to 1D. Feature Detection, in protein sequences, Secondary structure prediction, predicting 3D structures.

Unit 5: Applications and software Tools for Bioinformatics, Challenges for Bioinformatics, Industry Drug Design & DNA chip.

TBE-013 PLANT CELL BIOTECHNOLOGY

L : T: P
3 : 1: 0

1. Special features and organization of plant cells; totipotency and regeneration of plants, examples of regeneration from leaves, roots, stem etc.
2. Plant product of industrial importance, biochemistry of major metabolic pathways and products, cells suspension culture development.
3. Large scale production of secondary metabolites from suspension cultures. Characterization, kinetics of growth and the product formation, examples.
4. Nutrient optimization, cells growth regulators, biological and technological barriers, mutation, somaclonal variation.
5. Genetic engineering of plant cell, plant cells reactors and their performance. Immobilized plant cell reactor and novel design concepts.

References:

1. "Plant Tissue Culture and its Biotechnological Application", W. Barz, E. Reinhard and M.H. Zenk (Eds.); Springer-Verlag, Berlin.
2. "Plant Cell Biotechnology", H. Smith and Mantell (Eds); Cambridge University Press, Cambridge.

TBE-014: PRESERVATION OF BIOMATERIALS

L : T: P
3 : 1: 0

1. Preservation and maintenance of microbial cultures.
2. Chemical constituents of food/Biomaterials, their properties and function. Food spoilage and poisoning. Characteristic features of natural and processed foods.
3. Unit operations in food processing, Principles of food preservation: High and low temperatures.

4. Drying and dehydration, radiation and osmotic pressure.
5. Chemical preservatives, Legislation, safety and quality control.

References:

1. "Principles of Food Science", Part-II: Physical Methods of Food Preservation by M. Karel.
2. "Principles of Food Preservation" by V. Kyzlink, Elsevier Press.
3. "Modern Food Microbiology" by James M. Jay.
4. "Food Science" by N.N. Potter, VI Publications.

TBE-801: BIO SEPARATION PROCESSES

L : T: P
3 : 1: 0

1. Characteristics of bio products: Flocculation and conditioning of broth.
2. Mechanical separation: Filtration, centrifugation.
3. Cell disruption. Membrane based separation.
4. Protein precipitation and its separation; Aqueous two phase extraction, Adsorption.
5. Chromatographic separation based on size, charge, hydrophobic interaction, metal ion affinity, electrophoresis.

References:

1. "Biochemical Engineering Fundamentals" by J.E. Bailey and D.F. Ollis, McGraw-Hill Book Co., New York.
2. "Basic Biotechnology", J. Bu'lock, B. Kristiansen, Academic Press.
3. "Comprehensive Biotechnology"; Vol. 2, Murray-Moo-Young, Pergamon Press, New York.

TBE-802 : FOOD BIOTECHNOLOGY

L : T: P
3 : 1: 0

1. Microbes in food process operations and production, new protein foods, SCP, mushroom, algal protein etc.
2. Preparation and preservation of food by fermentation. Microbial food additives, colouring, flavours and vitamins.
3. Mechanisms of enzyme functions and reactions in process techniques, baking by amylases, deoxygenation and desugaring by glucose-oxidase.
4. Cheese making by protease and various other enzyme reactions in food processing, lipase and their application in oil quality improvement.
5. Bioconversion of process waste like whey, molasses, starch substrates to useful products.

References:

1. "Industrial Microbiology", S.C. Prescott and C.G. Dunn, McGraw-Hill Book Company, Inc. New York.
2. "Microbial Technology", Vol.II, H.J. Peppler and D. Perlman, Academic Press, New York.

TBE-803 : BIOPROCESS ENGINEERING

L : T: P
3 : 1: 0

1. Scale-up: Basic concepts and related problems. Fed batch fermentation: Principle and applications.
2. Continuous fermentation: Kinetic analysis, comparison with batch fermentations, applications and its limitations.
3. Bioreactor operation measurement and control: Aseptic operations, measurement and control of process variables (pH, dissolved oxygen, viscosity, temperature, NADH), agitative power, foam control, On-line analysis and computer control of fermentation process.
4. Packed and fluidized bed reactors: Analysis and application.
5. Non-mechanically agitated bioreactors such as airlift and bubble column.

References:

1. "Biochemical Engineering Fundamentals" by J.E. Bailey and D.F. Ollis, McGraw-Hill Book Co., New York.
2. "Principle of Fermentation Technology", P.F. Stanbury and A. Whitaker; Pergamon Press.

3. "Comprehensive Biotechnology"; Vol. 2, Murray-Moo-Young, Pergamon Press, New York.

TCH-806: INDUSTRIAL SAFETY AND HAZARD MANAGEMENT

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. 6

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. 8

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. 8

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, disaster planning and management 8

BE-851 : DESIGN PROJECT

Continuation of Term work of BE-753 with product and/or plant designing with a Techno-economic Feasibility Report of suitable size.

BE-852 : EDUCATIONAL TOUR

L : T: P

0: 0: 12