

ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R-2008

B.TECH. PHARMACEUTICAL TECHNOLOGY II TO VIII SEMESTERS CURRICULA & SYLLABI

SEMESTER II

(Common to all B. E. / B. Tech. Degree Programmes except B. E. – Marine Engineering)

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	HS2161	Technical English – II*	3	1	0	4
2.	MA2161	Mathematics – II*	3	1	0	4
3.	PH2161	Engineering Physics – II*	3	0	0	3
4.	CY2161	Engineering Chemistry – II*	3	0	0	3
5. a	ME2151	Engineering Mechanics (For non-circuit branches)	3	1	0	4
5. b	EE2151	Circuit Theory (For branches under Electrical Faculty)	3	1	0	4
5. c	EC2151	Electric Circuits and Electron Devices (For branches under I & C Faculty)	3	1	0	4
6. a	GE2151	Basic Electrical & Electronics Engineering (For non-circuit branches)	4	0	0	4
6. b	GE2152	Basic Civil & Mechanical Engineering (For circuit branches)	4	0	0	4
PRACTICALS						
7.	GE2155	Computer Practice Laboratory-II*	0	1	2	2
8.	GS2165	Physics & Chemistry Laboratory - II*	0	0	3	2
9. a	ME2155	Computer Aided Drafting and Modeling Laboratory (For non-circuits branches)	0	1	2	2
9. b	EE2155	Electrical Circuits Laboratory (For branches under Electrical Faculty)	0	0	3	2
9. c	EC2155	Circuits and Devices Laboratory (For branches under I & C Faculty)	0	0	3	2
TOTAL : 28 CREDITS						
10.	-	English Language Laboratory ⁺	0	0	2	-

A. CIRCUIT BRANCHES

I Faculty of Electrical Engineering

1. B.E. Electrical and Electronics Engineering
2. B.E. Electronics and Instrumentation Engineering
3. B.E. Instrumentation and Control Engineering

II Faculty of Information and Communication Engineering

1. B.E. Computer Science and Engineering
2. B.E. Electronics and Communication Engineering
3. B.E. Bio Medical Engineering
4. B.Tech. Information Technology

B. NON – CIRCUIT BRANCHES

I Faculty of Civil Engineering

1. B.E. Civil Engineering

II Faculty of Mechanical Engineering

1. B.E. Aeronautical Engineering
2. B.E. Automobile Engineering
3. B.E. Marine Engineering
4. B.E. Mechanical Engineering
5. B.E. Production Engineering

III Faculty of Technology

1. B.Tech. Chemical Engineering
2. B.Tech. Biotechnology
3. B.Tech. Polymer Technology
4. B.Tech. Textile Technology
5. B.Tech. Textile Technology (Fashion Technology)
6. B.Tech. Petroleum Engineering
7. B.Tech. Plastics Technology

SEMESTER III

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
PO3201	Mathematics III	3	1	0	4
PO3202	Physical Chemistry	3	0	0	3
PO3203	Physical Pharmacy	2	1	0	3
PO3204	Principles of Chemical Engineering	3	0	0	3
PO3205	Bioorganic Chemistry	3	0	0	3
PO3206	Cell Biology	2	1	0	3
PO3207	Microbiology	3	0	0	3
PRACTICALS					
PO3209	Physical & Organic Chemistry Lab	0	0	4	2
PO3210	Microbiology Lab	0	0	4	2
TOTAL		19	3	8	26

SEMESTER IV

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
PO3211	Probability and Statistics	3	1	0	4
PO3212	Instrumental Methods of Analysis	3	0	0	3
PO3213	Environmental Science & Engineering	3	0	0	3
PO3214	Medicinal Chemistry	3	0	0	3
PO3215	Fundamentals of Human Anatomy & Physiology	3	0	0	3
PO3216	Biochemical Engineering	3	0	0	3
PO3217	Fundamentals of Heat and Mass Transfer	3	0	0	3
PRACTICALS					
PO3219	Instrumental Methods of Analysis lab	0	0	4	2
PO3220	Chemical Engineering Lab	0	0	4	2
TOTAL		21	1	8	26

SEMESTER V

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
PO3301	Biochemical Engineering – II	3	0	0	3
PO3302	Molecular Biology	3	0	0	3
PO3303	Pharmaceutical Analysis	3	0	0	3
PO3304	Pharmacokinetics	3	0	0	3
PO3305	Fundamental of Nano Science	3	0	0	3
E1	Electives I	3	0	0	3
PRACTICALS					
PO3307	Molecular Biology Lab	0	0	4	2
PO3308	Pharmaceutical Analysis Lab	0	0	4	2
PO3309	Pharmacokinetics Lab	0	0	4	2
PO3310	Technical Seminar	0	0	2	1
TOTAL		18	0	14	25

SEMESTER – VI

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
PO3311	Chemical Reaction Engineering	3	0	0	3
PO3312	Genetic Engineering	3	0	0	3
PO3313	Separation Process	3	0	0	3
PO3314	Regulatory issues in Pharmaceutical Industry and Drug Validation	3	0	0	3
PO3315	Total Quality Management	3	0	0	3
E2	Elective II	3	0	0	3
PRACTICALS					
PO3317	Communication Skills and Soft Skills Lab	0	0	2	1
PO3318	Bio Process Lab	0	0	6	3
PO3319	Genetic Engineering Lab	0	0	4	2
TOTAL		18	0	12	24

SEMESTER – VII

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
PO3401	Immunology	3	0	0	3
PO3402	Formulation of Drugs	3	0	0	3
PO3403	Pharmacognosy	3	0	0	3
PO3404	Pharmacology and Chemotherapy	3	0	0	3
PO3405	Professional Ethics in Engineering	3	0	0	3
E3	Electives III	3	0	0	3
PRACTICALS					
PO3407	Computer Aided Drug Design	0	0	4	2
PO3408	Pharmacognosy Lab	0	0	4	2
PO3409	Formulation Technology Lab	0	0	4	2
TOTAL		18	0	12	24

SEMESTER VIII

CODE NO	COURSE TITLE	L	T	P	C
PO3410	Project Work	0	0	12	6
TOTAL		0	0	12	6

LIST OF ELECTIVES

ELECTIVE I

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
PO3001	Numerical Methods	3	1	0	4
PO3002	Pharmaceutical Industrial Management	3	0	0	3
PO3003	Technical Writing & Communication	3	0	0	3
PO3004	Natural And Synthetic Drug Technology	3	0	0	3

ELECTIVE II

CODE NO	COURSE TITLE	L	T	P	C
PO3005	Process Economics and Industrial Management	3	0	0	3
PO3006	Protein Engineering	3	0	0	3
PO3007	Bio Informatics	3	0	0	3
PO3008	Metabolic Engineering	3	0	0	3
PO3009	Operation Research	3	0	0	3
PO3010	Principles of Drug Design	3	0	0	3

ELECTIVE III

CODE NO	COURSE TITLE	L	T	P	C
PO3011	Immunotechnology	3	0	0	3
PO3012	Pharmacogenomics	3	0	0	3
PO3013	Drug Bioevaluation	3	0	0	3
PO3014	Down Stream Processing	3	0	0	3
PO3015	Clinical Research And Regulations	3	0	0	3
PO3016	Creativity, Innovation & New Product Development	3	0	0	3

AIM

To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES

- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.
- To familiarize students with different rhetorical functions of scientific English.
- To enable students write letters and reports effectively in formal and business situations.

UNIT I**12**

Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading& predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:

1. Exercises on word formation using the prefix 'self' - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings
4. and predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II**12**

Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:

1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III**12**

Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations .

Suggested activities:

1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different

- grammatical forms of the same word. (Eg: object –verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
 3. Reading comprehension exercises with critical questions, Multiple choice question.
 4. Sequencing of jumbled sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

UNIT IV

12

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:

1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V

9

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:

1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TOTAL: 60 PERIODS

TEXT BOOK

1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment, Industry)

REFERENCES

1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition, Pearson Education, 2007.

Extensive Reading:

1. Robin Sharma, 'The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

Note:

The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy’s and Legendre’s linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green’s theorem in a plane, Gauss divergence theorem and Stokes’ theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : $w = z + c$, cz , $1/z$, and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration – Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

UNIT V LAPLACE TRANSFORM 12

Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions.

Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL : 60 PERIODS**TEXT BOOKS**

1. Bali N. P and Manish Goyal, “Text book of Engineering Mathematics”, 3rd Edition, Laxmi Publications (p) Ltd., (2008).
2. Grewal. B.S, “Higher Engineering Mathematics”, 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES

1. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, “Advanced Engineering Mathematics”, 3rd Edition, Pearson Education, (2007).
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, 7th Edition, Wiley India, (2007).
4. Jain R.K and Iyengar S.R.K, “Advanced Engineering Mathematics”, 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect – Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications – magnetic recording and readout – storage of magnetic data – tapes, floppy and magnetic disc drives.
Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High T_c superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V MODERN ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications.
Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA
Nanomaterials: synthesis –plasma arcing – chemical vapour deposition – sol-gels – electrodeposition – ball milling - properties of nanoparticles and applications.
Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition - structure – properties and applications.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Charles Kittel ‘ Introduction to Solid State Physics’, John Wiley & sons, 7th edition, Singapore (2007)
2. Charles P. Poole and Frank J.Owenn, ‘Introduction to Nanotechnology’, Wiley India(2007) (for Unit V)

REFERENCES

1. Rajendran, V, and Marikani A, ‘Materials science’Tata McGraw Hill publications, (2004) New delhi.
2. Jayakumar, S. ‘Materials science’, R.K. Publishers, Coimbatore, (2008).
3. Palanisamy P.K, ‘Materials science’, Scitech publications(India) Pvt. LTd., Chennai, second Edition(2007)
4. M. Arumugam, ‘Materials Science’ Anuradha publications, Kumbakonam, (2006).

AIM

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES

- The student should be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements.
- Principles of corrosion control
- Chemistry of Fuels and combustion
- Industrial importance of Phase rule and alloys
- Analytical techniques and their importance.

UNIT I ELECTROCHEMISTRY 9

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes – Standard Hydrogen electrode – Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe^{2+} vs dichromate and precipitation – Ag^+ vs Cl^- titrations) and conduct metric titrations (acid-base – HCl vs, NaOH) titrations,

UNIT II CORROSION AND CORROSION CONTROL 9

Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating.

UNIT III FUELS AND COMBUSTION 9

Calorific value – classification – Coal – proximate and ultimate analysis metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – catalytic cracking and methods-knocking – octane number and cetane number – synthetic petrol – Fischer Tropsch and Bergius processes – Gaseous fuels-water gas, producer gas, CNG and LPG, Flue gas analysis – Orsat apparatus – theoretical air for combustion.

UNIT IV PHASE RULE AND ALLOYS 9

Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT V ANALYTICAL TECHNIQUES 9

Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

TOTAL: 45 PERIODS

UNIT IV DYNAMICS OF PARTICLES 12
Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton’s law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12
Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction.
Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TOTAL: 60 PERIODS

TEXT BOOK

1. Beer, F.P and Johnson Jr. E.R. “Vector Mechanics for Engineers”, Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES

1. Rajasekaran, S, Sankarasubramanian, G., “Fundamentals of Engineering Mechanics”, Vikas Publishing House Pvt. Ltd., (2000).
2. Hibbeller, R.C., “Engineering Mechanics”, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., “Engineering Mechanics – Statics & Dynamics”, Tata McGraw-Hill, (2001).
4. Irving H. Shames, “Engineering Mechanics – Statics and Dynamics”, IV Edition – Pearson Education Asia Pvt. Ltd., (2003).
5. Ashok Gupta, “Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)”, Pearson Education Asia Pvt., Ltd., (2002).

EE2151 CIRCUIT THEORY L T P C
(Common to EEE, EIE and ICE Branches) **3 1 0 4**

UNIT I BASIC CIRCUITS ANALYSIS 12
Ohm’s Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS 12
Network reduction: voltage and current division, source transformation – star delta conversion.
Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III RESONANCE AND COUPLED CIRCUITS 12
Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS 12
Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

UNIT V ANALYSING THREE PHASE CIRCUITS 12

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & unbalanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL : 60 PERIODS

TEXT BOOKS

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, (2002).
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, (2007).

REFERENCES

1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi (2001).
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
4. Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003).

EC2151 ELECTRIC CIRCUITS AND ELECTRON DEVICES L T P C
(For ECE, CSE, IT and Biomedical Engg. Branches) **3 1 0 4**

UNIT I CIRCUIT ANALYSIS TECHNIQUES 12

Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II TRANSIENT RESONANCE IN RLC CIRCUITS 12

Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor – single tuned and double tuned circuits.

UNIT III SEMICONDUCTOR DIODES 12

Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy band structure – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics.

UNIT IV TRANSISTORS 12

Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.

UNIT V SPECIAL SEMICONDUCTOR DEVICES (Qualitative Treatment only) 12

Tunnel diodes – PIN diode, varactor diode – SCR characteristics and two transistor equivalent model – UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD.

TOTAL : 60 PERIODS**TEXT BOOKS**

1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series, Tata McGraw Hill, (2001)
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, (2008).
3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, (2008).

REFERENCES

1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7th Edition, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and Steven M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyabranta Jit, "Electronic Devices & Circuits", Tata McGraw Hill, 2nd Edition, 2008.

GE2151 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
(Common to branches under Civil, Mechanical and Technology faculty) **4 0 0 4**

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS 12

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

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

UNIT II ELECTRICAL MECHANICS 12

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS 12

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

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 12
Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

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

TOTAL : 60 PERIODS

TEXT BOOKS

1. V.N. Mittle “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. R.S. Sedha, “Applied Electronics” S. Chand & Co., 2006.

REFERENCES

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press (2005).
3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, (1994).
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, (2002).
5. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers, (2003).

GE2152 BASIC CIVIL & MECHANICAL ENGINEERING L T P C
(Common to branches under Electrical and I & C Faculty) **4 0 0 4**

A – CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 15
Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

UNIT II BUILDING COMPONENTS AND STRUCTURES 15
Foundations: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

TOTAL: 30 PERIODS

B – MECHANICAL ENGINEERING

UNIT III POWER PLANT ENGINEERING 10
Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV I C ENGINES 10
 Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10
 Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

TOTAL: 30 PERIODS

REFERENCES

1. Shanmugam G and Palanichamy M S, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi, (1996).
2. Ramamrutham. S, “Basic Civil Engineering”, Dhanpat Rai Publishing Co. (P) Ltd. (1999).
3. Seetharaman S. “Basic Civil Engineering”, Anuradha Agencies, (2005).
4. Venugopal K and Prahu Raja V, “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam, (2000).
5. Shantha Kumar S R J., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, (2000).

GE2155 COMPUTER PRACTICE LABORATORY – II L T P C
0 1 2 2

LIST OF EXPERIMENTS

1. UNIX COMMANDS 15

Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING 15

Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX 15

Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL : 45 PERIODS

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

- . 1 UNIX Clone Server
- . 33 Nodes (thin client or PCs)
- . Printer – 3 Nos.

Software

- . OS – UNIX Clone (33 user license or License free Linux)
- . Compiler - C

LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material – non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
4. Determination of viscosity of liquid – Poiseuille's method.
5. Spectrometer dispersive power of a prism.
6. Determination of Young's modulus of the material – uniform bending.
7. Torsional pendulum – Determination of rigidity modulus.

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.
- The lab examinations will be held only in the second semester.

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)
2. Conduct metric titration (Mixture of weak and strong acids)
3. Conduct metric titration using BaCl_2 vs Na_2SO_4
4. Potentiometric Titration (Fe^{2+} / KMnO_4 or $\text{K}_2\text{Cr}_2\text{O}_7$)
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper sulphate)
7. Estimation of Ferric iron by spectrophotometry.

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.
- The lab examinations will be held only in the second semester.

List of Exercises using software capable of Drafting and Modeling

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

7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

TOTAL: 45 PERIODS

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

List of Equipments for a batch of 30 students:

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

EE2155

ELECTRICAL CIRCUIT LABORATORY
(Common to EEE, EIE and ICE)

L T P C
0 0 3 2

LIST OF EXPERIMENTS

1. Verification of ohm's laws and kirchoff's laws.
2. Verification of Thevemin's and Norton's Theorem
3. Verification of superposition Theorem
4. Verification of maximum power transfer theorem.
5. Verification of reciprocity theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis.
8. Transient response of RL and RC circuits for DC input.
9. Frequency response of series and parallel resonance circuits.
10. Frequency response of single tuned coupled circuits.

TOTAL: 45 PERIODS

EC2155

CIRCUITS AND DEVICES LABORATORY

L T P C
0 0 3 2

1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET
11. Characteristics of Diac and Triac.
12. Characteristics of Photodiode and Phototransistor.

TOTAL: 45 PERIODS

1. Listening:**5**

Listening & answering questions – gap filling – Listening and Note taking- Listening to telephone conversations

2. Speaking:**5**

Pronouncing words & sentences correctly – word stress – Conversation practice.

Classroom Session**20**

1. Speaking: Introducing oneself, Introducing others, Role play, Debate- Presentations: Body language, gestures, postures. Group Discussions etc
2. Goal setting – interviews – stress time management – situational reasons

Evaluation

(1) Lab Session – 40 marks

Listening – 10 marks
Speaking – 10 marks
Reading – 10 marks
Writing – 10 marks

(2) Classroom Session – 60 marks

Role play activities giving real life context – 30 marks
Presentation – 30 marks

Note on Evaluation

1. Examples for role play situations:
 - a. Marketing engineer convincing a customer to buy his product.
 - b. Telephone conversation – Fixing an official appointment / Enquiry on availability of flight or train tickets / placing an order. etc.
2. Presentations could be just a Minute (JAM activity) or an Extempore on simple topics or visuals could be provided and students could be asked to talk about it.

REFERENCES

1. Hartley, Peter, Group Communication, London: Routledge, (2004).
2. Doff, Adrian and Christopher Jones, Language in Use – (Intermediate level), Cambridge University Press, (1994).
3. Gammidge, Mick, Speaking Extra – A resource book of multi-level skills activities , Cambridge University Press, (2004).
4. Craven, Miles, Listening Extra - A resource book of multi-level skills activities, Cambridge, Cambridge University Press, (2004).
5. Naterop, Jean & Rod Revell, Telephoning in English, Cambridge University Press, (1987).

LAB REQUIREMENTS

1. Teacher – Console and systems for students
2. English Language Lab Software
3. Tape Recorders.

AIM

To understand important concepts in physical chemistry.

OBJECTIVE

- To understand the different states of matter, theoretical principles governing the solid, liquid, mesomorphic and solid states and to know methods for experimental determination of characteristic properties of the states.
- To understand the principles of thermodynamics in deciding the spontaneity of reactions and energy changes involved in physical and chemical processes.
- To understand the principles of photochemistry and catalysis.

UNIT I PROPERTIES OF MATTER. GASEOUS AND LIQUID STATES 12

Gaseous state Ideal gas – Gas laws – kinetic theory – Maxwell's distribution of molecular velocities – collision frequency – mean free path – real gas – van der Waal's equation of state – critical constants – law of corresponding states – liquefaction of gases (CO₂, NH₃, air, O₂ and N₂) Joule – Thomson effect – inversion temperature.

Liquid state Equilibrium vapour pressure – surface tension – viscosity – dipole moment – refractive index – optical rotation – methods of determination – relationship to molecular structure

UNIT II PROPERTIES OF MATTER MESOMORPHIC AND SOLID STATES 9

Mesomorphic state or liquid crystals Thermotropic and lyotropic mesomorphism – classification of thermotropic liquid crystals – smectic – nematic – cholesteric – disc-shaped – polymer – molecular arrangements in liquid crystals.

Solid state crystal structure – laws of crystallography – 7 crystal systems – 14 Bravais lattices – X-rays and crystal structure – Bragg's equation – types of crystals – molecular covalent – ionic – metallic – lattice energy – Born-Landé's equation – experimental determination using Born-Haber cycle – packing in metallic crystals – lattice-defects.

UNIT III THERMODYNAMICS I LAW AND THERMOCHEMISTRY 8

System – surroundings – properties – macroscopic – intensive – extensive processes – isothermal – adiabatic – reversible – irreversible – thermodynamic equilibrium – Zeroth law of thermodynamics – building thermometer – Celsius scale – perfect gas/ absolute temperature scale.

Internal energy – work done – isothermal, reversible and irreversible expansions – **compressions** – enthalpy – heat capacity at constant volume

C_v – at constant pressure **C_p** – relationship between **C_p** and **C_v** – work done

In adiabatic, reversible and irreversible expansions – compressions.

Thermochemistry – enthalpy changes – physical and chemical processes –

Kirchoff's equation – Hess' law of constant heat summation – enthalpy of

combustion – Bomb calorimeter – bond energies – applications

UNIT IV THERMODYNAMICS II AND III LAW 8

Spontaneous process – cyclic process – Carnot cycle – efficiency of a heat engine – entropy – concept – physical significance – changes accompanying processes – Free energy – Helmholtz – Gibbs – criteria for reversible and irreversible processes – Gibbs-Helmholtz equation – free energy and physical equilibria – Clapeyron and Clausius equation – free energy and chemical equilibria – van Hoff reaction isotherm – standard free energy changes – Third law – Nernst heat theorem – determination of entropy from thermal measurements – residual entropy

UNIT V PHOTOCHEMISTRY AND CATALYSIS 8
Absorption of light - consequences – laws of photochemistry -quantum yield - photochemical processes – primary – secondary - kinetics of photochemical reactions - hydrogen and chlorine -hydrogen and bromine – photosensitization – quenching - lasers. Catalysis – catalyst – promoter – inhibitor - poisoning of catalyst –homogeneous catalysis - acid-base -metal salts - heterogeneous-adsorption – physisorption chemisorption - surface area - industrially important processes – oxidation – cracking reforming.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Puri, B.R., L.R.Sharma and M.S.Pathania “Principles of Physical Chemistry:”.41st Edition. Vishal Publishing, 2006.
2. Atkins, Peter “Physical Chemistry” 9th Edition, Oxford University Press, 2009

REFERENCES

1. Bhal, B.S.,G.D. Tuli and Arun Bhal “Essentials of Physical Chemistry”. S.Chand & Co., 2010
2. Glasstone, Samuel “Thermodynamics for Chemists”. Narahari Press, 2008

PO3203

PHYSICAL PHARMACY

**L T P C
2 1 0 3**

UNIT I MICROMERITIC AND POWDER RHEOLOGY 10
Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, optical microscopy, sieving, sedimentation, measurement of particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness and flow properties.

UNIT II SURFACE, INTERFACIAL PHENOMENON, VISCOSITY AND RHEOLOGY 10
Liquid interface, surface and interfacial tension, surface free energy, measurement of surface and interfacial tensions, free energy, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interface, solid gas and solid-liquid interface, complex films, electrical properties of interface.
Newtonian system, Law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity: capillary, falling ball, rotational viscometers.

UNIT III DISPERSION SYSTEMS 10
a. Colloidal dispersions: Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy.
b. Suspensions and Emulsions : Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicle, rheological considerations, emulsions ; types, theories, physical stability.

TEXT BOOKS

1. McCabe, W.L., J.C. Smith and P.Harriot "Unit Operations of Chemical Engineering", 6th Edition, Mc Graw Hill, 2001.
2. Bhatt, B.I. and S.M. Vora "Stoichiometry (SI Units)", 3rd Edition, Tata McGraw- Hill, 1996.

REFERENCES

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

PO3205

BIOORGANIC CHEMISTRY

L T P C

(Common for IBT, Food and Pharmaceutical Technology)

3 0 0 3

UNIT I INTRODUCTION TO CHEMISTRY 13

Chirality, Enantiomers, Diastereomers, Enantiotopic Faces, Absolute configuration RS nomenclature, Bijvoet's method of determining absolute configuration. Conformers : Ethane, butane, cyclohexane – Reactivity due to change in conformers Reactions : SN₁, SN₂, E₁, E₂, Addition of electrophile on a double bond, Hydride transfer mechanisms Cannizzaro's reaction. Reactivity : Kinetics of Reactions, First order and kinetics of enzyme Determination of ΔG^\ddagger , ΔH^\ddagger , ΔS^\ddagger . Thermodynamics: Boltzmann's equation, Gibbs – Helmholtz equation. Acid – Base catalysis – Structure of water.

UNIT II INTRODUCTION TO ORGANIC SYNTHESIS 10

Useful Organic Transformations Retrosynthetic Analysis. Case Studies : Synthesis of Cholesterol, Synthesis of Chlorophyll.

UNIT III ENZYMES 5

MM kinetics – other mechanisms for enzyme action – Methods for following enzyme reactions – Analysis of Enzymatic reactions.

UNIT IV MECHANISMS 13

Case Studies : Lipase, Carboxypeptidases, Monooxygenases – Esterases

Case Study: Engineering an Enzyme – Subtilisin.

Case Study: Allosteric ATPase

Mechanisms of enzymes in a Pathway : Case Study : Serratia marcescens & Prodigiosin.

Domain Movements in Enzymes MD simulations Case Study : Lipase.

UNIT V BIOLOGICAL SUPERMOLECULES 4

Supramolecular Systems – Ion Channels – photosynthesis – artificial enzymes – catalytic antibodies – ribozymes..

TOTAL : 45 PERIODS

TEXT BOOKS

1. Page, M.I., and A. Williams, "Organic and Bioorganic Mechanisms," Pearson India Edition, 1997
2. Ariya, K. and T. Kumtake, "Supramolecular Chemistry : Fundamentals and Applications", Springer India Edition, 2006.
3. Morrison, R.T. and T.N. Boyd "Organic Chemistry", 6th Edition, Prentice Hall of India, 2003.
4. Palmer, Trevor "Enzymes: Biochemistry, Biotechnology, Clinical Chemistry", Affiliated East-West Press Pvt. Ltd., 2004.

REFERENCE

1. Fersht, Alan "Structure and Mechanism in Protein Science: A Guide to Enzyme Catalysis and Protein Folding", W.H. Freeman, 1998.

PO3206

CELL BIOLOGY

**L T P C
2 1 0 3**

AIM

To introduce students to the principles of cell biology to emphasize the role of organelles and their functions; signal transduction and crosstalk between the cells – towards biotechnological applications.

OBJECTIVES

- To provide to the students the fundamentals of cell biology and ability to solve problems in cell biology.
- To help students understand the pathway mechanisms.

UNIT I CELL STRUCTURE AND FUNCTION OF THE ORGANELLES 9

Eukaryotic, Prokaryotic cells, Subcellular Organelles and Functions Principles of membrane organization membrane proteins, cytoskeletal proteins eg. RBC cytoskeletal contractile proteins Actin, myosin, Actin Polymerization Act- myosin complex, mechanism of myosin-ATPase activity, contraction; microtubules, microfilaments activity in Organelle movement.

UNIT II CELL DIVISION AND CONNECTION 8

Cell cycle – Mitosis, Meiosis, Molecules controlling cell cycle, Extra cellular matrix, role of matrix in cell enthere : Gap junctions, Tight junctions, Desmosomes, Hemidesmosomes.

UNIT III TRANSPORT ACROSS CELL MEMBRANE 9

Passive and Active Transport, Permeases, Ion channels, ATP pumps. Na^+ / K^+ / Ca^{+2} pumps uniport, symport antiporter system. Ligand gated / voltage gated channels, Agonists and Antagonists.

UNIT IV SIGNAL TRANSDUCTION 10

Receptors – extracellular signaling, Cell surface / cytosolic receptors and examples, Different classes of receptors antocrine / paracrine / endocrine models, Secondary messengers molecules.

UNIT V SIGNAL AMPLIFICATION AND CROSSTALK 9
Signal amplification and crosstalk caspases and cell death, Role of Ras and Raf in oncogenesis, introduction to gene therapy.

TOTAL : 45 PERIODS

REFERENCES

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

PO3207

MICROBIOLOGY

L T P C
3 0 0 3

AIM

To introduce students to the principles of Microbiology to emphasize structure and biochemical aspects of various microbes.

OBJECTIVE

- To provide to the students the fundamentals of Microbiology and solve the problems in microbial infection and their control.

UNIT I INTRODUCTION 6

Basics of microbial existence; history of microbiology, classification and nomenclature of microorganisms, microscopic examination of microorganisms, light and electron microscopy; principles of different staining techniques like gram staining, acid fast, capsular staining, flagellar staining.

UNIT II MICROBES- STRUCTURE AND MULTIPLICATION 12

Structural organization and multiplication of bacteria, viruses, algae and fungi, with special mention of life history of actinomycetes, yeast, mycoplasma and bacteriophages.

UNIT III MICROBIAL NUTRITION, GROWTH AND METABOLISM 12

Nutritional requirements of bacteria; different media used for bacterial culture; growth curve and different methods to quantify bacterial growth; aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules.

UNIT IV CONTROL OF MICROORGANISMS 6

Physical and chemical control of microorganisms; host-microbe interactions; anti-bacterial, anti-fungal and anti-viral agents; mode of action and resistance to antibiotics; clinically important microorganisms.

UNIT V INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY 9

Primary metabolites; secondary metabolites and their applications; preservation of food; production of penicillin, alcohol, vitamin B-12; biogas; bioremediation; leaching of ores by microorganisms; biofertilizers and biopesticides; microorganisms and pollution control; biosensors

TOTAL: 45 PERIODS

TEXT BOOKS

1. Pelczar M.J., E.C.S. Chan and N.R. Krieg. "Microbiology". 5th Edition, Tata McGraw Hill, 1993
2. Prescott, L.M., J.P. Harley, and D.A. Klein. "Microbiology," 7th Edition, Mc Graw-Hill, 2008
3. Casida, L.E. "Industrial Microbiology". New Age International, 1968.
4. Reed, Gerald "Prescott & Dunn's Industrial Microbiology" 4th Edition, CBS, 1987.

REFERENCES

1. Schlegel, Hans G. "General Microbiology", Cambridge University Press, 1993.
2. Stanier, Roger Y et al., "General Microbiology" 5th Edition, Macmillan, 1986.
3. Talaro, Kathleen and Arthur Talaro. "Foundations in Microbiology" 2nd Edition, Wm.C. Brown Publishers, 1996.

PO3209

PHYSICAL & ORGANIC CHEMISTRY LAB

**L T P C
0 0 4 2**

1. Determination of Heat of ionisation / Neutralisation of acids.
2. Determination of rate constants and activation energy of simple first and second order reactions.
3. General acid catalysed reactions – Catalytic coefficients and Dissociation Constants.
4. Determination of molecular weight of substances.
5. Experiments based on the principles of Electrochemistry. Applications of Thermodynamic principles and Surface Chemistry.
6. Systematic qualitative analysis of organic compounds by solubility, elemental analysis, group detection, physical constant and derivatization
7. Estimation of selected organic compounds such as aniline/phenol, formaldehyde/acetone, glucose, glycerol.
8. Neutral equivalence of acids and bases and estimations of the following functions groups-amide, ester, acid, amino nitro.
9. Separation and purification of binary mixtures of the type: water soluble water insoluble – water insoluble, liquid-solid and liquid-liquid.
10. Preparation of simple organic compounds involving importance unit operations.

TOTAL : 60 PERIODS

REFERENCES

1. Shoemaker, D.P., C.W. Garland and J.W. Nibler "Experiments in Physical Chemistry", 5th Edition, McGraw-Hill, 1989.
2. Furniss, B.S. et al., "Vogel's Textbook of Practical Organic Chemistry", 5th Edition, [EIBS] Addison Wesley Longman Ltd., 1989.
3. Leonard, J., B. Lygo and G. Procter "Advanced Practical Organic Chemistry", 2nd Edition, Stanley Thomes Pvt. Ltd., 1998

(Common for IBT, Food and Pharmaceutical Technology)

EXPERIMENTS

1. Introduction, Laboratory Safety, Use of Equipment; Sterilization Techniques;
2. Culture Media-Types and Use; Preparation of Nutrient broth and agar
3. Culture Techniques, Isolation and Preservation of Cultures- Broth: flask, test tubes; Solid: Pour plates, streak plates, slants, stabs
4. Microscopy – Working and care of Microscope
5. Microscopic Methods in the Study of Microorganisms; Staining Techniques- Simple, Differential- Gram's Staining
6. Quantification of Microbes: Sampling and Serial Dilution; Bacterial count in Soil – TVC
7. Effect of Disinfectants- Phenol Coefficient
8. Antibiotic Sensitivity Assay
9. Growth Curve in Bacteria and Yeast
10. Effect of pH, Temperature, UV radiation on Growth Bacteria

EQUIPMENT NEEDED FOR 20 STUDENTS

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

TOTAL : 60 PERIODS**TEXT BOOKS**

1. Cappuccino, J.G. and N. Sherman "Microbiology : A Laboratory Manual", 4th Edition, Addison-Wesley, 1999.
2. Collee, J.G. et al., "Mackie & McCartney Practical Medical Microbiology" 4th Edition, Churchill Livingstone, 1996.

AIM

This course aims at providing the required skill to apply the statistical tools in engineering problems.

OBJECTIVES

- The students will have a fundamental knowledge of the concepts of probability.
- Have knowledge of standard distributions which can describe real life phenomenon.
- Have the notion of sampling distributions and statistical techniques used in management problems.

AIM

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

OBJECTIVE

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

UNIT I OPTICAL SPECTROSCOPY 9

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

UNIT II CHROMATOGRAPHY 9

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

UNIT III STRUCTURAL ELUCIDATION 9

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

UNIT IV MASS SPECTROMETRY 9

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

UNIT V ELECTROCHEMICAL MEASUREMENTS 9

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

TOTAL : 45 PERIODS

TEXTBOOKS

1. Skoog, D.A., f.J. Holler and S.R. Crouch “Principles of Instrumental Analysis”.6th Edition, Thomson/Brooks/Cole, 2002.
2. Willard, H.H. et al., “Instrumental Methods of Analysis”.7th Edition. CBS Publishers, 1986.
3. Braun, Robert D. “Introduction to Instrumental Analysis” Pharma Book Syndicate, 1987.
4. Ewing, G.W. “Instrumental Methods of Chemical Analysis” 5th Edition, Tata McGraw-Hill, 1985

AIM

To create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participates.

OBJECTIVE

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

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

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

UNIT II ENVIRONMENTAL POLLUTION 8

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

UNIT III NATURAL RESOURCES 10

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

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

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

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

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

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Masters, G.M. "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 1998.
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, 2006.

REFERENCES

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

PO3214**MEDICINAL CHEMISTRY****L T P C
3 0 0 3****UNIT I CONCEPT OF AROMATICITY AND AROMATIC 9**

Characteristics of organic compounds. Huckel rule, Structures of benzenoid and nonbenzenoid compounds. Idea of homoaromaticity and antiaromaticity. Orienting influence of different substituents present in benzene and naphthalene rings – Charge distribution method and stability of the intermediate method, general mechanism of an aromatic electrophilic substitution reaction. Friedel–Crafts and related reaction: Principle involved, alkylation and acylation, industrial applications, Fries rearrangement, Hoesch reaction, formylation reactions – Gatterman, Gatterman-Koch, Vilsmeier, Reimer – Tiemann, Duff, chloromethylation reaction, Kolbe reaction.

UNIT II HALOBENZENES 9

Halogenation reaction, Aromatic nucleophilic substitution reactions, Mechanisms including benzyne mechanism. Nitroaromatics: Mechanisms of aromatic nitration reaction, Uses of nitrocompounds, Reduction products of nitrocompounds. Aromatic

UNIT II HOMEOSTASIS AND INTERCELLULAR COMMUNICATION 9

Nervous and Muscular Systems; The Brain & Nervous System ; Structure of the Neuron ; Types of Neurons ; The Central Nervous System – Brain, Spinal cord, Limbic system; The Peripheral Nervous System – Afferent division, Efferent division (somatic nervous system, autonomic nervous system [sympathetic & parasympathetic divisions]) ; Receptors The Blood-Brain Barrier Membrane Potentials – Graded potentials & Action potentials (resting, initiation, transmission and integration of neural signals);

UNIT III SYNAPSES NEUROTRANSMITTERS & NEUROMODULATORS 7

The Muscular System, Types of Muscle Tissue – Skeletal (types of skeletal muscle fibres), Smooth (types of smooth muscle fibres), Cardiac muscle Muscle Contraction – Skeletal muscle fibre & Smooth muscle fibre Regulation.

UNIT IV CARDIOVASCULAR AND RESPIRATORY SYSTEMS 9

The Cardiovascular System ,Structure of the Heart , The Cardiac Cycle Regulation;The Circulation of Blood – Pulmonary, Systemic & Portal circulation; The Vascular System – Arteries, Arterioles, Capillaries, Venules, Veins; The Respiratory System Structure – The lungs & Airways; The Dynamics of Respiration, Gas Exchange, Gas Transport in Blood Regulation

UNIT V THE RENAL SYSTEM AND REGULATION OF ACID-BASE BALANCE 13

The Renal System Structure – The renal system & Kidney ; Structure of the Nephron & Network of Blood Capillaries ;Types of Nephrons , Formation of Urine, Concentration of Urine; Regulation of Acid-Base Balance; The Chemical Acid-Base Buffer Systems of Body Fluids; Role of the Respiratory System,Role of the Kidneys

THE GASTROINTESTINAL SYSTEM AND ENDOCRINE CONTROL OF GROWTH & METABOLISM

The Gastrointestinal System; Structure & Function of the Gastrointestinal Tract (secretion, motility, digestion and absorption) , Structure & Function of the Liver, Spleen & Pancreas (exocrine) ;Endocrine Control of Growth & Metabolism; Endocrine Glands – Pituitary, Thyroid, Parathyroids, Adrenals, Islets of Langerhans, Pineal, Thymus, Testes, Ovaries (endocrine control of ovaries in the female life cycle – puberty, pregnancy, childbirth, menopause) – Structure, Hormones & Functions

TOTAL : 45 PERIODS

TEXT BOOKS

1. Guyton, A.C. and Hall,J.E. “Textbook of Medical Physiology”, 11th Edition, Saunders, 2006.
2. Ganong, W.F. “Review of Medical Physiology”, 22nd Edition (A Lange Medical book series) McGraw – Hill (International Ed.) 2005.
3. Khurana, Indu “A Textbook of Medical Physiology” Elsevier, 2006.
4. Johnson, L.R. “Essential Medical Physiology”, 3rd Edition, Academic Press / Elsevier), 2003.

REFERENCES

1. Waugh, Anne and Allison Grant “Ross and Wilson Anatomy and Physiology in Health and Illness”, 10th Edition, Churchill – Livingstone / Elsevier), 2006.
2. Carola, R., J.P. Harley and C.R. Noback. “Human Anatomy & Physiology”, 2nd Edition, McGraw – Hill, 1992.
3. Vander, A.J., J.H. Sherman and D.S. Luciano “Human Physiology: The Mechanisms of Body Function”, 5th Edition, McGraw – Hill, 1990.

UNIT I	INTRODUCTION TO ENZYMES	9
	Classification of enzymes. Mechanisms of enzyme action; concept of active site and energetics of enzyme substrate complex formation; specificity of enzyme action; principles of catalysis – collision theory, transition state theory; role of entropy in catalysis.	
UNIT II	KINETICS OF ENZYME ACTION	9
	Kinetics of single substrate reactions; estimation of Michelis – Menten parameters, multisubstrate reactions- mechanisms and kinetics; turnover number; types of inhibition & models –substrate, product. Allosteric regulation of enzymes, Monod changeux wyman model, pH and temperature effect on enzymes & deactivation kinetics.	
UNIT III	ENZYME IMMOBILIZATION	6
	Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages.	
UNIT IV	OVERVIEW OF FERMENTATION PROCESSES	9
	Overview of fermentation industry, general requirements of fermentation processes, basic configuration of fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes.	
UNIT V	RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS	12
	Criteria for good medium, medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation of optimal growth and product formation, examples of simple and complex media, design of various commercial media for industrial fermentations – medium optimization methods	

TOTAL: 45 PERIODS

TEXT BOOKS

1. Bailey, J.E. and Ollis, D.F. "Biochemical Engineering Fundamentals", 2nd Edition, McGraw-Hill, 1986.
2. Blanch, H.W. and D.S. Clark "Biochemical Engineering", Marcal Dekker, Inc., 1997.
3. Lee, James M. "Biochemical Engineering", Prentice – Hall, 1992.

REFERENCES

1. Palmer, Trevor "Enzymes: Biochemistry, Biotechnology, Clinical Chemistry", Affiliated East-West Press Pvt. Ltd., 2004.
2. Stanbury, P.F., A. Whitaker and S.J. Hall "Principles of Fermentation Technology", 2nd Edition, Butterworth – Heinemann (an imprint of Elsevier), 1995.
3. Wiseman, Alan "Handbook of Enzyme Biotechnology", 3rd Edition, Ellis Harwood Publications, 1999.
4. Hartmeier, Winfried "Immobilized Biocatalysts : An Introduction", Springer – Verlag, 1986.

(Common for Food and Pharmaceutical Technology)

AIM

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

OBJECTIVES

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

UNIT I	HEAT TRANSFER	11
Phenomena of heat transfer by conduction-concept of heat conduction resistances – application of heat conduction in series – heat transfer coefficient –heat convection phenomena- application for different situations –combined conduction and convection-overall heat transfer coefficient –application to design of heat exchangers- Principles of radiation heat transfer – Laws in radiation- View factor concepts – application.		
UNIT II	DIFFUSION & MASS TRANSFER COEFFICIENTS	8
Diffusion in Mass Transfer –gas, liq, solid diffusion and mass transfer-Diffusion in biological solutions-measurement of diffusion Coefficients – concept of mass transfer Coefficients-application for different situations.		
UNIT III	ABSORPTION	9
Interphase mass transfer and overall mass transfer Coefficients – Absorption equipments-Hydraulics of Packed Absorbers-Process Design of Packed Absorbers-Concept of height of transfer units and number of transfer units in design.		
UNIT IV	DISTILLATION	9
Vapour Liquid equilibrium and distillation-simple Distillation, Steam distillation, Flash distillation-Staged distillation Column-Design by Mc Cabe-Thiele method-Enthalpy-Concentration diagrams and use in Distillation Column design.		
UNIT V	LIQUID EXTRACTION & LEACHING	8
Principles of liq-extraction-Equilibrium –staged extraction calculation – continuous extraction equipments. Principles of Leaching –equilibrium-staged leaching – Leaching equipments. Principles of adsorption -Design of packed adsorber.		

TOTAL: 45 PERIODS

TEXT BOOKS

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

REFERENCES

1. Coulson, J.M. and etal. "Coulson & Richardson's Chemical Engineering", 6th Edition, Vol. I & II, Butterworth – Heinman (an imprint of Elsevier), 2004.
2. McCabe, W.L., J.C. Smith and P.Harriot "Unit Operations of Chemical Engineering", 6th Edition, Mc Graw Hill, 2003.

PO3219 INSTRUMENTAL METHODS OF ANALYSIS LAB**L T P C
0 0 4 2**

1. Precision and validity in an experiment using absorption spectroscopy .
2. Validating Lambert-Beer's law using KMnO_4
3. Finding the molar absorbtivity and stoichiometry of the Fe (1,10 phenanthroline)₃ using absorption spectrometry.
4. Finding the pKa of 4-nitrophenol using absorption spectroscopy.
5. UV spectra of nucleic acids.
6. Chemical actinometry using potassium ferrioxalate.
7. Estimation of SO_4^- by nephelometry.
8. Estimation of Al^{3+} by flourimetry.
9. Limits of detection using aluminium alizarin complex.
10. Chromatography analysis using TLC.
11. Chromatography analysis using column chromatography.

TOTAL : 60 PERIODS**PO3220 CHEMICAL ENGINEERING LAB****L T P C
0 0 4 2**

1. Flow measurement
2. Pressure drop in pipes and packed columns
3. Fluidization
4. Filtration
5. Heat exchanger
6. Simple and steam distillation
7. Distillation in packed column
8. Liquid-liquid equilibria in extraction
9. Adsorption equilibrium

TOTAL : 60 PERIODS**PO3301 BIOCHEMICAL ENGINEERING II****L T P C
3 0 0 3****AIM**

To expose the students to the principles, methods and techniques of cultivation at industrial scale.

OBJECTIVE

- To understand the methods of sterilization
- To understand the metabolic phenomenon
- To predict the kinetics of growth, product formation etc.

UNIT I STERILIZATION KINETICS**5**

Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air sterilization and design of sterilization equipment - batch and continuous.

UNIT II METABOLIC STOICHIOMETRY AND ENERGETICS 12
Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT III KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION- UNSTRUCTURED KINETIC MODELS 8
Modes of operation - batch, fed batch and continuous cultivation. Simple unstructured kinetic models for microbial growth, Monod model, growth of filamentous organisms, product formation kinetics - Leudeking-Piret models, substrate and product inhibition on cell growth and product formation.

UNIT IV KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION- STRUCTURED KINETIC MODELS 8
Study of structured models for analysis of various bioprocess – compartmental models, models of cellular energetics and metabolism, single cell models, plasmid replication and plasmid stability model.

UNIT V BIOREACTOR SCALE – UP 12
Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors – Mass transfer Coefficient- methods for the determination of mass transfer coefficients; mass transfer correlations. Power requirements of Bioreactors. Scale-up considerations on heat transfer oxygen transfer, power consumption and impeller tip speed.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Lee, James M. "Biochemical Engineering", PHI,1992.
2. Shuler, M.L. and Kargi, F. "Bioprocess Engineering : Basic Concepts", 2ndEdition, PHI, 2002.
3. Bailey, J.E. and Ollis, D.F. "Biochemical Engineering Fundamentals" 2nd Edition, McGraw – Hill, 1988.
4. Blanch, H.W. and Clark, D.S. "Biochemical Engineering", Marcel Decker Inc., 1997.

REFERENCES

1. Moser, Anton. "Bioprocess Technology : Kinetics and Reactors", Springer – Verlag, 1988.
2. Stanbury, P.F. etal. "Principles of Fermentation Technology", 2nd Edition, Butterworth – Heinemann / Elsevier, 1995.

PO3302 MOLECULAR BIOLOGY L T P C 3 0 0 3

UNIT I CLASSICAL GENETICS 5
Mendelian genetics, linkage, crossing over, classical experiments – Hershey and chase; Avery McLeod & McCarty. Bacterial conjugation, transduction and transformation.

UNIT II STRUCTURE OF NUCLEIC ACIDS AND DNA REPLICATION 15
Conformation of DNA and RNA; replication in prokaryotes, D-loop and rolling circle mode of replication, replication of linear viral DNA. Organisation of eukaryotic chromosome – cot value, replication of telomeres in eukaryotes

UNIT III OTHER TITRATIONS 9

Precipitation titration, Solubility Product, Argentimetric titrations, Mohr's method, Vollhard's method, examples in pharmacopoeia, complexometric titration, indicators for, redox titrations, oxidation, reduction - definitions, half reactions and half equations, common oxidising and reducing agents used in volumetric analysis, redox equivalent weights, reduction potential, significance of reduction potential, standard reduction potentials, titrations with potassium permanganate, iodimetry, iodometry, iodine displacement reactions, phenol estimation, iodine absorbing substance in penicillins

UNIT IV ULTRAVIOLET SPECTROSCOPY 9

Electromagnetic spectrum, UV range, UV spectroscopy, principle of, factors governing absorption of radiation, electronic transitions and wavelength of absorption, Instrumentation source of light, sample, solvents used, UV spectrometer, terms used to describe structure- spectra relationships, Applications, structure effects, UV spectra of some representative drug molecules, benzenoid chromophore quantitative analysis, Beer Lambert Law, example of quantitative assay

UNIT V CHROMATOGRAPHY 9

Thin Layer Chromatography TLC, R_f, definition, How to run a TLC, Adsorbents, solvents, elutropic series, uses, limit test for impurities using TLC, known impurity, unknown impurity, HPLC High Performance Liquid Chromatography, technique, advantages, basic HPLC, Columns, Detectors, Qualitative analysis and Quantitative Analysis, Packing materials, Normal and reversed phase, Solvents, HPLC terms, retention factor, selectivity factor, resolution, distribution of analytes between phases, theoretical plate.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Atherden, L.M. "Bentley and Driver's Textbook of Pharmaceutical Chemistry". 8th Edition, Oxford University Press, 1977.
2. Siddiqui, Anees A. "Pharmaceutical Analysis". Vol.I & II, CBS, 2006.
3. Parimoo, P. "Pharmaceutical Analysis". CBS, 1998.

REFERENCES

1. Gennaro, Alfonso R. "Remington : The Science and Practice of Pharmacy" Vol. I & II, 20th Edition, Lippincott Williams & Wilkins / B.I. Publication, 2000.
2. Connors, Kenneth A. "A Textbook of Pharmaceutical Analysis". 3rd Edition, John Wiley & Sons, 1982.
3. Ohannesian, Lena and Streeter, A.J. "Handbook of Pharmaceutical Analysis". Marcek Dekker, 2002.
4. Stahl, Egon "Thin - Layer Chromatography : A Laboratory Handbook". 2nd Edition, Springer, 2005.
5. Ermer, Joachim "Method Validation in Pharmaceutical Analysis ; A Guide to Best Practice", Wiley - VCH, 2005.
6. Evans, Gary "A Handbook of Bioanalysis and Drug Metabolism", CRC Press, 2004.

UNIT I INTRODUCTION TO PHARMACOKINETICS 10

Definitions; biopharmaceutics, pharmacokinetics, the ADME process bioavailability, relevance to clinical practice;

GIT absorption of drugs – mechanisms, factors affecting drug absorption

Distribution, metabolism and elimination of drugs

Bioavailability and bioequivalence – definitions, federal requirements, methods of determination of bioavailability, protocol design for bioequivalence assessment

UNIT II COMPARTMENT AND NON-COMPARTMENTAL MODELS 3

COMPARTMENT MODELS: Preliminary aspects, concept of a compartment models, assumptions and limitations of models and modeling, open v closed systems types of models: catenary v mammillary ,kinetics: linear v non-linear

UNIT III ONE COMPARTMENT OPEN MODEL 10

Compartmental models – one compartment open model with first order kinetics – pharmacokinetics of single dose administration by IV “bolus” administration, IV infusions.

UNIT IV TWO COMPARTMENT MODEL 7

Two compartment open model with first order elimination kinetics, kinetics of single dose administration as applied to IV, oral administration. Pharmacokinetics of sustained release formulations.

UNIT V ABSORPTION KINETICS NON – LINEAR KINETICS AND NON COMPARTMENTAL MODELS 15

Curve fitting, Wagner nelson, Loo Riegelman, Urinary excretion - Michaelis Menton Kinetics-In Vivo estimation of K_m and V_m , Dosage Regimen - Non Compartmental Models

TOTAL : 45 PERIODS

TEXT BOOKS

1. Brahmancker, D.M. and S.B. Jaiswal “Biopharmaceutics and Pharmacokinetics : A Treatise”. Vallabh Prakashan, 1995.
2. Venkateswarlu, V. “Biopharmaceutics and Pharmacokinetics”. Pharmabook Syndicate, 2004.

REFERENCES

1. Notari, R.E. “Biopharmaceutical and Clinical Pharmacokinetics : An Introduction”.4th Edition, Marcel Dekkar, 1987.
2. Welling, P.G. “Pharmacokinetics : Regulatory, Industrial and Academic Perspective”. 2nd Edition, Marcel Dekker, 1995.
3. Gibaldi, Milo “Pharmacokinetics” 2nd Edition, Marcek Dekker, 1982.
4. Burton, M.E. “Applied Pharmacokinetics & Pharmacodynamics : Principles of Therapeutics” 4th Edition, Lippincott Williams Wilkins, 2006.
5. Shargel, Leon “Applied Biopharmaceutics & Pharmacokinetics”. 5th Edition, McGraw – Hill, 2005.
6. Burton, M.E. “Applied Pharmacokinetics & Pharmacodynamics” : Principles Therapeutic Drug Monitoring”. 4th Edition, Lippincott Williams & Wilking, 2006.

AIM

To make the students understand the importance, relevance and potentialities of this emerging field of study.

OBJECTIVES

- Study the basic nano technology and nano science.
- Understand interdisciplinary nature of this field.
- Understand the importance role of physics, chemistry, biology.
- Recognize that the rules of nano science are fundamentally different than those we experience.
- Study the basic fabrication strategies of nano science.

UNIT I INTRODUCTION 10

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

UNIT II PREPARATION METHODS 10

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

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 5

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

UNIT IV PREPARATION ENVIRONMENTS 10

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

UNIT V CHARACTERISATION TECHNIQUES 10

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale characterisation of surfaces & Interfaces", 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

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

1. Isolation of bacterial DNA
2. Isolation of plant cell and animal cell genomic DNA
3. Agarose gel electrophoresis
4. Restriction enzyme digestion
5. Competent cells preparation
6. Transformation and screening for recombinants
7. Agarose gel electrophoresis
8. Restriction enzyme digestion
9. Competent cells preparation
10. Blue and white selection for recombinants
11. Plating of ϕ phage
12. λ phage lysis of liquid cultures

TOTAL : 60 PERIODS

Equipments Required

Laminar flow hood
Shaker
Agarose gel electrophoresis kit
Refrigerated centrifuge

REFERENCE

1. Ausubal, F.M. "Short Protocols in Molecular Biology", 4th Edition, John Wiley, 1999.

1. Standardization of analytical weights and calibration of volumetric apparatus.
2. **Acid Base Titrations** ; Preparation and standardization of acids and bases, some exercise related with determination of acids and bases separately in mixture form, some official assay procedure e.g. boric acid should also be covered.
3. **Oxidation reduction titrations** ; Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate, etc., some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, titanous chloride, sodium 2,6-di chlorophenol indophenol, ceric ammonium sulphate be designed.
4. **Precipitation Titrations** ; Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate, titrations according to Mohrs Volhards and Fajans methods.
5. **Gravimetric Analysis** : Preparation of Gooch crucible for filtration and use of sintered glass crucible, determination of water of hydration, some exercises related to gravimetric analysis should be covered.

6. **Non-aqueous Titrations** ; Preparation and standardization of perchloric acid and sodium/ potassium/lithium methoxides solutions, Estimations of some pharmacopoeial products.

7. **Complexometric titrations** ; Preparations and standardization of EDTA solution, some exercises related to pharmacopoeial assays by complexometric titrations.

TOTAL : 60 PERIODS

REFERENCES

1. Atherden, L.M. "Bentley and Driver's Textbook of Pharmaceutical Chemistry". 8th Edition, Oxford University Press, 1977.
2. Siddiqui, Anees A. "Pharmaceutical Analysis". Vol.I & II, CBS, 2006.
3. Parimoo, P. "Pharmaceutical Analysis". CBS, 1998.
4. Higuchi, Tekeru and Brochmann, Einar "Pharmaceutical Analysis". CBS Publishers, 1997.
5. Gennaro, Alfonso R. "Remington : The Science and Practice of Pharmacy" Vol. I & II, 20th Edition, Lippincott Williams & Wilkins / B.I. Publication, 2000.
6. Connors, Kenneth A. "A Textbook of Pharmaceutical Analysis". 3rd Edition, Johnwiley & Sons, 1982.
7. Ohannesian, Lena and Streeter, A.J. "Handbook of Pharmaceutical Analysis". Marcek Dekker, 2002.
8. Stahl, Egon "Thin – Layer Chromatography : A Laboratory Handbook". 2nd Edition, Springer, 2005

PO3309

PHARMACOKINETICS LAB

**L T P C
0 0 4 2**

1. Bioavailability studies - protein binding
3. One compartment models – IV Bolus
4. One compartment models – IV Infusion
5. 2 compartment models
6. Kinetics – oral administration
7. Kinetics – oral administration – Nelson Wagner
8. Kinetics based on urinary excretion data
9. Non Linear Kinetics
10. Computer Applications – Single Dose simulations

Equipments Required

Wet Granulator

Tablet dissolution test apparatus

Ultrasonics

Liquid filling

Tablet disintegration test apparatus

Friability test apparatus

Tablet hardness tester

TOTAL : 60 PERIODS

REFERENCES

1. Brahmaner, D.M. and S.B. Jaiswal "Biopharmaceutics and Pharmacokinetics : A Treatise". Vallabh Prakashan, 1995.
2. Venkateswarlu, V. "Biopharmaceutics and Pharmacokinetics". Pharmabook Syndicate, 2004.
3. Notari, R.E. "Biopharmaceutical and Clinical Pharmacokinetics : An Introduction". 4th Edition, Marcel Dekkar, 1987.

4. Welling, P.G. "Pharmacokinetics : Regulatory, Industrial and Academic Perspective". 2nd Edition, Marcel Dekker, 1995.
5. Gibaldi, Milo "Pharmacokinetics" 2nd Edition, Marcek Dekker, 1982.
6. Burton, M.E. "Applied Pharmacokinetics & Pharmacodynamics : Principles of Therapeutics" 4th Edition, Lippincott Williams Wilkins, 2006.
7. Shargel, Leon "Applied Biopharmaceutics & Pharmacokinetics". 5th Edition, McGraw – Hill, 2005.
8. Burton, M.E. "Applied Pharmacokinetics & Pharmacodynamics" : Principles Therapeutic Drug Monitoring". 4th Edition, Lippincott Williams & Wilking, 2006.

PO3311

CHEMICAL REACTION ENGINEERING

**L T P C
3 0 0 3**

AIM

To understand kinetics of reaction and rate equations
To understand design principles of reactors.

OBJECTIVES

- To estimate kinetic parameter
- To apply design equations.

UNIT I KINETICS OF HOMOGENEOUS REACTIONS 10

Principles of Homogeneous reactions – and rate equations-estimation of rate constants using constant volume and constant pressure Batch reactor-data for typical reactions – Arrhenius equation-Non elementary reaction kinetics-Multiple reactions-yield Concepts.

UNIT II IDEAL REACTORS 8

Performance equations for single batch reactor, ideal CSTR, ideal PFR-Application to design.

UNIT III MULTIPLE REACTORS & NON ISOTHERMAL REACTORS 8

Multiple reactor systems – selection of suitable reactor systems for multiple reactions-recycle reactor-Principles in non isothermal reaction and reactors.

UNIT IV NON IDEAL FLOW & REACTORS 10

Non Ideal reactors- Non Ideal Flow-Tracer experiments and application-TIS model, Axial Dispersion model-for tubular reactors. Exchange volume and By Pass and dead volume models for CSTR.

UNIT V MULTIPHASE REACTIONS & REACTORS 9

Gas-Liquid Reactions-kinetics-G-L reactor design Principles-Principle of Catalysis-types of Catalytic reactors-Concept of effectiveness factor in Catalytic reactions-G-L-S-reactors – slurry reactor.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Levenspiel, Octave "Chemical Reaction Engineering", 3rd Edition, John – Wiley & Sons, 1999.
2. Fogler, H.S. "Elements of Chemical Reaction Engineering", 2nd Edition, Prentice Hall, 1999.
3. Richardson, J.E. and D.G. Peacock "Coulson & Richardson's ChemicalEngineering", Vol.3 (Chemical & Biochemical Reactors & Process control) 3rd Edition, Butterworth – Heinemann / Elsevier, 2006.

UNIT I REGULATORY ASPECTS**10**

Drugs & Cosmetics Act - Schedules particularly M, NPPA, Aspects of GMP, Magic Remedies Act, Prevention of Food Adulteration Act Pharmacopoeias, Drug control, FDA, ICH

UNIT II GOOD MANUFACTURING PRACTICE FOR PHARMACEUTICALS**5**

Introduction, WHO guidelines, practice of GMP- Procedure (SOP'S), Building, Equipment, Personnel, Components, Documentation, Containers, Labeling, Laboratory Control, Distribution Records, Recovery & Reprocessing

UNIT III INTELLECTUAL PROPERTY RIGHTS AND ETHICAL ISSUES IN PATENTING LIFE FORMS**9**

What are patents, know-how, copyright, trademark, service mark, design, Conditions for patentability; Indian Patent Act; Opposition and Infringements of patents; Case study on patenting indigenous products (e.g. Neem, turmeric), DNA, Microbes, Transgenic Plants and Animals Industrial property, TRIPS, WTO, treaties, Budapest Convention. Application process for a patent and the post application process.

UNIT IV ETHICAL ISSUES IN HEALTH AND DISEASE, TRANSGENIC TECHNOLOGY**12**

Animal experimentation: concerns of welfare, Justification of use of animals in research; use of alternatives; Human experimentation-Nuremberg code and Helsinki declaration; Assisted Reproductive Technologies, Pre-implantation genetic diagnosis, Surrogacy, Use of Embryos; Therapeutic and Reproductive Cloning-Ethical, Legal and Social Issues; genetic testing and Genetic Screening, Types of Testing, Clinical Utility and Validity of Tests, Testing processes, Social stigma, discrimination, misuse of data; HGP & ELSI, case study; Somatic and Germline gene therapy; Organ transplantation and Xenotransplantation; Eugenics and Euthanasia.

UNIT V ETHICAL ISSUES IN TRANSGENIC TECHNOLOGY;**9**

Genetically modified foods; genetically modified organisms; effect on biodiversity; guidelines for testing, transplantation and release-Cartagena Protocol on Biosafety Considerations; Transgenic animals for food and drugs; Terminator technology, GURTS and farmer's rights; Environmental Issues; DBT, NIH and Paul Berg guidelines on the use and release of transgenics. Biosafety and biodiversity: Classification of microorganisms based on safety, Biosafety levels, Risk groups, Risk Assessment and Management, Spill Protocols, Biosafety Containment guidelines; Biodiversity – Need and Methods for Protection; Convention for preservation of biodiversity and farmer's rights; patenting of biodiversity: ethical issues

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Malik, Vijay "Drugs and Cosmetics Act – 1940", 11th Edition, Eastern Book Co., 1998.
2. "Quality Assurance of Pharmaceuticals : A Compendium of Guidelines and Related Materials", Vol.I and Vol.II. Good Manufacturing Practices and Inspection", WHO / Pharma Book Syndicate, 2002.

REFERENCES

1. Abraham, John and Smith, Helen Lawton, "Regulation of the Pharmaceutical Industry", Palgrave / Macmillan, 2003.
2. Weinberg, Sandy "Good Laboratory Practice Regulations", 3rd Rev. Edition, Marcel Dekker Inc., 2003.
3. Gad. Shayne C. "Drug Safety Evaluation", John Wiley Intersciences, 2002.
4. Thomas, J.A. and Fuchs, R.L. "Biotechnology and Safety Assessment", 3rd Edition, Academic Press, 2002.

AIM

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

OBJECTIVES

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

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES 9

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDCA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9

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

UNIT IV TQM TOOLS & TECHNIQUES II 9

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

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL: 45 PERIODS

TEXT BOOK

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCES

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

AIM

To enhance the overall capability of students and to equip them with the necessary Communication Skills and Soft Skills that would help them excel in their profession.

OBJECTIVES

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

1. PC based session**A. Career Lab (15 periods) Viewing and discussing audio-visual materials**

Resume / Report Preparation / Letter Writing: (3)

Letter writing – Job application with Resume - Project report - Email etiquette.

Presentation skills: (3)

Elements of effective presentation – Structure of presentation - Presentation tools – Body language.

3. Soft Skills: (3)

Time management – Stress management – Assertiveness – Negotiation strategies, Psychometrics - Analytical and logical reasoning.

Group Discussion: (3)

Group discussion as part of selection process, Structure of group discussion – Strategies in group discussion – Mock group discussions.

Interview Skills: (3)

Kinds of interviews – Interview techniques – Corporate culture – Mock interviews.

II. Class Room Session**45 periods**

Resume / Report Preparation / Letter writing: Students prepare their own resume and report. (9)

Presentation Skills: Students make presentations on given topics. (12)

Group Discussion: Students participate in group discussions. (12)

Interview Skills: Students participate in Mock Interviews (12)

Note: Classroom sessions are practice sessions.

REFERENCES

1. Prakash, P. "Verbal and Non-Verbal Reasoning". 2nd Edition. Macmillan India Ltd., 2004.
2. Seely, John. "The Oxford Guide to Writing and Speaking". Oxford University Press, 2004.
3. Anderson, Paul V. "Technical Communication". 6th Edition Thomson Wadsworth, 2007.
4. Thorpe, Showick. "Objective English". 2nd Edition, Pearson Education, 2007.
5. Evans, David. "Decision Maker". Cambridge University Press, 1997.

Lab Requirement:

Teacher console and systems for students.

English Language Lab Software

Tape recorders

AIM

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

OBJECTIVE

- To sterilize the bioreactor
 - To operate the bioreactor
 - To design experiments to evaluate the performance of the bioreactor
 - To develop enzyme immobilized processes.
1. Growth of bacteria – estimation of biomass, calculation of specific growth rate, yield coefficient
 2. Medium optimization – Plackett Burman design, response surface methodology
 3. Enzyme kinetics – Michelis Menton parameter, effect of temperature and pH
 4. Enzyme immobilization – gel entrapment, cross linking
 5. Preparation of bioreactor, utilities for bioreactor operation
 6. Thermal death kinetics
 7. Batch sterilization design
 8. Batch cultivation, estimation of $K_L a$ – dynamic gassing method, exhaust gas analysis – carbon balancing, gas balancing
 9. Fed batch cultivation, exhaust gas analysis – carbon balancing, gas balancing
 10. Estimation of $K_L a$ – sulphite oxidation method
 11. Estimation of overall heat transfer coefficient

TOTAL : 90 PERIODS

REFERENCES

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

Equipment Required:

Shaker
Laminar flow hood
Spectrophotometer
Laboratory scale reactor
Table top centrifuge

1. Preparation of plasmid DNA
2. Elution of DNA from agarose gels
3. Ligation of DNA into expression vectors
4. Transformation
5. Optimisation of inducer concentration for recombinant protein expression
6. Optimisation of time of inducer for recombinant protein expression
7. SDS-PAGE
8. Western blotting
9. Hybridisation with anti-sera
10. PCR.

TOTAL : 60 PERIODS

Equipments Required:

1. Laminar flow hood
2. Shaker
3. Agarose gel electrophoresis kit
4. Refrigerated centrifuge
5. Western blotting apparatus

REFERENCE

1. Sambrook, Joseph and David W. Russell "The Condensed Protocols : From Molecular Cloning ; A Laboratory Manual" Cold Spring Herbor Laboratory Press, 2006.

UNIT I INTRODUCTION 6

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

UNIT II CELLULAR RESPONSES 12

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

UNIT III INFECTION AND IMMUNITY 16

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

UNIT IV TRANSPLANTATION AND TUMOR IMMUNOLOGY 8

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

UNIT V AUTOIMMUNITY 3

Autoimmunity, Autoimmune disorders and diagnosis.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Male, David et al., "Immunology", 7th Edition, Mosby Publication, 2007.
2. Kindt, T.J. et al., "Immunology", 6th Edition, W.H. Freeman, 2007.
3. Janeway, C.A. et al., "Immunology : The Immune Systems in Health and Diseases", 6th Edition, Garland Science, 2005.

REFERENCES

1. Coico, R. et al., "Immunology : A Short Course", 5th Edition, Wiley – Liss, 2003.
2. Parham, Peter "The Immune System", 2nd Edition, Garland Science, 2005.
3. Abbas, A.K. et al., "The Cellular and Molecular Immunology", 6th Edition, Sanders / Elsevier, 2007.
4. Weir, D.M. and Stewart, John "Immunology", 8th Edition, Churchill Pvt. Ltd., 2000.
5. Lydyard, P.M. "Instant Notes in Immunology", Viva Books Pvt. Ltd., 2000.

PO3402

FORMULATION OF DRUGS

**L T P C
3 0 0 3**

UNIT I LIQUID DOSAGE FORMS, SEMI – SOLID DOSAGE FORMS 9

Introduction, types of additives used, vehicles, stabilizers, preservatives, emulsifying agents, solubilizers, colors, flavours , manufacturing, packaging and evaluation of solutions, suspensions and emulsions

Definitions, types, mechanisms of drug penetration through skin, factors influencing penetration, semisolid bases and their selection. General formulation/manufacture of semisolids, clear gels, evaluation and packaging.

UNIT II ORAL DOSAGE FORMS 12

Advantage and disadvantages of capsule dosage form, size of capsules, material for production of hard gelatin capsules, Formulation of hard gelatin capsules, method of capsule filling, soft gelatin capsule, shell and capsule content, stability testing & storage of capsule dosage forms.

Introduction to types of tablets; excipients, granulation techniques, Machinery for large scale granulation, compression machinery, In process controls, processing problems , Evaluation parameters and equipments.

Coating of tablets: objective, types of coating, film forming materials, formulation of coating solution, equipment for coating, coating process, evaluation of coated tablets , coating defects, specialized coating process.

Microencapsulation

UNIT III PARENTERAL PRODUCTS 9

Routes of administration, vehicles- aqueous, nonaqueous; pyrogenicity, Pyrogen testing, isotonicity, containers and closures -types, characteristics

Manufacture and evaluation of parenteral products - design of manufacturing facility, sources of contamination and method of prevention, aseptic techniques, evaluation

UNIT IV PHARMACEUTICAL AEROSOLS 6

definitions, propellants, general formulation, manufacture, packaging and evaluation

UNIT V CONTROLLED DRUG DELIVERY 9

concept, routes of delivery – design of oral, parental products, transdermal delivery, implants

TOTAL : 45 PERIODS

TEXT BOOKS

1. Lachman, Leon et al., "The Theory and Practice of Industrial Pharmacy", 3rd Edition, Varghese Publishing House, 1986.
2. Ansel, H.C. "Pharmaceutical Dosage Forms and Drug Delivery Systems", 7th Edition, Lippincott Williams & Wilkins, 2000.
3. Lieberman, H.A. et al., "Pharmaceutical Dosage Forms : Tablets" (Vol. I, II & III) 2nd Edition, Marcel Dekkar, 1989.

REFERENCES

1. Li, Xiaoling and Bhaskara R. Jasti "Design of Controlled Release Drug Delivery Systems", Mc Graw – Hill, 2006.
2. Wise, Donald L. "Handbook of Pharmaceutical Controlled Release Technology", Marcel Dekker, 2000.
3. Lieberman, H.A. et al., "Pharmaceutical Dosage Forms: Disperse Systems" (Vol.I, II & III) 2nd Rev. Edition, Marcel Dekker, 1996.
4. Avis, K.E. et al., "Pharmaceutical Dosage Forms : Parental Medications", (Vol.I, II & III) 2nd Rev. Edition, Marcek Dekker, 1992.
5. Jain, N.K. "Advances in Controlled and Novel Drug Delivery", CBS Publishers, 2001.
6. Jain, N.K. "Controlled and Novel Drug Delivery" CBS Publishers, 1997.

PO3403

PHARMOCOGNOSY

L T P C

3 0 0 3

9

UNIT I

Definition, history, scope and development of pharmacognosy.

UNIT II

9

Sources and Classification of drugs : Biological, marine, geographical and plant tissue cultures as sources of drugs. Alphabetical, morphological, taxonomical, pharmacological and chemical. Cultivation, collection, processing and storage of crude drugs. Factors influencing cultivation of medicinal plants, types of soil and fertilizers of common use. Pest management and natural pest control agents. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants.

UNIT III

9

Quality control of crude drugs : Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation.

UNIT IV

9

An Introduction to chemical constituents of drugs : their isolation, classification and properties & systematic pharmacognostic study of following :

- a) Carbohydrates and derived products : Agar, Guar gum, Gum acacia, Honey, Isabgol, Pectin, Starch, Sterculia and Tragacanth.
- b) Lipids : Bees wax, Castor oil, Coca butter, Cod-liver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Rice bran oil, shark liver oil and wool fat.
- c) Resins and resin combinations : Colophony, Podophyllum, Jalap, Cannabis, Capsicum, Myrrh, Asafoetida, Balsam of Peru, Balsam of Tolu, Benzoin, Turmeric.
- d) Tannins and tannins containing drugs : Gambir, black catechu, gall and myrobalan.
- e) Volatile oils : General methods of obtaining volatile oils from plants. Study of volatile oils of Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Cumin, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandal wood.

UNIT V**9**

Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups containing glycosides. Saponins: glycyrrhiza, ginseng, dioscorea, sarsaparilla and senega. Cardioactive sterols : digitalis, squill, strophanthus and thevita. Anthraquinone cathartics: Aloe, Senna, rhubarb and cascara. Psoralea, Ammi, gentian, saffron, chirata, quassia.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Evans, W.C. "Trease and Evans Pharmacognosy", 15th Edition, Saunders / Elsevier, 2005.
2. Kokate, C.K. et al., "Pharmacognosy", 39th Edition, Nirali Prakashan, 2007.
3. Wallis, T.E. "Textbook of Pharmacognosy", 5th Edition, CBS Publishers, 1985.

REFERENCES

1. Gennaro, A.R. "Remington : The Science and Practice of Pharmacy", Vol. I & II. 20th Edition, B.I. Publications Pvt. Ltd. / Lippincott Williams & Wilkins, 2004.
2. Mohammed Ali, "Textbook of Pharmacognosy", 2nd Edition, CBS Publishers, 1994.
3. Kalia, A.N. "Textbook of Industrial Pharmacognosy", CBS Publishers, 2005.

PO3404**PHARMACOLOGY AND CHEMOTHERAPY****L T P C****3 0 0 3****UNIT I GENERAL PHARMACOLOGY****9**

Introduction to pharmacology, sources of drugs, dosage forms and routes of administration. Mechanism of action, combined effect of drugs, factors modifying drug action, tolerance and dependence, Pharmacogenetics drug receptors, dose response relationship. Absorption, Distribution, Metabolism and excretion of drugs. Principles of Basic and Clinical Pharmacokinetics. Adverse Drug Reactions and treatment of Poisoning, ADME drug interactions

UNIT II PHARMACOLOGY OF PERIPHERAL NERVOUS SYSTEM**9**

Neurohumoral transmission (autonomic and somatic), Parasympathomimetics, Parasympatholytics, Sympathomimetics, adrenergic receptor and neuron blocking agents, ganglionic stimulants and blocking agents. Neuromuscular blocking agents. Local anesthetic agents.

UNIT III AUTOCOIDS**9**

Histamine, 5-HT and their antagonists. Prostaglandins, thromboxane and leukotrienes. Pentagastrin, cholecystinin, Angiotensin, Bradykinin and substance P.

UNIT IV CHEMOTHERAPY**12**

General principles of chemotherapy. Sulphonamides, co-trimoxazole, Quinolones, nitrofurans. Antibiotics:- Penicillines, cephalosporins, Betalactams, Tetracyclines, Aminoglycosides, Chloramphenicol, Erythromycin and Miscellaneous Antibiotics. Chemotherapy of tuberculosis, leprosy, fungal Diseases, viral diseases, urinary tract infections and sexually Transmitted Diseases [STD]. Chemotherapy of malignancy and Immunosuppressive Agents. Chemotherapy of the parasitic diseases:- Helmenthiasis, malaria, amoebiasis and other Protozoal infections.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) - Discrimination

UNIT V GLOBAL ISSUES 9

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics Concepts and Cases", Thompson Learning, (2000).

REFERENCES

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003)

PO3407

COMPUTER AIDED DRUG DESIGN

**L T P C
0 0 4 2**

Stereochemistry and Drug Design

Structurally Rigid Groups – Conformation – Configuration.

Structure, Activity Relationship

Changing size and shape – degree of unsaturation Addition and removal of ring system – New substitutions – methyl – halogen. Basic groups – changing existing substituents for a lead compound.

Quantitation Structure – Activity Relationship

Partitional parameters – partition coefficients – hepo substituent constants – electronic parameters – Hammett constant steric parameters – Hansch analysis

Docking

Docking ligands to macromolecules – Docking algorithms - Dock – AUTODOCK

Molecular Simulations

Molecular dynamic simulations – GROMACS – GROMOS – AMBER

TOTAL : 60 PERIODS

TEXT BOOKS

1. Cohen, N.C. "Guide Book on Molecular Modeling on Drug Design", Academic Press / Elsevier, 2006.
2. Eliel, E.L. "Stereo Chemistry of Organic Compounds", John Wiley, 1994.
3. Leach, Andrew R. "Molecular Modeling and Applications", 2nd Edition, Pearson / Dorling Kindersley (India) Pvt. Ltd., 2010.

REFERENCES

1. Frenkel, Dean and Berend Smith "Understanding Molecular Simulation: From Algorithms to Applications", 2nd Edition Academic Press, 2002.
2. Lee, Mike S. "Integrated Strategies for Drug Discovery using Mass Spectrometry" John Wiley – Interscience, 2005.

PO3408

PHARMACOGNOSY LAB

**L T P C
0 0 4 2**

1. Macroscopic Identification-1: Adhatoda, Datura, Cinnamon, Clove, Coriander
Macroscopic Identification-2 Arjuna, Liquorice, Ashwagandha, Turmeric, Cardamom
2. Microscopic Identification-1: Adhatoda, Datura, Tulsi or suitable specimens
3. Microscopic Identification-2: Arjuna, Liquorice, Ashwagandha or suitable specimens
4. Chemical Screening: Adhatoda, Datura, Liquorice, Aloes, Acacia, Gelatin
5. Fibre analysis: Cotton, Silk, Wool, Jute
6. Herbarium- 10 specimens
7. Preparations: Potato from starch
8. Curcumin from turmeric or caffeine from tea leaves or nicotine from tobacco leaves or suitable preparation
9. Andrographolide form Andrographis or suitable preparation depending upon material and apparatus availability

TOTAL : 60 PERIODS

Equipments Required

Microscope

REFERENCES

1. Kokate, C.K. "Practical Pharmacognosy", 4th Edition, Vallabh Prakashan, 1994.
2. Sharma, Varun Dutt "Pharmacognosy : Practical Note book", CBS Publishers,2007.

1. Preparation and evaluation of suspensions
2. Preparation and evaluation of emulsions
3. Preparation and evaluation of creams
4. Preparation and evaluation of ointments
5. Preparation of granules
6. Physical parameters - angle of repose
7. Tablets - manufacture
8. Tablets - evaluation
9. Preparation and evaluation of injections
10. Preparation and evaluation of a sustained drug delivery dosage form

TOTAL : 60 PERIODS**Equipments Required**

Mortar and Pestle

Sieve

REFERENCES

1. Lachman, Leon et al., "The Theory and Practice of Industrial Pharmacy", 3rd Edition, Varghese Publishing House, 1986.
2. Ansel, H.C. "Pharmaceutical Dosage Forms and Drug Delivery Systems", 7th Edition, Lippincott Williams & Wilkins, 2000.
3. Lieberman, H.A. et al., "Pharmaceutical Dosage Forms : Tablets" (Vol. I, II & III) 2nd Edition, Marcel Dekkar, 1989.
4. Lieberman, H.A. et al., "Pharmaceutical Dosage Forms: Disperse Systems" (Vol.I, II & III) 2nd Rev. Edition, Marcel Dekker, 1996.
5. Avis, K.E. et al., "Pharmaceutical Dosage Forms: Parental Medications", (Vol.I, II & III) 2nd Rev. Edition, Marcek Dekker, 1992.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 10 +3

Solution of algebraic and transcendental equations - Fixed point iteration method - Newton-Raphson method- Solution of linear system of equations - Gauss Elimination method - Pivoting - Gauss-Jordan methods - Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method and by Jacobi's method.

UNIT II INTERPOLATION AND APPROXIMATION 8 + 3

Interpolation with unequal intervals - Lagrange interpolation - Newton's divided difference interpolation - Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9 + 3

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules - Romberg's method - Two point and three point Gaussian quadrature formulae - Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9 + 3

Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Multi-step methods - Milne's and Adams-Bashforth predictor-corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Finite difference methods for solving two-point linear boundary value problems. Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.

L : 45 , T : 15, TOTAL : 60 PERIODS

TEXT BOOKS

1. Grewal, B.S. and Grewal, J.S., "Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, 2004.
2. Sankara Rao, K. "Numerical methods for Scientists and Engineers", 3rd Edition Prentice Hall of India Private Ltd., 2007.

REFERENCES

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, 2007.
2. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, 2006.
3. Brian Bradie, "A Friendly Introduction to Numerical analysis", Pearson Education Asia, 2007.

**PO3002 PHARMACEUTICAL INDUSTRIAL MANAGEMENT L T P C
3 0 0 3**

UNIT I ACCOUNTANCY, FINANCE AND FOREIGN TRADE 7

Principles of Accountancy ledger posting and book entries preparation of trial balance columns of a cash book Bank reconciliation statement rectification of errors profits and loss account balance sheet purchase keeping and pricing of stocks treatment of cheques bills of exchange promissory notes and hundies documentary bills. (Preliminary idea) Principles of economics with special reference to the laws of demand and supply demand schedule demand curves general principles of insurance and inland and foreign trade procedure of exporting and importing goods.

UNIT II PHARMACEUTICAL MARKETING AND SALESMANSHIP 9

Introduction functions- buying selling transportation storage finance feedback information. Channels of distribution- wholesale retail departmental store multiple shop and mail order business.
Principles of Sales promotion advertising ethics of sales merchandising literature detailing.

UNIT III MARKETING INFORMATION & RESEARCH 7

Marketing information system (MIS) components characteristics. Research-meaning process methods of data collection techniques types of survey.

UNIT IV PRINCIPLES OF MANAGEMENT: BASIC INFORMATION SERVICES 11
 Concept of Management functions Administrative Management (planning organisation) Principles of Management (Co-ordination controlling communication decision-making leadership innovation Creativity Delegation of Authority / Responsibility Record keeping.) A brief exposure of the basic principles of materials Management ABC analysis

UNIT V INDUSTRIAL PSYCHOLOGY AND INDUSTRIAL SOCIOLOGY 11
 Recruitment selection training efficiency evaluation compensation to the pharmacist service conditions Termination etc.) Motivation-Maslow's, theory Herzberg's theory approaches and styles of leadership
 Meaning types role of industry in national development, cottage & large scale industry. Problems of industrialization w.r.t pharmaceutical industry. History of labour movement in India problems of trade unions in India (collective bargaining industrial disputes causes and remedies) labour welfare.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Kesiraju, Krishna Phani "Pharma Sector : Trends and Cases", Vol. I, II & III, ICFAI University, 2004.
2. Aishiya, Manish "TRIPS and Pharmaceutical Industry : Impact on Developing Countries", ICFAI University, 2007.
3. Kaushesh, Anshul "Pharmaceutical Marketing : Emerging Trends", ICFAI University, 2002.

REFERENCES

1. Kotler, P., and Kevin Lane Keller. "Marketing Management", 12th Edition, Prentice Hall, 2006.
2. Sreenivasan, N.S. and V. Narayana "Managing Quality : Concepts and Tasks", New Age International, 2005.
3. Pandey, I.M. "Financial Management", 9th Edition, vikas Publications, 2004.
4. Wood, J.P. "Containment in the Pharmaceutical Industry", Marcel Dekker, 2001.
5. Pala, Surya and A. Srikant "TRIZ : A New Framework for Innovations ; Concepts and Cases", ICFAI University, 2005.
6. Suresh, K. "New Product Development : Concepts and Cases", ICFAI University, 2006.
7. Narasimha Rao, A.V. "Pharma Patents : An Introduction", ICFAI University, 2007.
8. Chakraborty, Shibashish "New Patent Regime ; Lessons for Indian Pharma", ICFAI University, 2006.
9. Madapati, Ravi S. "Entrepreneurial Finance ; Concepts and Cases", ICFAI University, 2004.

PO3003 TECHNICAL WRITING AND COMMUNICATION L T P C
3 0 0 3

UNIT I RESEARCH & WRITING 9
 The project/term paper, selecting a topic, using a library, compiling a working bibliography, taking notes, plagiarism, outlining, writing drafts, guides to writing.

UNIT II MECHANICS OF WRITING 9
 Spelling, punctuation, numbers, titles and quotations.

UNIT III FORMAT OF A TERM/PROJECT REPORT 9
 Typing, paper, margins, spacing, heading and title of paper, page numbers, tables and illustrations, corrections and insertions, binding.

UNIT IV PREPARATION OF CITATIONS 9
General guidelines, placement, arrangement, citing books, citing articles in periodicals, documenting sources, what is a document, parenthetical documentation, information required in parenthetical documentation, readability, sample references.

UNIT V ABBREVIATIONS AND REFERENCES 9
Introduction, time, common scholarly abbreviations and references words, publishers names, symbols and abbreviations used in proof-reading and correction, literary and scientific indexing.

TOTAL : 45 PERIODS

TEXT BOOK

1. Gibaldi W.S. "Achtert Handbook for Writers of Research Papers ", Wiley Eastern, 1987.

REFERENCE

1. "Chicago Manual of Style 14th Edition", Chicaco, University of Chicaco Press, 1996.

**PO3004 NATURAL AND SYNTHETIC DRUG TECHNOLOGY L T P C
3 0 0 3**

UNIT I FUNDAMENTALS OF DRUGS FROM NATURAL SOURCE 15
Introduction, history, Chemistry of selected natural products. Special emphasis on the synthesis of steroids, terpenes, alkaloids, pheromones, prostaglandins, macrolides and polyether antibiotics. Selected topics from the current literature.

UNIT II THE HERBAL DRUG INDUSTRY 10
Overview, potential, products. Plants in complementary and traditional systems of medicine

UNIT III API'S MANUFACTURE TECHNOLOGY 15
Overview of the drug industry evolution, economics, prospects, process development, scale up considerations Chemistry and synthesis of select examples of drugs belonging to important classess like cardiovascular, hormones, anti cancers, gastrointestinal etc

UNIT IV REGULATORY ASPECTS 2
Regulatory aspects: Guidelines for manufacture of herbal preparations standardization of natural drugs

UNIT V DRUGS FORM OTHER SOURCES 3
Drugs form other sources: Drugs from animal, marine sources - introduction, history, development

TOTAL : 45 PERIODS

TEXT BOOKS

1. Bisset, N.G. and Wichtl, M. "Herbal Drugs and Phytopharmaceuticals", 2nd Edition, Meelpharmscientific Publishers / CRC, 2001.
2. Hanson, J.R. "Natural Products : The Secondary Metabolites", Royal Society of Chemistry, 2003.
3. Someswaro Rao, C. "The Chemistry of Process Development in Fine Chemical & Pharmaceutical Industry", Asian Books, 2004.

REFERENCES

1. Dewick, P.M. "Medicinal Natural Products : A Biosynthetic Approach", John Wiley, 2002.
2. Zhang, Lixin "Natural Products : Drug Discovery and Therapeutic Medicine", Humana, 2005.
3. Ikan, Raphael "Natural Products : A Laboratory Guide", Academic Press, 2005.

PO3005 PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT L T P C
3 0 0 3

AIM

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

OBJECTIVES

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

UNIT I PRINCIPLES OF PRODUCTION MANAGEMENT AND ORGANISATION 15

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

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

Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital, invested capital and profitability.

UNIT III PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENTS 8

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

UNIT IV ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE 4

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

UNIT V ECONOMIC BALANCE AND QUALITY AND QUALITY CONTROL 8

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

TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCES

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

PO3006

PROTEIN ENGINEERING

L T P C
3 0 0 3

UNIT I **BONDS AND ENERGIES IN PROTEIN MAKEUP** **5**

Covalent, Ionic, Hydrogen, Coordinate, hydrophobic and Vander walls interactions in protein structure. Interaction with electromagnetic radiation (radio, micro, infrared, visible, ultraviolet, X-ray) and elucidation of protein structure.

UNIT II **AMINO ACIDS AND THEIR CHARACTERISTICS** **5**

Amino acids (the students should be thorough with three and single letter codes) and their molecular properties (size, solubility, charge, pKa), , Chemical reactivity in relation to post-translational modification (involving amino, carboxyl, hydroxyl, thiol, imidazole groups) and peptide synthesis.

UNIT III **PROTEIN ARCHITECTURE** **12**

Primary structure: peptide mapping, peptide sequencing - automated Edman method & mass-spec. High-throughput protein sequencing setup Secondary structure: Alpha, beta and loop structures and methods to determine

Super-secondary structure: Apha-turn-alpha, beta-turn-beta (hairpin), beta-sheets, alpha-beta-alpha, topology diagrams, up and down & TIM barrel structures nucleotide binding folds, prediction of substrate binding sites

Tertiary structure: Domains, folding, denaturation and renaturation, overview of methods to determine 3D structures, Quaternary structure: Modular nature, formation of complexes.

UNIT IV **STRUCTURE-FUNCTION RELATIONSHIP** **15**

DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Trp repressor, Eucaryotic transcription factors, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers, Membrane proteins: General characteristics, Trans-membrane segments, prediction, bacteriorhodopsin and Photosynthetic reaction center, Immunoglobulins: IgG Light chain and heavy chain architecture, abzymes and Enzymes: Serine proteases, understanding catalytic design by engineering trypsin, chymotrypsin and elastase, substrate-assisted catalysis other commercial applications.

UNIT V **PROTEIN ENGINEERING** **8**

Advantages and purpose, overview of methods, underlying principles with specific examples: thermal stability T4-lysozyme, recombinant insulin to reduce aggregation and inactivation, *de novo* protein design.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Voet, D. and Voet, G., "Biochemistry". 3rd Edition, John Wiley and Sons, 2001.
2. Branden C. and Tooze J., "Introduction to Protein Structure", 2nd Edition, Garland Publishing, 1999.
3. Creighton, T.E. "Proteins : Structure and Molecular Properties", 2nd Edition, W.H. Freeman, 1993.

REFERENCES

1. Whitford, David "Proteins : Structure and Function". John Wiley & Sons, 2005.
2. Holland, I Barry & etal., "ABC Proteins : From Bacteria to Man". Academic Press Elsevier, 2003.
3. Alberghina, L. "Protein Engineering in Industrial Biotechnology". Harwood Academic Publications, 2000.
4. Moody P.C.E. and Wilkinson A.J. "Protein Engineering". IRL Press, Oxford, 1990.
5. Rees, A.R., Sternberg, M.J.E. and Wetzel, R. "Protein Engineering : A Practical Approach". IRL Press, 1992.

PO3007

BIO INFORMATICS

L T P C

3 0 0 3

UNIT I INTRODUCTION

9

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

UNIT II DATABASES

9

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

UNIT III PATTERN MATCHING & MACHINE LEARNING

9

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

UNIT IV PHYLOGENY

9

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

UNIT V ADVANCED TOPICS IN BIOINFORMATICS

9

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

TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCES

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

UNIT I INTRODUCTION TO EXAMPLES OF PATHWAY MANIPULATION - QUALITATIVE TREATMENT 9

Enhancement of Product yield and Productivity, Extension of substrate Range, Extension of Product spectrum and Novel products, Improvement of Cellular properties, Xenobiotic degradation.

UNIT II MATERIAL BALANCES AND DATA CONSISTENCY 9

Comprehensive models of cellular reactions; stoichiometry of cellular reactions, reaction rates, dynamic mass balances, yield coefficients and linear rate equations, analysis of over determined systems- identification of gross measurement errors. Introduction to MATLAB®

UNIT III METABOLIC FLUX ANALYSIS 9

Theory, overdetermined systems, underdetermined systems- linear programming, sensitivity analysis, methods for the experimental determination of metabolic fluxes by isotope labeling, applications of metabolic flux analysis.

UNIT IV METABOLIC CONTROL ANALYSIS 9

Fundamentals of Metabolic Control Analysis, control coefficients and the summation theorems, Determination of flux control coefficients, MCA of linear pathways, branched pathways, theory of large deviations

UNIT V ANALYSIS OF METABOLIC NETWORKS 9

Control of flux distribution at a single branch point, Grouping of reactions, case studies, extension of control analysis to intermetabolite, optimization of flux amplifications, consistency tests and experimental validation.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Stephanopoulos, G.N. "Metabolic Engineering : Principles and Methodologies". Academic Press / Elsevier, 1998.
2. Lee, S.Y. and Papoutsakis, E.T. "Metabolic Engineering". Marcel Dekker, 1998.
3. Nielsen, J. and Villadsen, J. "Bioreaction Engineering Principles". Springer, 2007.

REFERENCES

1. Voit, E.O. "Computational Analysis of Biochemical Systems : A Practical Guide for Biochemists and Molecular Biologists". Cambridge University Press, 2000.
2. Scheper, T. "Metabolic Engineering" Vol 73 (Advances in Biochemical Engineering Biotechnology) Springer, 2001.
3. Rhodes, P.M. and P.F. Stanbury "Applied Microbial Physiology " A Practical Approach". IRL Press, 1997.
4. Caldwell, D.R. "Microbial Physiology & Metabolism". Wm. C. Brown, 1995.
5. Rehm, H.J. and G. Reed, "Biotechnology : Products of Primary Metabolism Vol.6 and Biotechnology : Products of Secondary Metabolism Vol.7, VCH / Wiley, 1997.

PO3009

OPERATION RESEARCH

L T P C
3 0 0 3

UNIT I

9

Concept and Scope of Operation Research (OR) – Development of OR - Phases of OR – Models in OR. Linear Programming: Methods of solution – Graphical and SIMPLEX methods of solution – VARIATIONS – Duality in LP – Revised SIMPLEX method – Application for business and Industrial Problems.

UNIT II

9

Integer programming: Formulation – Graphical Representation – Gomory's Cutting Plane Method. Transportation and Assignment Problems: Initial solution – Methods of improving the initial solution – travelling salesman Problem. Dynamic Programming – Principle of Optimality

UNIT III

9

Sequencing and Scheduling Problems: Job sequencing – Jobs through Two Machines, Two Jobs through Machines and n Jobs through Machines. PERT and CFM techniques – Critical Path – Normal and crash time. Resource allocation – Resource Leveling and Smoothing

UNIT IV

9

Inventory Problems: Deterministic model –Costs – Decision Variables – Economic order Quantity – Instantaneous and Non – Instantaneous receipt of goods with and without Shortage – Quantity Discount – Probabilistic inventory Model – Inventory systems– Safety Stock – Reorder Level (ROL) Reorder Point (ROP) determination.

UNIT V

9

Maintenance and Replacement Problems: Models for routine maintenance and preventive maintenance decisions – Replacement models that deteriorate with time and those that fail completely. (spr/rm/vec)

TOTAL : 45 PERIODS

TEXT BOOKS

1. Sharma, S.D. "Operation Research" Kedarnath Ramnath & Co.,
2. Gillet, Billy E. "Introduction to Operation Research", TMH Publishing Co.,
3. Gupta, P.K. and Manomohan "Operation Research and Quantitative Analysis", S.Chand & Co.,

REFERENCE

1. Hambleis, S. and Stevens "Operation Research" McGraw – Hill, Taha, H.A. "Operation Research", Macmillian,

PO3010

PRINCIPLES OF DRUG DESIGN

L T P C
3 0 0 3

UNIT I

INTRODUCTION TO THE DRUG DISCOVERY/DEVELOPMENT

9

Definition of Drug Discovery 2. Stages of drug discovery 3. Strategic Issues in drug discovery . Drug Development 1. Chemistry 2. Preclinical Studies 3. Transition from Preclinical to Clinical 4. Planning the Drug Development Process 5. Clinical Research C.. Source of Drugs 1. Drugs from Natural Sources (Natural Products) a. Plants b. Animals c. Microorganisms (Fungi, Bacteria) 2. Drugs from Organic Synthesis II.

UNIT I INTRODUCTION 4

Animal handling and restraint; managing immunocompromised animals; immunisation; blood collection; removal of lymphoid organs from mice; adjuvants: basics and mode of action.

UNIT II ANTIBODY PRODUCTION AND PURIFICATION AND APPLICATIONS 10

Production of antibodies: polyclonal and monoclonal; purification and fragmentation of antibodies; western blot analysis; immunoelectrophoresis; immunoprecipitation; ELISA, non-radio isotopic methods of detection – chemiluminescence assays.

UNIT III TECHNIQUES IN CELLULAR IMMUNOLOGY 12

Isolation and identification of mononuclear cell populations: fractionation; depletion; enrichment – FACS, MACS; T-cell activation assays – measurement of CTL activity; proliferative assays, estimation of cytokines; B-cell activation assays; macrophage activation assays.

UNIT IV TECHNIQUES FOR IMMUNOPATHOLOGY 7

Preparation and storage of tissues; identification of various cell types; immunohistochemistry, immunofluorescence, immunoenzymatic and immunoferritin techniques; immunoelectron microscopy; microarrays and expression analysis.

UNIT V THERAPEUTIC ANTIBODIES AND ANTIGENS 12

Engineered antibodies; antibody based fusion proteins; gene targeting – knockout animals; catalytic antibodies and catELISA; vaccine technology.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Male, David, Jonathan Brostoff, David B Roth and Ivan Roitt, "Immunology", 7th Edition, Mosby / Elsevier, 2006
2. Kindt, T.J., R.A.Goldsby and B.A. Osborne, "Kuby Immunology", 6th Edition, W.H. Freeman, 2007.
3. Weir, D.M. and J. Stewart "Immunology" 8th Edition, Churchill Livingstone, 2000.

REFERENCES

1. Harris, W.J. and Cunningham, C. "Antibody Therapeutics". Springer, 1995
2. Wawrzyuczak, E.J. "Antibody Therapy". BIOS Scientific Publication, 1995.
3. Borrebaeuk, Carl A.K. "Antibody Engineering". 2nd Edition, Oxford University Press, 1995.
4. Shepherd, P. and Dean, C. "Monoclonal Antibodies". Oxford University Press, 2000.
5. Rastogi, S.C. "Immunodiagnosics : Principles and Practice". New Age International, 1996.
6. Lydyard, P.M. "Instant Notes in Immunology", Viva Books, 2000.
7. Abbas, A.K., A.H. Lichtman and Shiv Pillai "Cellular and Molecular Immunology", 6th Edition, Saunders / Elsevier, 2007.
8. Davis, J.M. "Basic Cell Culture : A Practical Approach", IRL Press, 1994.
9. Master, J.R.W. "Animal Cell Culture", 3rd Edition, Oxford University Press, 2000.
10. Glick, B.R. and J.J. Pasternak, "Molecular Biotechnology : Principles and Applications of Recombinant DNA", 3rd Edition, ASM Press.

UNIT I INTRODUCTION TO PHARMACOGENOMICS 9

Pharmacogenetics-The roots of pharmacogenomics, It is not just pharmacogenomics, Genetic drug response profiles, the effect of drugs on Gene expression, pharmacogenomics in drug discovery and drug development.

UNIT II THE HUMAN GENOME 9

Expressed sequence Tags (EST) and computational biology, Microbial genomics, computational analysis of whole genomes, computational genome analysis, Genomic differences that affect the out come of host pathogen interactions: A template for the future of whole genome-based pharmacological science.

UNIT III ASSOCIATION STUDIES IN PHARMACOGENOMICS 9

Viability and ADR in drug response: contribution of genetic factor, Multiple inherited genetic factors influence the out come of drug treatments, Plasma binding proteins, Drug targets.

UNIT IV GENOMICS APPLICATIONS THAT FACILITATE THE DERSTANDING OF DRUG ACTION AND TOXICITY 9

Genomics, Proteomics, Bioinformatics, The pharmaceutical process, applications of pharmaceutical industry, Understanding biology and diseases, Target identification and validation, Drug candidate identification and optimization.

UNIT V PHARMACOGENOMICS AND DRUG DESIGN 9

The need of protein structure information, protein structure and variation in drug targets-the scale of problem, Mutation of drug targets leading to change in the ligand binding pocket.

TOTAL : 45 PERIODS**TEXT BOOK**

1. Chaknaborty, Chiranjib and Atanu Bhatta Charya "Pharmacogenomics : An Approach to New Drug Development", Biotech Books, 2004.

REFERENCES

1. Rothstein, Mark A. "Pharmacogenomics: Social, Ethical and Clinical Dimensions", John - Wiley & Sons, 2003.
2. Licinio, Julio and Ma-Liwong "Pharmacogenomics : The Search for Individualized Therapies", Wiley – VCH, 2002.

UNIT I BIOASSAY OF DRUGS AND BIOLOGICAL STANDARDIZATION 9

Importance, principles and methods of bioassay. Pyrogen testing, discovery and development of New Drugs. Bioassay methods of important drugs.

UNIT II DRUGS ACTING ON THE HEMOPOIETIC SYSTEM 9

a) Haematinics. b) Anticogulants, Vitamin K and hemostatic agents. c) Fibrinolytic and anti-platelet drugs d) Blood and plasma volume expanders.

UNIT III DRUGS ACTING ON THE URINARY SYSTEM 9
a) Fluid and electrolyte balance. b) Diuretics.

UNIT IV DRUGS ACTING ON THE RESPIRATORY SYSTEM 9
a) Anti-asthmatic drugs including bronchodilators. b) Anti-tussives and expectorants. c) Respiratory stimulants

UNIT V DRUG ACTING ON THE GASTROINTESTINAL TRACT 9
a) Antacids, Antisecretory and Anti-ulcer Drugs. b) Laxatives and antidiarrhoeal drugs. c) Appetite stimulants and suppressants. d) Emetics and anti-emetics. e) In Miscellaneous; carminatives, demulcents, protectives, mucolytics, Adsorbants, Astringents, Digestants and Enzymes.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Tripathi, K.D. "Essentials of Medical Pharmacology", 6th Edition, Jaypee Brothers Medical Publishers, 2008.
2. Bennett, P.N. and M.J. Brown "Clinical Pharmacology", 9th Edition, Churchill Livingstone, 2003.
3. Dipalma, J.R. and G.J. Digregorio "Basic Pharmacology in Medicine", 3rd Edition, McGraw – Hill Publishing, 1989.

REFERENCES

1. Hardman, J.G. and L.E. Limbird "Goodman & Gilman's The Pharmacological Basis of Therapeutics", 10th Edition, McGraw – Hill, 2001.
2. Myeek, M.J. et al., "Lippincott's Illustrated Reviews Pharmacology", 2nd Edition, Lippincott Williams & Wilkins, 2000.
3. Rang, H. P. et al., "Pharmacology", 5th Edition, Churchill Livingstone, 2003.

PO3014 DOWNSTREAM PROCESSING L T P C
3 0 0 3

UNIT I DOWNSTREAM PROCESSING 10
Introduction to downstream processing principles characteristics of biomolecules and bioprocesses. Cell disruption for product release – mechanical, enzymatic and chemical methods. Pretreatment and stabilisation of bioproducts.

UNIT II PHYSICAL METHODS OF SEPERATION 6
Unit operations for solid-liquid separation - filtration and centrifugation.

UNIT III ISOLATION OF PRODUCTS 12
Adsorption, liquid-liquid extraction, aqueous two-phase extraction, membrane separation – ultrafiltration and reverse osmosis, dialysis, precipitation of proteins by different methods.

UNIT IV PRODUCT PURIFICATION 12
Chromatography – principles, instruments and practice, adsorption, reverse phase, ion-exchange, size exclusion, hydrophobic interaction, bioaffinity and pseudo affinity chromatographic techniques.

UNIT V FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS 5
Crystallization, drying and lyophilization in final product formulation.

TOTAL : 45 PERIODS

AIM

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

OBJECTIVES

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

UNIT I INTRODUCTION 9

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

UNIT II PROJECT SELECTION AND EVALUATION 9

Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques)

UNIT III NEW PRODUCT DEVELOPMENT 9

Research and new product development - Patents - Patent search - Patent laws - International code for patents - Intellectual property rights (IPR).

UNIT IV NEW PRODUCT PLANNING 9

Design of proto type - testing - quality standards - marketing research - introducing new products

UNIT V MODEL PREPARATION & EVALUATION 9

Creative design - Model Preparation - Testing - Cost evaluation - Patent application

TOTAL: 45 PERIODS

TEXT BOOKS

1. Brain Twiss, "Managing Technological Innovation", Pitman Publishing Ltd., 1992.
2. Harry B.Watton, "New Product Planning", Prentice Hall Inc., 1992.

REFERENCES

1. Harry Nystrom, "Creativity and Innovation", John Wiley & Sons, 1979.
2. N.Khandwalla – "Fourth Eye (Excellence through Creativity) - Wheeler Publishing", Allahabad, 1992.
3. I.P.R. Bulletins, TIFAC, New Delhi, 1997.