



**ANNA UNIVERSITY CHENNAI
CHENNAI - 600 025**

UNIVERSITY DEPARTMENTS

**REGULATIONS 2012
CURRICULA AND SYLLABI FOR
I TO VIII SEMESTERS**

**B.TECH. PHARMACEUTICAL
TECHNOLOGY (FULL TIME)**

ANNA UNIVERSITY, CHENNAI-600 025

UNIVERSITY DEPARTMENTS

R – 2012

B.TECH. PHARMACEUTICAL TECHNOLOGY

I – VIII SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

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

SEMESTER II

| CODE NO | COURSE TITLE | L | T | P | C |
|---------------|------------------------|---|---|---|---|
| THEORY | | | | | |
| HS8251 | Technical English - II | 3 | 1 | 0 | 4 |
| MA8251 | Mathematics - II | 3 | 1 | 0 | 4 |
| PH8255 | Physics of Materials | 3 | 0 | 0 | 3 |
| GE8251 | Engineering Mechanics | 3 | 1 | 0 | 4 |

| | | | | | |
|-------------------|--|-----------|----------|----------|-----------|
| PM8206 | Fundamentals of Human Anatomy and Physiology | 3 | 0 | 0 | 3 |
| PM8256 | Food and Pharmaceutical Biochemistry | 3 | 0 | 0 | 3 |
| PRACTICALS | | | | | |
| PM8211 | Experimental Physiology Lab | 0 | 0 | 4 | 2 |
| PM8262 | Food and Pharmaceutical Biochemistry Lab | 0 | 0 | 4 | 2 |
| TOTAL | | 18 | 3 | 8 | 25 |

SEMESTER III

| CODE NO | COURSE TITLE | L | T | P | C |
|-------------------|--------------------------------------|-----------|----------|----------|-----------|
| THEORY | | | | | |
| MA8356 | Probability and Statistics | 3 | 1 | 0 | 4 |
| PM8301 | Microbiology | 3 | 0 | 0 | 3 |
| PM8302 | Pharmaceutical Chemistry - I | 3 | 0 | 0 | 3 |
| PM8303 | Pharmaceutical Chemistry - II | 3 | 0 | 0 | 3 |
| PM8304 | Pharmacology I | 3 | 0 | 0 | 3 |
| PM8351 | Fundamentals of Chemical Engineering | 3 | 0 | 0 | 3 |
| PRACTICALS | | | | | |
| PM8311 | Microbiology Lab | 0 | 0 | 4 | 2 |
| PM8312 | Pharmacology Laboratory | 0 | 0 | 4 | 2 |
| TOTAL | | 18 | 1 | 8 | 23 |

SEMESTER IV

| CODE NO | COURSE TITLE | L | T | P | C |
|---------------|--|---|---|---|---|
| THEORY | | | | | |
| GE8351 | Environmental Science and Engineering | 3 | 0 | 0 | 3 |
| IB8451 | Analytical Methods and Instrumentation | 3 | 0 | 0 | 3 |
| PM8401 | Medicinal Chemistry I | 3 | 0 | 0 | 3 |
| PM8402 | Pharmacology II | 3 | 0 | 0 | 3 |
| PM8403 | Physical Pharmaceutics | 3 | 0 | 0 | 3 |
| PM8404 | Unit Operations in Pharmaceutical Industry | 4 | 0 | 0 | 4 |

| PRACTICALS | | | | | |
|-------------------|--|-----------|----------|----------|-----------|
| PM8411 | Analytical Methods and Instrumentation Lab | 0 | 0 | 4 | 2 |
| PM8412 | Physical Pharmaceutics lab | 0 | 0 | 4 | 2 |
| | TOTAL | 19 | 0 | 8 | 23 |

SEMESTER V

| CODE NO | COURSE TITLE | L | T | P | C |
|-------------------|--|-----------|----------|----------|-----------|
| THEORY | | | | | |
| FT8551 | Biochemical Engineering | 3 | 0 | 0 | 3 |
| PM8501 | Medicinal chemistry II | 3 | 0 | 0 | 3 |
| PM8502 | Regulatory issues in Pharmaceutical Industry and Drug Validation | 3 | 0 | 0 | 3 |
| PM8551 | Cell and Molecular Biology | 4 | 0 | 0 | 4 |
| E1 | Elective I | 3 | 0 | 0 | 3 |
| E2 | Elective II | 3 | 0 | 0 | 3 |
| PRACTICALS | | | | | |
| PM8511 | Advanced Medicinal Chemistry Lab | 0 | 0 | 4 | 2 |
| PM8512 | Bioprocess Lab | 0 | 0 | 4 | 2 |
| | TOTAL | 19 | 0 | 8 | 23 |

SEMESTER VI

| CODE NO | COURSE TITLE | L | T | P | C |
|----------------|--|----------|----------|----------|----------|
| THEORY | | | | | |
| MG8654 | Total Quality Management | 3 | 0 | 0 | 3 |
| IB8651 | Creativity, Innovation and New Product Development | 3 | 0 | 0 | 3 |
| PM8601 | Genetic Engineering and Pharmacogenomics | 4 | 0 | 0 | 4 |
| PM8602 | Pharmaceutical Dosage forms | 4 | 0 | 0 | 4 |
| E3 | Elective III | 3 | 0 | 0 | 3 |
| E4 | Elective IV | 3 | 0 | 0 | 3 |

| PRACTICALS | | | | | |
|-------------------|---|-----------|----------|-----------|-----------|
| HS8561 | Employability Skills | 0 | 0 | 2 | 1 |
| FT8661 | Molecular Biology and Genetic Engineering Lab | 0 | 0 | 4 | 2 |
| PM8611 | Pharmaceutical Dosage forms lab | 0 | 0 | 4 | 2 |
| | TOTAL | 20 | 0 | 10 | 25 |

SEMESTER VII

| CODE NO | COURSE TITLE | L | T | P | C |
|-------------------|------------------------------------|-----------|----------|----------|-----------|
| THEORY | | | | | |
| IB8753 | Immunology | 3 | 0 | 0 | 3 |
| PM8701 | Advanced Drug Delivery systems | 3 | 0 | 0 | 3 |
| PM8702 | Pharmacognosy | 3 | 0 | 0 | 3 |
| E5 | Elective V | 3 | 0 | 0 | 3 |
| E6 | Elective VI | 3 | 0 | 0 | 3 |
| E7 | Elective VII | 3 | 0 | 0 | 3 |
| PRACTICALS | | | | | |
| PM8711 | Advanced Drug Delivery systems lab | 0 | 0 | 4 | 2 |
| PM8712 | Pharmacognosy Lab | 0 | 0 | 4 | 2 |
| | TOTAL | 18 | 0 | 8 | 22 |

SEMESTER VIII

| CODE NO | COURSE TITLE | L | T | P | C |
|----------------|---------------------|----------|----------|-----------|----------|
| PM8811 | Project Work | 0 | 0 | 18 | 9 |
| | TOTAL | 0 | 0 | 18 | 9 |

LIST OF ELECTIVES FOR PHARMACEUTICAL TECHNOLOGY

| CODE | SUBJECT | L | T | P | C |
|-------------|---|----------|----------|----------|----------|
| PM8001 | Biopharmaceutics and Pharmacokinetics | 3 | 0 | 0 | 3 |
| PM8002 | Chemistry of Natural Products | 3 | 0 | 0 | 3 |
| PM8003 | Clinical Research and Regulations | 3 | 0 | 0 | 3 |
| PM8004 | Colloids and Interfacial Phenomena | 3 | 0 | 0 | 3 |
| PM8005 | Computer Aided Drug Design | 3 | 0 | 0 | 3 |
| PM8006 | Experimental Design and Biostatistics | 3 | 0 | 0 | 3 |
| PM8007 | Fundamentals of Material Science and Engineering | 3 | 0 | 0 | 3 |
| PM8008 | Fundamentals of Molecular Pathology | 3 | 0 | 0 | 3 |
| PM8009 | Fundamentals of Polymer Science and Engineering | 3 | 0 | 0 | 3 |
| PM8010 | Introduction to Biomaterials and Tissue Engineering | 3 | 0 | 0 | 3 |
| PM8011 | Molecular Modeling and Drug Design | 3 | 0 | 0 | 3 |
| PM8012 | Nutraceuticals | 3 | 0 | 0 | 3 |
| PM8013 | Principles of Bioengineering | 3 | 0 | 0 | 3 |
| PM8014 | Vaccine Technology | 3 | 0 | 0 | 3 |
| GE8071 | Fundamentals of Nano Science | 3 | 0 | 0 | 3 |
| CH8651 | Process Instrumentation, Dynamics and Control | 3 | 0 | 0 | 3 |
| IB8071 | Bioconjugate Technology and Applications | 3 | 0 | 0 | 3 |
| IB8072 | Biological Spectroscopy | 3 | 0 | 0 | 3 |
| IB8551 | Protein Structure, Function and Proteomics | 3 | 1 | 0 | 4 |
| IB8751 | Bioinformatics and Computational Biology | 3 | 0 | 0 | 3 |
| IB8752 | Downstream Processing | 3 | 0 | 0 | 3 |
| IB8754 | Metabolic Engineering | 3 | 0 | 0 | 3 |

TOTAL NO.OF. CREDITS : 177

(Semester I)**OBJECTIVES**

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

UNIT I

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

UNIT II

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking & answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Lab descriptions (general/specific description of laboratory experiments) - Definitions - Recommendations; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association; E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading

- Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause & effect / compare & contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV

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

UNIT V

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

TOTAL : 60 PERIODS

TEXT BOOKS

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

REFERENCE BOOKS

1. Pickett, Nell Ann, Ann A.Laster and Katherine E.Staples. Technical English: Writing, Reading and Speaking. New York: Longman, 2001.
2. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.

3. Morgan, David and Nicholas Regan. Take-Off: Technical English for Engineering. Reading: Garnet Publishing Limited, 2008.
4. Thorn, Michael and Alan Badrick. An Introduction to Technical English. Harlow: Prentice Hall Europe, 1993.
5. Rizvi, M.Ashraf. Effective Technical Communication. New Delhi: Tata McGraw-Hill Publishing Company, 2007.

EXTENSIVE READERS

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

WEBSITE RESOURCES

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

MA8151

MATHEMATICS – I

L T P C

(Common to all branches of B.E. / B.Tech. Programmes)

3 1 0 4

(I Semester)

OBJECTIVES

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES**9+3**

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

UNIT II INFINITE SERIES**9+3**

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

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

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

UNIT IV IMPROPER INTEGRALS**9+3**

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

UNIT V MULTIPLE INTEGRALS**9+3**

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

TOTAL : 60 PERIODS**TEXT BOOKS**

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 40th Edition, 2007.

- Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.

REFERENCES

- Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
- Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
- Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education, New Delhi, 2nd Edition, 5th Reprint, 2009.
- Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

PH8151

ENGINEERING PHYSICS

L T P C

(Common to ALL Branches of B.E./B.Tech. Programmes)

3 0 0 3

OBJECTIVE

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

UNIT I PROPERTIES OF MATTER

9

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

UNIT II ACOUSTICS AND ULTRASONICS

9

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

UNIT III THERMAL PHYSICS

9

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

UNIT IV APPLIED OPTICS

9

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its application - Lasers - Einstein's coefficients - CO₂, Nd:YAG and semiconductor lasers - homo junction and hetro junction - construction and working - applications - Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

UNIT V SOLID STATE PHYSICS

9

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

TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCE BOOKS

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

UNIT I CHEMICAL THERMODYNAMICS**9**

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

UNIT II POLYMER CHEMISTRY**9**

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

UNIT III KINETICS AND CATALYSIS**9**

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

UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY**9**

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

UNIT V NANOCHEMISTRY

9

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: Nanocluster, nanorod, nanotube and nanowire. Synthesis: Precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and Applications. Risk discussion and Future perspectives.

TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCE BOOKS

1. P.W. Atkins and de Paula Julio, "Physical Chemistry", Oxford University Press, 8th Ed., (Indian Student Edition) (2009).
2. K. K. Rohatgi-Mukherjee, "Fundamental of Photochemistry" New Age International (P) Ltd., New Delhi, 1986.
3. G.A. Ozin and A.C. Arsenault, "Nanotechnology: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
4. V.R.Gowariker, N.V.Viswanathan and Jayadev Sreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006

GE8151

COMPUTING TECHNIQUES

L T P C
3 0 0 3

UNIT I INTRODUCTION

8

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

UNIT II C PROGRAMMING BASICS

10

Problem formulation – Problem Solving - Introduction to 'C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables –

Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS 9

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

UNIT IV FUNCTIONS AND POINTERS 9

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

UNIT V STRUCTURES AND UNIONS 9

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

TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCES

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

OBJECTIVES

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

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)**1**

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

UNIT I PLANE CURVES AND FREE HAND SKETCHING**14**

Basic Geometrical constructions, Curves used in engineering practices : Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

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

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES**14**

Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces

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

UNIT III PROJECTION OF SOLIDS**14**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

14

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS

15

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

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)

3

Introduction to drafting packages and demonstration of their use.

TOTAL : 75 PERIODS

TEXT BOOKS

1. N.D.Bhatt and V.M.Panchal, “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010

REFERENCES

1. K.R.Gopalakrishna., “Engineering Drawing” (Vol I&II combined) Subhas Stores, Bangalore, 2007
2. Luzzader, Warren.J., and Duff,John M.,” Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production”, Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005
3. M.B.Shah and B.C.Rana, “Engineering Drawing”, Pearson, 2nd Edition, 2009
4. K.Venugopal and V.Prabhu Raja, “Engineering Graphics”, New Age International (P) Limited ,2008.
5. K. V.Natrajan, “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi,2008.

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

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

SPECIAL POINTS APPLICABLE TO UNIVERSITY EXAMINATIONS ON ENGINEERING GRAPHICS:

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

PH8161

PHYSICS LABORATORY

L T P C

(common to all branches of B.E./B.Tech. Programmes)

0 0 2 1

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

TOTAL : 30 PERIODS

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1,10-phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of poly vinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics – ester hydrolysis.
13. Corrosion experiment – weight loss method.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL : 30 PERIODS

REFERENCE BOOKS

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

LIST OF EXPERIMENTS

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

TOTAL : 45 PERIODS**OBJECTIVE**

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

GROUP – A (CIVIL & ELECTRICAL)**1. CIVIL ENGINEERING PRACTICE****12****PLUMBING**

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

- Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK

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

STUDY

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

2. ELECTRICAL ENGINEERING PRACTICE 9

- Basic household wiring using switches, fuse, indicator – lamp etc.,
- Preparation of wiring diagrams
- Stair case light wiring
- Tube – light wiring
- Study of iron-box, fan with regulator, emergency lamp

GROUP – B (MECHANICAL AND ELECTRONICS) 15

3. MECHANICAL ENGINEERING PRACTICE

WELDING

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

4. ELECTRONIC ENGINEERING PRACTICE

9

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

TOTAL : 45 PERIODS

HS8251

TECHNICAL ENGLISH II

LT P C

(For all branches of B.E / B.Tech programmes)

3 1 0 4

OBJECTIVES

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

UNIT I

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

UNIT II

Listening - Listening to situation based dialogues; **Speaking** - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); **Reading** - Reading a short

story or an article from newspaper, Critical reading, Comprehension skills; **Writing** - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his success, thanking one's friend / relatives); **Grammar** - Modal verbs, Purpose expressions; **Vocabulary** - Phrasal verbs and their meanings, Using phrasal verbs in sentences; **E-materials** - Interactive exercise on Grammar and vocabulary, Extensive reading activity (reading stories / novels from links), Posting reviews in blogs - **Language Lab** - Dialogues (Fill up exercises), Recording students' dialogues.

UNIT III

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

UNIT IV

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

UNIT V

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; **Speaking** - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/ agreement – assertiveness in expressing opinions – mind mapping technique; **Reading** - Note

making skills – making notes from books, or any form of written materials - Intensive reading
Writing - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); **Grammar** - Use of clauses; **Vocabulary** – Collocation; **E-materials** - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises - Pictures for discussion; **Language Lab** - Different models of group discussion

TOTAL : 60 PERIODS

TEXT BOOKS

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

REFERENCE BOOKS

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

EXTENSIVE READERS

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

WEB RESOURCES

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

OBJECTIVES

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

UNIT I DIFFERENTIAL EQUATIONS**9+3**

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

UNIT II VECTOR CALCULUS**9+3**

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

UNIT III ANALYTIC FUNCTION**9+3**

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

UNIT IV COMPLEX INTEGRATION**9+3**

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

UNIT V LAPLACE TRANSFORMS

9+3

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

TOTAL : 60 PERIODS

TEXT BOOKS

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

REFERENCES

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

PH8255

PHYSICS OF MATERIALS

L T P C

**(Common to Chemical, Ceramic, Food, Leather,
Industrial Biotechnology and Pharmaceutical)**

3 0 0 3

UNIT I PREPARATION AND PROCESSING OF MATERIALS

9

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

UNIT II PROPERTIES OF CONDUCTING AND SUPER CONDUCTING MATERIALS 9

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

UNIT III ELECTRONIC MATERIALS 9

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

UNIT IV INSULATING AND MAGNETIC MATERIALS 9

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

UNIT V CERAMIC AND NEW MATERIALS 9

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

TOTAL : 45 PERIODS

REFERENCES

1. Raghavan. V. Materials Science and Engineering, Prentice Hall of India, 2002.

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

GE8251

ENGINEERING MECHANICS

L T P C

3 1 0 4

OBJECTIVE

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

UNIT I BASICS AND STATICS OF PARTICLES

9 + 3

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

UNIT II EQUILIBRIUM OF RIGID BODIES

9 + 3

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

UNIT III PROPERTIES OF SURFACES AND SOLIDS

9 + 3

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass

moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES

9 + 3

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

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS

9 + 3

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

TOTAL: 60 PERIODS

(L:45 + T:15)

BOOKS

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

REFERENCES

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

AIM

To develop understanding about the structure (gross and histology) and functions of various organs of the human body; describe the various homeostatic mechanisms and their imbalances of various systems; identify the various tissues and organs of the different systems of the human body and appreciate coordinated working pattern of different organs of each system

UNIT I FOUNDATIONS OF PHYSIOLOGY, HOMEOSTASIS**7**

Organization of the Human Body , Chemical Foundations – Atoms, Ions, Molecules, Bonds, Solutions, Classes of organic molecules; Physical Foundations – Morphology of the cell (plasma membrane, nucleus, cell organelles) Elementary tissues of the human body: epithelial, connective, Muscular and nervous tissues-their sub-types and characteristics, Cellular Transport – Intracellular movement, Intercellular movement, Movement of molecules across the plasma membrane, intercellular communication.

UNIT II NERVOUS AND MUSCULO-SKELETON SYSTEM**12**

Anatomy and physiology of brain, blood-brain barrier, spinal cord, structure and types of the neuron, synapses neurotransmitters, organization of spinal and cranial nerves, central and peripheral nervous system, autonomic nervous system, receptors membrane potentials – graded potentials and action potentials, physiology of vision, audition, olfaction, taste and skin; anatomy and physiology of muscular system, types of muscle tissue – skeletal, smooth, cardiac, contraction, muscle fibre regulation, Osseous system - structure, composition and functions of the Skeleton, classification of joints, types of movements of joints and their disorders

UNIT III GASTROINTESTINAL AND RENAL SYSTEM**7**

Anatomy and physiology of the gastrointestinal tract (secretion, motility, digestion and absorption), structure and function of the liver, spleen, gall bladder, pancreas; the renal system structure – Anatomy and physiology kidney; structure of the nephron and network of blood capillaries urinary tract, formation of urine, concentration of urine; regulation of acid-base balance; the chemical acid-base buffer systems of body fluids and disease conditions

UNIT IV CARDIOVASCULAR AND PULMONARY SYSTEM**9**

Anatomy and physiology of the heart, lungs, cardiac cycle; circulation of blood, heart rate, blood pressure, ECG and heart sounds, lymphatic vessel, systemic and portal circulation; vascular

system – arteries, arterioles, capillaries, venules. Anatomy of respiratory tract, mechanism and dynamics of respiration, lung volumes, transport of oxygen and carbon dioxide, disorders like cyanosis

UNIT V ENDOCRINE AND REPRODUCTIVE SYSTEM

10

Anatomy and physiology of Pituitary, thyroid, parathyroid, adrenal and pancreatic hormones and disorders of these glands, endocrine control of growth and metabolism; pineal, thymus, testes, ovaries, structure and physiology of reproductive systems, sex hormones, physiology of fertilization, menstruation, menopause, spermatogenesis and oogenesis, pregnancy and parturition and clinical disorders

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.

PM8256

FOOD AND PHARMACEUTICAL BIOCHEMISTRY

L T P C

3 0 0 3

AIM

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

UNIT I BIOCHEMICAL ORGANIZATION AND BIOENERGETICS 10

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

UNIT II BIOMOLECULES 12

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

UNIT III BIOENERGETICS 5

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

UNIT IV MACROMOLECULES, VITAMINS, HORMONES, ENZYMES 10

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

UNIT V BIOCHEMISTRY OF CLINICAL DISEASES 8

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

TOTAL: 45 PERIODS

TEXTBOOKS

1. Principles of Biochemistry . Ed. Lehninger , Nelson & Cox, CBS publishers and distributors
2. Harpers Biochemistry Ed. R.K. Murray , D.K. Granner, P.A. Mayes and V.W.Rodwell, Appleton and Lange ,Stanford ,Conneticut.
3. Textbook of Biochemistry with clinical correlations. Ed. Thomas M. Devlin. Wiley Liss Publishers

REFERENCES

1. Tietz Textbook of Clinical chemistry, Ed. Burtis & Ashwood W.B. Saunders Company
2. Biochemistry Ed Lubert Stryer . W.H. Freeman and company ,New york.
3. Biochemistry Ed. Donald Voet & Judith G. Voet John Wiley and Sons ,Inc.
4. Textbook of Biochemistry by Rama Rao.
5. Textbook of Biochemistry by Deb.

PM8211

EXPERIMENTAL PHYSIOLOGY LABORATORY

L T P C

0 0 4 2

AIM

To learn the gross histology, structure and functions of various organs of the human body and perform the physiological tests and appreciate the interlinked mechanisms in the maintenance of normal functioning of human body

EXPERIMENTS

1. Study of different systems with the help of models (axial skeleton, appendicular skeleton, cardiovascular system, respiratory system, digestive system, urinary system, nervous system, special senses, reproductive system)
2. Principles of mounting tissue, examination, preservation,
3. Microscopic study of different tissues, epithelial, muscular, connective tissue, nervous tissue
4. Determination of bleeding and clotting time
5. Determination of R.B.C. count of blood
6. Estimation of Haemoglobin

7. Enumeration of W.B.C. count of blood
8. Determination of differential count of blood
9. Determination of Erythrocyte Sedimentation Rate
10. Blood group determination
11. Heart rate and blood pressure recording
12. Identification of human bones and joints, anatomic features
13. Determination of vital capacity

TOTAL : 60 PERIODS

EQUIPMENT REQUIRED :

1. Microscope
2. Pippete aids
3. Haemocytometer
4. B.P.meter

TEXT BOOKS

1. Goyal, R. K, Natvar M.P, and Shah S.A, Practical anatomy, physiology and biochemistry, latest edition, Publisher: B.S Shah Prakashan, Ahmedabad.
2. Tortora Gerard J. and Nicholas, P. Principles of anatomy and physiology Publisher Harpercollins college New York

REFERENCES

1. Ranade VG, Text book of practical physiology, Latest edition, Publisher: PVG, Pune
2. Anderson Experimental Physiology, Latest edition, Publisher: NA
3. Best and Tailor's "Physiological basis of Medical Practice".
4. Guyton A.C. Hall J.E. Text book of Medical Physiology.
5. Human Physiology by C.C. Chatterjee.
6. Samson Wright's Applied Physiology by Cyril A. Keek, Eric Neil and Norman Joels.
7. Textbook of Preventive and Social Medicine by J.E. Park and K. Park.

AIM

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

EXPERIMENTS

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

TOTAL : 60 PERIODS**Equipment Required**

1. UV-Visible Spectrophotometers
2. pH meter
3. Centrifuge

TEXT BOOKS

1. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
2. Introduction of Practical Biochemistry by David T. Phummer. (II Edition)

REFERENCES

1. Harpers Biochemistry Ed. R.K. Murray , D.K. Granner, P.A. Mayes and V.W.Rodwell, Appleton and Lange ,Stanford ,Conneticut.
2. Textbook of Biochemistry with clinical correlations. Ed. Thomas M. Devlin. Wiley Liss Publishers

MA8356

PROBABILITY AND STATISTICS

L T P C

3 1 0 4

OBJECTIVES

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

UNIT I RANDOM VARIABLES

9+3

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

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES

9+3

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

UNIT III TESTS OF SIGNIFICANCE

9+3

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

UNIT IV DESIGN OF EXPERIMENTS

9+3

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

UNIT V STATISTICAL QUALITY CONTROL

9+3

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

TOTAL : 60 PERIODS

TEXT BOOKS

1. Milton, J. S. and Arnold, J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, New Delhi, 4th Edition, 3rd Reprint, 2008.
2. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2011.

REFERENCES

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

PM8301

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. Sterilization: Detail study of different methods of sterilization including their merits and demerits.

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. "Microbiology", 5th Edition, Tata McGraw-Hill, 1993.
2. Ananthanarayanan, R. and C.K. Jayaram Paniker, "Textbook of Microbiology", 4th Edition, Orient Longman, 1990.
3. Stanier, R.Y. et al., "General Microbiology", 5th Edition, Macmillan, 1986.
4. Casida, L.E. "Industrial Microbiology", New Age International, 1968.
5. Schlegel, H.G. "General Microbiology", 7th Edition, Cambridge University Press, 1993.

REFERENCES

1. Nester, E.W. et al., "Microbiology : A Human Prespective", 4th Edition, McGraw- Hill, 2004.
2. Talaro, K.T. and Arthur Talaro "Foundations in Microbiology", 2nd Edition, Wm.C. Brown Publisher, 1996.
3. Prescott, L.M. "Microbiology", 6th Edition, McGraw-Hill, 2005.
4. Prescott, S.C. and Cecil G. Dunn "Industrial Microbiology", Agrobios(India), 2005.

PM8302

PHARMACEUTICAL CHEMISTRY I

L T P C

3 0 0 3

AIM

To inculcate understanding of the properties and principles of medicinal agents that originates from inorganic sources and their application in pharmaceutical industry

UNIT I PRINCIPLES OF TEST FOR PURITY IN PHARMACEUTICAL SUBSTANCES

9

Identification and characterisation of impurities in Pharmaceutical substances, Limit tests: Definition, importance, general procedure for limit test for chlorides, sulphates, iron, arsenic, heavy metals, lead and modifications with suitable examples.

UNIT II RADIOPHARMACEUTICALS AND CONTRAST MEDIA

9

Nuclear reactions, nomenclature, units and measurement of radioactivity, clinical applications and dosage, hazards and precautions, radio pharmaceutical preparations and standards of radioactive material iodine-131(I131), Cobalt 58. Radio opaque contrast medium-barium sulphate

UNIT III STUDY OF INORGANIC COMPOUNDS IN PHARMACOPEIA

12

Method of preparation, assay, identification test, test for purity, official preparation, storage conditions and belonging to the following categories.

Gastrointestinal agents and related compounds – Acidifiers, Antacids, Adsorbents and protectives, Saline cathartics; Topical Agents – Protectives, Astringents, Anti-microbials topical agents; Dental products –Role of Fluorides as anti-caries agents, Sodium fluoride,

Dentifrices; Major intra and extra cellular electrolytes – Physiological acid-base balance and its importance, Electrolytes in replacement therapy and Electrolytes used in the acid-base therapy; Medicinal Gases – Oxygen, Carbon dioxide, Helium, Nitrogen and Nitrous Oxide,

UNIT IV IMPORTANT INORGANIC GASES

5

Oxygen, Nitrogen, Nitrous Oxide, carbon dioxide, Helium, Ammonia and their compounds as per I.P.

UNIT V PHARMACEUTICAL AIDS AND CO-ORDINATION COMPOUNDS

10

Definition, principles and properties of various agents such as – Sodium bisulphate, Sodium metabisulphate, Sulphurdioxide, Bentonite, Magnesium stearate, Zinc stearate, Aluminium sulphate, Sodium benzoate, Sodium carboxy methyl cellulose, Sodium formaldehyde sulphonylate, Sodium methylparaben, Sodium lauryl sulphate, Purified water, Water for injection, Sterile water for injection and Zinc chloride. Theory of co-ordination compounds with special reference to application in Pharmacy such as – EDTA, Dimercaprol, Penicillamine, 1, 10-Phenanthroline

TOTAL : 45 PERIODS

TEXT BOOKS

1. Beckett, A.H. and Stenlake, J.B. "Practical Pharmaceutical Chemistry" 4th Ed., Part I & II. CBS Publications, 1997.
2. George, Mathew and Liney Joseph "Texture of Pharmaceutical Chemistry" Viva Books, 2009.
3. Chatwal, G.R. "Pharmaceutical Chemistry" Organic & Inorganic. Himalaya Publications.
4. Mohammed Ali "Textbook of Pharmaceutical Chemistry" Part-I Inorganic, Part II Organic Chemistry, CBS Publications, 1997.
5. Bhandari, anil and G.K.Singh "Pharmaceutical Chemistry – I" CBS Publishers, 1998.

REFERENCES

1. Blanders, Christie M. "Pharmaceutical Chemistry: Therapeutic aspects of Biomacromolecules" John Wiley & Sons.
2. Bentley and Driver's Textbook of Pharmaceutical Chemistry.
3. Inorganic Medicinal and Pharmaceutical Chemistry by J.H. Block, E.B. Roche, T.O. Soine and C.O. Wilson.
4. Roger's Inorganic Pharmaceutical Chemistry by T.O. Soine and C.O. Wilson.

5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake Vol. I.
6. Pharmaceutical Chemistry by M.L. Schroff.
7. Indian Pharmacopoeia 1996.
8. Organic Chemistry Reactions and Reagents by O.P. Agarwal.

PM8303

PHARMACEUTICAL CHEMISTRY II

L T P C

3 0 0 3

AIM

To provide understanding about different classes of organic compounds, mechanism, orientation of the reaction, order of reactivity, named organic reactions with mechanisms, principle involved in the preparation some pharmaceutical organic compounds.

UNIT I STRUCTURE, PROPERTIES AND STEREOCHEMISTRY

9

Molecular orbital theory, wave equations, molecular orbitals, bonding, anti-bonding orbitals, unshared pair of electrons and hybrid orbitals, polarity of bonds and molecules, dipole moment, resonance, inductive, mesomeric and electromeric effects, intramolecular and intermolecular hydrogen bonding, acids and bases, stereoisomerism, optical activity, enantiomers, diastereomerism, mesostructures, specification of R and S, D and L configuration, racemic modification and resolution of racemic mixtures, conformational analysis, geometrical isomerism, nomenclature of isomers and determination of configuration.

UNIT II CHEMISTRY OF ALIPHATIC AND AROMATIC COMPOUNDS

10

Characteristics of organic compounds, structure, nomenclature, preparation and reaction mechanism of alkyl and aryl halides (Mechanism of SN1, SN2, E1 and E2), Huckel rule, structures of benzenoid and nonbenzenoid compounds, mechanism of electrophilic and nucleophilic aromatic substitution, theory of effect of substituent on reactivity and orientation, orienting influence of different substituent present in benzene and naphthalene rings – Charge distribution method and stability of the intermediate method, general mechanism of an aromatic electrophilic substitution reaction. alcohols, ethers, epoxides, amines, aldehydes, ketones, carboxylic acids and functional derivatives of carboxylic acids

UNIT III PROTOTYPE REACTIONS AND PHARMACEUTICAL COMPOUNDS

12

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, preparation and properties of poly aromatic compounds, naphthalene, anthracene, phenanthrene, diphenyl methane, triphenyl methane and diphenyl ethane. Preparation and medicinal uses of chloroform, iodoform, mephenesin, glyceryl trinitrate, propylene, citric acid, lactic acid, benzoic acid, benzoic acid and benzyl benzoate, dicophane, gammadene, saccharin, chloramine, chloramine-t, salicylic acid, methyl salicylate, aspirin, phenindione, ethyl biscoumacetate, hexamine, vanillin, EDTA, urethane, carbromal, amphetamine and acetanilide.

UNIT IV CHEMISTRY OF HETEROCYCLIC COMPOUNDS

9

Classification of heterocyclic compounds, nature and nomenclature, preparation and important reactions of pyrrole, furan, thiophene, pyrazole, imidazole, oxazole, isoxazole, thiazole, pyridine, pyrimidine, indole, quinoline, isoquinoline, acridine, phenothiazine, azepines, diazepines, quinolones and quinazolones and structural examples of medicinal compounds and examples prototype pharmaceutical compounds

UNIT V PHOTOCHEMISTRY

5

Theory-energy transfer-characteristics of photoreactions – typical photo reaction

TOTAL : 45 PERIODS

TEXT BOOKS

1. Textbook of Organic Chemistry by B.S. Bahl and Arun Bahl
2. Organic Chemistry by I.L. Finar Vol. I and II
3. Organic Chemistry by P.L. Soni
4. T.R.Morrison and R. Boyd - Organic chemistry,
5. Bentley and Driver-Text book of Pharmaceutical chemistry

REFERENCE BOOKS

1. Indian Pharmacopoeia (I.P.)
2. Vogel's Practical Organic Chemistry.
3. Organic chemistry – J.M.Cram and D.J.Cram
4. Organic chemistry- Brown
5. Advanced organic chemistry- Jerry March, Wiley
6. Organic chemistry- Cram and Hammered, Pine Hendrickson

AIM

To know in detail the classification, therapeutic use, mechanism of action, metabolism, adverse effects of medicinal agents pertaining to nervous system, cardiovascular system, urinary system and respiratory system

UNIT I INTRODUCTION TO PHARMACOLOGY 9

Sources of drugs, dosage forms and routes of drug administration, mechanism of action of drugs. Combined effect of drugs, factors modifying drug action, tolerance and dependence. Absorption, Distribution, Metabolism and Excretion of drugs. Principles of basic and clinical pharmacokinetics. Adverse drug reactions. Drug interactions, Bioassay of drugs and biological standardisation, Overview of drug discovery and development.

UNIT II PHARMACOLOGY OF PERIPHERAL NERVOUS SYSTEM 9

Autonomic and somatic nerve transmission, parasympathomimetics, parasympatholytics, sympathomimetics, sympatholytics, adrenergic receptor and neuron blocking agents, ganglionic agonists and antagonists agents, neuromuscular blocking agents, local anaesthetic agents

UNIT III PHARMACOLOGY OF CENTRAL NERVOUS SYSTEM 9

Nerve conduction and transmission in the C.N.S, general anaesthetics, sedatives, hypnotics, anti-anxiety agents and centrally acting muscle relaxants, Psychopharmacological agents – Anti-psychotics, antidepressants, neuroleptics, anti-manics and hallucinogens, thymoleptics, anti-epileptic drugs, Anti-parkinsonism drugs, analgesics, antipyretics, anti-inflammatory (NSIADs) and anti-gout drugs, narcotic analgesics and antagonists, C.N.S. stimulants, drug addiction and drug abuse.

UNIT IV PHARMACOLOGY OF CARDIOVASCULAR SYSTEM 9

Cardiac glycosides, anti-hypertensive drugs, anti-anginal and vasodilator drugs including calcium channel blockers and beta adrenergic antagonists, Anti-arrhythmic drugs, anti-hyperlipidemic drugs, Drugs used in the therapy of shock

UNIT V PHARMACOLOGY OF URINARY SYSTEM AND RESPIRATORY SYSTEM 9

Fluid and electrolyte balance, Diuretics and Anti-diuretics, Anti-asthmatic drugs including bronchodilators, leukotriene inhibitors, anti-tussives and expectorants, Respiratory stimulants.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Satoskar, Pharmacology and Therapeutics
2. Tripathi, K.D. Medical Pharmacology
3. Mycek M.J., Gerlnet S.B and Perper M.M. Pharmacology, Lippincott's Illustrated Reviews, Lipincott Company, Philadelphia.

REFERENCES

1. Rang, M.P, Dale M.M, Reter J.M-Pharmacology.
2. Goodman and Gilman's, The Pharmacological basis of therapeutics.
3. Kulkarni S.K., Hand book of Experimental Pharmacology
4. Katzung, B.G., Basic and Clinical Pharmacology, Prentice Hall International.

PM8351 FUNDAMENTALS OF CHEMICAL ENGINEERING

L T P C
3 0 0 3

AIM

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

OBJECTIVES

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

UNIT I BASIC PRINCIPLES OF STOICHIOMETRY

8

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

UNIT II MATERIAL BALANCES

10

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

UNIT III ENERGY BALANCES

9

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

UNIT IV FLUID MECHANICS

9

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

UNIT V AGITATION FLOW THROUGH PACKINGS, FLUIDIZATION, FLUID TRANSPORT

9

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. McCabe, W.L., J.C. Smith and P.Harriot “Unit Operations of Chemical Engineering”, 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 (an imprint of Elsevier), 2004.

PM8311

MICROBIOLOGY LABORATORY

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

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

TOTAL : 60 PERIODS

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 |

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.

PM8312

PHARMACOLOGY LABORATORY

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

AIM

To learn and understand the pharmacological aspects of drugs and carry out the animal experiments confidently; To correlate and apply the knowledge to appreciate the importance of pharmacology subject as a basis of drug development and evaluation

PRACTICALS

1. Study of laboratory animals and their handling (Mice, Rats, Jirds/Gerbils, Mastomys, Guinea Pigs, Frogs, rabbits)
2. Study of physiological salt solutions and laboratory appliances used in experimental pharmacology.
3. Routes of drug administration in animal models
4. Experiments to study analgesic effects of drugs
5. Experiments to study anti-inflammatory effects of drugs (rat-paw edema, Writhing reflex etc)
6. Experiments to study local anaesthetic effects of drugs in animals
7. Experiments to study general anaesthetic effects of drugs in animals (spinal block in frogs etc)
8. Experiments to study antidepressants in animals (Swimming Test, Tail Suspension Test for Rats)
9. Experiments to study antiparasitic drugs in animals (in-vitro /in-vivo methods, filariasis, leishmaniasis)
10. Experiments to study anticancer drugs in animals (in-vitro /in-vivo methods)
11. Experiments to study antidiabetic drugs in animals (in-vitro /in-vivo methods)
12. Bioassay experiments for studying the effects of the more important biogenic agents like histamine, acetylcholine, and their effect in the presence of antagonist on suitable isolated tissue preparations (organ bath experiments)
13. Monitoring of drug concentration in saliva/urine /blood

EQUIPMENTS REQUIRED :

1. Animal House facility
2. UV-Visible spectrophotometers

TOTAL : 60 PERIODS

REFERENCES

1. The Pharmacological basis of therapeutics – Goodman and Gilman's.
2. Pharmacotherapy – DiPiro.
3. Pharmacology – Katzung.
4. Fundamentals of experimental pharmacology by M.N.Ghosh.
5. Handbook of experimental pharmacology by S.K.Kulkarni.
6. Text book of In vitro practical pharmacology by IanKitchen.
7. Pharmacological experiments on intact preparations by Churchill Livingstone.

8. Hand book of clinical pharmacokinetics- Gibaldi and Prescott.
9. Principles of drug action by Goldstein, Amaow and Kalman.
10. Clinical pharmacology by Molmon and Morrelli.
11. Clinical trails and tribulations by Allen E. Cato.
12. Drug interactions by Ivan H. Stockley.
13. Text book of therapeutics- drug, disease and management by Herfindal and Gourley.

GE8351

ENVIRONMENTAL SCIENCE AND ENGINEERING

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

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. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

REFERENCE BOOKS

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

IB8451

ANALYTICAL METHODS AND INSTRUMENTATION

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

AIM OF THE COURSE

To provide the student with a basic understanding of the format of the pharmacopoeial monograph and the major physical and instrumental methods used in the monographs to specify standards, the scope, advantages and disadvantages together with a brief account of the regulatory framework such as The Drugs and Cosmetics Act 1940 and an introduction to the ICH Guidelines.

UNIT I INTRODUCTION, PHYSICAL METHODS, GRAVIMETRY

9

Introduction to Pharmaceutical Analysis, Definition, Significance, Qualitative and quantitative analysis, Drugs and Cosmetics Act 1940, Pharmacopoeia, Typical monograph and ICH Guidelines.

Physical methods: Melting point, Boiling point, refractive index, optical rotation, density, specific gravity, Gravimetry, Thermogravimetry - uses, limitations, advantages, and method of determination for each method

UNIT II ACID-BASE TITRATIONS

9

Introduction, definitions of titration, analyte, acid base theory- Arrhenius, Bronsted-Lowry, Lewis acid, Acid-base strength, conditions for use of titrimetry, precision, accuracy, ion product of water, Henderson-Hasselbalch equation, uses, limitation, pH, buffer, effective range, acid-base indicators, theory of, effective range and choice of, titration curves for acid-base titration, mixed solvents, non-aqueous titration, pharmacopoeial applications .

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

Theory of atomic and molecular spectra, Electronic transitions, Beer and Lambert's law, Derivation and deviations, Chromophores, Auxochromes, Spectral shifts, Solvent effect on absorption spectra. Instrumentation - Sources of radiation, wavelength selectors, sample cells, Detectors- Barrier layer cell, Photo tube, Photomultiplier tube, Photodiode. Applications.

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, symmetry factor, resolution, 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.

PM8401

MEDICINAL CHEMISTRY I

L T P C
3 0 0 3

AIM

To know the basics of medicinal chemistry, biochemical and molecular basis of mechanism of action, structure activity relationship including stereo chemical aspects, physicochemical properties and synthesis of medicinal agents.

UNIT I PRINCIPLES OF MEDICINAL CHEMISTRY

10

History/development of medicinal chemistry, Physicochemical properties in relation to biological action – Ionization, Drug distribution and pKa values, hydrogen bonding, protein binding, chelation, optical and geometrical isomerism, steric effect, redox potential and surface activity. Prodrugs –concepts/application of prodrug design.Introduction to QSAR.

UNIT II MEDICINAL CHEMISTRY OF DRUGS ACTING ON CNS

9

Classification, biochemical/molecular basis of mechanism of action, structure activity relationship including stereo chemical aspects, physicochemical properties and synthesis of selected drugs belonging to the class of General anaesthetics, Anxiolytics, Sedatives and Hypnotics, Antipsychotics, Anticonvulsants/antiepileptics, CNS stimulants and Psychedelics, Analgesics, Morphine and related drugs.

UNIT III MEDICINAL CHEMISTRY OF DRUGS ACTING ON ANS

9

Classification, biochemical/molecular basis of mechanism of action, structure activity relationship including stereo chemical aspects, and synthesis of selected drugs belonging to the class of adrenergic neurotransmitters, sympathomimetic agents. adrenergic antagonists, cholinergic receptors drugs and related agents, cholinergic blocking agents, ganglionic blocking agents and neuromuscular blockers.

UNIT IV MEDICINAL CHEMISTRY OF LOCAL ANAESTHETICS AND DIURETICS 9

Classification, structural basis of mechanism of action, structure activity relationship including stereo chemical aspects, physiochemical properties, design and synthesis of selected drugs belonging to the class of local anaesthetics and diuretics.

UNIT V MEDICINAL CHEMISTRY OF ANTIHISTAMINIC AGENTS AND EICOSANOIDS 8

Classification, structure basis of mechanism of action, structure activity relationship including drugs acting on Histamine receptors, eicosanoids biosynthesis, drug action mediated by eicosanoids, design of eicosanoid drugs, antipyretics, anti-rheumatoid drugs and non-steroidal anti-inflammatory drugs.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Ashutoshkar's Medicinal Chemistry.
2. Patric Medicinal chemistry

REFERENCES

1. Burger's medicinal chemistry Vol I to IV.
2. W.A. Foye, Medicinal Chemistry
3. Wilson and Giswold, Medicinal Chemistry
4. Indian/British Pharmacopoeia

PM8402

PHARMACOLOGY II

L T P C

3 0 0 3

AIM

To know in detail the classification, therapeutic use, mechanism of action, metabolism, adverse effects of drugs pertaining to GIT, endocrine system, haemopoietic system and also know the principles of chemotherapy and toxicology.

UNIT I PHARMACOLOGY OF GASTROINTESTINAL TRACT AND ENDOCRINE SYSTEM 12

Antacids, anti-secretory and anti-ulcer drugs, Laxatives and Anti-diarrhoeal drugs, Appetite stimulants and suppressants, Emetics and anti-emetics. Hypothalamic and pituitary hormones, Thyroid hormones and anti-thyroid drugs, Parathormone, Calcitonin and Vitamin D, Insulin, Oral hypoglycaemic agents and glucagon. ACTH and corticosteroids, Androgens and anabolic steroids, Estrogens, progesterone and oral contraceptives, Drugs acting on the uterus. Chronopharmacology – Definition of rhythms and cycles. Biological clock and their significance leading to chronotherapy.

UNIT II CHEMOTHERAPY 12

General principles of chemotherapy, Sulfonamides, Antibiotics – Penicillins, Cephalosporins, Chloramphenicol, macrolides, Quinolones, fluroquinolones and other antibiotics. Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy and immuno suppressive agents.

UNIT III DRUGS ACTING ON THE HAEMOPOIETIC SYSTEM 7

Haematinics, Anticoagulants, vitamin K and haemostatic agents, Fibrinolytic and anti-platelet drugs, Blood plasma volume expanders. Autocoids – Histamine, 5-HT and their antagonists, Prostaglandins, Thromboxanes and Leukotrienes, Pentagastrin, Cholecystokinin, Angiotensin, Bradykinin

UNIT IV PRINCIPLES OF TOXICOLOGY 7

Definition of poison, general principles of treatment of poisoning, Heavy metals and heavy metal antagonists, Definition for acute, sub acute and chronic toxicity, genotoxicity, carcinogenicity, teratogenicity and mutagenicity studies.

UNIT V IMMUNOPHARMACOLOGY 7

Cell and biochemical mediators involved in allergy, immunomodulation and inflammation, Classification of hypersensitivity reactions and diseases involved Therapeutic agents for allergy, asthma COPD and other immunological diseases with emphasis on immunomodulators

TOTAL : 45 PERIODS

TEXT BOOKS

1. Satoskar, Pharmacology and Therapeutics
2. Tripathi, K.D. Medical Pharmacology
3. Mycek M.J., Gerlmet S.B and Perper M.M. Pharmacology, Lippincott's Illustrated Reviews, Lippincott Company, Philadelphia.

REFERENCES

1. Rang, M.P, Dale M.M, Reter J.M-Pharmacology.
2. Goodman and Gilman's, The Pharmacological basis of therapeutics.
3. Ghosh M.N, Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
4. B. Lammer, Chronopharmacology
5. Katzung, B.G., Basic and Clinical Pharmacology, Prentice Hall International.

PM8403

PHYSICAL PHARMACEUTICS

L T P C

3 0 0 3

UNIT I MICROMERITICS 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.

UNIT IV DIFFUSION & DISSOLUTION

5

Definitions, Steady state diffusion, Procedures and apparatus, Dissolution, Drug release. Complexation and protein binding Metal complexes, organic molecular complexes, inclusion compounds, methods of analysis, protein binding, complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.

UNIT V KINETICS AND DRUG STABILITY

10

General considerations and concepts, half-life determination, Influence of temperature, light, catalytic species, solvent and other factors, Accelerated stability study, expiration dating.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Sinko, Patrick J. "Martin's Physical Pharmacy and Pharmaceutical Sciences " 5th Edition, Wolters, Kluwer/ Lippincott Williams & Wilkins Publishing , 2006
2. Carter, S.J. "Cooper and Gunn's Tutorial Pharmacy, 6th Edition. CBS Publishers, 1986.
3. Manavalan, R. and C. Ramasamy. "Physical Pharmaceutics" Vignesh Publishers, 2nd Ed., 2001.

REFERENCE BOOKS

1. Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth edition, Patrick J. Sinko (ED),Lippincott Williams & Wilkins 2006.
2. Remington, the science and practice of pharmacy, 21st Edition, Lippincott Williams and Wilkins
3. Monihan, Humphery and Abina Gean "The Physicochemical Basis of Pharmaceuticals" Oxford University Press, 2009

AIM

To know in detail the basic engineering principles and unit operations pertaining to pharmaceutical plants

UNIT I MATERIALS OF PHARMACEUTICAL PLANT CONSTRUCTION 12

Overview of composition, corrosion, resistance, properties and applications of the materials of construction with special reference to stainless steel and glass, Industrial Hazards and Safety Precautions – Mechanical, Chemical, Electrical, Fire and Dust hazards, Industrial dermatitis, Accident records, etc.

UNIT II FLUID FLOW, HEAT TRANSFER IN PHARMACEUTICAL OPERATIONS 12

Types of flow, Reynold's number, Viscosity, Concepts of boundary layer, Basic equation of fluid flow, Valves, Flow meters, Manometers and Measurement of flow and pressure, source of heat, heat transfer, steam and electricity as heating media, determination of requirement of amount of steam / electrical energy, steam pressure, Boiler capacity and Mathematical problems on heat transfer.

UNIT III FILTRATION, CENTRIFUGATION AND CRYSTALLIZATION 12

Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary press, rotary filter, edge filter, etc. Factors affecting filtration, mathematical problems on filtration, optimum-cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters and centrifugal sedimenters, Characters of crystals like purity, size, shape, geometry, habit, forms, size and factors affecting them. Solubility curves and calculation of yields. Material and heat balances around Swenson Walker crystalliser, Super saturation theory, its limitations, nucleation mechanism and crystal growth. Study of various types of crystallisers. Caking of crystals and its prevention and numerical problems on yields.

UNIT IV HUMIDITY CONTROL, REFRIGERATION, AND AIR-CONDITIONING IN PHARMA PLANTS 12

Basic concepts, definition, wet bulb and adiabatic saturation temperatures, psychometric chart and measurement of humidity, application of humidity measurement in pharmacy. Equipments for dehumidification operations, principle and applications of refrigeration and air conditioning.

Basic concepts of phase equilibrium, factors affecting evaporation, evaporators, film evaporators, single effect and multiple effect evaporators and Mathematical problems on evaporation, Raoult's law, phase diagrams, volatility, simple steam flash distillation, principles of rectification, method for calculation of number of theoretical plates, Azeotropic and extractive distillation and Mathematical problems of distillation, Moisture content, mechanism of drying, rate of drying, time of drying, calculations; classification, types of dryers, dryers used in pharmaceutical industries, special drying methods and mathematical problems on drying.

TOTAL : 60 PERIODS

TEXT BOOKS

1. MaCabe WL , Smith J.C and Harriott "Unit operations of Chemical Engineering" McGraw Hill International Book Co. London
2. Geankopolis, C.J "Transport process and separation process principles" 4th edition, prentice Hall of India 2005

REFERENCES

1. Introduction to Chemical Engineering by Walter J. Badger.
2. Cooper and Gunn's Tutorial Pharmacy, S.J. Carter.
3. Refrigeration and Air conditioning by L. Ballaney.
4. Remington's, The Science and Practice of Pharmacy, Mack Publishing Co. Easton.
5. Harry R.H. and Chi Kon, C.H. Chemical Engineers Handbook of Kogakusha Ltd.

PM8411 ANALYTICAL METHODS AND INSTRUMENTATION LABORATORY

L T P C
0 0 4 2

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.
8. Separation & identification of amino acids by paper chromatography
9. Separation & identification of alkaloids by TLC
10. UV spectrometric determination of Ibuprofen

EQUIPMENTS REQUIRED :

1. Hot air oven
2. pH meter
3. UV-Visible spectrophotometers
4. Weighing balance
5. Water bath

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, Takeru 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

AIM

To develop understanding and demonstrate the effect of the physico-chemical properties phenomena on pharmaceutical systems.

1. Determination of latent heat, vapor pressure, critical point.
2. Studies on polymorphs, their identification and properties.
3. Determination of particle size, particle size distribution and surface area using various methods of particle size analysis.
4. Determination of derived properties of powders like density, porosity, compressibility, angle of repose, etc.
5. Determination of surface/interfacial tension, HLB value and critical micellar concentration (CMC) of surfactants.
6. Study of rheological properties of various types of systems using different viscometers.
7. Study of different types of colloids and their properties.
8. Preparation of various types of suspensions and determination of their sedimentation parameters.
9. Preparation and stability studies of emulsions.
10. Studies on different types of complexes and determination of their stability constants.
11. Determination of half-life, rate constant and order of reaction.
12. Preparation of pharmaceutical buffers and determination of buffer capacity.
13. Experiments involving tonicity adjustments.

TOTAL : 60 PERIODS

REFERENCES

1. Physical Pharmacy by Alfred Martin.
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper & Gunn.
4. Stocklosam J. Pharmaceutical calculation, Lea & Febiger, Philadelphia.
5. Liberman H.A., Riogor M.M, & Banker G. Pharmaceutical dosage forms - Disperse systems, Vol.1, 2 and 3 Marcel Dekker Inc, Ny.
6. Liberman H.A, Lachman C. Pharmaceutical Dosage forms, Tablets, Vol.1-3, Marcel Dekker Inc.
8. Physical Pharmaceutics by R. Manavalan and C. Ramasamy.

AIM

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

OBJECTIVE

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

UNIT I**9**

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

UNIT II**9**

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

UNIT III**9**

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

UNIT IV**9**

Modes of operation - batch, fed batch and continuous cultivation. Simple unstructured kinetic models for microbial growth, Monod model, growth of filamentous organisms, product formation

kinetics - leudeking-piret models. Types of reactor- Air Lift Reactor, Bubble Column Reactor, Immobilized enzyme reactors- packed bed, fluidized bed, membrane reactors.

UNIT V

9

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. Shuler, M.L. and Kargi, F. "Bioprocess Engineering : Basic Concepts", 2nd Edition, PHI, 2002.
2. Pauline & Doren, Bioprocess Engineering Principles, 1995.
3. Blanch, H.W. and Clark, D.S. "Biochemical Engineering", Marcel Decker Inc., 1997.
4. Stanbury, P.F. et al. "Principles of Fermentation Technology", 2nd Edition, Butterworth – Heinemann / Elsevier, 1995.
5. Ghasem D.Najafpour, Biochemical Engineering & Biotechnology, Elsevier, 2007.
6. Palmer, Trevor "Enzymes : Biochemistry, Biotechnology, Clinical Chemistry", Affiliated East-West Press Pvt. Ltd., 2004.
7. Stanbury, P.F., A. Whitaker and S.J. Hall "Principles of Fermentation Technology", 2nd Edition, Butterworth – Heinemann (an imprint of Elsevier), 1995.
8. Blanch, H.W. and D.S. Clark "Biochemical Engineering", Marcel Dekker, Inc., 1997.
9. C.F.A Bryce and EL.Mansi, Fermentation microbiology & Biotechnology, 1999.

REFERENCES

1. Moser, Anton. "Bioprocess Technology : Kinetics and Reactors", Springer – Verlag, 1988.
2. Bailey, J.E. and Ollis, D.F. "Biochemical Engineering Fundamentals" 2nd Edition, McGraw – Hill, 1988.
3. Shigeo Katoh and Fumitake Yoshida, Biochemical engineering –A text book for engineers, chemists & Biologists. Wiley –VCH, 2009.
4. Lee, James M. "Biochemical Engineering", Prentice – Hall, 1992.
5. Wiseman, Alan "Handbook of Enzyme Biotechnology", 3rd Edition, Ellis Harwood Publications, 1999.
6. Hartmeier, Winfried "Immobilized Biocatalysts : An Introduction", Springer – Verlag, 1986.

AIM

To know the basics of medicinal chemistry, principles of drug design, biochemical and molecular basis of mechanism of action, structure activity relationship including stereo chemical aspects, physicochemical properties and synthesis of medicinal agents.

UNIT I PRINCIPLES OF DRUG DESIGN 9

Traditional analog classification, Quantitative Structure Activity Relationship (QSAR) and mechanism based approaches, brief introduction to graph theory, application of mechanism based approaches, application of quantum mechanics, computer aided drug designing and molecular modelling, visualisation of leads and receptors, brief introduction to combinatorial chemistry.

UNIT II MEDICINAL CHEMISTRY OF ANTI-INFECTIVE AGENTS 9

structural basis of mechanism of action, structure activity relationship including stereo chemical aspects, physicochemical properties, design and synthesis of selected drugs belonging to the class of sulphonamides and sulphones, antibiotics like penicillins and cephalosporins, aminoglycosides, tetracyclines. macrolides. lincomycins, polypeptides, unclassified antibiotics – chloramphenicol and its prodrugs, peptide antibiotics, novobiocin and mupirocin, antiviral agents, anti-HIV agents, local anti-infective agents, anti-fungal agents, synthetic antibacterial agents, anti-tubercular agents, anti-protozoal agents, anthelmintics, anti-scabious and anti-pedicular agents, antimalarials

UNIT III MEDICINAL CHEMISTRY OF ANTICANCER DRUGS 9

chemistry and nomenclature, structure basis of mechanism of action, structure activity relationship including stereo chemical aspects, physicochemical properties, design and synthesis of selected drugs belonging to the class of antimetabolites, DNA alkylating agents, antibiotic anticancer agents, hormonal anticancer agents, antitubulin inhibitors.

UNIT IV MEDICINAL CHEMISTRY OF DRUGS ACTING ON CVS 9

structural basis of mechanism of action, structure activity relationship including stereo chemical aspects, physicochemical properties, design and synthesis of selected drugs belonging to the class of anti-anginal, vasodilators, calcium channel blockers, cardiac glycosides, anti-arrythmic drugs, anti-hypertensive agents, anti-hyperlipidemic agents, antiplatelet inhibitors, anti-coagulants and anti-thrombolytics

UNIT V MEDICINAL CHEMISTRY OF HORMONES, STEROIDS AND RELATED DRUGS

9

Structural basis of mechanism of action, structure activity relationship including stereo chemical aspects, physiochemical properties, design and synthesis of selected drugs belonging to the class of hypoglycemic agents, synthetic hypoglycemic agents, glucocorticoids, mineralocorticoids, oestrogens, progestrogens, Androgens, chemistry of natural hormones and synthetic derivatives including contraceptives, insulin and its preparation, oxytocin and vasopressin, thyroid and anti-thyroid drugs, medicinal chemistry of Diagnostic drugs and reagents:

TOTAL : 45 PERIODS

TEXT BOOKS

1. Ashutoshkar's Medicinal Chemistry.
2. Patric Medicinal chemistry

REFERENCES

1. Burger's medicinal chemistry Vol I to IV.
2. W.A. Foye, Medicinal Chemistry
4. Wilson and Giswold, Medicinal Chemistry
5. Indian/British Pharmacopoeia

**PM8502 REGULATORY ISSUES IN PHARMACEUTICAL INDUSTRY AND DRUG VALIDATION L T P C
3 0 0 3**

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.

PM8551

CELL AND MOLECULAR BIOLOGY

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

UNIT I CELL STRUCTURE AND FUNCTION OF THE ORGANELLES 12

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

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

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

UNIT III CHEMISTRY OF NUCLEIC ACIDS & DNA REPLICATION 12

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

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

UNIT IV TRANSCRIPTION

12

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

UNIT V TRANSLATION

12

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

TOTAL : 60 PERIODS

TEXT BOOKS

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

REFERENCES

1. Waston, J.D. "Molecular Biology of the Gene", 5th Edition, Pearson Education, 2004.
2. Walker, J.M. and R. Rapley "Molecular Biology and Biotechnology" 4th Edition, Panima, 2002.
3. Karp, Gerald. "Cell and Molecular Biology :Concepts and Experiments."2nd Edition, John Wiley & Sons, 1999.
4. Lodish, Harvey etal., " Molecular Cell Biology," 6th Edition. W.H.Freeman, 2008.
5. Alberts, Bruce, "Molecular Biology of Cell", 5th Edition, Garland Science, 2008.
6. Cooper,G.M. "The Cell: A Molecular Approach, 4th Edition, ASM Press, 2007.
7. Alberts, Bruce etal., "Essentail Cell Biology", 2nd Edition, Garland Science, 2004

1. Study on stereo-chemistry of some selected drugs with models and in-silico viewer
2. Synthesis of Drugs used in Diabetes involving two or more steps and their spectral analysis.
3. Synthesis of Drugs used in Anti-Hypertensive drugs involving two or more steps and their spectral analysis.
4. Synthesis of Drugs used in Gastro-intestinal disorders drugs involving two or more steps and their spectral analysis.
5. Synthesis of Drugs used in Respiratory disorders drugs involving two or more steps and their spectral analysis
6. Establishing the Pharmacopoeial standards of the Diabetes drugs synthesized .
7. Establishing the Pharmacopoeial standards of the Anti-Hypertensive drugs synthesized.
8. Establishing the Pharmacopoeial standards of the Gastro-intestinal disorders synthesized.
9. Establishing the Pharmacopoeial standards of the Respiratory disorders drugs synthesized
10. Assays of the drugs.

EQUIPMENTS REQUIRED :

1. Weighing balance
2. pH meter
3. Rotary evaporator
4. Refluxing and distillation units
5. Hot air oven
6. UV-Visible spectrophotometers

TOTAL : 60 PERIODS**TEXT BOOKS**

1. A Text Book of Medicinal Chemistry Vol. I and II by Surendra N. Pandeya, S.G. Publisher, 6, Dildayal Nagar, Varanasi -10.
2. Pharmaceutical Chemistry drug Synthesis Vol. I and II by H. J. Roth and A. Kleemann.

REFERENCE BOOKS

1. Wilson and Gisvold's Text book of Organic, Medicinal and Pharmaceutical Chemistry, Lippincott-Raven Publishers-New York, Philadelphia.

2. William.O.Foye, Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd., New Delhi.
3. Indian Pharmacopoeia

PM8512

BIOPROCESS LABORATORY

L T P C
0 0 4 2

AIM

To enable the students to understand the concepts and operation of equipment in handling of enzymes and cultivation of microbes 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 : 60 PERIODS

REFERENCES

1. Bailey, J.E. and Ollis, D.F. "Biochemical Engineering Fundamentals" 2nd Edition, McGraw – Hill, 1988.

2. Lee, James M. "Biochemical Engineering", PHI, U.S.A. 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 | 1 |
| Laminar flow hood | 2 |
| Spectrophotometer | 1 |
| Laboratory scale reactor | 2 |
| Table top centrifuge | 2 |

MG8654

TOTAL QUALITY MANAGEMENT

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

AIM

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

OBJECTIVES

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

UNIT I INTRODUCTION

9

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

UNIT II TQM PRINCIPLES**9**

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

UNIT III TQM TOOLS & TECHNIQUES I**9**

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

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

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

UNIT V QUALITY SYSTEMS**9**

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

TOTAL : 45 PERIODS**TEXT BOOK**

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint , 2006.

REFERENCE BOOKS

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, Third 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 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.

PM8601

GENETIC ENGINEERING AND PHARMACOGENOMICS

L T P C

4 0 0 4

UNIT I BASICS OF RECOMBINANT DNA TECHNOLOGY

12

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

UNIT II DNA LIBRARIES

12

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

UNIT III SEQUENCING AND AMPLIFICATION OF DNA

12

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

UNIT IV HUMAN GENOME AND ASSOCIATION STUDIES IN PHARMACOGENOMICS

12

Expressed sequence Tags (EST) and computational biology, Microbial genomics, computational analysis of whole genomes, computational genome analysis, Genomic differences that affect the outcome of host pathogen interactions: A template for the future of whole genome-based pharmacological science, Viability and ADR in drug response: contribution of genetic factor, Multiple inherited genetic factors influence the outcome of drug treatments, Plasma binding proteins, Drug targets.

Understanding biology and diseases, Target identification and validation, Drug candidate identification and optimization incorporation of pharmacogenomics principles, cases studies for CVS, CNS, immunomodulators, antioxidants etc.

TOTAL : 60 PERIODS

TEXT BOOKS

1. Primrose, S. Twyman, R. "Principles of Gene Manipulation and Genomics" 7th Edition, Blackwell Publishing, 2006.
2. Brown, T.A. "Gene Cloning & DNA Analysis : An Introduction", 5th Edition, Blackwell Publishing, 2006.
3. Watson, James., "Molecular Biology of the Gene" 5th Edition, Pearson Education, 2004.
4. Chaknaborty, Chiranjib and Atanu Bhatta Charya "Pharmacogenomics : An Approach to New Drug Development", Biotech Books, 2004.

REFERENCES

1. Winnacker, Ernst – L. "From Genes to Clones : Introduction to Gene Technology", Panima, 2003.
2. Karp, Gerald. "Cell and Molecular Biology: Concepts and Experiments", 4th Edition, John – Wiley & Sons, 2005.
3. Mc Pherson, M.J. and S.G. Moller "PCR" Bios Scientific Publication, 2000.
4. Hughes, S. and Moody, "PCR" Scion Publishing Ltd., 2007.
5. Glick, B.R. and J.J. Pasternak "Molecular Biotechnology : Principles and Applications of Recombinant DNA", 3rd Edition, ASM, 2003.
6. Rothstein, Mark A. "Pharmacogenomics: Social, Ethical and Clinical Dimensions", John - Wiley & Sons, 2003.
7. Licinio, Julio and Ma-Liwong "Pharmacogenomics : The Search for Individualized Therapies", Wiley – VCH, 2002.

PM8602**PHARMACEUTICAL DOSAGE FORMS****L T P C****4 0 0 4****UNIT I PREFORMULATION STUDIES****12**

Study of physical/physicochemical properties of drugs like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution, organoleptic properties and their

effect on formulation, stability and bioavailability. Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemisation, polymerization etc. and their influence on formulation. **Stability Studies:** Basic concept and objectives of stability study.

UNIT II LIQUIDS AND SEMI – SOLID DOSAGE FORMS 12

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 III SOLID DOSAGE FORMS 12

Classification of different types of tablets, tablets equipments, granulation technology on large scale by various techniques. Tablets tooling, different types of tablets compression machinery, processing problem of tablets and evaluation of tablets. Coating of tablets: Types of coating, Sugar coating, film forming materials, formulation of coating solution, equipment for coating, film defects and evaluation of coated tablets. Advantages & disadvantages of capsule dosage form, extraction of gelatin, production of hard gelatin capsules, size of capsules and method of capsule filling. Soft gelatin capsule, Nature of capsule shell & capsule content, importance of base adsorption, minimum gm factors in soft capsules, production, quality control, stability testing and storage of capsule dosage forms.

UNIT IV PARENTERAL PRODUCTS 12

Preformulation factors, routes of administration, water for injection, pyrogenicity, non-aqueous vehicles, isotonicity & methods of its adjustment. Formulation details, containers and closures and their selection. Prefilling treatment, washing the container and closers, preparation of solution and suspension, filling, closing of ampoules, vials infusion fluids, lyophilization, preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products. Aseptic techniques: Source of contamination, methods of prevention, design of aseptic area, laminar flow bench, air handling units, services and maintenance.

UNIT V PHARMACEUTICAL AEROSOLS 12

Definition, propellants, general formulation, manufacturing, packaging methods, pharmaceutical applications and evaluation.

TOTAL : 60 PERIODS

TEXT BOOKS

1. Lachman, Leon et al. "The Theory and Practice of Industrial Pharmacy" 3rd Ed., Varghese Publishing House, 1987.
2. Aulton, Michael E. "Pharmaceutics: The Science of Dosage Form Design" 2nd Ed., Churchill Livingstone, 2002.
3. Allen, Loyd V. et al. "Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems" 9th Ed., Wolters Kluwer/Lippin Cott Williams & Wilkins, 2011.
4. H. A. Liberman,, L. Lachman, and J. B. Schwartz: Pharmaceutical dosage forms: Tablets, Vol. 1,2 and 3, 2nd Edition Marcel Dekke r, 1989.

REFERENCES

1. Avis, K.E. et al. "Pharmaceutical Dosage Forms: Parenteral Medications" Vol.1-3, 2nd Ed., Marcel Dekker, 2005.
2. Libermann, H.A. et al. " Pharmaceutical Dosage Forms : Tablets" Vol.1-3, 2nd Ed., Marcel Dekker, 2005.
3. Libermann, H.A. et al., "Pharmaceutical dosage forms: Disperse Systems" Vol. 1-3, 2nd Ed., Marcel dekker, 2005.
4. Remington's Pharmaceutical Sciences (RPS).
5. Modern Pharmaceutics by Banker and Gilberts.
6. Theory and Practice of Industrial Pharmacy by Lachman.
7. Hard Capsules by Ridgway. K. Pharmaceutical Press, London.

HS8561

EMPLOYABILITY SKILLS
(Lab / Practical Course)

L T P C
0 0 2 1

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

OBJECTIVES

- To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
- To help them improve their soft skills, including report writing, necessary for the workplace situations
 1. Making presentations – introducing oneself – introducing a topic – answering questions – individual presentation practice
 2. Creating effective PPTs – presenting the visuals effectively
 3. Using body language with awareness – gestures, facial expressions, etc.

4. Preparing job applications - writing covering letter and résumé
5. Applying for jobs online - email etiquette
6. Participating in group discussions – understanding group dynamics - brainstorming the topic
7. Training in soft skills - persuasive skills – sociability skills - questioning and clarifying skills – mock GD
8. Writing reports – collecting, analyzing and interpreting data – drafting the report
9. Attending job interviews – answering questions confidently
10. Interview etiquette – dress code – body language – mock interview

TOTAL: 30 PERIODS

REQUIREMENTS FOR A CLASS OF 30 STUDENTS

1. A PC or a lap top with one or two speakers
2. A Collar mike and a speaker
3. An LCD projector and a screen
4. CD's and DVD's on relevant topics
5. Individual chairs for conducting group discussions

REFERENCE BOOKS

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

EXTENSIVE READERS

1. Covey, Stephen R. The 7 Habits of Highly Effective People. New York: Free Press, 1989.
2. Bagchi, Subroto. The Professional. New Delhi: Penguin Books India, 2009.

WEB RESOURCES

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

LIST OF EXPERIMENTS

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

TOTAL : 60 PERIODS**REFERENCES**

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

1. Preformulation studies on prepared granules
2. Preparation and evaluation of suspensions
3. Preparation and evaluation of emulsions
4. Preparation and evaluation of creams

5. Preparation and evaluation of ointments
6. Preparation and evaluation of injections
7. Manufacture and evaluation of granules
 - ordinary compressed tablet- wet granulation
 - tablets prepared by direct compression
 - soluble tablet
 - chewable tablet
8. Formulation and filling of hard gelatin tablets
9. Manufacture of parenterals
 - Ascorbic acid injection
 - Calcium gluconate injection
 - Sodium chloride injection
 - Dextrose and sodium chloride injection/infusion
10. Preparation of microcapsules
 - Non-solvent method
 - Salt-addition method

TOTAL: 60 PERIODS

REFERENCES

1. Pharmaceutical dosage forms: Tablets volume – 3 by Liberman and Lachman
2. Pharmaceutical dosage forms: Parenteral medications Vol-1, 2 by Liberman and Lachman.
3. Pharmaceutical dosage forms: Disperse systems Vol-1, by Liberman and Lachman.
4. Remington's Pharmaceutical Sciences (RPS).
5. Modern Pharmaceutics by Banker and Gilberts.
6. Theory and Practice of Industrial Pharmacy by Lachman.
7. Hard Capsules by Ridgway. K. Pharmaceutical Press, London.
8. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi.

9. Novel Drug Delivery System by Y.W. Chein.
10. Biopharmaceutics and Pharmacokinetics – An introduction by Robert. E. Notari.

IB8753

IMMUNOLOGY

L T P C
3 0 0 3

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.

PM8701

ADVANCED DRUG DELIVERY SYSTEMS

L T P C

3 0 0 3

UNIT I SUSTAINED RELEASE FORMULATIONS

10

Introduction, concept advantages and disadvantages. Physicochemical and biological properties of drugs relevant to sustained release formulations.

UNIT II TRANSDERMAL DRUG DELIVERY SYSTEMS

8

Permeation through skin, factors affecting permeation, basic components of TDDS, formulation approaches used in development of TDDS and their evaluation, permeation enhancers.

UNIT III PARENTERAL CONTROLLED RELEASE DRUG DELIVERY SYSTEMS

7

Approaches for injectable controlled release formulations and development of Implantable drug delivery systems.

UNIT IV TARGETED DRUG DELIVERY SYSTEMS

12

Concept. Advantages and disadvantages, biological processes and event involved in drug targeting, nano particles, liposomes, resealed erythrocytes, microspheres, magnetic microspheres, and monoclonal antibodies.

UNIT V FUTURE DIRECTIONS OF DRUG DELIVERY AND TARGETTING**8**

Plasmid based Gene therapy, Protein delivery system, Nucleic acids delivery, Integrating Drug Discovery and delivery and New Generation Technology

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Binghe wang , Teruna Siahaan and Richard A Soltero “Drug delivery principles and applications” John wiley and Sons Inc, 2005.
2. Junginger H.E “ Drug Targeting and Delivery- concepts in dosage form design” Ellis Harwood series in Pharmaceutical Technology.
3. Vasant Ranade , mannfred A Hollinger “Drug delivery systems” II ed , CRC Press.
4. Grietje Molema and Dirk K F Meijer “ Drug Targetting organ-specific strategies” WILEY-VCH , 2001
5. Anya M Hillery et al “ Drug Delivery and Targeting”, CRC Press, 2010.

PM8702**PHARMACOGNOSY****L T P C****3 0 0 3****UNIT I****9**

Definition, history, scope and development of pharmacognosy. Sources and Classification of drugs : Biological, marine, geographical and plant tissue cultures as sources of drugs. Alphabetical, morphological, taxonomical, pharmacological and chemical Classification. 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 II**9**

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

UNIT III

9

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

- a) Carbohydrates and derived products : Agar, Gum Acacia, Gum tragacanth, Honey, Isapgol, pectin, Starch.
- 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, Caraway, Dill, Clove, Fennel, Nutmeg, Cardamom, Lemon grass oil, Eucalyptus, Sandalwood, palmarosa and citronella.

UNIT IV

9

Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagonistic 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 thevitia. Anthraquinone cathartics: Aloe, Senna, rhubarb and cascara. Psoralea, Ammi, gentian, chirata, quassia.

UNIT V

9

Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagonistic macroscopic and microscopic features and specific chemical tests of following groups containing Alkaloids: Quinine, reserpine, morphine, papaverine, ephedrine, ergot, Belladonna, vinca alkaloids, atropine, Cinchona, Ipecac, Rauwolfia, Nuxvomica.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Evans, W.C. "Trease and Evans Pharmacognosy", 15th Edition, Saunders / Elsevier, 2005.
2. Kokate, C.K. etal., "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.

PM8711 **ADVANCED DRUG DELIVERY SYSTEMS LABORATORY**

L T P C
0 0 4 2

1. Preparation of transdermal films
2. Preparation of microspheres
3. Preparation and evaluation of matrix tablets using various polymers
4. Study on diffusion of drugs through various polymeric membranes
5. Preparation of solid dispersions
6. Study of in vitro dissolution of various sustained release formulations of marketed products
7. Preparation of Liposomes.
8. Preparation of polysaccharide particle based drug delivery
9. Preparation of DNA liposome complex.

TOTAL: 60 PERIODS

EQUIPMENTS REQUIRED

1. Weighing balance
2. pH meter
3. Rotary evaporator
4. Hot plate
5. Phase contrast microscope

REFERENCES

1. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
2. S.P.Vyas and R.K.Khar, Controlled Drug Delivery -concepts and advances, VallabhPrakashan, New Delhi, First edition 2002. Remington: The science and practice

of pharmacy, 20th edition Pharmaceutical Science (RPS)

3. Theory And Practice Of Industrial Pharmacy by Liberman&Lachman
4. Pharmaceutics-the science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition
5. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger, Philadelphia, 5th edition, 2005

PM8712

PHARMACOGNOSY LABORATORY

**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.

UNIT I INTRODUCTION TO BIOPHARMACEUTICS**7**

Definition and Role in Product Development, Explanation of the Terms: Bioavailability, and Bioequivalence, Equivalence Types: Chemical, Clinical, Therapeutic, Generic, and Pharmaceutical Alternatives. Bio-equivalency testing studies

UNIT II PRINCIPLES OF DRUGS DISSOLUTION**11**

Dissolution of solids: Mechanisms and Models of Dissolution, Factors influencing Dissolution Rate (in vitro Release), Quantitative Study of Dissolution- Methods, In-vitro Dissolution & Interpretation of Dissolution Data. Dissolution of Tablets & Capsules. Disintegration & Factors affecting DT. In vitro- In vivo correlations.

UNIT III PRINCIPLES OF DRUG ABSORPTION AND BIO-AVAILABILITY**11**

- Physico– Chemical Factors: Lipid Solubility, Dissociation & pH, Complexation & Surface –active agents.
- Pharmaceutical Factors: Dosage Form Types and Formulation Variables
Biological Factors: Passage of Drugs through Natural Membranes, Gastric Emptying & Intestinal Transition. Blood Flow, G.I. –Metabolism & Degradation, Interactions with Food & Co-administered Drugs, Disease State and Route of Administration.

UNIT IV PHARMACOKINETICS**11**

Principles of Pharmacokinetics, Concepts of Compartmental Model, Characteristics of One Compartment Model and One Compartment Model – based Pharmacokinetic Derivations (involving the concepts of (a.) Experimentally Determined Rates, (b.) Methods of Residuals and (c.) Trapezoidal Rule for the following modes of Drug Administration: Intra-Venous Administration (Plasma Level & Urinary Excretion Data)-Single Dose, Absorption Based Administration (Single Dose) - Absorption Rate Constant (k_a), Elimination Rate Constant (K) & Elimination Half life ($t_{1/2}$), AUC, C_{max} , and t_{max} . Apparent Volume of Distribution (V_d) & Renal Clearance (Q).

UNIT V MULTIPLE DOSAGE REGIMENS**5**

Concept, Accumulation, Persistent and elimination factors. Calculation of dosage regimen following repetitive iv and oral administration

TOTAL: 45 PERIODS

TEXT BOOKS

1. Brahmankar, D.H. and Sunil B.Jaiswal "Biopharmaceutics and Pharmacokinetics:a Treatise" Vallabh Prakashan, 1995.
2. Kulkarni, J.S. et al. "Biopharmaceutics and Pharmacokinetics", CBS Publishers, 2006.
3. Chatwal, G.R. "Biopharmaceutics and Pharmacokinetics" Himalaya Publishing House, 2003.
4. Jambhekar, Sunil S. and Philip J.Breen "Basic Pharmacokinetics" Pharmaceutical Press, 2009.

REFERENCES

1. Gibaldi: "Biopharmaceutics & Clinical Pharmacokinetics," 3rd ed., Lea Febiger, 1984.
2. Swarbrick, Ed.,: "Current Concepts in Pharmaceutical Sciences (Bio-pharmaceutics)," Lea & Febiger, 1970.
3. Rowland & Tozer: "Clinical Pharmacokinetics (Concepts & Applications)," 3rd ed., Lea & Febiger – Waverly, 1995.
4. Notari: "Biopharmaceutics & Clinical Pharmacokinetics (an introduction)," 4th ed. (Revised & Expanded), Marcel Dekker, 1987.
5. Shargel & Yu: "Applied Biopharmaceutics & Pharmacokinetics," 4th ed., Appleton & Lange, 1999.
6. Gibaldi & Perrier : "Pharmacokinetics," 2nd ed. (Revised & Expanded), Marcel Dekker (series in Text-Books & Monographs: Swarbrick, Ed., vol.15), 1982.
7. Welling & Tse, Eds: "Pharmacokinetics," 2nd ed., Marcel Dekker, 1995.

PM8002

CHEMISTRY OF NATURAL PRODUCTS

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

OBJECTIVES

To learn, classify and understand chemistry and structural aspects of medicinal compounds from various natural sources and relate to therapeutic applications

UNIT I STRUCTURAL BASIS OF NATURAL PRODUCTS

9

Chemical and spectral approaches to simple molecules of natural origin. identification of natural products by chromatographic and spectroscopic methods and application of I.R., N.M.R. and Mass spectroscopy in the structural elucidation of organic compounds. Concept of

stereoisomerism taking examples of natural products Eg. citral, menthol, camphor, ephedrine, atropine etc.; standardization of traditional drug formulations, chromatographic study of some herbal constituents

UNIT II GLYCOSIDES

8

Classification, biosynthetic studies and basic metabolic pathways, introduction to biogenesis of secondary metabolites, chemistry, general methods of extraction, isolation, chemical tests, isolation, medicinal properties and structural elucidation of sennosides, cardinolides and bufadienolides, digoxin and digitoxin, introduction to scillaren A and ouabain.

UNIT III ALKALOIDS

12

Classification, biosynthetic studies and basic metabolic pathways, introduction to biogenesis of secondary metabolites, chemistry, general methods of extraction, isolation, chemical tests, isolation and structural elucidation of Pyridine alkaloids, Tropane alkaloids, Quinoline and Isoquinoline alkaloids, Phenanthrine alkaloids, Indole alkaloids, Imidazole alkaloids, Alkaloid amines, Glycoalkaloid, Xanthine alkaloid

UNIT IV TERPENES AND FLAVONOIDS

8

Classification, biosynthetic studies and basic metabolic pathways, introduction to biogenesis of secondary metabolites, chemistry, general methods of extraction, isolation, chemical tests, isolation, medicinal properties and structural elucidation, flavonoids, quercetin; Terpenes—special isoprene rule, mono, diterpenes, triterpenoids and sesquiterpenes, and structural elucidation of citral, carvone, menthol and camphor; Steroids – cholesterol, colour reactions, reactions of steroids, stigmasterol, β -Sitosterol, bile acids, ergosterol, diosgenin, solasodine, hecogenin

UNIT V STUDY OF TRADITIONAL DRUGS

8

Classification of indigenous drugs traditional drugs, common vernacular names, botanical source, chemical constituents, uses and marketed formulations with ingredients like – Amla, Satavari, Bhilwua, bael, bach, rasna, punarnava, gokhru, shankhapusphi, brahmi adusa, arjuna, lahsun, guggul, gymnema, neem ,tulsi, Shilajit and Spirulina

TOTAL: 45 PERIODS

TEXT BOOKS

1. Chemistry of Organic Natural Products (Vol.-1 & 2) by O.P. Agarwal.

2. Organic Chemistry of Natural Products (Vol.-1 & 2) by Gurdeep Chatwal.
3. Organic Chemistry (Vol.-2) by I.L. Finar.

REFERENCE BOOKS

1. Pharmacognosy by Brady and Tyler.E.
2. Pharmacognosy by G.E. Trease & W.C.Evans.

PM8003

CLINICAL RESEARCH AND REGULATIONS

L T P C

3 0 0 3

UNIT I DRUG DEVELOPMENT MODULE

12

Drug development overview ,Phases of clinical research ,Pre-clinical (Non-clinical) development.Discovery and selection of compounds,Toxicology,,Pharmacology

Clinical Development programmes;Basics of clinical research statistics

UNIT II CLINICAL RESEARCH MODULE I

7

Understanding the evolving role of the Clinical Trial Administrator (CTA)/Clinical Project Assistant (CPA);Good Clinical Practice (GCP) and international harmonisation

Case Report Forms;Protocols ;Informed Consent ;Ethics Committees/Institutional Boards. Role of the Sponsor including the Clinical Research Associate/Monitor

UNIT III CLINICAL RESEARCH MODULE II

8

Clinical trial set up ;Trial Master Files and study filling,Data Management. Review of the EU Clinical Trial Directive;How to prepare for Regulatory Inspections or Audit; Fraud in clinical research

UNIT IV ADVANCED CLINICAL RESEARCH MODULE

9

Project Management ;How to develop a proactive approach to supporting clinical trials Building a successful working relationship with your manager(s) and the rest of the clinical research team;Team effectiveness: working as an effective clinical research team ;Working in partnership with CROs .Legal aspects of clinical research ;Laboratory tests Communication skills,Cross-cultural communication with other offices and departments internationally.Time management and optimising your effectiveness

UNIT V REGULATORY AFFAIRS AND SAFETY MODULE

9

Regulatory requirements for international clinical research - Regulatory requirements for biotechnology products, medical devices and veterinary products ;Health economics ;Safety reporting;Responding to drug safety alerts Postmarketing surveillance

TOTAL : 45 PERIODS

TEXT BOOKS

1. Matoren, Gary M. "The Clinical Research Process in the Pharmaceutical Industry", Marcel Dekker, 1984.
2. Abraham, John "Regulation of the Pharmaceutical Industry", Palgrave, 2003.
3. Blaisdell, Peter, "Twenty – First Century Pharmaceutical Development", Interpharm Press, 2001.

REFERENCE

1. Gad, Shayne C. "Drug Safety Evaluation", John – Wiley & Sons, 2002.

PM8004

COLLOIDS AND INTERFACIAL PHENOMENA

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

UNIT I INTRODUCTION TO INTERFACE AND COLLOIDAL SCIENCE

9

Examples of surface and colloidal phenomena in industry and nature, Historical perspective. Areas where future research is needed, nature of interfaces, Surface free energy, Work of cohesion and adhesion, Surface activity and surfactant structures, Physical and chemical interactions between atoms and molecules interactions between surfaces and particles, Surface tension.

UNIT II ADSORPTION

9

Gibbs Surface Excess, Gibbs Adsorption Isotherm, Adsorption at solid-vapour interface, Energetic considerations, Physical adsorption versus chemisorption, Chemisorption and catalysis, Solid-Vapour adsorption isotherms: Langmuir, Freundlich, BET, Adsorption at solidliquid interfaces. Adsorption at liquid-liquid interfaces, Gibbs monolayers.

UNIT III CAPILLARITY

9

Capillary flow, Driving forces, Interfacial tension, Contact angle, Laplace expression for pressure difference across a curved interface, Capillary flow and spreading processes, Contactangle effects, Some practical capillary systems such as wetting in woven fibers and papers, repellency control, detergency, enhanced oil recovery

UNIT IV ELECTROSTATIC FORCES AND ELECTRICAL DOUBLE LAYER 9

Sources of interfacial charge, Electrostatic theory, Coulomb's law, Boltzmann's distribution and the Electrical double layer, Double layer thickness, Specific ion adsorption and the stern layer, Overview of electrokinetic phenomena (Electro-osmosis and Electrophoresis).

UNIT V COLLOIDS AND COLLOIDAL STABILITY 9

Working definition of colloids, Practical applications of colloids and colloids phenomena. Mechanisms of colloid formation, Sources of colloidal stability, Steric or entropic stabilization, Coagulation kinetics, DLVO theory and its applications. Emulsion formation, Classification of emulsifiers and stabilizers, Flocculation and coalescence. Adsorption at liquid-liquid interfaces, General considerations of emulsion formation and stability. Mechanistic details of stabilization, Solubility parameters, Hydrophilic-Lipophile balance. Phase inversion temperature, Association colloids such as micelles, Ionic and nonionic surfactants. Kraft temperature, Critical micelle concentration, Microemulsions

TOTAL : 45 PERIODS

TEXT BOOK AND REFERENCES

1. Drew Myers, "Surfaces, Interfaces and Colloids: Principles and Applications", Second Edition, Wiley-VCH, 1999.
2. Adamson Arthur M. and Gast A.P., "Physical Chemistry of Surfaces", Sixth Ed, John Wiley & Sons, 1997
3. Hiemenz P. C., Rajagopalan R., "Principles of Colloid and Surface Science", Third Edition, Marcel Dekker, 1997

**PM8005 COMPUTER AIDED DRUG DESIGN L T P C
3 0 0 3**

UNIT I STEREOCHEMISTRY AND DRUG DESIGN 9

Structurally Rigid Groups – Conformation – Configuration.

UNIT II STRUCTURE, ACTIVITY RELATIONSHIP 9

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.

UNIT III QUANTITATION STRUCTURE – ACTIVITY RELATIONSHIP 9

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

UNIT IV DOCKING 9

Docking ligands to macromolecules – Docking algorithms - Dock – AUTODOCK

UNIT V MOLECULAR SIMULATIONS 9

Molecular dynamic simulations – GROMACS – GROMOS – AMBER

TOTAL : 45 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.

**PM8006 EXPERIMENTAL DESIGN AND BIOSTATISTICS L T P C
3 0 0 3**

OBJECTIVES

To define, learn, and understand the principles of experimental design; To plan and select statistical tools; To execute effectively and analyze results of experimental data

UNIT I FUNDAMENTALS OF STATISTICS 9

Define Statistics, intuitive biostatistics, relevance to research, preparation of data, analysis of data, frequency tables, graphical techniques, measuring variability, identify measures of

central tendency and variability, probability, tools in statistics, selection of various statistics tools

UNIT II PRINCIPLES OF EXPERIMENTAL DESIGN 9

Designing an experiment, controlled experiments, natural and quasi-experiments, population definitions, sampling unit, types of variables, treatment structure, design structure, collecting and analyzing data, types of effects, randomization, replication, blocking, orthogonality, factorial design, completely randomized design, randomized complete block design,

UNIT III CORRELATION AND REGRESSION 9

Correlation and regression: Graphical presentation of two continuous variables; Pearson's product moment correlation coefficient; its statistical significance; Multiple and partial correlations; Linear regression; Regression line; Coefficient of determination; Interval estimation and hypothesis testing for population slope; Introduction to multiple linear regression models; Probit and logit transformations.

UNIT IV PARAMETRIC TESTS 9

Estimation and Hypothesis testing: Point and interval estimation including fiducial limits; Concepts of hypothesis testing and types of errors; Student-t and Chi square tests; Sample size and power; Experimental design and analysis of variance: Completely randomized, randomized blocks; Latin square and factorial designs; Post- hoc procedures.

UNIT V NON-PARAMETRIC TESTS 9

Non-parametric tests: Sign; Mann-Whitney U; Wilcoxon matched pair; Kruskal wallis and Friedman two way anova tests. Spearman rank correlation; Statistical techniques in pharmaceuticals: Experimental design in clinical trials; Parallel and crossover designs; Statistical test for bioequivalence; Dose response studies; Statistical quality control.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Gupta S.P, Statistical Methods, Sultan Chand & Sons, New Delhi, 2005.
2. P.S.S. Sundar Rao, P.H.Richard, J.Richard, An introduction to Biostatistics, Prentice Hall of India(P) Ltd., New Delhi, 2003.

REFERENCE BOOKS

1. Jerrold H. Zar, Bio Statistical Analysis, Tan Prints(I) Pvt. Ltd., New Delhi, 2003.

2. Goulden, Methods of Statistical Analysis, Asia Publishing Co., New Delhi, 1962.
3. Intuitive Biostatistics by Harvey Motulsky. Copyright © 1995 by Oxford University Press Inc.

PM8007 FUNDAMENTALS OF MATERIAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

The course is aimed to impart basic knowledge about crystal structures, phase diagrams and properties of materials.

OBJECTIVES

On completion of the course the students are expected to

- Have a basic understanding about crystal structures and various laws related to structures.
- Have learnt about various properties.
- Have basic knowledge about phase diagrams

UNIT I CRYSTAL STRUCTURE 9

Introduction – material classification of materials – structure- property relationship - atomic Structure - space lattice and crystal structure- Miller indices, crystal planes – symmetry – crystal imperfections – point, line, surface, volume – solid solutions - ceramic crystal structures. Diffusion: Fick's laws of diffusion – mechanism and applications.

UNIT II PHASE DIAGRAMS 9

Gibb's Phase rule – thermodynamic criteria for phase stability – phase diagrams - single, binary and ternary phase diagrams – lever rule – applications of phase diagrams

UNIT III MECHANICAL PROPERTIES 9

Elastic behavior – plastic deformation by slip – dislocation movement – effect of stress and temperature – work hardening – creep – fracture, modes of fracture - fracture toughness – hardness – wear - corrosion.

UNIT IV ELECTRICAL AND ELECTRONIC PROPERTIES**9**

Classification of materials using free electron theory and band theory -conductivity of metals – Matheisen’s Rule – concentration and mobility of charge carriers and their variation with temperature .– energy gap in solids – dielectric materials - types of polarizations – polarization calculations – polymer dielectrics – Fast ionic conductors – ionic conduction in zirconia and other systems - dipole moment – static permittivity – dielectric constant – dielectric loss – dielectric breakdown – superconductivity – semiconducting materials

UNIT V MAGNETIC ,THERMAL AND OPTICAL PROPERTIES**9**

Introduction – types of magnetic materials - Classification of dia- para -ferro- antiferro and ferri magnetic materials – magnetic semiconductors – specific heat capacity – thermal conductivity – measurement by Laser Flash and other methods - thermal expansion – Light Interaction with solids – optical properties of metals & non metals – refraction, reflection, absorption, transmission , color, opacity, translucency - applications.

TOTAL : 45 PERIODS**REFERENCES**

1. Saxena, B.S., R.C. Gupta and P.N. Saxena, Fundamentals of Solid State Physics, 1988, Pragathi Pragasan, Meerut.
2. Raghavan,V., Materials Science and Engineering, 1982, Prentice Hall India, NewDelhi.
3. Schewmon, P.G. Diffusion of Solids, 1963, McGraw- Hill Book Company, New York.
4. Bergeron, C.G., and S.H.Risbud, Introduction to Phase Equillibria in Ceramics, 1984, Am.Ceram.Soc, Inc., Westerville Ohio, USA.
5. Arzamasov, B., Materials Science, 1989, Mir Publishers, Moscow.
6. Weidmann, G., P.Lewis and N.Reid, Structural Materials, 1990, Butterworths, London.
7. William D Callister.Jr, Materials Science & Engineering, 2000, John Wiley & Sons

PM8008**FUNDAMENTALS OF MOLECULAR PATHOLOGY****L T P C****3 0 0 3****UNIT I OVERVIEW****5**

Historical perspective - discovery of microscope, Louis Pasteur’s contributions, Robert Koch’s postulates, early discoveries of microbial toxins, toxic assays, vaccines, antibiotics and birth of molecular genetics and modern molecular pathogenesis studies, Various pathogen types and modes of entry.

UNIT II HOST-DEFENSE AGAINST PATHOGENS AND PATHOGENIC STRATEGIES 8

Attributes & components of microbial pathogenesis, Host defense: skin, mucosa, cilia, secretions, physical movements, limitation of free iron, antimicrobial compounds, mechanism of killing by humoral and cellular defense mechanisms, complements, inflammation process, general disease symptoms, Pathogenic adaptations to overcome the above defenses.

UNIT III MOLECULAR PATHOGENESIS (WITH SPECIFIC EXAMPLES) 16

Virulence, virulence factors, virulence-associated factors and virulence lifestyle factors, molecular genetics and gene regulation in virulence of pathogens, Vibrio Cholerae: Cholera toxin, co-regulated pili, filamentous phage, survival E.coli pathogens: Enterotoxigenic E.coli (ETEC), labile & stable toxins, Entero- pathogenic E.coli (EPEC), type III secretion, cytoskeletal changes, intimate attachment; Enterohaemorrhagic E.coli (EHEC), mechanism of bloody diarrhoea and Hemolytic Uremic Syndrome, Enteroaggregative E.coli (EAEC). Shigella: Entry, macrophage apoptosis, induction of macropinocytosis, uptake by epithelial cells, intracellular spread, inflammatory response, tissue damage Plasmodium: Life cycle, erythrocyte stages, transport mechanism and processes to support the rapidly growing schizont, parasitiparous vacuoles, and knob protein transport, Antimalarials based on transport processes. Influenza virus: Intracellular stages, Neuraminidase & Haemagglutinin in entry, M1 & M2 proteins in assembly and disassembly, action of amantidine.

UNIT IV EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS 8

Virulence assays: adherence, invasion, cytopathic, cytotoxic effects. Criteria & tests in identifying virulence factors, attenuated mutants, molecular characterization of virulence factors, signal transduction & host responses

UNIT V MODERN APPROACHES TO CONTROL PATHOGENS 8

Classical approaches based on serotyping. Modern diagnosis based on highly conserved virulence factors, immuno & DNA-based techniques. New therapeutic strategies based on recent findings on molecular pathogenesis of a variety of pathogens, Vaccines - DNA, subunit and cocktail vaccines.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Chandrasoma, Prakrama and Clive R.Taylor "Concise Pathology", 3rd Ed., Mc Fraw-Hill, 2001.
2. Stevens, Han and James Lowe "Pathology" 2nd Ed., Moshy 2000.

REFERENCES

1. Kumar, Vinay, Abdul K. Abbas and Nelson Fausto "Robbins and Cotran Pathologic Basis of Disease" 17th Ed., Saunders, 2004.
2. Cook, D.J. "Cellular Pathology" 2nd Ed., Scion, 2006
3. Iglewski B.H and Clark V.L "Molecular basis of Bacterial Pathogenesis", Academic Press, 1990.
4. Peter Williams, Julian Ketley & George Salmond, "Methods in Microbiology : Bacterial Pathogenesis, Vol. 27", Academic Press, 1998.
5. Recent reviews in Infect. Immun., Mol. Microbiol., Biochem. J., EMBO etc
6. Nester, Anderson, Roberts, Pearsall, Nester, "Microbiology: A Human Perspective", McGraw Hill, 3rd Edition, 2001.
7. Eduardo A. Groisman, Principles of Bacterial Pathogenesis, Academic Press, 2001.

PM8009 FUNDAMENTALS OF POLYMER SCIENCE AND ENGINEERING L T P C
3 0 0 3

UNIT I BASIC CONCEPTS OF POLYMERS 9

Basic concepts of polymers – classification of polymers – organic and inorganic polymers.- classification based on occurrence, end use, thermal properties and structure. Tacticity and its determination using ¹H NMR. Crystalline and amorphous polymers – Factors affecting crystallinity and crystallisability. Effect of crystallinity on properties- Glass transition temperature and its determination.- thermal transitions- dilatometer-variation of specific volume of polymers with temperature- Factors affecting glass transition temperature.

UNIT II CHAIN POLYMERISATION 9

Kinetics and mechanism of free radical, cationic and anionic polymerization Trommsdorff's effect – chain transfer reactions and constants – living polymers – alfin catalysts — coordination polymerisation -Ziegler-Natta catalysts-iniferters -Atom transfer radical polymerization.

UNIT III STEP GROWTH POLYMERISATION 9

Kinetics of polycondensation reactions – copolymerization – co-polymer equation – copolymer compositions from ¹H-NMR, FT-IR, UV spectra and chemical methods – Monomer reactivity ratios- Mayo-Lewis and Fineman-Ross methods- significance of reactivity ratios-Sequence length–Metathetical, Group transfer, Electrochemical and Ring-opening polymerisation

UNIT IV POLYMERIZATION TECHNIQUES**6**

Polymerisation techniques– homogeneous and heterogeneous polymerisation – bulk (liquid, gas and solid monomers), solution, suspension and emulsion polymerisation –merits and demerits –interfacial, and melt polycondensation.

UNIT V MOLECULAR WEIGHT AND ITS DISTRIBUTION AND POLYMER PROPERTIES**12**

Number, weight and viscosity average molecular weights of polymers– determination of constants in Mark Houwink's equation. Poly dispersity index and molecular weight distribution – Molecular weight determination by GPC and viscometry; Polymer dissolution, thermodynamics of polymer dissolution –solubility parameter – Fractionation of polymers–fractional precipitation and fractional dissolution methods. Effect of structure on mechanical, chemical, thermal, electrical and optical properties

TOTAL : 45 PERIODS**TEXT BOOK AND REFERENCES**

1. V.R.Gowarikar, N.V.Viswanathan and Jayadev Sreedhar, Polymer Science,Wiley Eastern Limited, Madras (2006).
2. F.N. Billmayer, Text Book of polymer Science, 3rd Edn. John Wiley & Sons, New York(2002).
3. George Odian, Principles of Polymerisation, 3rd Edn, McGraw Hill Book Company, New York (2003).
4. M.S.Bhatnagar, "A Text Book of Polymers (chemistry and Technology of polymers), Vol I, II & III, 1st Edn., S.Chand and Company, New Delhi (2007).
5. R.S. Young, Introduction to Polymers, Chapman and Hall Ltd., London (1999).

PM8010 INTRODUCTION TO BIOMATERIALS AND TISSUE ENGINEERING**L T P C
3 0 0 3****UNIT I INTRODUCTION****9**

Surface Chemistry of materials, Tissue Reaction, Wound Kinetics, biocompatibility, Various Techniques used for sterilization

UNIT II TYPES OF MATERIALS AND THEIR TESTING 9

Metals, Ceramics, treated natural materials. Testing with Tissue Culture, Testing with Soft Tissues and Testing At non Thrombogenic surface

UNIT III BIOMEDICAL IMPLANTS 9

Cardiac Implants, Orthopedic Implants, Neural and Neuro Muscular Implants, Transcutaneous Implants, Intraocular lenses

UNIT IV FUNDAMENTALS OF TISSUE ENGINEERING 9

Tissue Exchange and Tissue Development, objectives of Tissue engineering, Element of Tissue development. Cell growth and differentiation, Cell and tissue mechanism, cell adhesion, cell migration, cell aggregation and tissue equivalent. Cell delivery and recirculation, Delivery molecular agents in tissue engineering, control releaser agents in time and space. cell interaction with polymer cell, cell interaction with polymer in suspension, cell interaction with gels.

UNIT V APPLICATIONS OF TISSUE ENGINEERING 9

Artificial organs, synthetic components, Replacement in Tissue structure or Functional Tissue engineering cartilage, Skin, and nerve regeneration.

TOTAL : 45 PERIODS

TEXT BOOKS

1. W. Mark Saltzman Tissue Engineering – Engineering principles for design of replacement organs and tissue — Oxford University Press inc New York 2004.
2. Larry L. Hench and Julian R.Jones, Biomaterials, Artificial organs and Tissue Engineering, 2005.
3. Bernhard O.Palsson,Sangeeta N.Bhatia, "Tissue Engineering" Pearson Publishers 2009.
4. Meyer, U.; Meyer, Th.; Handschel, J.; Wiesmann, H.P. .Fundamentals of Tissue Engineering and Regenerative Medicine.2009.

REFERENCES

1. J.H.U.Brown (Ed), Advances in Bio Medical Engineering, Academic Press 1975.
2. Andrew F.Von Racum, Hand Book of Bio Medical Evaluation, Mc-Millan Publishers, 1980.
3. Jacob Cline, Hand Book of Bio Medical Engineering, Academic Press in Sandiego, 1988.

4. Jonathan Black, Biological Performance of Materials- Fundamentals of bio compatibility, 4th Edition, CRC Press 2005.
5. Buddy D.Ratner,Allan S .Hoffman, Frederick J. Schoen, Jack E. Lemons, Biomaterial Science; An Introduction to Materials in Medicine,2nd Edition, Elsevier Academic Press,San Diego,2004.

PM8011

MOLECULAR MODELING AND DRUG DESIGN

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

OBJECTIVES

To learn, and understand the principles of ligand properties and prerequisites of computer aided ligand design; To plan and select in-silico approaches and tools; To execute effectively and analyse results of in-silico docking experiments for research in drug development

UNIT I INTRODUCTION TO THE DRUG DISCOVERY/DEVELOPMENT 9

Definition of Drug Discovery, Stages of drug discovery, Strategic Issues in drug discovery and Development, Chemistry,.ligand sources – Natural, (Plants, Animals, Microorganisms), synthetic and semi-synthetics, graphical and structure viewers, structure file formats, protein databases, validation, advantage and limitations of various models, chemiinformatic databases

UNIT II CRYSTALLOGRAPHY METHODS OF MODEL DEVELOPMENT 9

Overview of protein crystallography, protein crystals, diffraction data, electron density data, phases, judging the molecular models, other diffraction methods for model building, tools for studying macromolecules

UNIT III EMPIRICAL FORCE FIELDS MOLECULAR MECHANISMS 9

Bond Stretching-Angel Bending -Torsional terms -Out of Plane bonding motions-Electrostatic interactions- Van Der Waals interactions-Effective pair Potentials-Hydrogen Bonding-Simulation of liquid water

UNIT IV COMPUTER SIMULATION METHODS 12

Calculation of thermodynamic properties-Phase space-Practical aspects of computer simulation-Boundaries monitoring Equilibrium-Long range process-Analysing results of

simulation and estimating errors; molecular dynamics simulation methods, simulation-Constant dynamics-Time dependent properties-Molecular Dynamics at constant temperature and pressure, Monte Carlo Simulation Methods

UNIT V MOLECULAR MODELLING METHODS

6

Molecular modelling in drug discovery-Deriving and using 3D Pharma cores-Molecular docking –Structure Based methods to identify lead components-Denovo ligand design

TOTAL: 45 PERIODS

TEXT BOOKS

1. A.R.Leach, “ Molecular Modelling Principles and Applications “, Longman, 1996.
2. J.M. Haile, “ Molecular Dynamics Simulation Elementary Methods “, John Wiley and Sons, 1997.
3. Crystallography made crystal clear by Gale Rhodes

REFERENCE BOOKS

1. COOT manuals
2. CCPSi suite manuals
3. GROMOS 95 Manual, BIOMOS Switzerland, 1995.
4. HYPERCHEM Manual tpercube Canada, 1995.

PM8012

NUTRACEUTICALS

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

OBJECTIVES

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

UNIT I

INTRODUCTION AND SIGNIFICANCE

6

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

UNIT II ANALYSIS OF PHYTOCHEMICALS**11**

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

UNIT III ASSESSMENT OF ANTIOXIDANT ACTIVITY**11**

In vitro and In vivo methods for the assessment of antioxidant activity, Comparison of different In Vitro methods to evaluate the antioxidant, Prediction of the antioxidant activity of natural phenolics from electrotopological state indices, Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources

UNIT IV ROLE IN HEALTH AND DISEASE**11**

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

UNIT V SAFETY ISSUES**6**

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

TOTAL : 45 PERIODS**TEXT BOOKS**

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

REFERENCES

1. Asian Functional Foods (Nutraceutical Science and Technology) by John Shi (Editor), Fereidoon Shahidi (Editor), Chi-Tang Ho (Editor), CRC Publications, Taylor & Francis, 2007
2. Functional Foods and Nutraceuticals in Cancer Prevention by Ronald Ross Watson (Author), Blackwell Publishing, 2007
3. Marketing Nutrition: Soy, Functional Foods, Biotechnology, and Obesity by Brian Wansink (Author).
4. Functional foods: Concept to Product: Edited by G R Gibson and C M Williams, Woodhead Publ., 2000
5. Hanson, James R. "Natural Products : The Secondary Metabolites", Royal Society of Chemistry, 2003.

PM8013

PRINCIPLES OF BIOENGINEERING

L T P C
3 0 0 3

UNIT I INTRODUCTORY CONCEPTS

9

Scaling in biology: basic review of the various sizes, time, and energy scales found in biological systems from organisms to atoms **Microfabrication techniques:** extensive review of the fundamentals of microfabrication technology: photolithography, electron beam lithography, micromachining, micromolding, and soft lithography

UNIT II MICROPATTERNING NON-CONVENTIONAL MATERIALS

9

Review of self-assembled monolayers, chemical grafting of biomolecules and thin polymeric layers; approaches to patterning those materials as well as cells)

UNIT III MEMS APPLICATIONS

9

Microelectromechanical sensing of cell behavior: Introduction to bioelectricity, interaction of cells with electric fields, microphysiometer. **Microengineered biosensors:** Introduction to massively parallel measurements, implantable electrodes, microtweezers, immunosensors. **The frontiers of BioMEMS:** Nanolithography, biomimetic nanodevices. Laboratory exercises will reinforce critical concepts provided in lectures.

UNIT IV MICROFLUIDICS AND NANOFUIDICS**9**

Microengineering fluid flows: Introduction to microfluidics and Nanofluidics, properties of biological fluids in microchannels, mathematical modeling of fluid flow, Applications in Drug delivery system design

UNIT V TISSUE MICROENGINEERING AND APPLICATIONS**9**

Introduction to biomimetic substrates, microscaffolds, cellular co-cultures Microfabrication techniques that enable the control of cell-substrate, cell-cell, and cell-medium interactions, Introduction to enzymatic assays, DNA microarrays, optical detection methods amenable to miniaturization. Applications in controlled and targeted drug delivery

TOTAL : 45 PERIODS**TEXT BOOK AND REFERENCES**

1. Robert P. Lanza, Robert Langer Joseph, Vacanti, "Principles of Tissue Engineering" Second Edition
2. Ferrari, Mauro (eds) BioMEMS and Biomedical Nanotechnology Volume I
3. Steven S. Saliterman, Fundamentals of BioMEMS and Medical Microdevices

PM8014**VACCINE TECHNOLOGY****L T P C
3 0 0 3****AIM**

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

UNIT I IMMUNOLOGICAL CONCEPTS IN VACCINOLOGY**9**

Short history of vaccination, requirements for induction of immunity, Epitopes, linear and conformational epitopes, characterisation and location of APC, MHC and immunogenicity, Rationale vaccine design based on clinical requirements: Hypersensitivity, Immunity to Infection, Autoimmunity, Transplantation, Tumor immunology, immunodeficiency, mechanism of adjuvant action, Scope of future vaccine strategies

UNIT II CLASSIFICATION OF VACCINES AND ITS PREPARATIONS

10

Active and passive immunization; Viral/bacterial/parasite vaccine differences, methods of vaccine preparation – Live, killed, attenuated, sub unit vaccines; Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein based vaccines, plant-based vaccines, edible vaccines, reverse vaccinology, combination vaccines, therapeutic vaccines; Peptide vaccines, conjugate vaccines; Antibody genes and antibody engineering- chimeric and hybrid monoclonal antibodies; Catalytic antibodies and generation of immunoglobulin gene libraries, Transfusion of immuno-competent cells; Cell based vaccines

UNIT III VACCINE RESEARCH AND DESIGN

9

Fundamental research to rational vaccine design , Antigen identification and delivery , T-Cell expression cloning for identification of vaccine targets for intracellular pathogens , Fundamentals of Immune recognition , implications for manipulating the T-Cell repertoire , Targetting Dendritic cells ; a rational approach for Vaccine development , Cellular basis of T- Cell memory , Rational design of new vectors , CpG adjuvant activity , Transcutaneous immunisation , Vaccination studies and recent advances in Malaria, Tuberculosis , HIV

UNIT IV COMPUTATIONAL TOOLS FOR VACCINE DESIGN

8

Antigen Sequence analysis, Epitope Mapping, Predictions of Immunogenic peptides of T-Cell and B-Cells. Prediction of HLA binding peptides, Comparitive Genomics as a tool for vaccine design, introduction to online epiptope databases

UNIT V ANIMAL TESTING, COMMERCIALISATION, QUALITY CONTROL

9

Quality control and regulations in vaccine research, In-vitro experimental validations for predictions of vaccines by software , Animal testing , Rational design to clinical trials ,Large scale production , Commercialisation , ethics.

TOTAL : 45 PERIODS

TEXTBOOKS

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.
4. Lydyard, P.M. “Instant Notes in Immunology”, Viva Books Pvt. Ltd., 2000.

REFERENCES

1. S. Hockfield, S. Carlson, C. Evans, P. Levitt, J. Pintar, L. Silberstein, Selected Methods for Antibody and Nucleic Acid probes, Volume1, Cold Spring Harbor Ed Harlow, David Lane, Antibodies Laboratory Manual, Cold Spring Harbor, Laboratory Press, 1988 Laboratory Press,1993.
2. Coico, R. etal., "Immunology : A Short Course", 5th Edition, Wiley – Liss, 2003.
3. Parham, Peter "The Immune System", 2nd Edition, Garland Science, 2005.
4. Abbas, A.K. etal., "The Cellular and Molecular Immunology", 6th Edition, Sanders / Elsevier, 2007.
5. Weir, D.M. and Stewart, John "Immunology", 8th Edition, Churchill Pvt. Ltd., 2000.

GE8071

FUNDAMENTALS OF NANO SCIENCE

L T P C
3 0 0 3

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 charecterisation of surfaces & Interfaces, Second edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

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

CH8651 PROCESS INSTRUMENTATION DYNAMICS AND CONTROL

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

AIM

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

OBJECTIVE

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

UNIT I INSTRUMENTATION

6

Principles of measurements and classification of process instruments, measurement of

temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity, pH, concentration, electrical and thermal conductivity, humidity of gases.

UNIT II OPEN LOOP SYSTEMS

11

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

UNIT III CLOSED LOOP SYSTEMS

10

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

UNIT IV FREQUENCY RESPONSE

9

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

UNIT V ADVANCED CONTROL SYSTEMS

9

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. Stephanopoulos, G., "Chemical Process Control", Prentice Hall of India, 2003.
2. Coughnour, D., "Process Systems Analysis and Control", 2nd Edn., McGraw Hill, New York, 1991.

REFERENCES

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

UNIT I FUNCTIONAL TARGETS 9

Modification of Amino Acids, Peptides and Proteins – Modification of sugars, polysaccharides and glycoconjugates – modification of nucleic acids and oligonucleotides.

UNIT II CHEMISTRY OF ACTIVE GROUPS 9

Amine reactive chemical reactions – Thiol reactive chemical reactions – carboxylate reactive chemical reactions – hydroxyl reactive chemical reactions – aldehyde and ketone reactive chemical reactions – Photoreactive chemical reactions.

UNIT III BIOCONJUGATE REAGENTS 9

Zero length cross linkers – Homobifunctional cross linkers – Heterobifunctional cross linkers – Trifunctional cross linkers – Cleavable reagent systems – tags and probes.

UNIT IV ENZYME AND NUCLEIC ACID MODIFICATION AND CONJUGATION 9

Properties of common enzymes – Activated enzymes for conjugation – biotinylated enzymes – chemical modification of nucleic acids – biotin labeling of DNA- enzyme conjugation to DNA – Fluorescent of DNA.

UNIT V BIOCONJUGATE APPLICATIONS 9

Preparation of Hapten-carrier Immunogen conjugates - antibody modification and conjugation – immunotoxin conjugation techniques – liposome conjugated and derivatives- Colloidal – gold-labeled proteins – modification with synthetic polymers.

TOTAL: 45 PERIODS

TEXT BOOK AND REFERENCE

1. Bioconjugate Techniques , G.T. Hermanson, Academic Press, 1999

UNIT I OPTICAL ROTATORY DISPERSION 5

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

UNIT II NUCLEAR MAGNETIC RESONANCE 10

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

UNIT III MASS SPECTROMETRY 10

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

UNIT IV X-RAY DIFFRACTION 10

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

UNIT V SPECIAL TOPICS AND APPLICATIONS 10

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

TOTAL: 45 PERIODS

TEXT BOOK

1. Banwell, Colin N. and E.M. McCash. "Fundamentals of Molecular Spectroscopy" 4th Edition, Tata McGraw-Hill, 1994.
2. Aruldas, G. "Molecular Structure and Spectroscopy". 2nd Edition, Prentice Hall of India, 2007.

- Pavia, D.L., G.M. Lampman and G.S. Kriz. "Introduction to Spectroscopy:" 3rd Edition, Thomson, Brooks/ Cole, 2001.
- Williams, Dudley H. and Ian Fleming. "Spectroscopic Methods in Organic Chemistry". 5th Edition, Tata McGraw-Hill, 1995.

REFERENCES

- Siuzdak, Gary. "Mass Spectrometry for Biotechnology ". Academic Press / Elsevier, 1996.
- Hammes, Gordon G. "Spectroscopy for the Biological Sciences". John Wiley, 2005.
- Campbell I.D and Dwek R.A., " Biological Spectroscopy ", Benjamin Cummins and Company, 1986.
- Atkins P.W., "Physical Chemistry ", Oxford IV Edition, 1990.

IB8551 PROTEIN STRUCTURE, FUNCTION AND PROTEOMICS L T P C 3 1 0 4

UNIT I BONDS, ENERGIES, BUILDING BLOCKS OF PROTEINS 12

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. 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).

UNIT II 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.

UNIT III TERTIARY STRUCTURE 12

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

12

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 PROTEOMICS

12

Introduction to the concept of proteome, components of proteomics, proteomic analysis, importance of proteomics in biological functions, protein-protein interactions and methods to study it: protein arrays, cross linking methods, affinity methods, yeast hybrid systems and protein arrays.

TOTAL : 60 PERIODS

TEXTBOOKS

1. Voet D. and Voet G., Biochemistry, Third edn. John Wiley and Sons, 2001
2. Branden C. and Tooze J., Introduction to Protein Structured, Second Edition, Garland Publishing, NY, USA, 1999
3. Creighton T.E. Proteins, Freeman WH, Second Edition, 1993
4. Moody P.C.E. and Wilkinson A.J. Protein Engineering, IRL Press, Oxford, UK,1990.

REFERENCES

1. Voet D. and Voet G., Biochemistry, Third edn. John Wiley and Sons, 2001
2. Branden C. and Tooze J., Introduction to Protein Structured, Second Edition, Garland Publishing, NY, USA, 1999
3. Creighton T.E. Proteins, Freeman WH, Second Edition, 1993
4. Moody P.C.E. and Wilkinson A.J. Protein Engineering, IRL Press, Oxford, UK, 1990.

IB8751

BIOINFORMATICS AND COMPUTATIONAL BIOLOGY

LT P C

3 0 0 3

UNIT I

9

Introduction to Operating systems, Linux commands, File transfer protocols ftp and telnet, Introduction to Bioinformatics and Computational Biology, Biological sequences, Biological

databases, Genome specific databases, Data file formats, Data life cycle, Database management system models, Basics of Structured Query Language (SQL).

UNIT II **9**

Sequence Analysis, Pairwise alignment, Dynamic programming algorithms for computing edit distance, string similarity, shotgun DNA sequencing, end space free alignment. Multiple sequence alignment, Algorithms for Multiple sequence alignment, Generating motifs and profiles, Local and Global alignment, Needleman and Wunsch algorithm, Smith Waterman algorithm, BLAST, PSIBLAST and PHIBLAST algorithms.

UNIT III **8**

Introduction to phylogenetics, Distance based trees UPGMA trees, Molecular clock theory, Ultrametric trees, Parsimonious trees, Neighbour joining trees, trees based on morphological traits, Bootstrapping. Protein Secondary structure and tertiary structure prediction methods, Homology modeling, abinitio approaches, Threading, Critical Assessment of Structure Prediction, Structural genomics.

UNIT IV **11**

Machine learning techniques: Artificial Neural Networks in protein secondary structure prediction, Hidden Markov Models for gene finding, Decision trees, Support Vector Machines. Introduction to Systems Biology and Synthetic Biology, Microarray analysis, DNA computing, Bioinformatics approaches for drug discovery, Applications of informatics techniques in genomics and proteomics: Assembling the genome, STS content mapping for clone contigs, Functional annotation, Peptide mass fingerprinting.

UNIT V **8**

Basics of PERL programming for Bioinformatics: Datatypes: scalars and collections, operators, Program control flow constructs, Library Functions: String specific functions, User defined functions, File handling.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Introduction to Bioinformatics by Arthur K. Lesk , Oxford University Press.
2. Algorithms on Strings, Trees and Sequences by Dan Gusfield, Cambridge University Press.

3. Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by R.Durbin, S.Eddy, A.Krogh, G.Mitchison.
4. Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press.
5. Beginning Perl for Bioinformatics: An introduction to Perl for Biologists by James Tindall, O'Reilley Media

REFERENCE BOOKS

1. Bioinformatics The Machine Learning Approach by Pierre Baldi and Soren Brunak, MIT Press.

IB8752

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 SEPARATION

6

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

UNIT III ISOLATION OF PRODUCTS

12

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

UNIT IV PRODUCT PURIFICATION

12

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

UNIT V FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS

5

Crystallization, drying and lyophilization in final product formulation.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Belter, P.A., Clussler, E.L. "Bioseparation – Downstream Processing & Biotechnology". John – Wiley Interscience, 1998.
2. Asenjo, Juan A. "Separation Processes in Biotechnology". Taylor & Francis / CRC, 1990.
3. Scopes, R.K. "Protein Purification : Principles and Practice". Narosa Publication, 1994.

REFERENCES

1. Ghosh, Raja "Principles of Bioseparations Engineering". World Scientific, 2006.
2. "Product Recovery in Bioprocess Technology". (BIOTOL – Biotechnology by Open Learning Series). Butterworth – Heinmann / Elsevier, 2004.

IB8754

METABOLIC ENGINEERING

L T P C
3 0 0 3

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. Metabolic Engineering: Principles and Methodologies Gregory N. Stephanopoulos , Aristos A. Aristidou, Jens Nielsen, Academic Press 1998
2. Metabolic Engineering Sang Yup Lee E. Terry Papoutsakis Marcel Dekker.inc 1998
3. Nielsen J and Villadsen J. (1994) Bioreaction Engineering Principles. New york:Plenum Press

REFERENCES

1. Computational Analysis of Biochemical Systems: A Practical Guide for Biochemists and Molecular Biologists by Eberhard O. Voit Cambridge University Press 2000 Applications of Plant Metabolic Engineering. R. Verpoorte, A. W. Alfermann and T. S.
2. Johnson (eds). Springer, P.O. Box 17, 3300 AA Dordrecht, The Netherlands. 2007.
3. Systems Modeling in Cellular Biology: From Concepts to Nuts and Bolts Edited by Zoltan Szallasi, Jorg Stelling and Vipul Periwal MIT Press Cambridge 2006

