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**TOTAL NO. OF CREDITS : 177**
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.

OUTCOME

• Learners should be able to speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
• Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range.

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
REFERENCE BOOKS

EXTENSIVE READERS

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
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.

OUTCOME

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

UNIT I MATRICES

UNIT II  INFINITE SERIES


UNIT III  FUNCTIONS OF SEVERAL VARIABLES


UNIT IV  IMPROPER INTEGRALS


UNIT V  MULTIPLE INTEGRALS


Total: 60 Periods

TEXT BOOKS

REFERENCES

PH8151 ENGINEERING PHYSICS
(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.

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

UNIT I PROPERTIES OF MATTER
UNIT II  ACOUSTICS AND ULTRASONICS  

UNIT III  THERMAL PHYSICS  

UNIT IV  APPLIED OPTICS  

UNIT V  SOLID STATE PHYSICS  
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

REFERENCE BOOKS

CY8151 ENGINEERING CHEMISTRY (Common to all branches of Engineering and Technology) L T P C 3 0 0 3

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

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

UNIT I CHEMICAL THERMODYNAMICS
Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; 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
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: Tg, Tacticity, Molecular weight – weight average, number average, and polydispersity index. Techniques of polymerisation: Bulk, emulsion, solution and suspension.
UNIT III KINETICS AND CATALYSIS


UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY


UNIT V NANO CHEMISTRY


TOTAL : 45 PERIODS

TEXT BOOKS

OBJECTIVE

- To provide an awareness to Computing and Programming
- To enable the student to learn the major components of a computer system
- To know the correct and efficient ways of solving problems

OUTCOME

At the end of the course, the student will be able to:

- Design C Programs for problems.
- Write and execute C programs for simple applications.

UNIT I  INTRODUCTION


UNIT II C PROGRAMMING BASICS


UNIT III ARRAYS AND STRINGS


UNIT IV FUNCTIONS AND POINTERS

UNIT V STRUCTURES AND UNIONS

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

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

GE8152 ENGINEERING GRAPHICS L T P C
2 0 3 4

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

OUTCOME
On Completion of the course the student will be able to
• perform free hand sketching of basic geometrical constructions and multiple views of objects, orthographic projection of lines and plane surfaces.
• draw projections and solids and development of surfaces.
• prepare isometric and perspective sections of simple solids.
• demonstrate computer aided drafting.
CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)

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


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

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

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

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

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)

Introduction to drafting packages and demonstration of their use.

TOTAL : 75 PERIODS

TEXT BOOKS


REFERENCES


PUBLICATION OF BUREAU OF INDIAN STANDARDS:

• IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Method

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
(common to all branches of B.E./B.Tech. Programmes) 0 0 2 1

OBJECTIVE
To make the students understand and get hands-on in the basic concepts of practical Physics.

OUTCOME
Familiarizes the basic concept in experiments and provide strong platform to apply hands-on experience gained here for experimenting higher level concepts.

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

CY8161  CHEMISTRY LABORATORY  L T P C
(Common to all branches of Engineering and Technology)  0 0 2 1

OBJECTIVE
To provide hands-on experience in using PH meter, potentiometry, titration methods and estimating the strength of given solutions.

OUTCOME
Ability to perform all kinds of titrations and estimate the unknown chemical samples.

1. Estimation of HCl using Na₂CO₃ 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.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL : 30 PERIODS

REFERENCE BOOKS

OBJECTIVE
• To enable the student to learn and use the major components of a computer system
• To make the students write programs and solve problems
• To learn to use office automation tools

OUTCOME
At the end of the lab session student will be able to use MS office and generate data, solve simple problems with C-Programming Language.
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

GE8162 ENGINEERING PRACTICES LABORATORY L T P C 0 0 3 2

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

OUTCOME:
• ability to fabricate carpentry components and pipe connections including plumbing works.
• ability to use welding equipments to join the structures.
• ability to fabricate electrical and electronics circuits

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 – outlet.
• 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 Tenon joint, Dovetail joint.

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

2. **ELECTRICAL ENGINEERING PRACTICE**

• 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)**

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

• 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

OUTCOME

Learners will be able to

• Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
• Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
• Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
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

REFERENCE BOOKS

**Extensive Readers**

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

**MA8251 MATHEMATICS II L T P C**
(Common to all branches of B.E. / B.Tech. Programmes in II Semester) 3 1 0 4

**OBJECTIVES**
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.
OUTCOME
The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

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
\[ w = z + c, \quad az, \quad \frac{1}{z}, \quad z^2 \] - Bilinear transformation.

UNIT IV    COMPLEX INTEGRATION  9+3


UNIT V    LAPLACE TRANSFORMS  9+3


Total : 60 Periods
TEXT BOOKS

REFERENCES

PH8255 PHYSICS OF MATERIALS
L T P C 3 0 0 3
(Common to Chemical, Ceramic, Food, Leather, Industrial Biotechnology and Pharmaceutical)

OBJECTIVE
To learn the basic physics concepts involved in different materials like conducting, superconducting, insulating, magnetic materials.

OUTCOME
The course helps the students to get an in depth idea of properties of materials.

UNIT I  PREPARATION AND PROCESSING OF MATERIALS 9
UNIT II PROPERTIES OF CONDUCTING AND SUPER CONDUCTING MATERIALS


UNIT III ELECTRONIC MATERIALS

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


UNIT V CERAMIC AND NEW MATERIALS


TOTAL : 45 PERIODS
REFERENCES

GE8251 ENGINEERING MECHANICS

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

OUTCOME
• ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
• ability to analyse the forces in any structures.
• ability to solve rigid body subjected to dynamic forces

UNIT I BASICS AND STATICS OF PARTICLES
9 + 3

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  


UNIT IV  DYNAMICS OF PARTICLES  


UNIT V  FRICITION AND ELEMENTS OF RIGID BODY DYNAMICS  

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

REFERENCES

PM8206 FUNDAMENTALS OF HUMAN ANATOMY AND PHYSIOLOGY L T P C
3 0 0 3

OBJECTIVE
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

OUTCOME
Student will gain knowledge in the organization and systems of human body, their role in life development.

UNIT I FOUNDATIONS OF PHYSIOLOGY, HOMEOSTASIS
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

REFERENCES

PM8256 FOOD AND PHARMACEUTICAL BIOCHEMISTRY L T P C 3 0 0 3

OBJECTIVE
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.

OUTCOME
Student learns the scientific basis of life processes, function of biomolecules and biochemistry concept of clinical diseases.

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


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

REFERENCES
5. Textbook of Biochemistry by Deb.

PM8211 EXPERIMENTAL PHYSIOLOGY LABORATORY L T P C
0 0 4 2

OBJECTIVE
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

OUTCOME
Hands-on experience in microscopic analysis of tissues, estimation of blood cells, identifying anatomic features in study models.

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. Pipette aids
3. Haemocytometer
4. B.P. meter

TEXT BOOKS
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”.
5. Human Physiology by C.C. Chatterjee.
7. Textbook of Preventive and Social Medicine by J.E. Park and K. Park
OBJECTIVE
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.

OUTCOME
Experience in estimating qualitatively and quantitatively proteins, lipids, carbohydrates and metabolites. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs. Therapeutic and diagnostic applications of enzymes.

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

MA8356 PROBABILITY AND STATISTICS

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.

OUTCOME
Students acquire knowledge in fundamental probability and statistical Techniques, notion of sampling distributions and statistical techniques used in engineering and management problems.

UNIT I RANDOM VARIABLES
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


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 (X̄ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVE

- To introduce students to the principles of Microbiology to emphasize structure and biochemical aspects of various microbes.
- To provide to the students the fundamentals of Microbiology and solve the problems in microbial infection and their control.

OUTCOME

The student will have idea in clinical and environmental applications of Microbiology with special reference to Pharmaceutical Industries and understanding of microorganisms and the role they play in health and disease.

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

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

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


REFERENCES

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

OUTCOME
At the end of the subject student will have a thorough knowledge in limit tests of impurities in Pharmaceutical substances, preparation of pharmaceutical aids, importance of inorganic gases and inorganic compounds.

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**

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

**UNIT V PHARMACEUTICAL AIDS AND CO-ORDINATION COMPOUNDS**

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 sulphoxylate, 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**

REFERENCES
2. Bentley and Driver’s Textbook of Pharmaceutical Chemistry.
7. Indian Pharmacopoeia 1996.

PM8303 PHARMACEUTICAL CHEMISTRY II L T P C
3 0 0 3

OBJECTIVE
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.

OUTCOME
Detailed insight about classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compound, mechanisms and orientation of reactions.

UNIT I STRUCTURE, PROPERTIES AND STEREOCHEMISTRY
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, gammaxene, 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
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

PM8304 PHARMACOLOGY I L T P C 3 0 0 3

OBJECTIVE
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

OUTCOME
Student understands what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the complete information about the drugs like sources, physico chemical properties, mechanism of action, physiological and biochemical effects (Pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.
UNIT I  INTRODUCTION TO PHARMACOLOGY  9

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 – Antipsychotics, antidepressants, neuroleptics, anti-maniacs and hallucinogens, thymoleptics, antiepileptic 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
REFERENCES
2. Goodman and Gilman’s, The Pharmacological basis of therapeutics.

PM8351 FUNDAMENTALS OF CHEMICAL ENGINEERING

OBJECTIVES
• To understand the principles of Process calculations.
• To understand principles of fluid mechanics and its application.
• To perform calculations pertaining to processes and operations.
• To apply fluid mechanics principles to applied problems.

OUTCOME
Student understands the principles of Process calculations, understand principles of fluid mechanics and its application.

UNIT I BASIC PRINCIPLES OF STOICHIOMETRY
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
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
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


UNIT V   AGITATION FLOW THROUGH PACKINGS, FLUIDZATION, FLUID TRANSPORT


TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVE
This lab course has been designed to provide the basic knowledge to the students in various microbiological practices.

OUTCOME
Students will be familiar with various aseptic techniques and sterilization methods.

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:
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

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Autocalve</td>
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<td>Hot Air Oven</td>
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<td>Incubators</td>
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<tr>
<td>Light Microscopes</td>
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<tr>
<td>Colorimeter</td>
<td>2</td>
</tr>
<tr>
<td>Lamina Flow Chamber</td>
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<tr>
<td>Glassware, Chemicals, Media</td>
<td>as required</td>
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</table>
TEXT BOOKS

PM8312 PHARMACOLOGY LABORATORY L T P C 0 0 4 2

OBJECTIVE
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.

OUTCOME
Students will be familiar with various animal handling techniques and to study the pharmacological effects in different organ system of the body.

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

**REFERENCES**
1. The Pharmacological basis of therapeutics – Goodman and Gilman’s.
7. Pharmacological experiments on intact preparations by Churchill Livingstone.
OBJECTIVE
Basic understanding of what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

OUTCOME
Student will obtain knowledge on the following after completing the course.
• Public awareness of environmental is at infant stage.
• Ignorance and incomplete knowledge has lead to misconceptions
• Development and improvement in std. of living has lead to serious environmental Disasters.

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

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

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

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V HUMAN POPULATION AND THE ENVIRONMENT


TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

IB8451 ANALYTICAL METHODS AND INSTRUMENTATION

OBJECTIVE
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.
OUTCOME
The student will be able to

• Understand the various techniques in the field of Pharmaceutical Analysis.
• Choose proper analytical method for qualitative and quantification of the pharmaceutical substances.

UNIT I INTRODUCTION, PHYSICAL METHODS, GRAVIMETRY

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

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

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

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

Thin Layer Chromatography TLC, Rf, 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

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

OUTCOME
Student understand the chemistry of drugs with respect to their pharmacological activity, understand the drug metabolic pathways, adverse effect and therapeutic value of drugs, know the Structural Activity Relationship of different class of drugs, write the chemical synthesis of some drugs.

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, physiochemical 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
OBJECTIVE
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.

OUTCOME
Student learns the mechanism of drug action and its relevance in the treatment of different diseases, comprehend the principles of toxicology and treatment of various poisonings, locate and isolate different organs/tissues from the laboratory animals used in pharmacological experiments, demonstrate the various receptor actions using isolated tissue preparation.

UNIT I PHARMACOLOGY OF GASTROINTESTINAL TRACT AND ENDOCRINE SYSTEM 12

UNIT II CHEMOTHERAPY 12
General principles of chemotherapy, Sulfonamides, Antibiotics – Penicillins, Cephalosporins, Chloramphenicol, macrolides, Quinolones, fluoroquinolones 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, Cholecystokin in, 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

REFERENCES
2. Goodman and Gilman’s, The Pharmacological basis of therapeutics.
4. B. Lammer, Chronopharmacology
OBJECTIVE
The course deals with the various physical, physicochemical properties and principle involved in dosage forms, formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development and stability studies of pharmaceuticals.

OUTCOME
Upon the completion of the course student shall be able to
- Understand various physicochemical properties of drug molecules in the designing the dosage form
- Know the principles of chemical kinetics & to use them in assigning expiry date for formulation.
- Appreciate physicochemical properties of drug molecules in formulation research and development.

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


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

REFERENCE BOOKS
2. Remington, the science and practice of pharmacy, 21st Edition, Lippincott Williams and Wilkins
OBJECTIVE
To know in detail the basic engineering principles and unit operations pertaining to pharmaceutical plants.

OUTCOME
Upon completion of the course student shall be able
- to know various unit operations used in Pharmaceutical Industries.
- to understand the material handling techniques.
- to perform various processes involved in pharmaceutical manufacturing process.
- to appreciate and comprehend significance of plant lay out design for optimum use of resources.

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

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.

UNIT V  EVAPORATION, DISTILLATION AND DRYING IN PHARMA PLANTS

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


REFERENCES

1. Introduction to Chemical Engineering by Walter J. Badger.
2. Cooper and Gunn’s Tutorial Pharmacy, S.J. Carter.
OBJECTIVE
This lab course is designed to impart good knowledge in various analytical techniques in pharmaceutical industry

OUTCOME
Students will be familiar with various titration and analytical methods used in pharmaceutical Industry.

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

OUTCOME
Students will be trained in the study of various rheological and kinetic parameters of various dispersion 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.
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.

FT8551 BIOCHEMICAL ENGINEERING L T P C
3 0 0 3

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.

OUTCOME

The student will be able to
• Understand the fundamentals of Enzyme kinetics, Inhibition kinetics and Immobilization
• Understand the concept of basic fermentation processes and its application during scale up operations.

UNIT I

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

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

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


UNIT V

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

REFERENCES

PM8501 MEDICINAL CHEMISTRY II L T P C 3 0 0 3

OBJECTIVE
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, physiochemical properties and synthesis of medicinal agents.

OUTCOME
The student will be able to
- Understand the molecular basis, biochemical, physiochemical properties and synthesis of medicinal agents.
- Understand the mechanism of action, structure activity relationship including stereochemical aspects of the medicinal agents acting on various physiological systems

UNIT I PRINCIPLES OF DRUG DESIGN
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.

76
UNIT II MEDICINAL CHEMISTRY OF ANTI-INFECTIVE AGENTS

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 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

Chemistry and nomenclature, structure 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 antimetabolites, DNA alkylating agents, antibiotic anticancer agents, hormonal anticancer agents, antitubulin inhibitors.

UNIT IV MEDICINAL CHEMISTRY OF DRUGS ACTING ON CVS

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 anti-anginal, vasodilators, calcium channel blockers, cardiac glycosides, anti-arrhythmic drugs, anti-hypertensive agents, anti-hyperlipidemic agents, antiplatelet inhibitors, anti-coagulants and anti-thrombolytics.

UNIT V MEDICINAL CHEMISTRY OF HORMONES, STEROIDS AND RELATED DRUGS

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, oesterogens, 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
OBJECTIVE
To provide the concept of the pharmaceutical industrial manufacturing practices, quality attributes of pharmacy products and patenting activities.

OUTCOME
The student will
- Familiarise with the pharmaceutical industrial manufacturing practices, quality attributes of pharmacy products, patenting activities, etc.,
- Understand the various quality guidelines of pharmaceutical products, patenting activities and the significance of its documentation.

UNIT I REGULATORY ASPECTS
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
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

What are patents, know-how, copyright, trademark, service mark, design, Conditions for patentibility; 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

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;

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

TEXTBOOKS

REFERENCES


PM8551  CELL AND MOLECULAR BIOLOGY  L T P C
4 0 0 4

OBJECTIVES:

- To provide the molecular processes of DNA replication, transcription and translation in cells.
- To provide the basic concepts of protein and nucleic acid structure and its function in both prokaryotic and eukaryotic organisms.

OUTCOMES:
The student will be able to

- Understand the various levels of gene regulation and protein function including signal transduction and cell cycle control.
- Interpret the outcome of experiments that involve the use of recombinant DNA technology and other common gene analysis techniques.
- Relate properties of cancerous cells to mutational changes in gene function.

UNIT I   CELL STRUCTURE AND FUNCTION OF THE ORGANELLES  12


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  


UNIT IV  TRANSCRIPTION  


UNIT V  TRANSLATION  


TOTAL : 60 PERIODS

TEXT BOOKS 

REFERENCES


PM8511 ADVANCED MEDICINAL CHEMISTRY LABORATORY

OBJECTIVE

To study the pharmacopoeial standards of various medicinal agents such as assays and their spectral analysis.

OUTCOME

Students will be able to experimentally analyse the qualitative and quantitative parameters of various drug agents.

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.
7. Establishing the Pharmacopoeial standards of the Anti-Hypertensive drugs 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**

**REFERENCE BOOKS**
3. Indian Pharmacopoeia
OBJECTIVE
To enable the students to understand the concepts and operation of equipment in handling of enzymes and cultivation of microbes on industrial scale.
- To sterilize the bioreactor
- To operate the bioreactor
- To design experiments to evaluate the performance of the bioreactor
- To develop enzyme immobilized processes.

OUTCOME
Students will be able to design batch sterilization, optimize media, estimating biomass and calculate bioreactor parameters

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

TOTAL: 60 PERIODS
REFERENCES


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

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

OUTCOME

The student would be able to apply the tools and techniques of quality management to manufacturing and services processes
UNIT I  INTRODUCTION  


UNIT II  TQM PRINCIPLES  

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  


UNIT IV  TQM TOOLS & TECHNIQUES II  


UNIT V  QUALITY SYSTEMS  


TOTAL : 45 PERIODS

TEXT BOOK

REFERENCE BOOKS

IB8651 CREATIVITY, INNOVATION AND NEW PRODUCT DEVELOPMENT

OBJECTIVES
To impart the knowledge of various aspects of Creativity, Innovation and New Product Development. To study the various issues related to Creativity, Innovation and New Product Development.

OUTCOME:
On completion of the course, students will have gained knowledge on various issues related to Patents, Quality, Creativity, Innovation, New Product Development, Planning and Evaluation

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

UNIT II PROJECT SELECTION AND EVALUATION
Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques)
UNIT III   NEW PRODUCT DEVELOPMENT  9

UNIT IV   NEW PRODUCT PLANNING  9
Design of prototype - 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

REFERENCES
OBJECTIVE

• To enable the student to know about genetic engineering and pharmacogenomics principles and application in human genome associated diseases.
• To provide the knowledge about the influence of genetic variation on drug response.

OUTCOME

The student will be able to

• Understand the influence of genetic variation on drug response in patients by correlating gene expression or single-nucleotide polymorphisms with a drug's efficacy or toxicity.
• Achieve an overview of advanced principles and techniques of human genetic engineering.

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

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.

UNIT V  PHARMACOGENOMICS AND DRUG DESIGN WITH CASE STUDIES

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


REFERENCES

OBJECTIVE
To provide the concepts of various parameters involved in the formulation and development of various dosage forms.

OUTCOME
The student will be able to
- Understand the factors influencing the development of various dosage forms.
- Understand the formulation concepts and evaluate different dosage forms to meet the compendial requirements.

UNIT I  PREFORMULATION STUDIES
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 III LIQUIDS AND SEMI – SOLID DOSAGE FORMS
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

REFERENCES
4. Remington’s Pharmaceutical Sciences (RPS).
5. Modern Pharmaceutics by Banker and Gilberts.
6. Theory and Practice of Industrial Pharmacy by Lachman.

HS8561 EMPLOYABILITY SKILLS L T P C
(Lab / Practical Course) 0 0 2 1
(Common to all branches of Fifth or Sixth Semester B.E / B.Tech programmes)

OBJECTIVE
• 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

OUTCOME
At the end of the course learners should be able to
• Participate in conversations both formal and informal, attend phone calls and interviews successfully.
• Read different types of texts.
• Listen to, and understand foreign accents.

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

EXTENSIVE READERS

WEB RESOURCES
1. www.humanresources.about.com
2. www.careerride.com
OBJECTIVE
To make the techniques like plasmid isolation, total DNA isolation, restriction, elution, Transformation, induction of protein expression familiar

OUTCOME
Student will be experienced in handling electrophoresis, recombinant protein expression and screening techniques

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.
5. Elution of DNA from Agarose gels.
6. Polymerase Chain Reaction [PCR].
7. Ligation of DNA into expression vector.
9. Induction of recombinant protein expression
10. SDS-PAGE.
11. Western blotting.

TOTAL : 60 PERIODS

REFERENCES
OBJECTIVE:
To study, the basic principles in formulating liquid, semisolid, solid and parenteral dosage forms and their evaluations.

OUTCOMES:
• Acquire knowledge to prepare and evaluate various liquid, semi solid, solid dosage forms.
• Application of the knowledge to formulate new dosage forms.

LIST OF EXPERIMENTS
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.
4. Remington’s Pharmaceutical Sciences (RPS).
5. Modern Pharmacaceutics by Banker and Gilberts.
6. Theory and Practice of Industrial Pharmacy by Lachman.
8. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi.
OBJECTIVE

This course exposes students to the basic principles of immunology and the principles to understand the cause of immunological disease and the basis of various immune disorders.

OUTCOME

The student will be expected to understand basic immunological concepts and to apply this knowledge to study the integration of the various components of the immune system.

UNIT I INTRODUCTION

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

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

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  TRANSPANTATION 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

REFERENCES
OBJECTIVE

- Understand the properties of polymer and its significance in drug delivery systems.
- Interpret physicochemical properties of the drug with the drug delivery system modules.

OUTCOME

The student will be able to

- Understand the properties and importance of polymer in novel drug delivery systems.
- Understand the application of polymer in sustained release, topical and targeted drug delivery systems.
- Apply the concepts of newer method of drug delivery systems involved in the pharmaceutical sciences and relevance of their drug delivery strategies.

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

TOTAL: 45 PERIODS

TEXT BOOKS

PM8702 PHARMACOGNOSY L T P C 3 0 0 3

OBJECTIVE
Study about the general pharmacognosy and drug containing various active substances, classify, identify and understand the medicinal compounds derived from plant sources and relate to therapeutic applications

OUTCOME
The student will be able to understand
- Various sources of natural drugs.
- Classification and identification of drugs of natural origin and detection of its adulterant.
- Plant derived important constituents and its therapeutic uses

UNIT I
Definition, history, scope and development of pharmacognosy. Sources and Classification of drugs: Biological, marine, geographical and plant tissue cultures as sources of drugs.

UNIT II

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

UNIT III

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

UNIT V

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

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

PM8711 ADVANCED DRUG DELIVERY SYSTEMS LABORATORY

OBJECTIVE
Understand and analyse the factors influencing the formulation of novel drug delivery Systems, choose right choice of excipients for the right delivery systems, characterize and interpret the results of marketed products.

OUTCOME
On successful completion students able to
- Comprehend various classes of excipients involved in formulation of novel drug delivery systems.
- Formulate and evaluate appropriate novel drug delivery formulations in a practical setting in response to defined criteria.
- Perform various quality control tests for the marketed products.
LIST OF EXPERIMENTS

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

TOTAL: 60 PERIODS

EQUIPMENTS REQUIRED

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

REFERENCES

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
OBJECTIVE

The lab course is to teach the main concepts, definitions, terminology in pharmacognosy and to study the pharmacognostical features of various medicinally important plants.

OUTCOME

The students will be familiar with pharmacognostical terminology, medicinal and photochemical importance of various plants.

LIST OF EXPERIMENTS

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 from Andrographis or suitable preparation depending upon material and apparatus availability

TOTAL: 60 PERIODS

Equipments Required

Microscope

REFERENCES

OBJECTIVE

• To teach important parameters involved in drug disposition and its principles in living systems.
• To make the students to understand how the drug disposition takes place in the *invitro* and *invivo* conditions.

OUTCOME

The student will be able to

• Narrate the various factors influencing the drug disposition, various pharmacokinetic parameters.
• Design and interpret the dissolution studies for various dosage forms.

UNIT I  INTRODUCTION TO BIOPHARMACEUTICS


UNIT II  PRINCIPLES OF DRUGS DISSOLUTION


UNIT III  PRINCIPLES OF DRUG ABSORPTION AND BIO-AVAILABILITY

• 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

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 (ka), Elimination Rate Constant (K) & Elimination Half life (t½), AUC, Cmax, and tmax. Apparent Volume of Distribution (Vd) & Renal Clearance (Q).

UNIT V MULTIPLE DOSAGE REGIMENS

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

TEXT BOOKS


REFERENCES


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

OUTCOME
The student will be able

- To classify extract, isolate and characterize the natural products by chemical tests.
- To understand the classification, metabolic pathways, metabolites and their structural elucidation.

UNIT I STRUCTURAL BASIS OF NATURAL PRODUCTS
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
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

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

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-Sitotsterol, bile acids, ergosterol, diosgenin, solasodine, hecogenin

UNIT V STUDY OF TRADITIONAL DRUGS

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, shankhapushphi, brahmi adusa, arjuna, lahsun, guggul, gymnema, neem, tulsi, Shilajit and Spirulina

TOTAL: 45 PERIODS

TEXT BOOKS
2. Organic Chemistry of Natural Products (Vol.-1 & 2) by Gurdeep Chatwal.

REFERENCE BOOKS
1. Pharmacognosy by Brady and Tyler.E.
OBJECTIVE
An opportunity to learn the different types and designs of clinical trials, requirements for conducting clinical trials, an opportunity to conceptualize, conduct, manage and report clinical trials.

OUTCOME
At completion of this paper it is expected that students will be able to (know, do and appreciate):
- Types of clinical trial designs
- Responsibilities of key players involved in clinical trials
- Site initiation, monitoring and close-out activities
- Safety monitoring and reporting in clinical trials
- Preparing clinical study reports and reporting in common technical document
- Quality control and assurance in conduct of clinical trial.

UNIT I   DRUG DEVELOPMENT MODULE
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
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
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

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

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
Marcel Dekker, 1984.

REFERENCE
OBJECTIVE
To focus on surface and colloidal phenomena in industry, basic surfactant structures, Capillarity systems like wetting agents, emulsifiers and stabilisers.

OUTCOME
Student gains insight in interface adsorption, the physics involved in interfacial adsorption, concept behind interfacial charge, electrokinetic phenomena and various colloid parameters.

UNIT I INTRODUCTION TO INTERFACE AND COLLOIDAL SCIENCE
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

UNIT III CAPILLARITY
Capillary flow, Driving forces, Interfacial tension, Contact angle, Laplace expression for pressure difference across a curved interface, Capillary flow and spreading processes, Contact angle 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  
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  

TOTAL : 45 PERIODS

TEXT BOOK AND REFERENCES
OBJECTIVE
The subject emphasis on modern techniques of drug design, which include quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry, and Computer aided drug design (CADD). To plan and select insilico approaches and tools.

OUTCOME
Students will be familiar with various stereochemical aspects of drug binding and analysis of various in silico docking experiments in drug research.

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 –

UNIT III  QUANTITATION STRUCTURE – ACTIVITY RELATIONSHIP  9

UNIT IV  DOCKING  9
Docking ligands to macromolecules – Docking algorithms - Dock – AUTODOCK
UNIT V     MOLECULAR SIMULATIONS

Molecular dynamic simulations – GROMACS – GROMOS – AMBER

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

PM8006     EXPERIMENTAL DESIGN AND BIOSTATISTICS     L T P C

OBJECTIVE
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

OUTCOME
The student will be able to understand the art of statistical data analysis combined with systematic approaches to experimental design.

UNIT I     FUNDAMENTALS OF STATISTICS

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

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

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

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

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

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS
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

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

OUTCOME
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

UNIT II  phase diagrams
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


UNIT IV Electrical and electronic properties


UNIT V Magnetic ,thermal and optical properties


TOTAL : 45 PERIODS

REFERENCES

OBJECTIVE
The course is aimed
- to impart basic knowledge in microbial pathogenesis
- to study the various aspects of host pathogen interactions.
- To study the advanced pathogen control techniques and its applications

OUTCOME
Students will be familiar with various microbial interactions in human system and modern approaches in microbial control.

UNIT I OVERVIEW
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
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)


UNIT IV EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS

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

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

REFERENCES
2. Cook, D.J. “Cellular Pathology” 2nd Ed., Scion, 2006

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

OBJECTIVE
To familiarize students on the basics of polymers, properties of polymers, mechanism of polymerization, techniques of polymerization in an industrial aspect.

OUTCOME
Students will have knowledge in factors affecting polymerization, reactions of polymerization, the catalyst involved, kinetics of polymerization.

UNIT I BASIC CONCEPTS OF POLYMERS 9
UNIT II  CHAIN POLYMERISATION


UNIT III  STEP GROWTH POLYMERSIATION

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 polymerization

UNIT IV  POLYMERIZATION TECHNIQUES

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

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


PM8010 INTRODUCTION TO BIOMATERIALS AND TISSUE ENGINEERING

OBJECTIVE
Basic knowledge in Tissue reaction, testing with tissues, Biomedical implants, industrial applications of tissue engineering

OUTCOME
Student will be able to understand concept of biomaterials, compatibility of biomaterials with tissues, tissue reactivity, testing of tissues, various biomedical implants.

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

UNIT II TYPES OF MATERIALS AND THEIR TESTING
Metals, Ceramics, treated natural materials. Testing with Tissue Culture, Testing with Soft Tissues and Testing at non Thrombogenic surface

UNIT III BIOMEDICAL IMPLANTS
Cardiac Implants, Orthopedic Implants, Neural and Neuro Muscular Implants, Transcutaneous Implants, Intraocular lenses.
UNIT IV   FUNDAMENTALS OF TISSUE ENGINEERING

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

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

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
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

OUTCOME
The students will be able to do various in silico experiments and to study the stereochemical aspects of various drug interactions.

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, diffracttion data, electron density data, phases, judging the molecular models, other diffraction methods for model building, tools for studying macromolecules

UNIT III  EMPRICAL 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 Simualtion Methods

UNIT V MOLECULAR MODELLING METHODS

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

TOTAL: 45 PERIODS

TEXT BOOKS
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

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

OUTCOME
Students will develop a good insight in the concepts of nutraceuticals and role of
nutraceuticals in health and disease
UNIT I  INTRODUCTION AND SIGNIFICANCE  
Introduction to Nutraceuticals and functional foods; importance, history, definition, classification, list of functional foods and their benefits, Phytochemicals, zoochemicals and microbes in food, plants, animals and microbes

UNIT II  ANALYSIS OF PHYTOCHEMICALS  
Qualitative and quantitative methods: phytoestrogens in plants; isoflavones; falavnols, polyphenols, tannins, saponins, lignans, Chitin; Caratenoids - Factors affecting bioavailability, chemical and histochemical characterization of cell wall polysaccharides in almond seed in relation to lipid bioavailability.

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

UNIT IV  ROLE IN HEALTH AND DISEASE  
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  
Health Claims, regulations and safety issues- International and national.

TOTAL : 45 PERIODS
TEXT BOOKS
3. WEBB, PP, Dietary Supplements and Functional Foods Blackwell Publishing Ltd (United Kingdom), 2006

REFERENCES
6. Asian Functional Foods (Nutraceutical Science and Technology) by John Shi (Editor), Fereidoon Shahidi (Editor), Chi-Tang Ho (Editor), CRC Publications, Taylor & Francis, 2007
OBJECTIVE
Basic concepts in scaling in biology, Microfabrication techniques, chemical grafting of biomolecules, Miroelectromechanical sensing of cells, biomimetic nanodevices, tissue microengineering and its industrial application.

OUTCOME
Students will have knowledge in microfabrication technology, microengineered biosensors, fluidics, application in drug delivery system design, biomimetic substrates.

UNIT I INTRODUCTORY CONCEPTS
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
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
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, immuno sensors. The frontiers of BioMEMS: Nanolithography, biomimetic nanodevices. Laboratory exercises will reinforce critical concepts provided in lectures.

UNIT IV MICROFLUIDICS AND NANOFLOWDICS
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

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
2. Ferrari, Mauro (eds) BioMEMS and Biomedical Nanotechnology Volume I
3. Steven S. Saliterman, Fundamentals of BioMEMS and Medical Microdevices

PM8014 VACCINE TECHNOLOGY

OBJECTIVE
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.

OUTCOME
Student gets a basic idea of types and preparation of vaccine, design of vaccine, testing and quality control of vaccines.

UNIT I IMMUNOLOGICAL CONCEPTS IN VACCINOLOGY

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

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

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

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

UNIT V  ANIMAL TESTING, COMMERCIALISATION, QUALITY CONTROL

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

REFERENCES


GE8071 FUNDAMENTALS OF NANO SCIENCE

OBJECTIVE
Provide scientific basis of Nano particles, properties and preparation methods, patterning of nanoscale devices and the characterisation techniques involved in nanoparticles.

OUTCOME
Knowledge gained in nanoparticle preparation, testing and characterisation methodologies.

UNIT I INTRODUCTION

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

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 NANO SCALE DEVICES

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

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

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

REFERENCES
1. G Timp (Editor), Nanotechnology, AIP press/Springer, 1999
OBJECTIVE
To familiarize the students with concepts of process dynamics and control leading to control system design. To introduce dynamic response of open and closed loop systems, control loop components and stability of control systems along with instrumentation.

OUTCOME
Students will develop knowledge in basics of process dynamics, measurement of pressure, fluid flow, physical parameters, dynamic response of loop systems, frequency response and control systems.

UNIT I INSTRUMENTATION
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
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
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

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

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

REFERENCES
OBJECTIVE
Provide basics to Bioconjugates, modification of functional targets, chemistry involved in active chemical groups and enzymes for conjugation.

OUTCOME
Scientific basics of enzyme conjugation and the industrial application of bioconjugates.

UNIT I  FUNCTIONAL TARGETS
9

UNIT II  CHEMISTRY OF ACIVE 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

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 APLICATIONS
9

TOTAL: 45 PERIODS
TEXT BOOK AND REFERENCE

IB8072 BIOLOGICAL SPECTROSCOPY L T P C 3 0 0 3

OBJECTIVE
Provide knowledge in optical rotation, determination of macromolecular structure resonance imaging, protein analysis by mass spectrometry and X-Ray diffraction.

OUTCOME
Students will gain insight in optical system and the molecular analysis and characterization of macro molecules by spectroscopic methods.

UNIT I OPTICAL ROTATORY DISPERSION 5

UNIT II NUCLEAR MAGNETIC RESONANCE 10

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
UNIT V  SPECIAL TOPICS AND APPLICATIONS

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

REFERENCES
OBJECTIVE
Provide basics on protein structure and their molecular properties, mapping and sequencing of proteins, structure-function relationship, basic concepts of proteomics.

OUTCOME
Students gain in-depth knowledge in protein structure, structure-function relationship, domains, folding and protein analysis.

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

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

REFERENCES
OBJECTIVE
Introduce concept of operating systems, protein and genomic databases, analysis and sequencing methods, structure prediction methods, programming tool for bioinformatics.

OUTCOME
Familiarise with bioinformatics tools, protein sequencing and analyzing techniques.

UNIT I
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
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
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


UNIT V

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.
5. Beginning Perl for Bioinformatics: An introduction to Perl for Biologists by James Tindall, O'Reilley Media

REFERENCE BOOKS
OBJECTIVE
Familiarise in down stream processing techniques, filtration, centrifugation, purification.

OUTCOME
Understand various methods of separation, purification. Finishing operations and formulations.

UNIT I  DOWNSTREAM PROCESSING
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
Unit operations for solid-liquid separation - filtration and centrifugation.

UNIT III  ISOLATION OF PRODUCTS
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
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
Crystallization, drying and lyophilization in final product formulation.

TOTAL : 45 PERIODS
TEXT BOOKS

REFERENCES

IB8754 METABOLIC ENGINEERING L T P C 3 0 0 3

OBJECTIVE
Introduction to cellular reactions, enhancement of product yield, analysis of metabolic flux, metabolic network analysis.

OUTCOME
Students familiarize with concept of metabolic pathways, flux analysis, material balances and optimization of metabolic flux.

UNIT I INTRODUCTION TO EXAMPLES OF PATHWAY MANIPULATION - QUALITATIVE TREATMENT

UNIT II MATERIAL BALANCES AND DATA CONSISTENCY
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®

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UNIT III METABOLIC FLUX ANALYSIS

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


UNIT V ANALYSIS OF METABOLIC NETWORKS

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

REFERENCES
OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of-community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

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

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

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

**TOTAL: 45 PERIODS**

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

**TEXTBOOKS:**

**REFERENCES**
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

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**GE8073 HUMAN RIGHTS L T P C** 3 0 0 3

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

**UNIT I**

**UNIT II**

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

UNIT V

TOTAL : 45 PERIODS

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

REFERENCES: