

With effect from 02/08/2016

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. PHARMACY COURSE STRUCTURE (2016-17)

I YEAR I SEMESTER

S. No	Course Code	Subject	L	T	P	Credits
1	BS101/ BS102	Remedial Mathematics / Remedial Biology - I	4/ 2	1/ 1	0	4/ 2
2	PS103	Dispensing and General Pharmacy	4	1	0	4
3	PS104	Anatomy, Physiology and Health Education – I	3	1	0	3
4	BS105	Pharmaceutical Organic Chemistry – I	4	1	0	4
5	HS106	Professional Communication in English	3	0	0	3
6	PS107	Dispensing and General Pharmacy Lab	0	0	3	2
7	PS108	Anatomy, Physiology and Health Education – I Lab	0	0	3	2
8	BS109	Pharmaceutical Organic Chemistry – I Lab	0	0	3	2
9	BS110	Remedial Biology - I Lab	0	0	3	2
10	*MC111	NSS	0	0	0	0
		Total Credits	18/16	4/4	12	24/24

I YEAR II SEMESTER

S. No	Course Code	Subject	L	T	P	Credits
1	BS201	Pharmaceutical Inorganic Chemistry	3	1	0	3
2	BS202	Pharmaceutical Organic Chemistry – II	4	1	0	4
3	PS203	Physical Pharmacy - I	4	1	0	4
4	BS204	Statistical Methods and Computer Applications	3	1	0	3
5	PS205	Anatomy, Physiology and Health Education – II	4	1	0	4
6	BS206	Pharmaceutical Inorganic Chemistry Lab	0	0	3	2
7	BS207	Statistical Methods and Computer applications Lab	0	0	3	2
8	PS208	Physical Pharmacy – I Lab	0	0	3	2
9	*MC209	Physical Education	0	0	0	0
		Total Credits	18	5	9	24

Note: For Bi.P.C Students to choose Remedial Mathematics (Theory).

For M.P.C Students to choose Remedial Biology (Theory: 2-1-0-2, Lab: 0-0-3-2)

***Mandatory Course**

REMEDIAL MATHEMATICS

B.Pharm. I Year I Sem.

Course Code: **BS101**

L T/P/D C

4 1/0/0 4

Course Objectives: This is an introductory course in mathematics, the subject deals with introduction to algebra, trigonometry, differential calculus, integral calculus etc.

Course Outcome: The student will learn the basics of mathematics which will be helpful in pharmaceutical calculation in the higher classes

UNIT I

Algebra: Permutations and combinations - Binomial theorem –Partial fractions (addition, subtraction and multiplication) –Matrices –Determinants -Application of determinants to solve simultaneous equations (Cramer's Rule).

UNIT II

Trigonometry: measurement of angles, trigonometry functions, compound angles, trigonometry ratios of multiple angles ($\sin 2$, $\cos 2$, $\tan 2$), Heights and distances (All simple problems only).

Co-ordinate Geometry: Distances between two points, Area of a triangle, division of line segment, locus.

UNIT III

Differential Calculus: Continuity and limit: Differentiation, derivative of product, derivative of function, derivation of a fraction of functions

Derivatives of trigonometric functions (excluding inverse trigonometric and hyperbolic functions).

Derivatives of Logarithmic and exponential functional, partial differentiation, maxima and minima (all simple problems)

UNIT IV

Integral Calculus: integration of algebraic and exponential functions, Integration of trigonometric functions, integration by parts, integration by the method of substitution, definite integrals, areas and curves (all simple problems)

UNIT V

Differential Equations: Formation of a differential equation, equation of 1st order and 1st degree, Homogenous, exact differential equation

Text Books

- 1) Intermediate first Year mathematics and Intermediate Second year mathematics, printed and published by Telugu Academy, Himayath nagar, Hyderabad
- 2) Remedial Mathematics by Shahnaz Bathul
- 3) Text book of Pharmaceutical Mathematics with Application to Pharmacy-Panchaksharappa Gowda. D. H.

References

- 1) Pharmaceutical Arithmetic's by Mohd. Ali CBS publishers and distributor, New Delhi.
- 2) Higher Engineering Mathematics by Grewal.

REMEDIAL BIOLOGY - I

B.Pharm. I Year I Sem.
Course Code: **BS102**

L T/P/D C
2 1/0/0 2

Course Objectives: This is an introductory course in biology which gives detailed study on natural sources such as plant and animal origin. This subject deals with the plant cell, animal cell classifications plant kingdom and study of animal issues and study about frogs and some animals.

Course Outcome: The student will learn details about plant and animal cells plant taxonomy classification and some aspects of physiology of frogs and animals.

UNIT I

Plant cell and tissues: ultra structure of plant cell and its inclusions. Cell division-mitosis and meiosis. Types of tissues and their functions, tissue systems.

UNIT II

Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed. Modifications of root and stem.

UNIT III

Taxonomy: Systemic position and classification of following families: umbelliferae, apocyanaceae and liliaceae.

UNIT IV

Animal cells and tissues: ultra structure of animal cell, cell division, types of cells and tissues and their functions

Study of anatomy of frog; Basic study of digestive system, CVS, nervous system, genito-urinary system, musculoskeletal system.

UNIT V

Structure and life history of parasites illustrated by Amoeba, Entamoeba, Trypanosome, Plasmodium, Taenia, Ascaris,

Suggested Text Books

- 1) Intermediate First Year and Second Year Botany / Zoology Text Books printed and published by Telugu Academy, Himayath nagar and Hyderabad.
- 2) A.C. Dutta, Text Book of Botany
- 3) Botany for Degree students Vol I and II by B. P. Pandey
- 4) Enger- Concepts biology

DISPENSING AND GENERAL PHARMACY

B.Pharm. I Year I Sem.

Course Code: **PS103**

L T/P/D C

4 1/0/0 4

Course Objectives: The student shall be given orientations to know the origin of pharmacopoeias on dispensing procedure of medicines, pharmaceutical calculation, and interpretations of incompatibilities.

Course Outcome: Student will be familiar with the Hospital pharmacy organization, drug distribution procedures, dispensing, storage, incompatibilities and patient related factors.

UNIT I

a. Genesis and Evolution of Pharmacy: History of Pharmacy, origin and development of the Pharmacopoeias, History of Ayurveda, salient features of IP, USP and BP.

Pharmacy Education – D. Pharm, B Pharm, M.Pharm, Pharma-D, Qualification for getting license.

b. Dispensing Pharmacy: Principles of dispensing, form of prescription, handling of prescription, source of errors in prescription, care required in dispensing procedures including labelling of dispensed products.

UNIT II

Calculations:

Weights and Measures, introduction to Latin terms, Percentage calculations, alligation method, proof spirit calculations, displacement value and calculations of isotonicity adjustment. General dispensing procedure- posology-calculations of doses.

UNIT III

Principles involved and procedures adopted in dispensing of the following classes of preparations.

(i) Mixtures (ii) Solutions (iii) Emulsions (iv) Powders

(v) Lotions and liniments (vi) Ointments (vii) Suspensions (viii) Syrups

(ix) Suppositories.

Definition of the following preparations like creams, capsules, pastes, jellies, suppositories, ophthalmics, lozenges, pills, inhalations, paints, sprays and tablet triturates .

UNIT IV

Pharmaceutical ethics

Introduction to Pharmaceutical ethics, ethical guidelines for retail pharmacist / community Pharmacist, manufacturing Pharmacist and pharmaceutical researcher

UNIT V

a. Fundamental operations: Weighing, measurement of liquids, procedure of dispensing solution.

b. Colours: Reasons for colouring pharmaceutical preparations, colouring of tablets, capsules and non-injectable fluids, Desirable properties of colouring agent, different types of colouring agents.

c. Excipients: Types of flavouring agents, preservatives and stabilisers

Text Books

- 1) Cooper and Gunns Dispensing Pharmacy, CBS, Publ. and Distributors New Delhi.
- 2) R.M Metha, Dispensing Pharmacy.
- 3) JS Quadry, Hospital Pharmacy.

References

- 1) Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
- 2) William Hassan, Hospital Pharmacy.

ANATOMY PHYSIOLOGY AND HEALTH EDUCATION - I

B.Pharm. I Year I Sem.

Course Code: **PS104**

L T/P/D C

3 1/0/0 3

Course Objectives: This course is designed to impart a fundamental knowledge on the structure and functions of the human body. The overall anatomy and physiology of organ systems and their coordination are being dealt.

Course Outcome: Describes the structure and functions of various organs of the human body and mechanisms in the maintenance of normal functioning and disease state are known.

UNIT I

Scope of Anatomy and Physiology and basic terminology used in these subjects. Structure of cell, its components and their function. Elementary tissues of the human body: epithelial, connective, muscular and nervous tissues, their sub-types and characteristics. Body fluids, Homeostasis

Skeletal system: Structure, composition and functions of skeleton, classification of joints, types of movements at joints,

Skeletal muscles: Gross anatomy, physiology of muscle contraction, physiological properties of skeletal muscles and their disorders. Rheumatoid arthritis, Gout.

UNIT II

Haemopoietic system and Lymphatic System: Composition and functions of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation, Anemias and its types, lymph organs.

UNIT III

Cardiovascular system: Basic anatomy, physiology and conduction system of heart, blood vessels and circulation. Basic pulmonary, coronary, hepatic, system, understanding of cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its regulation. Brief outline of cardiovascular disorders like hypertension, myocardial infarction, congestive heart failure and cardiac arrhythmias.

UNIT IV

Digestive System: Gross anatomy of the gastro-intestinal tract, functions of its different parts, various gastrointestinal secretions and their role in the absorption and digestion of food, peptic ulcer, ulcerative colitis, hepatic disorder.

UNIT V

Demography and Family Planning: population problem, family planning and various contraceptive methods. Medical termination of pregnancy.

Brief outline of communicable diseases, causative agents, modes of transmission and prevention (chicken pox, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, hepatitis, cholera, typhoid, malaria, rabies, tetanus, leprosy, syphilis and Aids).

Text Books

- 1) Tortora, G.J and Anagnodokas, Principles of Anatomy and Physiology, N.P Harper and Row Publishers N.Y
- 2) Ross and Willson, Text Book of Human Anatomy, M. J. Mycek S. B Gerther and MMPER
- 3) Human Anatomy and Physiology with health education by Padma B Sanghani

References

- 1) Guyton, Textbook of Medical Physiology, AC Guyton WB Sannders Company, 1995.
- 2) K. Sembulingam and Prema Sembulingam, Essentials of Medical Physiology, 3rd Edition, Jaypee Bros., New Delhi.

PHARMACEUTICAL ORGANIC CHEMISTRY - I

B.Pharm. I Year I Sem.
Course Code: **BS105**

L T/P/D C
4 1/0/0 4

Course Objectives: The organic compounds are classified based on their functional groups and character. The basic principles and mechanisms of different types of organic reactions are explained in an elaborative manner.

Course Outcome: The detailed study on the mechanisms involved in various reactions would help the students to understand the synthesis of higher organic compounds which would be dealt in future classes.

UNIT I

a. Structure and Activity of Organic Molecules: Shapes of organic molecules, bond lengths, bond angles and bond dissociation energies. Electronic effects in organic molecules: inductive effect, electromeric or mesomeric effect, hyperconjugation, concept of resonance; types of organic reagents and reactions.

b. Aliphatic/Alicyclic Hydrocarbons: Nomenclature, isomerism (chain, conformational and geometrical) relative stabilities (heats of combustion and hydrogenation), ring stabilities of cyclohexane, chair-boat conformation, Bayer's strain theory and sachse-mohr theory. Free radical substitution reactions (halogenation) of alkanes.

UNIT II

a. Alkenes: Electrophilic addition reactions of alkenes, Markovnikov's rule, Kharasch effect, Bayer's oxidation (cis-hydroxylation, polymerisation).

b. Alkadienes: Stability and 1,4 addition reactions of conjugated alkadienes.

c. Alkynes: Acidity of 1-alkynes, formation of metal acetylides. Stereo specific reduction of alkynes. Addition of hydrogen halide (HCl) addition of water and keto-enol tautomerism.

UNIT III

Aromatic Hydrocarbons: Kekule's structure of benzene, bond lengths, heats of hydrogenation and stability, molecular orbital picture of benzene, aromaticity, Huckel's rule, nomenclature of benzene derivatives, characteristic reactions of benzene, theory of reactivity and orientation in mono substituted benzenes.

UNIT IV

a. Halogen Compounds-Aromatic: Nomenclature, low reactivity of halo benzenes towards nucleophilic substitution, arenes.

b. Halogen Compounds-Aliphatic: Nomenclature, general methods of preparation, characteristic nucleophilic substitution reactions, factors that play role in SN^1 and SN^2 , Walden inversion, elimination reaction and Saytzeff's rule.

UNIT V

Alcohols: Nomenclature, classification, general methods of preparation, physical properties, hydrogen bonding, characteristic nucleophilic substitution reactions (replacement of -OH by -

Cl), elimination reactions, and relative reactivities of 1^o, 2^o and 3^o alcohols, Meerwein Ponderoff Verley reduction.

Text Books

- 1) T. R. Morrison and R. N. Boyd, Organic chemistry, prentice hall of India private Limited, New Delhi.
- 2) I.L. Finar Vol. I and Vol. II, the Fundamentals Principles of Organic Chemistry, ELBS/Longman.
- 3) Ball and Ball Advanced pharmaceutical organic chemistry.

References

- 1) Jerry March, Reactions and Mechanism 4th ed.
- 2) Jerry March, Advanced Organic Chemistry

PROFESSIONAL COMMUNICATION IN ENGLISH

B.Pharm. I Year I Sem.
Course Code: **HS106**

L T/P/D C
3 0/0/0 3

INTRODUCTION

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic and communicative competencies of Engineering students.

In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text book for detailed study. The students should be encouraged to read the texts/poems silently leading to reading comprehension. Reading comprehension passages are given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, from newspaper articles, advertisements, promotional material, etc. *The focus in this syllabus is on skill development, fostering ideas and practice of language skills.*

Course Objectives:

The course will help students to:

- a. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
- b. Equip students to study academic subjects more effectively using the theoretical and Practical components of English syllabus.
- c. Develop study skills and communication skills in formal and informal situations.

Course Outcomes:

Students will be able to:

1. Use English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately.
3. Communicate confidently in formal and informal contexts.

SYLLABUS

Reading Skills:

Objectives:

1. To develop an awareness in students about the significance of silent reading and comprehension.
2. To develop students' ability to guess meanings of words from the context and grasp the overall message of the text, draw inferences, etc., by way of:
 - Skimming and Scanning the text
 - Intensive and Extensive Reading
 - Reading for Pleasure

- Identifying the topic sentence
- Inferring lexical and contextual meaning
- Recognizing Coherence/Sequencing of Sentences

NOTE: The students will be trained in reading skills using the prescribed texts for detailed study. They will be tested in reading comprehension of different ‘unseen’ passages which may be taken from authentic texts, such as magazines/newspaper articles.

Writing Skills:

Objectives:

1. To develop an awareness in the students about writing as an exact and formal skill
2. To create an awareness in students about the components of different forms of writing, beginning with the lower order ones through;
 - Writing of sentences
 - Use of appropriate vocabulary
 - Paragraph writing
 - Coherence and cohesiveness
 - Narration / description
 - Note Making
 - Formal and informal letter writing
 - Describing graphs using expressions of comparison

In order to improve the proficiency of the students in the acquisition of language skills mentioned above, the following text and course contents, divided into Five Units, are prescribed:

Text Books:

1. *“Fluency in English – A Course book for Engineering Students”* by Board of Editors: **Hyderabad: Orient BlackSwan Pvt. Ltd. 2016. Print.**
2. Raman, Meenakshi and Sharma, Sangeeta. *“Technical Communication- Principles and Practice”*. **Third Edition. New Delhi: Oxford University Press. 2015. Print.**

The course content / study material is divided into **Five Units**.

Note: *Listening and speaking skills are covered in the syllabus of ELCS Lab.*

UNIT –I:

Chapter entitled ‘*Presidential Address*’ by *Dr. A.P.J. Kalam* from “*Fluency in English– A Course book for Engineering Students*” published by Orient BlackSwan, Hyderabad.

Vocabulary: Word Formation -- Root Words --The Use of Prefixes and Suffixes-- Collocations-- Exercises for Practice.

Grammar: Punctuation – Parts of Speech- Articles -Exercises for Practice.

Reading: *Double Angels* by David Scott-Reading and Its Importance- Techniques for Effective Reading- Signal Words- Exercises for Practice

Writing: Writing Sentences- Techniques for Effective Writing-- Paragraph Writing- Types, Structure and Features of a Paragraph-Coherence and Cohesiveness: Logical, Lexical and Grammatical Devices - Exercises for Practice

UNIT –II:

Chapter entitled *Satya Nadella: Email to Employees on his First Day as CEO* from “*Fluency in English– A Course book for Engineering Students*” Published by Orient BlackSwan, Hyderabad.

Vocabulary: Synonyms and Antonyms – Homonyms, Homophones, Homographs- Exercises for Practice (Chapter 17 ‘*Technical Communication- Principles and Practice*’. *Third Edition* published by Oxford University Press may also be followed.)

Grammar: Verbs-Transitive, Intransitive and Non-finite Verbs – Mood and Tense—Gerund – Words with Appropriate Prepositions – Phrasal Verbs - Exercises for Practice

Reading: Sub-skills of Reading- Skimming, Scanning, Extensive Reading and Intensive Reading - *The Road Not Taken* by **Robert Frost** -- Exercises for Practice

Writing: Letter Writing –Format, Styles, Parts, Language to be used in Formal Letters-Letter of Apology – Letter of Complaint-Letter of Inquiry with Reply – Letter of Requisition -- Exercises for Practice

UNIT –III:

From the book entitled ‘*Technical Communication- Principles and Practice*’. *Third Edition* published by Oxford University Press.

Vocabulary: Introduction- A Brief History of Words – Using the Dictionary and Thesaurus– Changing Words from One Form to Another – Confusables (From Chapter 17 entitled ‘*Grammar and Vocabulary Development*’)

Grammar: Tenses: Present Tense- Past Tense- Future Tense- Active Voice – Passive Voice- Conditional Sentences – Adjective and Degrees of Comparison. (From Chapter 17 entitled ‘*Grammar and Vocabulary Development*’)

Reading: Improving Comprehension Skills – Techniques for Good Comprehension- Skimming and Scanning- Non-verbal Signals – Structure of the Text – Structure of Paragraphs – Punctuation – Author’s viewpoint (Inference) – Reader Anticipation: Determining the Meaning of Words – Summarizing- Typical Reading Comprehension Questions. (From Chapter 10 entitled ‘*Reading Comprehension*’)

Writing: Introduction- Letter Writing-Writing the Cover Letter- Cover Letters Accompanying Resumes- Emails. (From Chapter 15 entitled ‘*Formal Letters, Memos, and Email*’)

UNIT –IV:

Chapter entitled ‘*Good Manners*’ by **J.C. Hill** from *Fluency in English – A Course book for Engineering Students*” published by Orient Blackswan, Hyderabad.

Vocabulary: Idiomatic Expressions –One- word Substitutes --- Exercises for Practice (Chapter 17 ‘*Technical Communication- Principles and Practice*’. *Third Edition* published by Oxford University Press may also be followed.)

Grammar: Sequence of Tenses- Concord (Subject in Agreement with the Verb) – Exercises for Practice

Reading: ‘*If*’ poem by **Rudyard Kipling**--Tips for Writing a Review --- Author’s Viewpoint – Reader’s Anticipation-- Herein the Students will be required to Read and Submit a Review of a Book (Literary or Non-literary) of their choice – Exercises for Practice.

Writing: Information Transfer-Bar Charts-Flow Charts-Tree Diagrams etc., -- Exercises for Practice.

Introduction - Steps to Effective Precis Writing – Guidelines- Samples (Chapter 12 entitled ‘*The Art of Condensation*’ from *Technical Communication- Principles and Practice. Third Edition* published by Oxford University Press)

UNIT –V:

Chapter entitled ‘*Father Dear Father*’ by **Raj Kinger** from *Fluency in English – A Course book for Engineering Students*” Published by Orient BlackSwan, Hyderabad

Vocabulary: Foreign Words—Words borrowed from other Languages- Exercises for Practice

Grammar: Direct and Indirect Speech- Question Tags- Exercises for Practice

Reading: Predicting the Content- Understanding the Gist – SQ3R Reading Technique- Study Skills – Note Making - Understanding Discourse Coherence – Sequencing Sentences. (From Chapter 10 entitled ‘**Reading Comprehension**’ - *Technical Communication- Principles and Practice. Third Edition* published by Oxford University Press.)

Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports –Formats- Prewriting – Structure of Reports (Manuscript Format) - Types of Reports - Writing the Report. (From Chapter 13 entitled ‘**Technical Reports**’ - *Technical Communication- Principles and Practice. Third Edition* published by Oxford University Press.)

 Exercises from both the texts not prescribed shall be used for classroom tasks.

References

- 1 Green, David. *Contemporary English Grammar –Structures and Composition*. MacMillan India. 2014 (Print)
2. Rizvi, M. Ashraf. *Effective Technical Communication*. Tata Mc Graw –Hill. 2015 (Print).

DISPENSING AND GENERAL PHARMACY LAB

B.Pharm. I Year I Sem.

Course Code: **PS107**

L T/P/D C

0 0/3/0 2

- 1) Dispensing of prescriptions falling under the categories; Mixtures, solutions, emulsions, creams, ointments, powders, pastes, lotions, liniments, inhalations, paints, syrups, Suppositories etc.
- 2) Dispensing procedures involving pharmaceutical calculations, pricing of prescriptions and dosage calculations for paediatric and geriatric patients.
- 3) Dispensing of prescriptions involving adjustment of tonicity.
- 4) Categorization and storage of pharmaceutical products based on legal requirements of labelling and storage.
- 5) Project report on visit to the community pharmacy for Counselling on the rational use of drugs and aspects of health care.

References:

1. Pharmaceutics –I, Practical manual by N. K. Jain, Vijay Mishra
2. Dispensing pharmacy practical manual by B. S. Sanmethi, K. Mehta and Anshu Gupta

ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION - I LAB

B.Pharm. I Year I Sem.

Course Code: **PS108**

L T/P/D C

0 0/3/0 2

(21 Experiments)

1. Study of human skeleton
2. Study of different systems with the help of charts and models
3. Microscopic study of different tissues
4. Estimation of Haemoglobin in blood, Determination of bleeding time, clotting time – 3 Experiments.
5. Estimation of R.B.C. count – 2 Experiments.
6. Estimation of W.B.C count – 2 Experiments.
7. Estimation of D.L.C.
8. Recording of body temperature, pulse rate and blood pressure, basic understanding of Electrocardiogram-PQRST waves and their significance
9. Determination of vital capacity, experiments on spirometry
10. Study of reproductive system with the help of charts and models
11. Various devices used in Family planning like Copper T, Lippers loop, Pills, Diaphragm and Condom.
12. Microscopic studies of abnormal tissue sections
13. Simple experiments involved in the analysis of normal and abnormal urine; collection of specimen, appearance, determination of pH, sugars, proteins, urea and creatinine
14. Study of special senses with the help of charts and models

References

1. Plummer, Practical Biochemistry
2. Chatterjee, Human Physiology
3. C. L. Ghai, Practical Physiology
4. Elaine N. Marieb, Human Anatomy and Physiology.

PHARMACEUTICAL ORGANIC CHEMISTRY-I LAB

B.Pharm. I Year I Sem.
Course Code: **BS109**

L T/P/D C
0 0/3/0 2

I. Introduction to Equipment and Glassware

1. Determination of melting point/boiling point by Thiels method.
2. Determination of Mixed melting point for organic compounds.
3. Recrystallization (Purification including decolourization) of two organic compounds.
4. Purification and drying of organic solvents.

II. Preparation of organic compounds (each involving a specific organic reaction covered in theory)

1. N-Acetylation : Preparation of Acetanilide from Aniline
2. O-Acetylation : Preparation of Aspirin from Salicylic acid
3. Nuclear Bromination : Preparation of p-Bromoacetanilide from Acetanilide
4. Hydrolysis : Preparation of p-Bromoaniline from p-Bromoacetanilide
5. Nuclear Nitration : Preparation of m-Dinitrobenzene from nitrobenzene
6. Oxidation : Preparation of Benzoic acid from Benzyl chloride
7. Esterification : Preparation of n-Butylacetate from n-Butylalcohol
8. Etherification : Preparation of β -Naphthyl methyl ether from β -Naphthol
9. α -Halogenation : Preparation of Iodoform from Oxidation of Acetone
10. Extensive Nuclear Substitution : Preparation of Tribromophenol or Bromination Tribromoaniline from Phenol or Aniline

III. Systematic qualitative Analysis (Identification) of Monofunctional Organic Compounds:

Avoid water-soluble compounds, and compounds containing more than one functional group; at least six individual compounds to be analyzed.

References

1. Vogel's Text Book of Practical Organic Chemistry, 5th Edition.
2. R. K. Bansal, Laboratory Manual of Organic Chemistry.
3. O. P. Agarwal Advanced Practical Organic Chemistry.
4. F. G. Mann and B.C. Saunders, Practical Organic Chemistry.
5. Organic Chemistry a lab manual, Cengage learning India Pvt. Ltd. By Pavia
6. Advanced Practical Organic Chemistry, Vishoi-Vikas Publications.

REMEDIAL BIOLOGY LAB

B.Pharm. I Year I Sem.

Course Code: **BS110**

L T/P/D C

0 0/3/0 2

- 1) Introduction to simple and compound microscope and their handling
- 2) Morphological study of various plant parts
- 3) Study of histology of monocot root, stem, leaf and dicot root, stem and leaf
- 4) Systemic study of representatives of following families: apocyanaceae, solanaceae, three sub families of leguminaceae and liliaceae
- 5) Demonstration of various systems of frog
- 6) Study of structure of human parasites and insects mentioned in theory with the help of specimen.
- 7) Microscopic examination of specimens slides related to plant and animal tissues.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. PHARMACY COURSE STRUCTURE (2016-17)

II YEAR I SEMESTER

S. No	Course Code	Subject	L	T	P	Credits
1	PS301	Pharmaceutical Organic Chemistry – III	4	1	0	4
2	PS302	Pharmaceutical Unit Operations – I	4	1	0	4
3	PS303	Hospital and Community Pharmacy	3	1	0	3
4	PS304	Pharmacognosy – I	3	1	0	3
5	PS305	Pharmaceutical Analysis – I	4	1	0	4
6	PS306	Pharmaceutical Organic Chemistry – III Lab	0	0	3	2
7	PS307	Pharmacognosy – I Lab	0	0	3	2
8	PS308	Pharmaceutical Analysis – I Lab	0	0	3	2
9	*MC309	Environmental Science and Technology	3	0	0	0
		Total	21	5	9	24

*MC – Mandatory Course

PS301: PHARMACEUTICAL ORGANIC CHEMISTRY - III

B. Pharm II Year I Sem

L	T	P	C
4	1	0	4

Course Objectives: The chemistry of highly complicated organic compounds like polynuclear hydrocarbons and heterocyclic compounds are discussed along with their stereochemical aspects

Course Outcome: As the structural and stereochemical aspects and chemistry of organic compounds are discussed, it would help the students to have a good command over structural composition of organic compounds to evaluate and analyze the chemistry of these compounds

**Note: Definition, nomenclature, structure, aromaticity, reactivity, acidity-basicity and characteristic reactions of the following heterocyclic compounds of Unit I and II
Few Examples of Drugs which contain the cited ring system.**

UNIT - I

Five membered and six membered ring systems with one hetero atom: Furan, pyrrole, thiophene and pyridine.

Fused ring systems with one hetero atom: Indole, quinoline, iso-quinoline, and acridine.

UNIT - II

Five membered and six membered ring systems with two heteroatoms: Pyrazole, imidazole, oxazole, isoxazole, thiazole, pyrazine, pyrimidine and pyridazine.

Fused ring systems with two heteroatoms: Benzimidazole and phenothiazine, Cinnoline, Quinazoline and Quinoxaline.

UNIT - III

Stereochemistry of Carbon compounds: Optical rotation, plane polarized light, optical activity, chirality, notations (assignment of configuration), relative configuration (Fischer DL configuration), absolute configuration (R & S), sequence rules (with examples), enantiomers, meso compounds, racemic mixture, resolution.

Stereochemistry of alkenes: Concept of E & Z configurations. Elements of symmetry.

UNIT - IV

a) Polynuclear aromatic hydrocarbons: Nomenclature, structure and aromatic character of naphthalene, anthracene, phenanthrene and naphthacene resonance structures, electron density and reactivity. Electrophilic substitution, oxidation and reduction reactions.

b) Purine derivatives (xanthine bases): Chemical structures of uric acid and methylated xanthines (caffeine, theophylline and theobromine) of physiological/ pharmaceutical significance.

- c) Definitions of nucleic Acids, nucleotides, nucleosides, A brief account on structure of DNA & RNA.

UNIT - V

A study of the mechanism and application in synthesis of the following named reactions:

1. Beckmann rearrangement
2. Birch reduction
3. Mannich reaction
4. Michael addition reaction
5. Wittig reaction
6. Lossen rearrangement
7. Curtius rearrangement
8. Schmidt reaction

TEXT BOOKS:

1. R Morrison and R. Boyd, organic chemistry, Pub by Printice Hall of India, New Delhi.
2. I L Finar, Organic Chemistry, Vol. I. & II, 6th Pearson education
3. Reagents & reaction by O.P Agarwal

REFERENCES

1. Jerry March, Advanced Organic Chemistry 4th Ed.
2. Solomons, Organic Chemistry

PS302: PHARMACEUTICAL UNIT OPERATIONS- I

B. Pharm II Year I Sem

L T P C
4 1 0 4

Course Objectives: The student shall be exposed to various aspects of handling of fluids, application of filtration, centrifugation, crystallization and humidification in pharmaceutical industry.

Course Outcome: Student will understand the concepts of fluid flow, parameter of filtration, centrifugation, crystallization and humidification. They also understand the safety factors and possess a sound knowledge on the above aspects.

UNIT - I

a. Fluid Flow: Types of flow, Reynold's number, viscosity, concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure.

b. Dehumidification and Humidity control

Basic concepts and definition, wet bulb and adiabatic saturation temperature. Psychrometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipments for dehumidification operations.

UNIT - II

Filtration and Centrifugation: Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration, mathematical problems of filtration, optimum-cleaning cycle in batch filters.

Principles of centrifugation, industrial centrifugal filters, centrifugal filters, and centrifugal sedimenters.

UNIT - III

Crystallization: Characteristics of crystals like; purity, size, shape, geometry, habit, forms, size and factors affecting it. Solubility curves and calculation of yields. Supersaturation theory and its limitations. Nucleation mechanisms, crystal growth. Study of various types of crystallizers such as Swenson walker crystallizer, vacuum crystallizer, crystal crystallizer. Caking of crystals and its prevention. Numerical problems on yields.

UNIT - IV

Distillation: Raoult's law, phase diagrams, volatility, simple steam and flash distillations, principles of rectification, Azeotropic and extractive distillation.

UNIT - V

Industrial hazards and safety precautions: Mechanical, Chemical, Electrical, fire and dust hazards. Industrial dermatitis, accident records etc.

TEXT BOOKS

1. S.J. Carter, Cooper and Gunn's Tutorial Pharmacy 6th ed CBS publisher, Delhi.
2. C.V.S. Subramanayam, Pharmaceutial Unit Operation, Vallabh Prakashan
3. Prof. K. Samba Murthy, Pharmaceutical Engineering.

REFERENCES

1. Perry's Handbook of Chemical Engineering.
2. Unit Operations by Mc Cabe & Smith.

PS303: HOSPITAL AND COMMUNITY PHARMACY

B. Pharm II Year I Sem

L T P C
3 1 0 3

Course Objectives: Upon completion of the course, the student shall be able to –

- know various drug distribution methods;
- know the professional practice management skills in hospital pharmacies;
- provide unbiased drug information to the doctors;
- know the manufacturing practices of various formulations in hospital set up;
- appreciate the practice based research methods; and
- appreciate the stores management and inventory control.

Course Outcome: Student will be familiar with the Hospital pharmacy organization, incompatibilities and patient related factors.

UNIT - I

- a) **Organization and Structure:** Organization of hospital and hospital pharmacy. Responsibilities of hospital pharmacist. Pharmacy and Therapeutic committee, Budget preparation and implementation.
- b) **Hospital Formulary:** Contents preparation and revision of hospital formulary.

UNIT – II

- a) Drug Store Management and Inventory Control
 1. Organisation of drug store, type of materials, stock, storage conditions.
 2. Purchase and Inventory control, principles purchase, procedures, purchase orders, procurement and stocking.
- b) Drug Distribution System in Hospitals
 1. Outpatient dispensing – method adopted.
 2. Dispensing of drug to inpatients, Types of drug distribution systems, charging policy, labeling.
 3. Dispensing of drugs to ambulatory patients.
 4. Dispensing of controlled drugs.

UNIT - III

- a) Central Sterile Supply Unit and their Management: Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments supply of sterile materials.
- b) Manufacture of Sterile & Non Sterile Products: Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice, master formula card, production control, manufacturing records.

UNIT - IV

- a) Drug Information Services: Sources of information on drugs, diseases, treatment schedules, procurement of information's, computerized services (e.g. MEDLINE) retrieval of information, medication error.
- b) Records and Reports: Prescription filing, drug profile, patient medication

UNIT - V

- a) Community Pharmacy-organisation and structure of retail and wholesale drug store-types of drug store, design and legal requirements for establishment, maintenance, dispensing of proprietary products, maintenance of records of retail and wholesale, patient counseling, role of pharmacists in community healthcare and education.
- b) Patient compliance-reason for noncompliance pharmacists' role in patients compliance.
- c) Responding to common symptoms

TEXT BOOKS: (latest editions)

1. Hospital pharmacy by William .E. Hassan
2. A text book of Hospital Pharmacy by S.H.Merchant & Dr. J.S. Qadry. Revised by R.K.Goyal & R.K. Parikh

REFERENCES

1. Allwood, M.C., Fell, J.T., Text Book of Hospital Pharmacy, Blackwell Scientific Publications, Oxford, UK.
2. Owunwonne, A Handbook of Radio Pharmaceuticals Narosa Publishing House, New Delhi.
3. Diana, M.C., Michael, E.A., Pharmaceutical Practice, ELBS, London.

PS304: PHARMACOGNOSY – I

B. Pharm II Year I Sem

L T P C
3 1 0 3

Course Objectives: To know the medicinal and pharmaceutical importance of drugs obtained from the natural sources and to acquire the knowledge on crude drugs by studying them under a suitable pharmacognostic scheme.

Course Outcome: At the end of the semester the student shall be aware of different sources of crude drugs, cultivation aspects of medicinal and aromatic plants, evaluation methods for crude drugs, the medicinal importance and the role of crude drugs as excipients in various pharmaceutical dosage forms.

UNIT - I

- (a) Definition, History and Scope of Pharmacognosy.
- (b) Classification of crude drugs: Alphabetical, Morphological, Taxonomical, Chemical constituent and Pharmacological classification of crude drugs.
- (c) Scheme for Pharmacognostic study of crude drugs.

UNIT II

- a) Cultivation of Crude drugs: Merits and demerits of cultivation of crude drugs. Exogenous factors affecting cultivation. Endogenous factors affecting cultivation: Plant growth regulators.
- b) Collection and processing of crude drugs. Methods of collection, drying, garbling and storage of crude drugs.

UNIT - III

- a) Quality Control of Crude Drugs: Crude drug Adulteration , Types of adulterants.
- b) Evaluation of crude drugs: Organoleptic evaluation, Microscopical, Physical, chemical and Pharmacological evaluation of crude drugs.

UNIT - IV

- a) A general introduction to Carbohydrates and Enzymes
- b) Systematic Pharmacognostic study of Agar and Isapgol
- c) Biological source, collection, preparation, chemical constituents, chemical tests and uses of the following crude drugs – Guar gum, Gum acacia, Honey, Pectin, Starch, Tragacanth, Papain and Diastase.

UNIT - V

- a) General Introduction to Lipids
- b) Biological source, collection, preparation, chemical constituents, chemical tests and uses of the following crude drugs – Castor oil, Olive oil, Linseed oil, Cod liver oil, Shark liver oil, Cocoa butter, Bees wax, Wool fat.

TEXT BOOKS:

1. Kokate C.K, Purohit AP & Gokhale Pharmacognosy S.B (Nirali)
2. Trease and Evans Pharmacognosy, Latest Edition.
3. A Textbook of Pharmacognosy by Dr. G.S. Kumar and Dr. K.N. Jayaveera

REFERENCES:

1. Atal C.R & Kapur B.M, Cultivation & Utilization of Medicinal Plants.
2. Ayurvedic Pharmacopoeia of India, Pub by Govt. of India.

PS305: PHARMACEUTICAL ANALYSIS –I

B. Pharm II Year I Sem

L	T	P	C
4	1	0	4

Course Objectives: The basic concepts and analytical techniques of various pharmaceuticals are discussed in a detailed manner.

Course Outcome: The knowledge gained upon the detailed study of the analytical techniques will be useful to analyze the pharmaceutical substances in a systematic qualitative and quantitative manner.

UNIT - I

- Computation of analytical results, significant figures, concept of error, precision, accuracy, standard deviation, rejection of doubtful values with special reference to volumetric analysis. Calibration of analytical equipment used in volumetric analysis.
- Theory of Neutralization Titrations:** Acid-base concept, Acidimetry, Alkalimetry, Common ion effect and solubility product, pH, buffers and indicators.
- General principles and theory of oxidation-reduction methods and precipitation methods. An account of the indicators used in these titrations.

Application of the above methods in the analysis of drugs, as under IP 2010

UNIT - II

- Complexometric titration:** Theory, types and application in pharmaceutical analysis. Masking and demasking and their applications.
- Non-aqueous titration:** Theory, types, solvents used and application in pharmaceutical analysis.
- Gravimetry:** Principles, Theory, Precipitation, co-precipitation and applications

UNIT - III

- Potentiometry: Introduction, electrochemical cells and half cells. Electrode, measurement of potential, applications in pharmaceutical analysis.
- Conductrometric titrations. Basic concepts, different types of conductrometric titrations, apparatus used, applications in pharmaceutical analysis.
- Polarography: Basic concepts, apparatus and principles, general polarographic analysis, applications in Pharmaceutical Analysis.
- Amperometric Titrations

UNIT - IV

Study of separations and determinations involving the following techniques and their applications in pharmacy

- Column chromatography; Adsorption and partition theory, preparation, procedure, methods of detection.
- Thin layer chromatography: theoretical consideration, preparation, procedure,

detection of compounds.

- c) Paper Chromatography: theory of partition, different techniques employed filter papers used, quantitative and quantitative detection.

UNIT - V

- a) Flamephotometry: Introduction, study and working principles of instrumentations used for analysis, applications in pharmaceutical analysis.
- b) Principle, instrumentation and applications involved in the following
 - i. Refractometry ii. Polarimetry iii. Nephelometry and turbidimetry
- c) Physical and chemical methods of determination of moisture content (including Karl-Fisher method).

TEXT BOOKS:

1. Skoog-Instrumental Analysis and Skoog fundamentals of analytical Chemistry
2. A.H. Beckett & J.B Stanlake Vol.I&II., Practical Pharmaceutical Chemistry, Athlone Press of the Univ of London
3. Chatwal & Anand, Instrumental Methods of Analysis.

REFERENCES:

1. A.I Vogel, Quantitative Chemical Analysis, ELBS ed.
2. B.K. Sarma, Instrumental Chemical Analysis, Goel Publishers

PS306: PHARMACEUTICAL ORGANIC CHEMISTRY-II LAB

B. Pharm II Year I Sem

L	T	P	C
0	0	3	2

I. Synthesis of some simple heterocyclic compounds.

- 3, 5-Dimethylpyrazole from Acetylacetone.
- 3, 5-Dimethylisoxazole from Acetylacetone.
- 4, 5-Diphenylimidazole from Benzil.
- Benzoxazole from o-Aminophenol.
- 2, 5-Dioxopiperazine from Glycine.
- Oxazolone from Benzoylglycine.

II. Molecular rearrangements and named reactions

- Benzimidazole from o-phenylenediamine (Phillip's Reaction).
- O-hydroxyacetophenone from phenyl acetate (Fries migration)
- Benzanilide from benzophenone oxime (Beckmann's rearrangement)
- Preparation of 2-phenylindole from Phenylhydrazine by Fischer's method.

III. Systematic analysis of organic binary mixtures (Minimum 4 numbers)

REFERENCES:

1. Indian Pharmacopoeia– 2010.
2. A.I. Vogel's – Practical Organic Chemistry
3. Mann and Saunders, Practical organic chemistry

PS307: PHARMACOGNOSY – I LAB

B. Pharm II Year I Sem

L	T	P	C
0	0	3	2

1. Introduction to the materials required for microscopic work, preparation of histological slides and their focusing to obtain the critical illumination with the instructions for the use of microscope.
2. Preparation of commonly used reagents in microscopic work.
3. Identification of following cell contents in plant materials by microscopical and microchemical tests: Starch grains in potato, maize, rice and wheat.
4. Identification of following cell contents in plant materials by microscopical and microchemical tests
5. Mucilage
6. Aleurone grains
7. Fixed oils
8. Measurement of dimensions of cells and cell contents. Introduction to micrometer and camera lucida (drawing ocular). Measurement of dimensions of starch grains in powdered ginger.
9. Identification of cinnamon by measuring the dimensions of starch grains
10. Detection/ identification of Carbohydrates by chemical tests.
11. Detection/ identification of lipids by chemical tests.
12. Isolation of starch from Potato.
13. Determination of Swelling factor in crude drugs
14. Identification of crude drugs mentioned in the theory by Organoleptic method.
15. Identification test for Tannins.
16. Identification test for Resins.
17. Determination of volatile oils content of Eucalyptus leaf or Fennel by using Clevenger apparatus
18. Determination of Eugenol content in clove oil and detection by TLC.

REFERENCES:

1. Kandhelwal, Practical Pharmacognosy.
2. C.K. Kokate et.al, Practical Pharmacognosy.
3. Iyengar, Practical Pharmacognosy
4. Practical Pharmacognosy, Dr. V. Duraiswamy, Dr. K.N. Jayaveera.
5. Anatomy of Crude Drugs by M.A.Iyengar and S.C.K.Nayak – 12th Edition
6. Practical Pharmacognosy by Dr. G.S. Kumar and Dr. K.N. Jayaveera
7. Practical Pharmacognosy by Saroja Joshi and Vidhu Aeri

PS308: PHARMACEUTICAL ANALYSIS – I LAB

B. Pharm II Year I Sem

L T P C
0 0 3 2

1. Assay of Pharmaceutical compounds based on chemical methods such as acid base, oxidation-reduction, non-aqueous, complexometric titration method.
2. Conductometric determination of equivalent point of titration of HCl with NaOH.
3. Potentiometric determination of pH of a solution.
4. Potentiometric titration of strong Acid vs strong Base
5. Potentiometric determination of strength of unknown solution and HCL with NaOH.
6. Nephelometric determination of sulphate & chloride.
7. Fluorimetric estimation of quinine sulphate.
8. Polarographic determination of amount of Nitrobenzene in solutions.
9. Flame photometric determination of Sodium and Calcium.
10. Flame photometric determination of Potassium.
11. Determination of refractive index of liquids by Abbe refractometer.
12. Identification of amino acids by paper chromatography(Ascending and Radial)
13. Identification of alkaloids by TLC.

MC309ES: ENVIRONMENTAL STUDIES

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	0

Course Objectives:

1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understanding the environmental policies and regulations

Course Outcomes:

1. Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT - I

Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT - II

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT - III

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT - IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics

of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

UNIT-V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

- 1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
- 2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela . 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B. PHARMACY COURSE STRUCTURE (2016-17)****II YEAR II SEMESTER**

S. No	Course Code	Subject	L	T	P	Credits
1	PS401	Pharmaceutical Unit Operations - II	4	1	0	4
2	BS402	Biochemistry	3	1	0	3
3	PS403	Pharmaceutical Jurisprudence	4	1	0	4
4	PS404	Physical Pharmacy – II	4	1	0	4
5	OE	HS405: Intellectual Property Rights PS405: Herbal Drugs Technology BS405: Green Chemistry	3	0	0	3
6	PS406	Pharmaceutical Unit Operations – II Lab	0	0	3	2
7	BS407	Biochemistry Lab	0	0	3	2
8	PS408	Physical Pharmacy – II Lab	0	0	3	2
9	*MC409	Gender Sensitization Lab	0	0	3	0
		Total	18	4	12	24

*MC – Mandatory Course

PS401: PHARMACEUTICAL UNIT OPERATIONS – II

B. Pharm II Year II Sem

L	T	P	C
4	1	0	4

Course Objectives: The student shall be taught on operations like evaporation, drying, objective of size reduction, size separation and mixing.

Course Outcome: Student will be familiar with concepts of evaporation, drying, size reduction, mixing and understand the pharmaceutical applications in industry.

UNIT - I

Evaporation: Basic concept of phase equilibria, factors affecting the evaporation, evaporators, film evaporators, and single effect evaporators.

UNIT - II

Drying: Moisture content and mechanism of drying, rate of drying and time of drying calculations, classification and types of dryers, dryers used in pharmaceutical industries tray dryer, Fluid bed dryer, spray dryer and freeze-dryer.

UNIT - III

Size Reduction: Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of a mill, types of mills including ball mill, hammer mill and fluid energy mill.

UNIT - IV

Size Separation: Official standards for powders, sieves, modes of motion in size separation. Sieve Analysis – Testing of powders. Equipment for size separation.

UNIT - V

Mixing: Theory of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipment, double cone, twin-shell, silverson mixer, colloid mill, sigma blade mixer, planetary mixer, propeller mixer and turbine mixer.

TEXT BOOKS:

1. S.J. Carter, Cooper and Gunn's Tutorial Pharmacy, 6th ed., CBS publisher, Delhi.
2. CVS Subhramanyam, Pharmaceutical Engineering.
3. K. Samba Murthy, Pharmaceutical Engineering

REFERENCE BOOKS:

1. W.I. Macebe and J. C. Smith Macro, Unit Operations To Chemical Engineering, Hill Int. Book Co., London.
2. L. Lachman, H. Lieberman & J. L Kaniz, The Theory And Practice Of Industrial Pharmacy, Lee & Febiger Philadelphia, USA

BS402: BIOCHEMISTRY

B. Pharm II Year II Sem

L	T	P	C
3	1	0	3

Course Objectives: The metabolism of complex biochemical substances are discussed in detail. The Biochemical organization and Bioenergetics which will help the students to understand the concepts of biochemistry.

Course Outcome: The metabolism of complex biochemical compounds would make the students to gain a good knowledge about biochemical organization in the human system.

UNIT - I

- (a) Biochemical organization of the cell, molecular constituents of membrane, active & passive transport process, sodium and potassium pumps, osmoregulation and homeostasis.
- (b) **Bio-energetics:** The concept of free energy, laws of thermodynamics. Determination of change in free energy from equilibrium constant & reduction potential.
- (c) The respiratory chain & its role in energy capture & its control. Oxidative phosphorylation & its energetics & Electron Transport Chain, mechanism of actions. Production of ATP and its biological significance

UNIT - II

Enzymes & Co-enzymes: Classification, Structure, mechanism of action, properties, factors affecting enzymes action. Activators & de activators of enzymes, enzyme kinetics & enzyme inhibitions, repressions with reference to drug action.

UNIT - III

Metabolism of Carbohydrates: Biochemistry of carbohydrates, Glycolysis, glycogenesis, glycogenolysis, gluconeogenesis, Krebs's cycle, HMP shunt & uronic acid pathways, anaerobic respiration in muscle.

UNIT - IV

Metabolism of Proteins: Biochemistry of proteins, *Amino acid structure & classifications, de amination, Trans-amination, de-carboxylation, Urea cycle, Metabolism of valine, cystine, cystein, tryptophan, tyrosine, methionine.*

UNIT - V

a) **Metabolism of Lipids:**

Biochemistry of lipids, Alpha, Beta, Gamma & Omega oxidations of fatty acids, biosynthesis of fatty acids, cholesterol, ketogenesis.

- b) Introduction to xenobiotic metabolism, detoxification mechanisms, biochemistry and metabolism of nucleic acids and vitamins.

TEXT BOOKS

1. Harper's Biochemistry
2. A.L. Lehninger, Principles of Biochemistry.
3. Satyanarayana, Text Book of Biochemistry

REFERENCES

1. L. Stryer, Text Book of Bio Chemistry.
2. E.E Conn & P.K. Stumpf, Outlines of Biochemistry by, Publ, John Wiley & sons, New York.

PS403: PHARMACEUTICAL JURISPRUDENCE

B. Pharm II Year II Sem

L	T	P	C
4	1	0	4

Course Objectives: The objective of the course is to expose the students, all the laws and roles, which are vagues in the country. The scope of the course is extended to update the all the laws and roles including recent amendments taken place.

Course Outcome: The outcomes which are expected from the students at the end of the course are: Familiarization of the students with all the legal tenets and enforceable in the country, besides Pharmaceutical ethics and policies.

UNIT - I

Introduction

- a. Pharmaceutical Legislations - A brief review
- b. Drugs & Pharmaceutical Industry - A brief review
- c. Pharmaceutical Education - A brief review.
- d. Pharmaceutical ethics & policy

An elaborate study of the following

- a. Pharmacy Act 1948
- b. Drugs and Cosmetics Act 1940 and Rules 1945

UNIT - II

Medicinal & Toilet Preparations (Excise Duties) Act 1955
Drugs (Prices Control) Order 1995.

UNIT - III

Narcotic Drugs & Psychotropic Substances Act 1985 & A.P. N. D. P.S Rules 1986

UNIT - IV

Drugs and Magic Remedies (Objectionable Advertisements) Act 1954 and Rules 1955.

UNIT - V

- A. study of the salient features of the following.
- a. Prevention of Cruelty to animals Act 1960.
 - b. AP State Shops & Establishments Act 1988 & Rules 1990.
 - c. Factories Act 1948.
 - d. WTO, GATT and The Indian Patents Act 1970
 - e. Pharmaceutical Policy 2002.

Note: The teaching of all the above Acts should cover the latest amendments.

TEXT BOOKS:

1. B.M.Mithal, Text book of Forensic Pharmacy, publ by Vallabh Prakashan
2. Prof. Suresh Kumar J.N, Text book of Forensic Pharmacy by. Frontline Publications
3. C.K.Kokate & S.B.Gokhale, Textbook of Forensic Pharmacy

REFERENCE BOOK:

1. Bare Acts and Rules Publ by Govt of India/state Govt from time to time.
2. AIR – reported judgments of Supreme Court of India and other High Courts

PS404: PHYSICAL PHARMACY – II

B. Pharm II Year II Sem

L T P C
4 1 0 4

Course Objectives: The student shall be taught on industrial phenomenon of liquids, rate & order of reactants, micromeritics, flow of liquids and type of colloids and their properties.

UNIT - I

Kinetics: Rates and orders of the reaction. Influence of temperature and other factors on reaction rates. Decomposition and stabilization of medicinal agents, kinetics in the solid state and accelerated stability analysis (relevant numerical problems).

UNIT - II

a. Interfacial Phenomena: Liquid interfaces, measurement of surface and interfacial tensions, adsorption at liquid interfaces. Surface-active agents and HLB scale. Adsorption at solid interfaces. Electrical properties of interfaces.

b. Colloids: Introduction, types of colloidal systems, solubilization, Stability of colloids, optical properties, kinetic properties, electrical properties and Donnan Membran equilibriaum.

UNIT - III

Micromeritics: Particle size and size distribution, methods for determining surface area, methods for determining particle size, pore size, particle shape and surface area, derived properties of powders.

UNIT - IV

Rheology: Newtons law of flow, Newtonian systems, non-Newtonian systems, thixotropy, measurement and applications in formulations. Determination of viscosity (study of working of different viscometers like cup and bob, Brookfield, oswald's, cone and plate, capillary viscometers) and its applications.

UNIT - V

Coarse Dispersions: Suspensions: Types of suspensions, interfacial properties of suspended particles, stability evaluation, settling in suspensions, formulation of suspensions.

Emulsions: Theories of emulsification, physical stability of emulsions, preservation of emulsions, rheological properties of emulsions and suspensions.

Outcome: Student will know about influence of temperature and other factors on rate of reactants, interfacial phenomena, particle size & distribution, Newtonian and Non-Newtonian flows.

TEXT BOOKS

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences 5th Edition.

2. CVS Subhramanyam, Physical Pharmacy, Vallabh prakashan.
3. L. Lachman, H. Lieberman The Theory And Practice Of Industrial Pharmacy J. L Kaniz Lee & Febiger Philadelphia, USA

REFERENCE

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
2. M.E. Aulton, Pharmaceutics –The science of dosage form design, 2nd edn

HS405: INTELLECTUAL PROPERTY RIGHTS

(Open Elective)

B. Pharm II Year II Sem

L	T	P	C
3	1	0	3

Course Objectives: Various types of Intellectual Property Rights Patentable Subject History of Indian Patent Protection, Patent filing procedure in India, Opposition- pre-grant opposition and post-grant opposition, Patent filing procedure under PCT, advantages, patent search and literature and Salient features of Indian Patents are discussed in detail.

Course Outcome: The clear information about the patent laws and intellectual property rights in India and abroad is gained by the students.

UNIT - I

Introduction, Types of Intellectual Property Rights (Patents, Trademarks, Copyrights, Geographical Indications Industrial Designs and Trade secrets), Structure of patent (Components of patents), Types of patent, non-Patentable

UNIT - II

Patentable inventions, essential requirements for patentability, (Novelty, Non-Obviousness, Utility, enablement and Best mode), patent writing skills and significance of claims

UNIT - III

- History of Indian Patent Protection, Rationale behind Patent System, Objectives and Advantages of Patent System.
- Patent filing procedure in India (Patent Prosecution), Specifications (Provisional and Complete), Claims- types of claims and legal importance of claims, Grant of patent, Rights of Patentee and co-owners
- Opposition- pre-grant opposition and post-grant opposition, Anticipation, Infringement, Compulsory Licensing, revocation of patents, and power of Controller.
- Salient features of Indian Patents (Amendments) Act 1999, 2002 and 2005.

UNIT - IV

Background, Salient Features and Impact of International Treaties / Conventions like

- Paris Convention, Berne convention
- World Trade Organization (WTO)
- World Intellectual Property Organization (WIPO)
- Trade Related Aspects of Intellectual Property Rights (TRIPS)

UNIT - V

- Patent filing procedure under PCT, advantages, patent search and literature
- Patent search, literature and prior art search
- Non- infringement techniques and design around strategies

TEXT BOOKS

1. IPR Handbook for Pharma Students and Researchers- Bansal
2. Intellectual Property Rights in Pharmaceutical Industry: Theory and Practice- Subba Rao Bayya
3. Protection of Industrial Property rights by P.Das and Gokul Das

REFERENCE BOOKS

1. Research Methodology concepts and cases by Depak Chawla, Neena Sondhi
2. Draft manual of Patent Practice and Procedure -2008 , The Patent Office, India

PS405: HERBAL DRUG TECHNOLOGY

(Open Elective)

B. Pharm II Year II Sem

L T P C
3 1 0 3

Course Objectives: Helps the students in getting exposed to methods of extraction

Course Outcome: Helps the students to understand the organization and research of natural products in herbal drugs industries.

UNIT - I

Herbal Extracts: types of Extraction methods such as Maceration, Percolation, Super critical fluid extraction and Ultra – Sonic extraction

Equipment for preparing herbal extracts: Process and equipments-Name of the equipment and its uses with merits and demerits in each of the following unit operations in the extraction process.

1. Size reduction
2. Extraction
3. Filtration
4. Evaporation/Distillation
5. Solvent recovery
6. Drying of extracts

UNIT - II

Excipients:

Definition, classification of natural Excipients: Source, chemical nature, description parameters pharmaceutical uses and storage condition of following natural excipients, binding agents, disintegrating agents, diluents, emulsifying agent:

Acacia, Tragacanth, Alginates, CMC, Gelatine, Pectin, Lactose, Starches, Talc, Ointment bases, suppository bases and Hardening agents: Bees wax, Cocoa butter, Lanolin, Hard Paraffin.

UNIT - III

Manufacturing:

Methods of Preparation and Evaluation of Herbal Tablets, Capsules, Semisolid dosage forms and liquids- study of any three formulations under each category with respect to their formulas and claims for various herbs used in them.

UNIT - IV

Herbal drug Standardization:

- a) Definition and Need for the study of standardization. General flow of activities in standardization.
- b) WHO guidelines on standardization Parameters: Botanical, Physic Chemical, Pharmacological, Toxicological standardization.

UNIT - V

- a) Name of the different companies' manufacturing different herbal extracts, standardized

extracts with concentration of marker compounds, active principles and claims regarding their uses.

- b) **Herbal drug regulatory Affairs:**Introduction, objectives of Herbal Drug Regulation, Current Status of Herbal Drug Regulatory Affairs.

TEXT BOOKS:

1. Textbook of Pharmacognosy by G.E.Trease, W.C.Evans,ELBS
2. Textbook of HPTLC by P.D. Seth.
3. Herbal Perfumes and cosmetics by Panda

REFERENCES:

1. Pharmacognosy by V.E Tyler, LR Brandy and JE Robbers (KM Varghese & co., Mumbai)
2. Indian Pharmacopoeia

BS405: GREEN CHEMISTRY

(Open Elective)

B. Pharm II Year II Sem

L	T	P	C
3	1	0	3

Course Objectives: Emphasis about the chemicals and solvents intermediates which are environment friendly during chemical synthesis of pharmaceutical products.

Course Outcome: The detailed study of Green chemistry in various reactions would help the students to understand the synthesis of organic compounds which are benign to environment and human life.

Basic principles, salient features and applications for the following units:

UNIT - I

Significance and importance of green chemistry and principles of green chemistry.

UNIT – II

Green chemical processes.

UNIT - III

Introduction to microwave synthesis.

UNIT - IV

Design and selection of safer chemicals and solvents.

UNIT - V

Use of catalytic reagent.

TEXT BOOKS:

1. Green Chemistry: Theory and Practice. P.T. Anastas and J.C. Warner. Oxford University Press.
2. Green Chemistry: Introductory Text. M. Lancaster Royal Society of Chemistry (London).
3. Introduction to Green Chemistry. M.A. Ryan and M.Tinnesand, American Chemical Society, (Washington).

REFERENCES:

1. P.Tundoet. al., Green Chemistry, Wiley –Blackwell, London (2007).
2. T.E Graedel, Streamlined Life cycle Assessment, Prentice Hall, NewJersey (1998).

PS406: PHARMACEUTICAL UNIT OPERATIONS - II LAB

B. Pharm II Year II Sem

L T P C
0 0 3 2

List of Experiments:

1. Measurement of flow of fluids and their pressure, determination of reynold's number and calculation of frictional losses.
2. Evaluation of filter media, determination of rate filtration and study of factors affecting filtration including filter aids.
3. Experiments to demonstrate applications of centrifugation.
4. Determination of Humidity-use of Dry Bulb and Wet Bulb thermometers and Psychometric charts.
5. Determination of rate of evaporation.
6. Experiments based on steam. Extractive and azeotropic distillations.
7. Determination of rate of drying, free moisture content and bound moisture content.
8. Experiments to illustrate the influence of various parameters on the time of drying.
9. Experiments to illustrate principles of size reduction, Laws governing energy and power requirements of a size reduction.
10. Experiments to illustrate solid-solid mixing, determination of mixing efficiency using different types of mixers.

BS407: BIOCHEMISTRY LAB

B. Pharm II Year II Sem

L	T	P	C
0	0	3	2

List of Experiments:

1. To prepare standard buffers (citrate, phosphate & carbonate) and measure the pH.
2. Titration curve for amino acids.
3. Separation of amino acids by two dimensional paper chromatography & gel electrophoresis.
4. The separation of lipids by T.L.C.
5. Identification of carbohydrates
6. Identification of amino acid.
7. Identification of lipids.
8. Estimation of glucose in urine.
9. Estimation of creatinine in urine.
10. Estimation of urea in blood.
11. Estimation of creatinine in blood.
12. Estimation of Serum protein.
13. Estimation of bile pigments in serum.
14. Estimation of alkaline phosphatase in serum
15. Effect of temperature on the activity of alpha-amylase

PS408: PHYSICAL PHARMACY-II LAB

B. Pharm II Year II Sem

L T P C
0 0 3 2

List of Experiments:

1. Determination of bulk density, true density and percentage of porosity.
2. Effect of particle size and effect of glidant on angle of repose.
3. Microscopic size analysis, plotting of the graphs, calculation of geometric mean, diameter etc.
4. Determination of particle size by andreason pipette.
5. Determination of CMC of a surfactant.
6. Adsorption Isotherm consturctions.
7. Partition coefficient determination.
8. Determination of sedimentation volume and degree of flocculation.
9. Determination of order of reaction – zero order
10. Determination of Order of reaction – First order.
11. Determination of Second order reaction rate constant.
12. Effect of temperature on solubility of solid in liquid.
13. Effect of addition of Salt/pH/cosolvent on the solubility
14. Surface tension determination using Stalagmometer.
15. HLB value estimation of surfactants.
16. Viscosity – by Ostwald Viscometer, Brookfield viscometer
17. Preparation of Multiple emulsions - Demonstration.
18. Preparation of Micro emulsion - Demonstration.
19. Determination of Zeta potential - Demonstration.
20. Determination of granular density
21. Preparation of emulsion, identification and evaluation

MC409HS: GENDER SENSITIZATION LAB

B.Tech. II Year II Sem.

L T P C
0 0 3 0

Course Objectives:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

UNIT-I

UNDERSTANDING GENDER

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)

Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT-II

GENDER AND BIOLOGY

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)
Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)

Two or Many? Struggles with Discrimination.

UNIT-III

GENDER AND LABOUR

Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)

“My Mother doesn’t Work.” “Share the Load.”

Women’s Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)

Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV

ISSUES OF VIOLENCE

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: “Chupulu”.

Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.

Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)

Blaming the Victim-“I Fought for my Life....” - Additional Reading: The Caste Face of Violence.

UNIT-V

GENDER: CO - EXISTENCE

Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

TEXTBOOK

All the five Units in the Textbook, “*Towards a World of Equals: A Bilingual Textbook on Gender*” written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu and published by **Telugu Akademi, Hyderabad**, Telangana State in the year **2015**.

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

REFERENCE BOOKS:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. “*I Fought For My Life...and Won.*” Available online at: <http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdul/>

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.PHARM. III YEAR COURSE STRUCTURE & SYLLABUS (R16)

Applicable From 2016-17 Admitted Batch

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	PS501	Pharmaceutical Microbiology	4	1	0	4
2	PS502	Pharmaceutical Technology - I	4	1	0	4
3	PS503	Pharmacology – I	4	1	0	4
4	PS504	Pharmacognosy – II	3	1	0	3
5		Open Elective - II	3	0	0	3
	PS505	Drug Regulatory Affairs				
	PS506	Active Pharmaceutical Ingredient Process Development				
	MS507	Entrepreneurship and Small Business Enterprises				
6	PS508	Pharmaceutical Microbiology Lab	0	0	3	2
7	PS509	Pharmaceutical Technology - I Lab	0	0	3	2
8	PS510	Pharmacology – I Lab	0	0	3	2
9	*MC500	Professional Ethics	3	0	0	0
		Total	21	4	9	24

III YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	PS601	Medicinal Chemistry - I	3	1	0	3
2	PS602	Pharmaceutical Technology – II	3	1	0	3
3	PS603	Pharmacology – II	4	1	0	4
4	PS604	Chemistry of Natural Products	3	1	0	3
5		Open Elective - III	3	0	0	3
	PS605	Generic Product Development				
	PS606	Drug Design and Discovery				
	PS607	Screening Methods in Pharmacology				
6	PS608	Medicinal Chemistry - I Lab	0	0	3	2
7	PS609	Pharmaceutical Technology – II Lab	0	0	3	2
8	PS610	Pharmacology – II Lab	0	0	3	2
9	HS611	Advanced English Communication skills Lab	0	0	3	2
		Total	16	04	12	24

PS501: PHARMACEUTICAL MICROBIOLOGY

B. Pharm III Year I sem

L	T	P	C
4	1	0	4

Course Objectives: Microbiology is always considered to be an essential component of Pharmacy curriculum because of its relevance to pharmaceutical sciences and more specifically to pharmaceutical industry.

This course deals with the various aspects of microorganism their classification morphology, laboratory cultivation, identification, maintenance and control of microorganism, sterility testing and biosafety measures.

The course also covers bacterial genetics, drug resistance and microbiological assays and microbial limit tests.

Course Outcomes: Upon completion of the subject student shall be able to –

- know the anatomy, identification & cultivation of microorganisms
- Perform sterilization of various pharmaceutical products, equipment, culture media etc.
- Perform sterility testing of pharmaceutical products.
- Perform microbiological assay of antibiotics, Vitamins and amino acids
- Do microbiological analysis of air, water and milk

UNIT I

a. Introduction to Microbiology: Origin, scope and discovery of spontaneous generation theory, contributions of Antony Van Leewenhoek, Louis Pasteur, Robert Koch and Joseph Lister.

b. Diversity of Microorganisms: Prokaryotes versus eukaryotes – three domains of life (bacteria, archaea and eukaryotes). A detailed study of bacteria, yeasts, molds and viruses including their classification. Characterization and identification of microorganisms.

UNIT II

Nutrition and Growth of Microbes: Nutritional requirements, Types of nutrient media and growth conditions and Nutritional types based on energy source.

Isolation, cultivation (aerobic & anaerobic) and preservation of microorganisms, physiology of growth, bacterial growth curve, influence of various factors (including environmental factors) on microbial growth, Enumeration of bacteria. Exponential growth and generation time. Bacterial growth in batch and continuous culture (chemostat and turbidostat) synchronous growth.

UNIT III

a. Control of Microorganisms: General concepts, Inhibition of growth and killing, sterilization and disinfection, antiseptics and sanitation, mode of action applications & limitations of physical agents (moist and dry heat, radiation and filtration) and chemical agents. Various types of disinfectants, factors affecting sterilization and disinfection, evaluation of antimicrobial activity.

b. Official methods of sterility testing of pharmaceuticals and biosafety measures.

UNIT IV

Bacterial Genetics: Genetic recombination in bacteria, DNA replication, transcription and translation. Gene regulation (lac operon and tryptophan operon). Mutagenesis, chemical and physical mutagens. A study on drug resistance.

UNIT V

a. Introduction to Microbiology of Air, Water and milk. Methods of quantitative evaluation of microbial Contamination.

b. Microbiological Assays: Principles and methods involved in assay of Antibiotics, Vitamins, Amino acids &

Bio-Sensors in Analysis.

c. Microbial limit tests official in IP

TEXT BOOKS

1. Pelzar and Reid, Text Book of Microbiology
2. Anantha Narayan and Jayram Panikar, Text Book of Microbiology, Orient Longman, Delhi, Hyderabad.
3. Indian Pharmacopoeia, 1996

REFERENCES

1. Tortora / Funke / Care / Microbiology an introduction.
2. Stephen. P, Denyer, N.A. Hodger- Hugo & Russel's Pharmaceutical Microbiology .

PS502: PHARMACEUTICAL TECHNOLOGY – I

B. Pharm III Year I sem

L	T	P	C
4	1	0	4

Course Objectives: The student shall be taught on preformulation factors and objectives of preformulation, stability and Bioavailability of formulation, concept of products, semisolids, aerosols and cosmetic preparations.

Course Outcome: Student will know the preformulation parameters in designing the dosage form, ICH guidelines, preparation and evaluation of semisolids, ophthalmic and cosmetics.

UNIT I

Preformulation:

- Introduction and objectives of preformulation study and development of dosage forms, Physical and Chemical aspects.
- Stability and bioavailability study of prodrugs in solving problems related to stability bio availability in formulations.
- Stability testing of finished products as per ICH guidelines.

UNIT II

a) Tablets: Formulation and evaluation of tablets:

Conventional, matrix, chewable, multi-layered tablets, buccal and sublingual, fast dissolving tablets and gastric retention drug delivery systems

b) Machinery used in granulation techniques like rapid mixer granulation, fluidised bed systems and tablet compression

UNIT III

Coating of Tablets: Types of coating, coating materials and their selection, formulation of coating solution, equipment for coating, coating processes and evaluation of coated tablets. Pellet technology

UNIT IV

a) Capsules: Advantage and disadvantages of capsule dosage forms, material for production of hard and soft gelatin capsules, sizes of capsules, capsule filling, processing problems in capsule manufacturing, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.

b) Microencapsulation: Types and importance in pharmacy, microencapsulation by coacervation phase separator, multi orifice centrifugal separation. Spray drying, spray congealing, polymerization complex emulsion, air suspension technique, and pan coating techniques and evaluation of microcapsules.

UNIT V

Cosmeticology and Cosmetic Preparations: Fundamentals of cosmetic science, Formulation, preparation and packaging of cosmetics for skin, hair, dentrificers like tooth powders, paste, gels and manicure preparations like nail polish, lipsticks, eye lashes, baby care products etc.

TEXT BOOKS

- L. Lachman, H.A, Lieberman and J.L. Kanig, Theory & Practice of industrial Pharmacy, Lea & Febieger, Philadelphia Latest Edn.
- CVS. Subramanyam, Pharmaceutical production and management, Vallabh Prakashan, New Delhi 2005.
- Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.

REFERENCES

1. Shobha Rani, Text of Industrial Pharmacy, Hiremath Orient Longman
2. Essentials of pharmaceutical technology by Ajay semelty, Mona Semalty

PS503: PHARMACOLOGY – I

B. Pharm III Year I sem

L	T	P	C
4	1	0	4

Course Objectives: This subject will provide an opportunity for the student to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, and route of administration, precautions, contraindications and interaction with other drugs.

Course Outcome: Understand the pharmacological aspects of drugs, importance of pharmacology subject as a basis of therapeutics and correlate the knowledge therapeutically.

UNIT I

General Pharmacology: Introduction to pharmacology, sources of drugs, dosage forms and routes of administration, Absorption, distribution, Metabolism and excretion of drugs, mechanism of action, combined effect of drugs, factors modifying drug action, Adverse drug reactions, tolerance and dependence, pharmacogenetics., principles of drug discovery and phases of drug development.

UNIT II

Pharmacology of Peripheral Nervous System:

- Neurohumoral transmission (autonomic and Somatic)
- Parasympathomimetics, parasympatholytics, sympathomimetics & sympatholytics
- Skeleton muscle relaxants

UNIT III

Pharmacology of Central Nervous System:

- Neurohumoral transmission in the C.N.S.
- General anesthetics.
- Alcohols and disulfiram.
- Pharmacology of Sedatives, hypnotics, anti-anxiety agents

UNIT IV

- Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs.
- Narcotic analgesics and antagonists.
- C.N.S. stimulants
- Drug Addiction and Drug Abuse.
- Local anesthetic agents

UNIT V

- Psychopharmacological agents (antipsychotics) Antidepressants, anti- maniacs and hallucinogens.
- Pharmacology of Anti-epileptic drugs
- Anti-Parkinsonian Drugs

TEXT BOOKS

- Tripathi, Textbook of Pharmacology, JAYPEE
- F.S.K Barar, Essentials of Pharmacotherapeutics.
- H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, : Churchill Living stone, 4th Ed.

REFERENCES

- Sathoskar, Pharmacology and pharmaco therapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.
- Pharmacology, An illustrated review by Mark A Simmons

PS504: PHARMACOGNOSY – II

B. Pharm III Year I sem

L	T	P	C
3	1	0	3

Course Objectives: To have knowledge on the formation of pharmaceutically important secondary metabolites in plants and their commercial significance. The role of fibres, natural sweetening agents, colorants, volatile oils, tannins, resins in pharmaceutical, cosmetic and food industry. To make the student aware of what is Ayurveda and its various preparations.

Course Outcome: After the study of the course, the student shall be able to know about the phytopharmaceuticals of commercial significance and the various applications of the crude drugs in the preparation of formulations as medicaments and excipients (Flavors, perfumes, sweeteners and colorants).

UNIT I

Biogenesis of Natural Products:

- A brief account of primary and secondary metabolite production in plants.
- Shikimic acid pathway and acetate mevalonate path way
- Biosynthesis of Alkaloids- Atropine, Morphine, Ergotamine, Reserpine, Isoprenoid compounds –Diosgenin and scillaren

UNIT II

- General introduction to Volatile oils.
- Systematic pharmacognostic study of the following: Cinnamon, Cassia, Clove and Cardamom.
- Biological source, collection preparation, chemical constituents uses of the following crude drugs – Fennel, Dill, Ginger, Eucalyptus oil, Gaultheria, Lemon grass oil, Oil of Citronella,
- Mentha oil.

UNIT III

- General introduction to Tannins and Resins
- Biological source, collection and preparation, chemical constituents, tests for identification and uses of following – Black Catechu, Pale Catechu, Myrobalan, Arjuna, Balsam of Tolu, Benzoin, Guggul and Podophyllum.

UNIT IV

- Herbal cosmetics: History and concept development of herbal cosmetics. A brief account on the following herbs in cosmetic preparation.
Skin care: Aloe, Neem, Turmeric, Saffron and Sandal wood.
Hair care: Amla, Henna, Hibiscus, Bringraj.
- An introduction to potential cardiovascular, anticancer/cytotoxic and antibiotic drugs from marine sources.

UNIT V

- Study of Fibres used in Pharmacy such as Cotton, Silk, Wool and Glass wool.
- Study of mineral drugs: Asbestos, Bentonite, Kaolin, kieselgurh and Talc

TEXT BOOKS

- Kokate C.K , Purohit AP & Gokhale, The Pharmacognosy S.B (Nirali)
- Trease and Evans, Pharmacognosy, Latest Edition.
- Tyler, Brady & Robert, Pharmacognosy.

REFERENCES

1. Atal C.R & Kapur B.M, Cultivation & Utilization of Medicinal Plants.
2. Mohammad Ali, Pharmacognosy. CBS Publications.

PS505: DRUG REGULATORY AFFAIRS
(Open Elective – II)

B. Pharm III Year I sem

L T P C
3 0 0 3

Course Objectives - Various procedures for approval of API and formulations for manufacture, sale, export and import of drugs.

Course Outcome: The clear information about the regulations in India and abroad is gained by the students.

UNIT I

Introduction to Drug regulatory affairs, organisation structure of India, in central and state Division of drug controller of India and their function

UNIT II

Procedure for obtaining manufacturing for basic drug and formulation, sale of drugs, import & export of drugs and their permission procedures.

UNIT III

Application for procedures for approval for formulations and Active Pharmaceutical Ingredient.

UNIT IV

USFDA & Europe, Japan guidelines for obtaining approval for API and formulations

UNIT V

Salient features and principles of Quality by Design (QBD), ICH and WHO, obtaining for API and formulations approval

TEXT BOOKS

1. Laws of drugs in India, Hussain
2. New drug approval process, 5th edition, by Guarino
3. Commercial Manual on Drugs and Cosmetics 2004, 2nd edition

REFERENCES

1. Good Manufacturing Practices for Pharmaceuticals, S.H. Wiling, Vol. 78, Marcel Decker.
2. fda.org, hc-sc.gc.ca, ich.org, cder.org

PS506: ACTIVE PHARMACEUTICAL INGREDIENT PROCESS DEVELOPMENT
(Open Elective – II)

B. Pharm III Year I sem

L	T	P	C
3	0	0	3

Course Objectives: Mainly emphasizes on development of process from pilot preparation to bulk drug synthesis in pharmaceutical industries.

Course Outcome: Students would understand the various aspects regarding process development and synthesis from pilot preparation to bulk drug.

Basic principles, salient features and applications for the following units:

UNIT-I:

Development and scale up techniques for the manufacture of new pharmaceutical active ingredients.

UNIT-II

Process optimisation, maximisation of synthetic route from pilot plant.

UNIT-III

Commercial production of bulk drugs like (i) reaction sequence (ii) process flow and engineering aspects.

UNIT-IV

Process technologies for natural products from plants, animals, marine and microbial sources.

UNIT-V

ICH Q11 for API development.

TEXT BOOKS:

1. Pharmaceutical Process Chemistry for Synthesis: Rethinking the Routes to Scale-Up ,
2. Peter J. Harrington ,John Wiley and Sons Inc. Publication 2011
3. Strategies for Organic Drug Synthesis and Design by Daniel Lednicer, 2nd Edition,John Wiley and Sons Inc. Publication, 2008

REFERENCE:

1. Good Pharmaceutical Manufacturing Practice: Rationale and Compliance by Sharp John, CRC Press; 1st edition Management Information Systems by Laudon Kenneth C. Prentice Hall; 12th edition, 2011.
2. ICH Guidelines, www.ich.org

MS507: ENTREPRENEURSHIP AND SMALL BUSINESS ENTERPRISES
(Open Elective – II)

B. Pharm III Year I sem

L	T	P	C
3	0	0	3

Course Objective: The aim of this course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship.

Course Outcome: It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

Unit – I:

Entrepreneurial Perspectives:

Evolution, Concept of Entrepreneurship, Types of Entrepreneurs, Entrepreneurial Competencies, Capacity Building for Entrepreneurs.

Entrepreneurial Training Methods; Entrepreneurial Motivations; Models for Entrepreneurial Development, The process of Entrepreneurial Development.

Unit – II:

New Venture Creation:

Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

Unit – III:

Management of MSMEs and Sick Enterprises

Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units.

Units – IV:

Managing Marketing and Growth of Enterprises:

Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

Units – V:

Strategic perspectives in Entrepreneurship:

Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship; Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India.

Text Books:

1. Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath, 2e, Pearson, 2014.
2. Entrepreneurship, A South – Asian Perspective, D. F. Kuratko and T.V.Rao, 3e, Cengage, 2012.

REFERENCES:

1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2015.

PS508: PHARMACEUTICAL MICROBIOLOGY LAB

B. Pharm III Year I sem

L	T	P	C
0	0	3	2

1. Introduction to equipment and glassware used in microbiology laboratory.
2. Study of morphology of different microbes
3. Preparation of various culture media, cultivation of microbes and observation of colony characteristics.
4. Sterilization techniques (moist and dry heat) and their validations.
5. Aseptic transfer of culture into different types of media.
6. Characterisation of microbes by staining techniques (simple, gram's, acid fast and negative staining).
7. Study of motility of bacteria by hanging drop method.
8. Characterization of microbes through Bio chemical reactions:
 - a. Indole test.
 - b. Methyl red test.
 - c. Voges proskauer test.
 - d. Starch hydrolysis test.
 - e. Fermentation of carbohydrates.
9. Isolation of pure cultures by streak plate, spread plate & pour plate techniques.
10. Enumeration of bacteria by pour plate/spread plate technique
11. Enumeration of bacteria by direct microscopic count.
12. Evaluation of any disinfectant by phenol coefficient test
13. Study of Oligodynamic action (of metals on bacteria)
14. Preservation of microorganisms (slant and stab cultures)
15. Microbiological Analysis of Water.

REFERENCE

1. Garg, F C Experimental Microbiology
2. Gaud, R.S, Gupta G.D, Practical Microbiology
3. Vanitha Kale and kishore Bhusari, Pratical microbiology principles and Techniques

PS509: PHARMACEUTICAL TECHNOLOGY - I LAB

B. Pharm III Year I sem

L	T	P	C
0	0	3	2

1. Preformulation studies
Bulk properties, different densities, size and size distribution analysis, compressibility, Carr's index, Angle of repose, hausner's ratio
2. Solubility profile estimation in different pH media
3. Partition coefficient determination
4. Effect of crystallinity/amorphous structures on the solubility of the given drugs
5. Preparation and evaluation of official ointments and gels (in each category any two)
6. Preparation and evaluation of dry syrups (ampicillin, amoxicillin)
7. Preparation and evaluation of the following cosmetics
 - a. Shampoos, tooth pastes, tooth powders, nail polish, baby shampoo,
 - b. Baby powders, lipsticks, vanishing cream, cold cream, depillators.
8. Evaluation of packaging materials such as glass, plastics, cotton (hydrolytic resistance test for glass) and light absorption test for rubber and closures.

PS510: PHARMACOLOGY – I LAB

B. Pharm III Year I sem

L	T	P	C
0	0	3	2

- 1. Introduction to Experimental Pharmacology**
 - Preparation of different solutions for experiments.
 - Drug dilutions, use of molar and w/v solutions in experimental Pharmacology.
 - Common laboratory animals and anesthetics used in animal studies.
 - Commonly used instruments in experimental pharmacology.
 - Some common and standard techniques.
 - Bleeding and intravenous injection, intragastric administration.
- 2. Experiments on intact preparations:**

Study of different routes of administration of drugs in mice/rats.
- 3. Experiments in Central Nervous system:**

Recording of spontaneous motor activity, stereotype, analgesia, anticonvulsant activity, anti-inflammatory activity,
- 4. To study the effect of autonomic drugs on rabbit's eye**
- 5. Experiments on Isolated Preparations:**

To study the effects of various agonists and antagonists and their characterisation using isolated preparations like frog's rectus abdominus muscle and isolated ileum preparation of rat & guinea pig.

 - To record the concentration response curve (CRC) of acetylcholine using rectus abdominus muscle preparation of frog.
 - To study the effects of physostigmine and d-tubocurarine on the CRC of acetylcholine using frog rectus abdominus muscle preparation of frog.
 - To record the CRC of 5-HT on rat fundus preparation.
 - To record the CRC of histamine on guinea pig ileum preparation.
 - To study the inotropic and chronotropic effects of drugs on isolated frog heart.
 - To study the effects of drugs on normal and hypodynamic frog heart.
- 6. Experiments pertaining to analgesia, anti-convulsant activity, anti-inflammatory activity (Only demonstration).**

REFERENCE:

Experimental Pharmacology, M.C. Prabhakar.

MC500: PROFESSIONAL ETHICS

B. Pharm III Year I sem

L	T	P	C
3	0	0	0

Course Objective: To enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and Professional lives.

Course Outcome: The students will understand the importance of Values and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

UNIT - I

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT - II

Basic Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

UNIT - III

Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession.

Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

UNIT - IV

Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.

Ethics in changing domains of research - The US government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.

UNIT - V

Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.

TEXT BOOKS:

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

REFERENCES

1. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e , Cengage learning, 2015.
2. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

PS601: MEDICINAL CHEMISTRY – I

B. Pharm III Year II sem

L	T	P	C
3	1	0	3

Course Objectives: The basic consideration of drug activity, drug metabolism and medicinal substances belonging to different categories are discussed in an elaborative manner. The synthesis and mechanism of action of the medicinal compounds are explained in an organized way which helps the students to understand the medicinal uses of the compounds.

Course Outcome: The students gain good knowledge about the usage of medicinal substances, the synthesis and drug-drug interactions, so that they can get involved with confidence in the patient counseling.

UNIT I

a. Basic considerations of Drug activity: Physico chemical properties of drug molecules in relation to biological activity – Solubility, lipophilicity, partition-coefficient, Ionization, hydrogen bonding, Chelation, redox potential and surface activity. Bioisosterism and steric features of drugs, drug distribution and protein binding: Introduction to Pro and soft drug approaches.

b. Drug metabolism and inactivation: Introduction, Phase-I and Phase-II reactions.

Note: Introduction, definition, nomenclature, chemical classification, structure, synthesis, general mechanism, and mode of action, SAR including physicochemical and stereo chemical aspects, metabolism and therapeutic uses of the drugs from each category shall be studied for the following units. An outline of synthetic procedure of only the drugs mentioned in each category.

UNIT II

Drugs acting on CNS: A brief study of the chemistry of neurotransmitters.

a. Hypnotics and Anxiolytics: Phenobarbital, diazepam, alprazolam, glutethimide

Anti-psychotics: Chlorpromazine, haloperidol, clozapine, oxyptentine.

Anti-epileptics: Phenytoin, valproic acid, carbamazepine, ethosuximide.

Anti-depressants: Imipramine, fluoxetine, doxepine

b. Local anesthetic and General anesthetic agents: benzocaine, procaine, dibucaine and lidocaine, halothane and thiopental sodium.

UNIT III

a. Adrenergic agents and adrenergic blockers. Isoproterenol, atenolol, hexoxybenzamine, amphetamine,

ephedrine, salbutamol,

b. Cholinergic agents and acetyl cholinesterase inhibitors

Cholinergics: Carbachol, bethanichol

Anticholinesterase: Neostigmine, pyridostigmine

Neuromuscular blockers: succinyl choline.

c. Anti-cholinergics: atropine, ipratropium bromide, dicyclomine, bipyridine, propantheline

UNIT IV

a. Prostaglandins. Introduction, nomenclature, functions, bio synthesis of prostaglandin E1, Structures of clinically useful prostaglandins.

b. Analgesics and NSAIDs (Non-steroidal anti-inflammatory agents):

i. Introduction and types of pain and inflammation

ii Classification and systematic development of analgesics of morphine, mild analgesics and strong analgesics: Meperidine and Methadone

- iii. NSAIDS – Aspirin, paracetamol, oxyphenbutazone, ibuprofen, indomethacin, diclofenac and meloxicam
- iv. A brief account on Cox-2 inhibitors and nimsulide.

UNIT V

General account of cardiovascular diseases

- a. Antihypertensives:** methyldopa, amlodipine, enalapril, losartan.
- b. Anti-arrhythmics:** procainamide
- c. Diuretics:** acetazolamide, hydrochlorthiazide, furosemide
- d. Anticoagulants, Anti-anginals and Coronary vasodilators:** Isosorbide dinitrate, verapamil, diltiazem

TEXT BOOKS:

1. William O. Foye, Textbook of Medicinal Chemistry, Lea Febiger, Philadelphia.
2. JH Block & JM Beale (Eds), Wilson & Giswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry, 11th Ed, Lipcott, Raven, Philadelphia, 2004.
3. Medicinal Chemistry by Korol Kavas.

REFERENCES

1. D. Abraham (Ed), Burger Medicinal chemistry ad Drug discovery, Vol. 1 & John Wiley & Sons, New York 2003, 6th Ed.
2. Daniel Iednicer, Strategies for Organic Drug Synthesis and Design, John Wiley, N. Y. 1998.

PS602: PHARMACEUTICAL TECHNOLOGY – II

B. Pharm III Year II sem

L	T	P	C
3	1	0	3

Course Objectives: Student will know the formulation and evaluation of tablets, coated tablets, capsules, micro-encapsules and parenteral preparations in laboratories and industrial scale.

Course Outcome: The students shall be exposed to various aspects of pharmaceutical product preparations and evaluations of tablets, capsules etc.

UNIT I

Semisolid dosage forms: Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semi solids, clear gels manufacturing procedure, evaluation and packaging.

UNIT II

a. Pharmaceutical aerosols: Definition, propellants general formulation, manufacturing and packaging methods, pharmaceutical applications and evaluation.

b. Dry Syrups, Formulation, Preparation, Evaluation and special applications with examples.

UNIT III

Parenteral Products

a. Preformulation factors, routes of administration, water for injection, treatment apyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment.

b. Formulation details, container and closures and selection.

c. Prefilling treatment, washing and sterilization of containers and closures, preparation of solution and suspensions, filling and closing of ampules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large-scale manufacture and evaluation of parenteral products.

Ophthalmic Preparations: Requirements, formulation, methods of preparation, containers and evaluation.

UNIT IV

Aseptic techniques, sources of contamination and method of prevention. Design of aseptic area, laminar flow benches, services and maintenance.

UNIT V

a. Packaging of Pharmaceutical products: Packaging components, types, specifications and methods of evaluation as per I.P. Factors influencing choice of containers, package testing, legal and other official requirements for containers, packing testing.

b. Methods of packing of solid, liquid and semi-solid dosage forms, Factors influencing packing material and stability aspects of packaging.

TEXT BOOKS

1. L. Lachman, H.A. Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy, Lea & Febieger, Philadelphia Latest Edn
2. HC Ansel introduction to Pharmaceutical Dosage forms
3. CVS. Subramanyam, Pharmaceutical production and management, Vallabh Prakashan, New Delhi 2005.

REFERENCES

1. Sagarian & MS Balsam, Cosmetics Sciences & Technology, Vol.1, 2 & 3
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences

PS603 PHARMACOLOGY – II

B. Pharm III Year II sem

L	T	P	C
4	1	0	4

Course Objectives: This subject will provide an opportunity for the student to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs.

Course Outcome: Understands the pharmacological aspects of drugs, importance of pharmacology subject as a basis of therapeutics and correlate the knowledge therapeutically.

UNIT I

Pharmacology of drugs acting in cardiovascular diseases

- Congestive heart failure
- Hypertension.
- Shock.
- Arrhythmias

UNIT II

- Pharmacology of Drugs used in coronary artery disease and Hyperlipidemias.
- Pharmacology of Drugs acting on hematopoietic system
Anti-coagulants, Anti-platelets, Thrombolytics & Hematinics.
- Pharmacology of Drugs acting on Urinary system
Diuretics

UNIT III

Autacoids

- Histamine, 5-HT and their antagonists.
- Prostaglandins, thromboxanes and leukotrienes
- Bradykinin and substance P.

UNIT IV

- Drugs acting on the respiratory system
Anti-asthmatic drugs.
Anti-tussives and expectorants.
Respiratory stimulants
- Bioassays: Applications, Principles and Methods of Bioassays.
- Study of bioassay methods for the following drugs
 - Digitalis,
 - D – tubocurarine,
 - Oxytocine
 - HCG.

UNIT V

Drugs acting on Endocrine system

- Insulin, Oral hypoglycaemic agents
- Adrenal steroids
- Anti thyroid agents.
- Oral contraceptives

TEXT BOOKS

- Tripathi, Textbook of Pharmacology, JAYPEE
- F.S.K Barar, Essentials of Pharmacotherapeutics
- H.P Rang, M. M. dale & J.M. Ritter, Pharmacology,: Churchill Living stone, 4th Ed.

REFERENCES

1. Crossland, Lewis 's Pharmacology, Church living stone
2. Mark A. Simmons, Pharmacology An Illustrated Review

PS604: CHEMISTRY OF NATURAL PRODUCTS

B. Pharm III Year II sem

L	T	P	C
3	1	0	3

Course Objectives: The chemistry including the structure elucidation of the natural products belonging to different groups such as amino acids, alkaloids, carbohydrates, steroids etc. are discussed in depth.

Course Outcome: The knowledge of the students is enhanced with the clear information about the natural products which are having medicinal importance.

UNIT I

Poly Functional Natural Products

(a) Carbohydrates: Introduction, Definition, Classification, Isolation, General Properties (including isomerism) and Pharmaceutical importance of Carbohydrates, Chemistry (Structure, Nomenclature and Reactions) of glucose, fructose, sucrose, maltose, cellulose and starch.

(b) Oils & Fats: Introduction, Definition, Classification, Isolation, General properties and Pharmaceutical importance of oils and fats. Chemistry (structure, nomenclature and reactions) of oils and fats and analysis according to Pharmacopoeial methods

UNIT II

Amino Acids and Proteins

Introduction, definition, classification, isolation, general properties and pharmaceutical importance of amino acids and their relationship to proteins and polypeptides.

Chemistry of Protein Hormones: Insulin, Oxytocin, Thyroxin and Anti-thyroid drugs

UNIT III

a. Flavonoids: Sources, uses, chemistry and General methods of structural determination (chemical & spectral analysis) of Amygdalin, arbutin and quercetin

b. Terpenoids: Definition and Classification: Isoprene rule, Special Isoprene rule for terpenes, General methods of isolation. Chemistry and structure elucidation of citral, menthol and camphor.

UNIT IV

a. Alkaloids

Introduction, definition, occurrence, classification, isolation, general properties and pharmaceutical importance of alkaloids. General methods of extraction, structure elucidation and chemistry (structure, nomenclature and reactions) of ephedrine, atropine, papaverine and quinine

b. Purine and Xanthine Derivatives

Chemistry and Pharmaceutical importance Caffeine, Theophylline, Theobromine and Uric acid.

UNIT V

Steroids

Introduction, Definition, Occurrence, Classification, Isolation, General properties and Pharmaceutical importance of Sterols: color reactions of cholesterol, stigmasterol, ergosterol. Importance & general concepts of bile acids. Steroidal saponins: Diosgenin and hecogenin. Androgens, Estrogens, Progestational agents, Steroidal contraceptives. Adrenocorticoids, Deoxycorticosterone, Cortisone, Prednisone, Aldosterone. Cardiac Glycosides of Digitalis other Cardiac drugs, Strophanthus and Squill.

TEXT BOOKS

1. Organic Chemistry, Vol.II by I.L. Finar, The English Language Book Society, London.
2. Natural Products Vol.I & II by O.P. Agarwal Goel publications – Meerut.

3. F.G.Mann & B. Saunders, Practical Organic Chemistry Longmans Green & Co. Ltd., U.K

REFERENCE BOOKS

1. Burger's Medicinal Chemistry, M.E. – Wolff, Ed., John Wiley & Sons, New York.
2. R. M. Acheson, An Introduction to the Chemistry of Heterocyclic Compounds, Interscience NY.

**PS605: GENERIC DRUG PRODUCT DEVELOPMENT
(Open Elective – III)**

B. Pharm III Year II sem

L	T	P	C
3	0	0	3

Course Objectives: To learn the generic drug product development process, dosage form design and development, analytical method development and dossier approval process.

Course Outcome: The knowledge of the students is enhanced with the clear information about the generic product development.

Unit I:

- a) Concept of generic drug product development, Hatch-Waxman act and its amendments.
- b) History of generic product development in US

Unit II:

Design of dosage form to meet equivalence to reference listed drug, product development steps, formula optimization, process optimization and packaging selection.

Unit III:

Analytical method development for verification and validation for active ingredient, in-process samples and finished dosage forms.

Unit IV:

- a) Stability studies on active ingredient and finished dosage forms, accelerated stability studies, stability studies at different conditions, determination or expiration date.
- b) Scale up studies to optimize manufacturing process and execution of exhibit batches.

Unit V:

- a) Bioequivalence studies, various designs of bioequivalence studies, bioequivalence criteria and in-vitro tests to ensure bioequivalence of test product.
- b) Introduction to electronic Common Technical Document (eCTD), various modules and the important information in each module.
- c) Drug product approval process in India and US.

REFERENCE

1. Generic Drug product Development: Solid oral dosage forms-Leon Shargel.
2. ICH guidelines.

PS606: DRUG DESIGN AND DISCOVERY
(Open Elective - III)

B. Pharm III Year II sem

L	T	P	C
3	0	0	3

Course Objectives: Emphasizes on the conceptual background and development of medicinal chemistry and drug design. Identification of lead for new drug design. Modification of lead aimed at changing Pharmacodynamic and Pharmacokinetics.

Course Outcome: The students would be in a position to identify lead for new drug design, to design and discover the novel drug with the knowledge they gained through the study of the various topics of the syllabus.

Basic principles, salient features and applications for the following units:

Unit-I

Introduction of modern drug discovery concept and technologies.

Unit-II

Principles of combinatorial chemistry.

Unit-III

Introduction to structure based drug design.

Unit-IV

Molecular modelling and drug design.

Unit-V

QSAR.

TEXT BOOKS

1. Textbook of Drug Design and Discovery, 4th Ed., by Larsen
2. Structure-based Drug Discovery by Jhoti, Harren
3. William H, Malick JB "Drug Discovery and Development" Humana Press Clifton.

REFERENCE

1. Robert GCK, ed., "Drug Action at the Molecular Level" University Park Press Baltimore.
2. Martin YC. "Quantitative Drug Design" Dekker, New York.

PS607: SCREENING METHODS IN PHARMACOLOGY
(Open Elective – III)

B. Pharm III Year II sem

L	T	P	C
3	0	0	3

Course Objectives:- The students is going to study about various techniques for screening of drugs for various pharmacological activities and guide lines for handling animals and human and animal ethics for screening of drugs.

Course Outcome: - The expected outcomes are student will know how to handle animals and know about various techniques for screening drugs for different pharmacological activities and guidelines and regulations for screening new drug molecules on animals and human volunteers.

UNIT I

Care Handling and breeding techniques of laboratory animals, CPCSEA guidelines, alternatives to animal studies, Good laboratory Practices.

UNIT II

Bioassays: Basic principles of Biological standardization, Merits and demerits, methods used in the bio-assay of Rabbis Vaccine and Oxytocin. Test for pyrogens.

UNIT III

Toxicity tests: OECD guidelines, determination of LD50, acute, subacute and chronic toxicity studies.

UNIT IV

Screening: Definition, types of screening methods. Pharmacological activity of new substances with emphasis on the evaluation of analgesic, antipyretic and anti-inflammatory activity.

UNIT V

Screening for the Pharmacological activity of epilepsy, cardiac, psychopharmacological, anti diabetic and anticancer.

TEXT BOOKS

1. Screening methods in Pharmacology, Vol.-1&2 by Robert .A. Turner and Peter Hebborn.
2. Pharmacological Screening Methods & Toxicology by Srinivasa Rao A, Pharmamed press publishers.
3. Handbook of experimental pharmacology by S.K. Kulkarni, Vallabh Prakashan, Delhi.

REFERENCE BOOKS

1. ICH of technical requirements for registration of pharmaceuticals for human use, ICH harmonized Tripartite guidelines - Guidelines for good clinical practice, E6, May 1996.
2. Good clinical practice - Guidelines for Clinical trails on pharmaceutical products in India, Central drug standard control organization, New Delhi, Minister of Health- 2001

PS608: MEDICINAL CHEMISTRY – I LAB

B. Pharm III Year II sem

L	T	P	C
0	0	3	2

i. Synthesis of some medicinal compounds and their analogues.

- Barbituric acid from Diethyl Malonate.
- Phenyton from Benzoin or Benzil.
- Paracetamol from *para*- nitro phenol or *para*- aminophenol.
- 1,4- di hydro pyridine from ethyl aceto acetate.
- Quinazolinone from anthranilic acid via benzoxazinone.
- Synthesis of Fenofibrate
- Isoniazid from γ -picoline.
- Antipyrine from ethyl aceto acetate.
- Benzocaine from *para*- nitro benzoic acid.

ii. Qualitative estimation of some functional groups. *

- Halogens (Strepheno's method).
- Hydroxyl groups (acetylation method)
- Methoxyl groups (Zeissel's method)
- Carboxyl groups (silver salt method).

REFERENCES

- 1) A.I. Vogel, Text Book of Practical Organic Chemistry, 5th Edition.
- 2) R.K. Bansal, Laboratory Manual of Organic Chemistry.
- 3) F.G. Mann & B.C. Saunders, Pratical Organic Chemistry, 4th Edition.
- 4) Advaced medicinal chemistry lab guide by N. Raghu Prasad and M. Raghuram Rao
- 5) Organic chemistry a Lab manual, Cengage learning India Pvt. Ltd. By Pavia

PS609: PHARMACEUTICAL TECHNOLOGY – II LAB

B. Pharm III Year II sem

L	T	P	C
0	0	3	2

1. Experiments to illustrate preparation, stabilization and evaluation of pharmaceutical products like capsules and tablets like conventional, matrix, fast dissolving, multilayered, chewable, buccal, sublingual and Gastric retention
2. Coating of tablets like sugar, film, enteric coating and evaluation

PS610: PHARMACOLOGY – II LAB

B. Pharm III Year II sem

L	T	P	C
0	0	3	2

1. Experiments on Isolated Preparations:
 - a. To calculate the PA_2 value of atropine using acetylcholine as an agonist on rat ileum preparation.
 - b. To calculate the PA_2 value of mepyramine or chlorampheniramine using histamine as agonist on guinea pig ileum.
 - c. To find out the strength of the given sample on (e.g. Acetylcholine, Histamine, 5-HT, Oxytocin etc.) Using a suitable isolated muscle preparation by
 - i. Matching Assay
 - ii. Two point Assay
 - iii. Three point Assay
2. Pharmacology of the Gastrointestinal Tract
To study the anti-secretory and anti-ulcer activity using pylorus ligated rats.

HS611: ADVANCED COMMUNICATION SKILLS (ACS) LAB

B. Pharm III Year II sem

L	T	P	C
0	0	3	2

Introduction

A course on *Advanced English Communication Skills (AECS) Lab* is considered essential at the third year level of B.Tech and B.Pharmacy courses. At this stage, the students need to prepare themselves for their career which requires them to listen to, read, speak and write in English both for their professional and interpersonal communication. The main purpose of this course is to prepare the students of Engineering for their placements.

Course Objectives: This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve students' fluency in spoken English
- To enable them to listen to English spoken at normal conversational speed
- To help students develop their vocabulary
- To read and comprehend texts in different contexts
- To communicate their ideas relevantly and coherently in writing
- To make students industry-ready
- To help students acquire behavioral skills for their personal and professional life
- To respond appropriately in different socio-cultural and professional contexts

Course Outcomes: Students will be able to:

- Acquire vocabulary and use it contextually
- Listen and speak effectively
- Develop proficiency in academic reading and writing
- Increase possibilities of job prospects
- Communicate confidently in formal and informal contexts

Syllabus

The following course activities will be conducted as part of the Advanced English Communication Skills (AECS) Lab:

1. **Inter-personal Communication and Building Vocabulary** - Starting a Conversation – Responding Appropriately and Relevantly – Using Appropriate Body Language – Role Play in Different Situations - Synonyms and Antonyms, One-word Substitutes, Prefixes and Suffixes, Idioms and Phrases and Collocations.
2. **Reading Comprehension** –General Vs Local Comprehension, Reading for Facts, Guessing Meanings from Context, , Skimming, Scanning, Inferring Meaning.
3. **Writing Skills** – Structure and Presentation of Different Types of Writing – Letter Writing/Resume Writing/ e-correspondence/ Technical Report Writing.
4. **Presentation Skills** – Oral Presentations (individual or group) through JAM Sessions/Seminars/PPTs and Written Presentations through Posters/Projects/Reports/ e-mails/Assignments... etc.,
5. **Group Discussion and Interview Skills** – Dynamics of Group Discussion, Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas and Rubrics of Evaluation- Concept and Process, Pre-interview Planning, Opening Strategies, Answering Strategies, Interview through Tele-conference & Video-conference and Mock Interviews.

Minimum Hardware Requirement

Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- **Spacious room with appropriate acoustics**
- **Eight round tables with five movable chairs for each table.**
- **Audio-visual aids**
- **LCD Projector**

- **Public Address system**
- **Computer with suitable configuration**

Suggested Software: The software consisting of the prescribed topics elaborated above should be procured and used.

- **Oxford Advanced Learner's Compass, 8th Edition**
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**

REFERENCES:

1. Kumar, Sanjay and Pushp Lata. *English for Effective Communication*, Oxford University Press, 2015.
2. Konar, Nira. *English Language Laboratories – A Comprehensive Manual*, PHI Learning Pvt. Ltd., 2011.