

MRSPTU B. PHARMACY SYLLABUS 2016 BATCH

B. Pharmacy (1st Year)

Total Contact Hours = 36

Total Marks = 1000

Total Credits = 28

SEMESTER 1 st		Contact Hrs.			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BHUM0-104	Communicative English	2	1	0	40	60	100	3
BPHA1101	Pharmacognosy-I	2	1	-	40	60	100	3
BPHA1 102	Pharmaceutical Chemistry-I(Inorganic pharmaceutical Chemistry)	3	1	-	40	60	100	4
BPHA1 103	Pharmaceutical Analysis-I	3	1	-	40	60	100	4
BCAP0 195	Computer Science & Application	2	1	-	40	60	100	3
BPHA1 104	Introduction to Dosage Form	2	1	-	40	60	100	3
BPHA1 105	Pharmacognosy-I Lab.	-	-	4	60	40	100	2
BPHA1 106	Pharmaceutical Chemistry-I Lab. (Inorganic pharmaceutical Chemistry)	-	-	4	60	40	100	2
BPHA1 107	Pharmaceutical Analysis-I Lab.	-	-	4	60	40	100	2
BCAP0196	Computer Science & Applications Lab.	-	-	4	60	40	100	2
Total	Theory = 6 Labs = 4	14	6	16	480	520	1000	28

Total Contact Hours = 37/39

Total Marks = 1000/1100

Total Credits = 29/30

SEMESTER 2 nd		Contact Hrs.			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BPHA1-208	Human Anatomy and Physiology-I	3	1	-	40	60	100	4
BPHA1-209	Pharmaceutical Organic Chemistry - I	3	1	-	40	60	100	4
BPHA1-210	Biochemistry	3	1	-	40	60	100	4
BPHA1-211	Physical Pharmaceutics-I	3	1	-	40	60	100	4
*BPHA1-212/ *BPHA1-213	Remedial Biology/Remedial Mathematics	2/3	-	-	40	60	100	2/3
BPHA1-214	Environmental Sciences	3	-	-	40	60	100	3
BPHA1-215	Human Anatomy and Physiology –I Lab	-	-	4	60	40	100	2
BPHA1-216	Pharmaceutical Organic Chemistry- I Lab	-	-	4	60	40	100	2
BPHA1-217	Biochemistry – Lab	-	-	4	60	40	100	2
BPHA1-218	Physical Pharmaceutics I - Lab	-	-	4	60	40	100	2
BPHA1-219	Remedial Biology - Lab	-	-	2	60	40	100	1
Total		17/18	4	16/18	480/540	520/560	1000 / 1100	30

* Non-medical students opt for Remedial Biology and Medical students opt for remedial mathematics

MRSPTU B. PHARMACY SYLLABUS 2016 BATCH

Total Contact Hrs.. = 36

Total Marks = 900

Total Credits = 28

SEMESTER 3 rd		Contact Hrs..			Marks			Credits
Course Code	Subject Name	L	T	P	Int.	Ext.	Total	
BPHA1-320	Pharmaceutical Organic Chemistry-II	3	1	-	40	60	100	4
BPHA1-321	Pharmaceutical Microbiology	3	1	-	40	60	100	4
BPHA1-322	Pharmaceutical Engineering	3	1	-	40	60	100	4
BPHA1-323	Human Anatomy and Physiology-II	3	1	-	40	60	100	4
BPHA1-324	Pathophysiology	3	1	-	40	60	100	4
BPHA1-325	Pharmaceutical Organic Chemistry-II Lab.	-	-	4	60	40	100	2
BPHA1-326	Pharmaceutical Microbiology Lab.	-	-	4	60	40	100	2
BPHA1-327	Pharmaceutical Engineering Lab.	-	-	4	60	40	100	2
BPHA1-328	Human Anatomy and Physiology-II Lab.	-	-	4	60	40	100	2
Total		15	5	16	440	460	900	28

Total Contact Hours = 36

Total Marks = 900

Total Credits = 28

SEMESTER 4 th		Contact Hrs..			Marks			Credits
Course Code	Subject Name	L	T	P	Int.	Ext.	Total	
BPHA1-429	Pharmaceutical Organic Chemistry –III	3	1	-	40	60	100	4
BPHA1-430	Medicinal Chemistry – I	3	1	-	40	60	100	4
BPHA1-431	Pharmacology-I	3	1	-	40	60	100	4
BPHA1-432	Physical Pharmaceutics-II	3	1	-	40	60	100	4
BPHA1-433	Pharmacognosy and Phytochemistry- I	3	1	-	40	60	100	4
BPHA1-434	Medicinal Chemistry – I Lab.	-	-	4	60	40	100	2
BPHA1-435	Pharmacology-I Lab.	-	-	4	60	40	100	2
BPHA2-436	Physical Pharmaceutics- II Lab.	-	-	4	60	40	100	2
BPHA1-437	Pharmacognosy and Phytochemistry I Lab.	-	-	4	60	40	100	2
Total		15	5	16	440	460	900	28

Overall

Semester	Marks	Credits
1 st	1000	28
2 nd	1000/1100	30
3 rd	900	28
4 th	900	28
Total	2900/3000	114

COMMUNICATIVE ENGLISH

Subject Code: BHUM0-104

L T P C
2 1 0 3

Duration: 35 Hrs.

Scope: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.

Course Objectives:

Upon completion of the course the student shall be able to

1. Understand the behavioural needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
2. Communicate effectively (Verbal and Non Verbal)
3. Effectively manage the team as a team player
4. Develop interview skills
5. Develop Leadership qualities and essentials

UNIT-I (3 Hrs.)

Communication Skills: Introduction, Definition, the Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context

Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment

UNIT-II (5 Hrs.)

Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication

Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style

UNIT-III (5 Hrs.)

Basic Listening Skills: Introduction, Self-Awareness, Active Listening, becoming an Active Listener, Listening in Difficult Situations

Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication

Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message

UNIT-IV (22 Hrs.)

Interview Skills: Purpose of an interview, Do's and Don'ts of an interview

Giving Presentations: Dealing with Fears, planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

Group Discussion: Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion

(Tutorials)

The following learning modules may be conducted using Wordsworth® English language lab software.

Basic communication covering the following topics

Meeting People
Asking Questions
Making Friends
What did you do?
Do's and Don'ts

Pronunciations covering the following topics

Pronunciation (Consonant Sounds)
Pronunciation and Nouns
Pronunciation (Vowel Sounds)

Advanced Learning

Listening Comprehension / Direct and Indirect Speech

- Figures of Speech
- Effective Communication
- Writing Skills
- Effective Writing
- Interview Handling Skills
- E-Mail etiquette
- Presentation Skills

Recommended Books

1. Andreja. J. Ruther Ford, 'Basic Communication Skills for Technology', 2nd Edn., Pearson Education, 2011.
2. Sanjay Kumar, Pushpalata, 'Communication Skills', 1stEdn., Oxford Press, 2011.
3. Stephen P. Robbins, 'Organizational Behaviour', 1st Edn., Pearson, 2013.
4. Gill Hasson, 'Brilliant-Communication Skills', 1st Edn., Pearson Life, 2011.
5. Gopala Swamy Ramesh, 'The Ace of Soft Skills: Attitude, Communication and Etiquette for Success', 5th Edn., Pearson, 2013.
6. Deborah Dalley, Lois Burton, Margaret, 'Developing your Influencing Skills', Green Hall, 1st Edn., Universe of Learning LTD, 2010.
7. Konar nira, 'Communication Skills for Professionals', 2nd Edn., PHI, 2011.
8. Barun K. Mitra, 'Personality Development and Soft Skills', 1st Edn., Oxford Press, 2011.
9. 'Soft Skill for Everyone', Butter Field, 1st Edn., Cengage Learning India Pvt. Ltd., 2011.
10. S.J. Francis Peters, 'Soft Skills and Professional Communication', 1st Edn., Mc Graw Hill Education, 2011.
11. John Adair, 'Effective Communication', 4th Edn., Pan Mac Millan, 2009.
12. Aubrey Daniels, 'Bringing out the Best in People', 2nd Edn., McGraw Hill, 1999.

PHARMACOGNOSY-I

Subject Code: BPHA1-101

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

Duration: 35 Hrs.

UNIT-I (9 Hrs.)

Definition, History, Scope and Development of Pharmacognosy; Sources of drugs: Biological, marine, mineral and plant tissue culture.

Plant Cell, Histology and Morphology: Structure of plant cell and its non-living inclusions, different types of plant tissues and their functions. Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed. Modifications of root and stem.

UNIT-II (7 Hrs.)

Classification of Drugs: Alphabetical, morphological, taxonomical, chemical and

pharmacological; Plant taxonomy: Study of the following families with special reference to medicinally important plants-Apocynaceae, Solanaceae and Rubiaceae.

Plant taxonomy: Study of the following families Umbelliferae, Leguminosae, Liliaceae, Labiatae, Cruciferae and Papaveraceae with special reference to medicinally important plants.

UNIT-III (10 Hrs.)

Cultivation, Collection, Processing and Storage of Crude Drugs: Factors influencing cultivation of medicinal plants. Polyploidy, mutation and hybridization with reference to medicinal plants.

Quality Control of Crude Drugs: Adulteration of Crude Drugs. Brief introduction to evaluation of crude drugs by organoleptic, microscopic, physical, chemical and biological methods.

UNIT-IV (9 Hrs.)

Introduction to crude drug monograph and its importance in registration of herbal products. Introduction to Chromatographic Techniques: Column, Paper, Thin Layer (TLC).

Introduction to Phytoconstituents of drugs: Definition, classification, properties and identification tests of carbohydrates, alkaloids, glycosides, terpenoids, steroids and flavonoids.

Recommended Books

1. G.E. Trease and W.C. Evans, 'Pharmacognosy', Elsevier, a Division of Reed Elsevier India Pvt. Ltd., New Delhi.
2. C.K. Kokate, A.P. Purohit and S.B. Gokhale, 'Pharmacognosy', Nirali Prakashan, Pune.
3. S.S. Handa and V.K. Kapoor, 'Textbook of Pharmacognosy', Vallabh Prashan, New Delhi.
4. T.E. Wallis, 'Textbook of Pharmacognosy', 5th Edn., CBS Publishers and Distributors, New Delhi.
5. V.C. Tyler, L.R. Brady and J.E. Robers, 'Pharmacognosy', Lea & Febiger, Philadelphia.
6. V.E. Tyler, Jr. and A.E. Schwarting, 'Experimental Pharmacognosy', Burgess Pub. Co, Hinneapois, Minnesota.
7. K.R. Brain and T.D. Turner, 'The Practical Evaluation of Phytopharmaceuticals', Wright-Scientotechnica, Bristol.

PHARMACEUTICAL CHEMISTRY-I (INORGANIC PHARMACEUTICAL CHEMISTRY)

Subject Code: BPHA1-102

**L T P C
3 1 0 4**

Duration: 45 Hrs.

UNIT-I (21 Hrs.)

Impurities in Pharmaceutical Substances & their control sources and types of impurities, their limits, limit test for chlorides, sulphates, iron, lead, arsenic & heavy metals.

Pharmaceutical Aids & Necessities (Antioxidants: Theory, the selection of Antioxidants, Official antioxidants (Hypophosphorus Acid, Sodium bisulphite, Sodium thiosulphate, Sodium nitrite)

Major Intra & Extracellular Electrolytes: Major Physiological ions (Chloride, Phosphate, Bicarbonate, Sodium, Potassium, Calcium, Magnesium); Electrolytes used in replacement therapy(Sodium chloride), Potassium replacement (potassium chloride), Calcium replacement (Calcium chloride, Calcium gluconate) Parenteral magnesium administration (Magnesium sulphate), Physiological acid base balance, Electrolytes used in acid base therapy (Sodium acetate, Potassium acetate, Sodium bicarbonate, Sodium citrate, Potassium citrate, Sodium lactate, Ammonium chloride), Electrolyte combination therapy.}; **Essential and Trace Elements** {Iron, Copper, Zinc, Chromium, Manganese, Molybdenum, Selenium, Sulphur and Iodine. Official Iodine Products (Iodine, Potassium iodide, Sodium iodide.

UNIT-II (7 Hrs.)

Gastrointestinal Agents {Acidifying agents, Antacids: (Sodium bicarbonate, Aluminium hydroxide, Aluminium phosphate, Dihydroxy Aluminium, Sodium carbonate, Calcium carbonate, Tribasic Calcium phosphate, Magnesium carbonate, Magnesium hydroxide, Magnesium oxide, Magnesium phosphate, Magnesium trisilicate) Combination antacid preparations.; **Protectives and Adsorbents:** Introduction. Bismuth containing products, Bismuth subnitrate, Bismuth subcarbonate, Kaolin, Activated charcoal.}; **{Saline Cathartics:** Introduction, Sodium phosphate, Potassium sodium tartrate, Magnesium hydroxide, Magnesium citrate, Magnesium sulphate, Potassium phosphate, Potassium bitartrate, Calomel.}

UNIT-III (5 Hrs.)

Protective: Definition, Protective products, Talc, Insoluble Zinc compounds (Zinc oxide, Calamine, Zinc stearate), Titanium dioxide, Aluminium as a protective agent, Silicone polymer; **Antimicrobials and Astringents:** Antimicrobial terminology, mechanism of action, control of antimicrobial/ astringent action; **Oxidative Antimicrobial Agents:** Hydrogen peroxide, Zinc peroxide, Sodium carbonate, Potassium permanganate, Iodine preparation and compounds.

UNIT-IV (12 Hrs.)

Protein Precipitant Antimicrobial Agents: Silver nitrate, Mild Silver Protein Mercury compounds (Yellow Mercuric oxide, Mercuric chloride), Sulphur and Sulphur compounds (Sublimed sulphur and Precipitated sulphur) Boric acid and Sodium borate, Antimony potassium tartrate, Official compounds of Aluminium and Zinc; **Dental Products:** Anticaries agents: Fluorides, official products (Sodium fluoride, Stannous fluoride), Phosphates, **Dentifrices:** Dentifrices containing Fluorides, Official products (Pumice). Dentifrices containing desensitizing agents, Official products (Zinc chloride and Zinc-Eugenol cement). **Co-ordination Compounds and Complexation:** Theoretical considerations and official products (Calcium disodium edentate, Disodium edetate, Dimercaprol & Penicillamine); **Miscellaneous Inorganic Pharmaceutical Agents:** Inhalants, respiratory stimulants, expectorants and emetics, antidotes, tableting aids and suspending agents.

Recommended Books

1. J.H. Block, E. Roche, T.O. Soine and C.O. Wilson, 'Inorganic Medicinal and Pharmaceutical Chemistry', Lea & Febiger, Philadelphia, P.A.
2. L.M. Artherden, Bentley and Drivers, 'Textbook of Pharmaceutical Chemistry', S& Ed., Oxford University Press, Delhi.
3. 'Pharmacopoeia of India', Govt. of India, Ministry of Health.
4. Block, Roche, Soine & Wilson, 'Inorganic Medicinal & Pharmaceutical Chemistry'. 1st Edn., Varghese Publishing House, Mumbai, 1986.
5. Chatwal, 'Pharmaceutical Chemistry Inorganic', 3rd Edn., Himalaya Publishing House, Mumbai, 2007.
6. Singh & Kapoor, Practical Pharmaceutical Chemistry, 4th Edn., Vallabh Prakashan, Delhi, 1998.

PHARMACEUTICAL ANALYSIS-I

Subject Code: BPHA1-103

L T P C

Duration: 45 Hrs.

3 1 0 4

UNIT-I (9 Hrs.)

Quantitative Analysis and Data Handling

Introduction to concept of Quality Control and Assurance in Pharmaceutical Industry and role of Statistics in pharmaceutical analysis. Significance of quantitative analysis in quality control,

different techniques of analysis, preliminaries and definitions, significant figures. Rules for retaining significant figures, Types of errors (Determinate and Indeterminate). Minimization of errors, Propagation of errors in addition and subtraction, multiplication and division, exponents, logarithms, precision and accuracy, selection of sample.

Acid Base Titrations

Acid base concept, role of the solvent, Relative strengths of acids and bases; Law of mass action; common ion effect, ionic product of water, pH, Hydrolysis of salts, Handerson – Hasselbach equation; Buffer and buffer capacity: Acid base indicators, Theory of indicators, Choice of indicators; Neutralization curves (Strong acid and strong base, strong acid weak base, weak acid strong base and weak acid weak base).

UNIT-II (13 Hrs.)

Acid Base Titrations

Polyprotic system, dissociation calculations for polyprotic acids, fractions and equilibrium concentrations of dissociating species at a given pH, salts of polyprotic acids, (Amphoteric salts and unprotonated salts), Buffer calculations for polyprotic acids, titrations of polyprotic acid, amino acid system and its titrations. Applications in assay of H_3BO_3 , HCl, NaOH and Na_2CO_3 .

Oxidation-Reduction Titrations

Concepts of oxidation and reduction, redox reactions, equivalent weights of oxidizing and reducing agents, electrochemical cells, reduction potential, standard reduction potential, Nernst equation, cell representations, measurement of electrode potential and its application in determining the equilibrium constant of a reaction.

UNIT-III (12 Hrs.)

Oxidation-Reduction Titrations

Concept of formal potential, oxidation reduction curves, redox indicators, potassium permanganate titrations, iodimetry and iodometry, ceric sulphate titrations, potassium iodate titrations, sodium 2, 6- dichlorophenol - indophenol titrations, pharmaceutical applications.

Precipitation Titrations

Precipitation reactions, solubility product, effects of common ion, acids, temperature and solvent upon the solubility of a precipitate, conditional solubility product, fractional precipitation.

UNIT-IV (11 Hrs.)

Precipitation Titrations

Argentometric titrations, ammonium or potassium thiocyanate titrations, mercuric nitrate titrations, indicators, Gay-Lussac method, Mohr's method, Volhard's method, Fajan's method, Pharmaceutical applications.

Gravimetric Analysis

Precipitation techniques, the colloidal state, gravimetric factor, super saturation, co-precipitation and its types, Post precipitation, digestion, washing of the precipitate, filtration, filter papers and crucibles, ignition, thermogravimetric curves of copper sulphate, specific examples like barium as barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, organic precipitants.

Recommended Books

1. Becket & Stenlake, 'Practical Pharmaceutical Chemistry', Vol. 1, 2, 4th Edn., CBS Publishers, New Delhi, 2005.
2. Jeffery, Bassett & Mendham, 'Vogel's Text Book of Quantitative Chemical Analysis', 5th Edn., Addison Wesley Longman Ltd., England, 1996.
3. K. Danzer, 'Analytical Chemistry', Springer, 2007.
4. R.M. Verma, 'Analytical Chemistry', 3rd Edn., CBS Publishers, New Delhi, 2007.
5. Alexeyev, 'Qualitative Analysis'. 2nd Edn., CBS Publishers, New Delhi, 2005.

6. L.M. Atherden, 'Bentley and Driver's Textbook of Pharmaceutical Chemistry', Oxford University Press, Delhi.

COMPUTER SCIENCE & APPLICATIONS

Subject Code: BCAP0-195

L T P C
2 1 0 3

Duration: 35 Hrs.

Scope of the Subject: Subject deals with computer fundamentals and operating system. Computer applications are expected to offer various pharmaceutical services as drug information services, drug design and pharmacokinetic analysis.

Objectives of the Subject: Upon completion of the subject student shall be able

- To understand the basic MS-Word, MS- Excel and MS- Power point
- To know computer programming, data analysis, calculation and graphing using formulae and function.

UNIT-I (9 Hrs.)

Computer Fundamentals Introduction to Computers:

Characteristics of computers, Historical perspectives of computers, Computer generations, types of computers and uses, Software, Hardware, Basic architecture and functions of CPU and its parts, Important I/O devices like Keyboard, Mouse, Printers, Video Monitors; **Number System:** Decimal, Binary, Basic Binary arithmetic (Conversion to and from decimal numbers, Binary addition and subtraction; **Memory Storage:** Memory Cells, Semiconductor and Magnetic core memory, ROM (its types), RAM, Cache and Virtual memory, Secondary storage devices and their organization (Hard disk, Floppy disk, CD, DVD).

Operating Systems

Definitions, Need, Organization, Functions, Types of Operating Systems, DOS, Windows, Handling Drives, Directories and files, Commands (Internal & External), Icons, Clipboard, Folders, Major differences between DOS & Windows.

UNIT-II (9 Hrs.)

Communication Networks

Hardware and software components, seven layers of OSI architecture, Network Topologies (Ring, Star, Fully Connected and Bus), LAN and WAN, Bounded and unbounded communication media, Internet, World Wide Web and I.T., Browsers, Important terminology regarding Internet applications, Electronic Mail, Potential uses and abuses of Internet.

Computer Programming

Programming languages, Classifications, Low level and high level languages, merits and demerits of languages, object oriented languages, Syntax and semantics, Basic steps involved in software development, Flow charts, Compilers and Interpreters.

UNIT-III (10 Hrs.)

Simple Programming Using

C Data types, Constants, Variables, Arithmetic and relational expressions, Symbolic constants, Input and output assignment statements, If-else, Switch statements, Loops (While, do-while and for), Transfer statements, Problem solving using "C" taking simple algorithms.

Computer Applications Word Processing

Techniques, File manipulation, Formatting, Printing setups Table handling, Mail merge, etc. using MS-Word; **Spreadsheet Package:** Worksheets, formatting sheets, Calculations and graphing using formulae and functions, Import and export of data using MS-Excel.

UNIT- IV(7Hrs.)

Computer Applications Graphics

Objectives and types of graphics, Presentation packages, Slides designing, Diagrams and graphs, Import & Export data using MS-Power Point; **Data Security against Viruses:**

Definition of computer viruses, Detection, prevention and cure against viruses using anti-virus software packages.

Pharmaceutical Applications

Basics of computer use in various pharmaceutical and clinical applications like drug information services, hospital and community pharmacy, drug design, pharmacokinetics and data analysis.

Recommended Books

1. Rajaraman, 'Fundamentals of Computers', Prentice Hall of India.
2. N.K. Tiwari, 'Computer Fundamental with Pharmacy Applications', 1st Edn., Pharm. Med Press, 2008.
3. Stultz, 'Learn MS-Office 2000', BPB Publications.
4. Ivens, 'Using Microsoft Windows', Prentice Hall of India, 1998.
5. Stultz, 'Learn DOS in a day', BPB Publications.

INTRODUCTION TO DOSAGE FORM

Subject Code: BPHA1-104

L T P C
2 1 0 3

Duration: 35 Hrs.

UNIT-I (2 Hrs.)

Pharmacy Profession

History of Pharmacy, Pharmacy as a career, Pharmaceutical education in India and abroad, Pharmacopoeia of India and other Pharmacopoeias, Other official books.

UNIT-II (13 Hrs.)

Introduction to different dosage forms, their classification with examples (Official formulation), their relative application; Definitions, general formulation, manufacturing procedures and official products of solutions, aromatic waters, syrups, spirits, elixirs, glycerides, lotions, liniments, gargles, mouth washes, suspension, emulsion, douches, draught preparation.

UNIT-III (10 Hrs.)

Additive of dosage forms Introduction, classification and uses of following additives in formulation of different dosage forms: preservatives, antioxidants, surfactants, hydrocolloids, emulsify agent, suspending agent, Diluents, binders, lubricants, organoleptic additives.

UNIT-IV (10 Hrs.)

Crude Extracts: Infusion, decoction, tincture, and extracts, methods of preparation of dry, soft and liquid extracts of IP.

Allergenic Extracts: Types of allergens, preparation of extracts testing and standardization of extracts.

Important Terms of Pharmaceutics Definition and examples of expectorant, pharmaceutical aid, additives.

Recommended Books

1. 'Remington's Pharmaceutical Sciences'.
2. 'Pharmacopoeia of India', Govt. of India, Ministry of Health.
3. Ansel, 'Introduction to Pharmaceutical Dosage Forms'.

PHARMACOGNOSY-I LAB.

Subject Code: BPHA1-105

L T P C
0 0 4 2

1. To study different features of a dicot stem (Sunflower)
2. To study different feature of a dicot root

3. To study various pharmacognostic characteristics of a monocot stem
4. To study various pharmacognostic characteristics of a monocot root (Maize)
5. To study various pharmacognostic characteristics of a monocot leaf
6. To study various pharmacognostic characteristics of a dicot leaf
7. To determine the veinlet and veinlet termination number.
8. To study diagnostic features of *Vinca rosea* (Apocynaceae)
9. To study diagnostic features of *Datura stramonium/metel* (Solanaceae)
10. To study diagnostic features of *Ocimum basilicum* (Labiatae)
11. To study diagnostic features of *Brassica campestris* (Cruciferae)
12. To study diagnostic features of *Fennel* (Umbelliferae)
13. To study diagnostic features of *Cassia fistula* (Leguminosae)
14. To identify accacia gum by performing various tests
15. To identify tragacanth by performing various tests
16. To identify honey by performing various tests
17. To perform tests for identification of castor oil
18. To perform tests for identification of sesame oil
19. To determine the stomatal number and stomatal index of senna leaf
20. To determine the palisade ratio of Indian senna
21. To determine the average diameter of starch grains (Cinnamon powder)
22. To measure the average width of fiber in Cinnamon powder
23. Preparations of minimum of 50 herbarium sheets (one each for every student) of selected medicinal plants

Recommended Books

1. G.E. Trease and W.C. Evans, 'Pharmacognosy', Elsevier, a Division of Reed Elsevier India Pvt. Ltd., New Delhi.
2. V.E. Tyler, Jr. and A.E. Schwarting, 'Experimental Pharmacognosy', Burgess Pub. Co, Hinneapois, Minnesota.
3. K.R. Brain and T.D. Turner, 'The Practical Evaluation of Phytopharmaceuticals', Wright-Scientetchnica, Bristol.
4. T.E. Wallis, 'Practical Pharmacognosy', 4th Edn, PharmaMed Press, Hyderabad, India, **2011.**
5. C.K. Kokate, 'Practical Pharmacognosy', 4th Edn., Published by M.K Jain for Vallabh Prakashan, Delhi, India, 1994.

PHARMACEUTICAL CHEMISTRY-I (INORGANIC PHARMACEUTICAL CHEMISTRY) LAB.

Subject Code: BPHA1-106

L T P C

0 0 4 2

1. To analyse the presence of acid radicals (anions) in the given mixture.
2. To analyse the presence of six radicals (three anions and three cations) in the given mixture by semi-micro method.
3. To perform detection of group I and group II radicals.
4. To perform determination of melting point and boiling points.
5. To perform identification tests for Magnesium Sulphate
6. To perform identification tests for Calcium chloride.
7. To perform identification tests for barium sulphate.
8. To perform identification tests for Hydrochloric acid and qualitatively analyse the chloride ions.
9. To perform identification tests for ferrous sulphate.

10. To perform identification tests for hydrogen peroxide.
11. To perform identification tests for Boric acid.
12. To perform identification tests for Potassium permanganate and qualitatively analyse for potassium ions.
13. To perform identification tests for ammonium chloride and qualitatively analyse for ammonium as cation and chloride as anion.
14. To perform limit tests for chloride in Magnesium sulphate.
15. To perform limit tests for sulphate.
16. To perform limit tests for iron.
17. To perform limit tests for heavy metals.
18. To perform limit tests for Arsenic.

Recommended Books

1. Nirmal Sharma, Yogeshwar Sharma, K.K. Thakur, Pratibha Nand, G.C. Sharma, 'Practical Inorganic Pharmaceutical Chemistry and Viva- voce', 1st Edn., Birla Publications Pvt. Ltd., 2007.
2. Singh & Kapoor, 'Practical Pharmaceutical Chemistry', 4th Edn., Vallabh Prakashan, Delhi, 1998.
3. G. Devala Rao, 'Practical Pharmaceutical Inorganic Chemistry', 3rd Edn., Birla Pub. (20101-2011).
4. Anees Ahmed Siddiqui, Mohammed Ali, 'Practical Pharmaceutical Chemistry', 1st Edn., CBS Publishers, **1997.**

PHARMACEUTICAL ANALYSIS-I LAB.

Subject Code: BPHA1-107

L T P C

0 0 4 2

1. To study the typical analytical balance, the requirements of a good balance, weights, care and use of balance, methods of weighing and errors in weighing.
2. To perform calibration of volumetric apparatus and weights including fractional weight using digital weighing balance of sensitivity 01 mg.
3. To carry out the standardization of 0.1 N HCl using standard solution of sodium carbonate.
4. To carry out the standardization of 0.1 N H₂SO₄ using standard solution of sodium carbonate.
5. To standardize the given of 0.1 N NaOH using standard solution of oxalic acid.
6. To perform the assay of given sample of sodium bicarbonate.
7. To perform the assay of given sample of boric acid.
8. To perform the assay of given sample borax using standard solution of HCl.
9. To standardise the given solution of 0.1N KMnO₄ using standard solution of oxalic acid.
10. To perform the assay of given sample of ferrous sulphate using standard solution of KMnO₄.
11. To perform the assay of the given sample of copper sulphate.
12. To perform the assay of the given sample of sodium chloride.
13. To perform the assay of the given sample of KCl.
14. To prepare and standardize 0.1 N iodine solution.
15. To prepare and standardise 0.1 N sodium thiosulphate solution.
16. To estimate the amount of barium present in the given solution

Recommended Books

1. Jeffery, Bassett & Mendham, 'Vogel Text Book of Quantitative Chemical Analysis',

- 5th Edn., Addison Wesley Longman ltd England, 1996.
2. R.M. Verma, 'Analytical Chemistry', 3rd Edn., CBS Publishers, New Delhi. Becket & Stenlake, 2007.
 3. 'Practical Pharmaceutical Chemistry', Vol.1 & 2, 4th Edn., CBS publishers, New Delhi, 2005.
 4. Alexeyev, 'Quantative Analysis', 2nd Edn., CBS publishers, New Delhi, 2005.
 5. L.M. Atherden, 'Bentley and Driver's Textbook of Pharmaceutical Chemistry', Oxford University Press, Delhi.

COMPUTER SCIENCE & APPLICATIONS LAB.

Subject Code: BCAP0-196

L T P C

0 0 4 2

1. Give the various components, their functions and identification of various parts of a computer and peripherals. Perform installation of a computer and loading system software and application software.
2. Installation of DOS and simple exercises on TYPE, REN, DEL, CD, MD, COPY, TREE, BACKUP commands.
3. Exercises on entering text and data (Typing Practice) Features of Windows as an operating system.
4. File Management using Ms Word, Page set up using Ms Word Editing a document using Ms Word.
5. Formatting a document using Ms Word Tables and Borders using Ms Word Working with more than one window in MS Word.
6. Perform application of MS Excel.
7. Application of Menu commands, Work books and Creating a chart.
8. Customize MS-Excel.
9. Introduction to MS-Power Point and use of Wizards and Templates Preparing Presentations.
10. Prepare and submit a scientific power point presentation using various effects and application of power point.
11. Prepare a program in C language to find sum of any two numbers.
12. Prepare a program in C language to find gross salary.
13. Prepare a program in C language to find table (mathematical) of any number.
14. Prepare a program in C language to find greatest in 3 numbers.
15. Prepare a program in C language to show the use of conditional operator.
16. Program to find that entered year is leap year or not.
17. Prepare a program in C language to find whether given no is even or odd
18. Display the kind of output on screen (in the left of the screen)
 - a. 1
 - b. 22
 - c. 333
 - d. 4444
19. Write a C program to find the sum of first 100 natural numbers.
20. Prepare a program in C language to find the sum of first 100 odd or even numbers.
21. Write a C program to display first 25 Fibonacci number.
22. Write a C program to display first 100 prime numbers.
23. Write a C program to find factorial numbers and to print the accepted no and its reverse number.

HUMAN ANATOMY AND PHYSIOLOGY-I

Subject Code: BPHA1-208

**L T P C
3 1 0 4**

Duration: 45 Hrs.

Scope:

1. This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Course Objectives:

Upon completion of this course the student should be able to

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the various experiments related to special senses and nervous system.
5. Appreciate coordinated working pattern of different organs of each system

UNIT-I (11 Hrs.)

Introduction to Human Body:

1. Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.

Cellular Level of Organization

1. Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine

Tissue Level of Organization

1. Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

UNIT-II (11 Hrs.)

Integumentary System

1. Structure and functions of skin

Skeletal System

1. Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system
2. Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction.

Joints

1. Structural and functional classification, types of joints movements and its articulation

UNIT-III (12 Hrs.)

Body fluids and blood

1. Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.

Lymphatic system

1. Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system

Peripheral Nervous System

1. Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system.

2. Origin and functions of spinal and cranial nerves.

Special senses

1. Structure and functions of eye, ear, nose and tongue and their disorders.

UNIT-IV (11 Hrs.)

Cardiovascular system

1. Heart – anatomy of heart, blood circulation, blood vessels,
2. Structure and functions of artery, vein and capillaries,
3. Elements of conduction system of heart and heartbeat, its regulation by autonomic nervous system, cardiac output, cardiac cycle.
4. Regulation of blood pressure, pulse, electrocardiogram
5. Disorders of heart.

Recommended Books

1. K. Sembulingam and P. Sembulingam, 'Essentials of Medical Physiology', Jaypee Brothers Medical Publishers, New Delhi.
2. Kathleen J.W. Wilson, 'Anatomy and Physiology in Health and Illness', Churchill Livingstone, New York.
3. Best and Taylor, 'Physiological Basis of Medical Practice', Williams & Wilkins Co, Riverview, MI USA.
4. C. Arthur, Guyton and John. E. Hall, 'Text book of Medical Physiology', Miamisburg, OH U.S.A.
5. Tortora Grabowski, 'Principles of Anatomy and Physiology', Palmetto, GA, U.S.A.
6. Inderbir Singh, 'Textbook of Human Histology', Jaypee Brother's Medical Publishers, New Delhi.
7. C.L. Ghai, 'Textbook of Practical Physiology', Jaypee Brother's Medical Publishers, New Delhi.
8. K. Srinageswari and Rajeev Sharma, 'Practical Workbook of Human Physiology', Jaypee Brother's Medical Publishers, New Delhi.
9. Best and Taylor, 'Physiological Basis of Medical Practice', Williams & Wilkins Co, Riverview, MI USA.
10. Arthur C. Guyton and John. E. Hall, 'Text book of Medical Physiology', Miamisburg, OH, U.S.A.
11. C.C. Chatterrje, 'Human Physiology', Vol. 1, 2, Academic Publishers, Kolkata.

PHARMACEUTICAL ORGANIC CHEMISTRY-I

Subject Code: BPHA1-209

**L T P C
3 1 0 4**

Duration: 45 Hrs.

Scope:

1. This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

Course Objectives:

Upon completion of the course the student shall be able to

1. Write the structure, name and the type of isomerism of the organic compound
2. Write the reaction, name the reaction and orientation of reactions
3. Account for reactivity/stability of compounds,
4. Identify/confirm the identification of organic compound

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained to emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

UNIT-I (10 Hrs.)

Classification, Nomenclature and Isomerism

1. Classification of Organic Compounds
2. Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds)
3. Structural isomerism in organic compounds

UNIT-II (12 Hrs.)

Alkanes*, Alkenes* and Conjugated dienes*

1. SP_3 hybridization in alkanes, Halogenation of alkanes, uses of paraffin. Stabilities of alkenes, SP_2 hybridization in alkenes
2. E_1 and E_2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 versus E_2 reactions, Factors affecting E_1 and E_2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.
3. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement

UNIT-III (12 Hrs.)

Alkyl halides*

1. SN_1 and SN_2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations.
2. SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions
3. Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.

Alcohols*-

1. Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

UNIT-IV (11 Hrs.)

Carbonyl Compounds* (Aldehydes and Ketones)

1. Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanillin, Cinnamaldehyde.

Carboxylic acids*

1. Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester
2. Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid
3. Aliphatic amines* - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine.

Recommended Books

1. Morrison and Boyd, 'Organic Chemistry'.
2. I.L. Finar, 'Organic Chemistry', Volume-I.
3. B.S. Bahl & Arun Bahl, 'Textbook of Organic Chemistry'.
4. P.L. Soni, 'Organic Chemistry'.
5. Mann and Saunders, 'Practical Organic Chemistry'.

6. 'Vogel's Text Book of Practical Organic Chemistry'.
7. N.K. Vishnoi, 'Advanced Practical Organic Chemistry'.
8. Pavia, Lampman and Kriz, 'Introduction to Organic Laboratory Techniques'.

BIOCHEMISTRY

Subject Code: BPHA1-210

L T P C
3 1 0 4

Duration: 45 Hrs.

Scope:

1. Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

Course Objectives:

Upon completion of course student shall able to

1. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
2. Understand the metabolism of nutrient molecules in physiological and pathological conditions.
3. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

UNIT-I (11 Hrs.)

Biomolecules

1. Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.

Bioenergetics

1. Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential.
2. Energy rich compounds; classification; biological significances of ATP and cyclic AMP

UNIT-II (11 Hrs.)

Carbohydrate Metabolism

1. Glycolysis – Pathway, energetics and significance
2. Citric acid cycle- Pathway, energetics and significance
3. HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency,
4. Glycogen metabolism Pathways and glycogen storage diseases (GSD)
5. Gluconeogenesis- Pathway and its significance
6. Hormonal regulation of blood glucose level and Diabetes mellitus

Biological Oxidation

1. Electron transport chain (ETC) and its mechanism.
2. Oxidative phosphorylation & its mechanism and substrate level phosphorylation
3. Inhibitors ETC and oxidative phosphorylation/Uncouplers.

UNIT-III (12 Hrs.)

Lipid Metabolism

1. β -Oxidation of saturated fatty acid (Palmitic acid)
2. Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid)
3. Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D

4. Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

Amino Acid Metabolism

1. General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders
2. Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alpeptonuria, tyrosinemia)
3. Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline
4. Catabolism of heme; hyperbilirubinemia and jaundice

UNIT-IV (11 Hrs.)

Nucleic Acid Metabolism and Genetic Information Transfer

1. Biosynthesis of purine and pyrimidine nucleotides
2. Catabolism of purine nucleotides and Hyperuricemia and Gout Disease Organization of mammalian genome
3. Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis
4. Genetic code, Translation or Protein synthesis and inhibitors

Enzymes

1. Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)
2. Enzyme inhibitors with examples
3. Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation
4. Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes – Structure and biochemical functions

Recommended Books

1. Lehninger, 'Principles of Biochemistry'.
2. Robert K. Murry, Daryl K. Granner and Victor W. Rodwell, 'Biochemistry', Harper Stryer, 'Biochemistry'.
3. D. Satyanarayan and U. Chakrapani, 'Biochemistry'.
4. Rama Rao, 'Textbook of Biochemistry'.
5. R.C. Gupta and S. Bhargavan, 'Practical Biochemistry'.
6. David T. Plummer, 'Introduction of Practical Biochemistry', 3rd Edn.
7. Rajagopal and Ramakrishna, 'Practical Biochemistry for Medical Students'.
8. Harold Varley, 'Practical Biochemistry'.

PHYSICAL PHARMACEUTICS-I

Subject Code: BPHA1-211

L T P C

Duration: 45 Hrs.

3 1 0 4

Scope:

1. The course deals with the various physical and physicochemical properties, and the principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Course Objectives:

Upon the completion of the course student shall be able to

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms

2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

UNIT-I (11 Hrs.)

1. **Solubility of Drugs:** Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions)
2. Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications

UNIT-II (11 Hrs.)

States of Matter and properties of matter:

1. State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols– inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism.

Physicochemical properties of drug molecules:

1. Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications

UNIT-III (11 Hrs.)

Surface and interfacial phenomenon:

1. Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface.

UNIT-IV (12 Hrs.)

Complexation and protein binding:

1. Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.

pH, buffers and Isotonic solutions:

2. Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.

Recommended Books

1. Alfred Martin, 'Physical Pharmacy'.
2. Eugene, Parott, 'Experimental Pharmaceutics'.
3. Cooper and Gunn, 'Tutorial Pharmacy'.
4. H.A. Liberman, C. Lachman, 'Pharmaceutical Dosage Forms, Tablets', Volume-1 to 3, Marcel Dekkar Inc.
5. H.A. Liberman, C. Lachman, 'Pharmaceutical Dosage Forms, Disperse Systems', volume 1, 2, 3. Marcel Dekkar Inc.
6. C. Ramasamy and R. Manavalan, 'Physical Pharmaceutics'.
7. C.V.S. Subramanyam, J. Thimma Settee, 'Laboratory Manual of Physical Pharmaceutics'.
8. C.V.S. Subramanyam, 'Physical Pharmaceutics'.
9. Gaurav Jain & Roop K. Khar, 'Text Book of Physical Pharmacy'.

REMEDIAL BIOLOGY

Subject Code: BPHA1-212

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

Duration: 25 Hrs.

Scope:

1. To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Course Objectives:

Upon completion of the course, the student shall be able to

1. Know the classification and salient features of five kingdoms of life
2. Understand the basic components of anatomy & physiology of plant
3. Know understand the basic components of anatomy & physiology animal with special reference to human

UNIT-I (6 Hrs.)

Living World:

1. Definition and characters of living organisms
2. Diversity in the living world
3. Binomial nomenclature
4. Five kingdoms of life and basis of classification. Salient features of Monera, Protista, Fungi, Animalia and Plantae, Virus,

Morphology of Flowering Plants

1. Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.
2. General Anatomy of Root, stem, leaf of monocotyledons & Dicotyledons.

UNIT-II (7 Hrs.)

Body Fluids and Circulation

1. Composition of blood, blood groups, coagulation of blood
2. Composition and functions of lymph
3. Human circulatory system
4. Structure of human heart and blood vessels
5. Cardiac cycle, cardiac output and ECG

Digestion and Absorption

1. Human alimentary canal and digestive glands
2. Role of digestive enzymes
3. Digestion, absorption and assimilation of digested food

Breathing and Respiration

1. Human respiratory system
2. Mechanism of breathing and its regulation
3. Exchange of gases, transport of gases and regulation of respiration
4. Respiratory volumes

UNIT-III (6 Hrs.)

Excretory Products and their Elimination

1. Modes of excretion
2. Human excretory system- structure and function
3. Urine formation
4. Renin angiotensin system

Neural Control and Coordination

1. Definition and classification of nervous system
2. Structure of a neuron
3. Generation and conduction of nerve impulse

4. Structure of brain and spinal cord
5. Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata

Chemical Coordination and Regulation

1. Endocrine glands and their secretions
2. Functions of hormones secreted by endocrine glands

Human Reproduction

1. Parts of female reproductive system
2. Parts of male reproductive system
3. Spermatogenesis and Oogenesis
4. Menstrual cycle

UNIT-IV (6 Hrs.)

Plants and Mineral Nutrition:

1. Essential mineral, macro and micronutrients
2. Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation

Photosynthesis

1. Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

Plant Respiration:

1. Respiration, glycolysis, fermentation (anaerobic).

Plant Growth and Development

1. Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators

Cell - The UNIT of life

1. Structure and functions of cell and cell organelles. Cell division

Tissues

1. Definition, types of tissues, location and functions.

Recommended Books

1. S.B. Gokhale, 'Text book of Biology'.
2. Thulajappa and Seetaram, 'A Text Book of Biology'.
3. Naidu and Murthy, 'A Text Book of Biology'.
4. A.C. Dutta, 'Botany for Degree Students'.
5. M. Ekambaranatha Ayyer and T.N. Ananthakrishnan, 'Outlines of Zoology'.
6. S.B. Gokhale and C.K. Kokate, 'A Manual for Pharmaceutical Biology Practical'.

REMEDIAL MATHEMATICS

Subject Code: BPHA1-213

L T P C
3 0 0 3

Duration: 25 Hrs.

Scope:

- This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform.

Course Objectives:

Upon completion of the course the student shall be able to:

- Know the theory and their application in Pharmacy
- Solve the different types of problems by applying theory
- Appreciate the important application of mathematics in Pharmacy

UNIT – I (6 Hrs.)

Partial Fraction

1. Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics

Logarithms

1. Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.

Function:

1. Real Valued function, Classification of real valued functions,

□ **Limits and continuity :**

Introduction , Limit of a function, Definition of limit of a function (□ - □□

definition) , $\lim_{x \rightarrow a} x^n = a^n$, $\lim_{x \rightarrow a} \frac{\sin x}{x} = 1$,
 $\lim_{x \rightarrow a} \frac{1}{x} = \frac{1}{a}$, $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$,
 $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x} = 0$ □□

UNIT-II (6 Hrs.)

Matrices and Determinant

1. Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants , Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix, Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations.

UNIT-II (6 Hrs.)

Calculus

Differentiation: Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function , Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – **Without Proof**, Derivative of x^n w.r.t. x, where n is any rational number, Derivative of e^x , Derivative of $\log_e x$, Derivative of a^x , Derivative of trigonometric functions from first principles (**without Proof**), Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application

UNIT-IV (7 Hrs.)

Analytical Geometry

Introduction:

Signs of the Coordinates, Distance formula,

Straight Line:

Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line

Integration:

Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application

Differential Equations:

1. Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear
2. Differential equations, Exact equations, Application in solving Pharmacokinetic equations

Laplace Transform:

1. Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations

Recommended Books

1. Shanthinarayan, 'Differential Calculus'.
2. Panchaksharappa Gowda D.H., 'Pharmaceutical Mathematics with Application to Pharmacy'.
3. Shanthinarayan, 'Integral Calculus'.
4. B.S. Grewal, 'Higher Engineering Mathematics'.

ENVIRONMENTAL SCIENCES

Subject Code: BPHA1-214

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

Duration: 45 Hrs.

Scope:

1. Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

Course Objectives:

Upon completion of the course the student shall be able to:

1. Create the awareness about environmental problems among learners.
2. Impart basic knowledge about the environment and its allied problems.
3. Develop an attitude of concern for the environment.
4. Motivate learner to participate in environment protection and environment improvement.
5. Acquire skills to help the concerned individuals in identifying and solving environmental problems.
6. Strive to attain harmony with Nature.

UNIT-I (11 Hrs.)

1. The Multidisciplinary nature of environmental studies
2. Natural Resources
3. Renewable and non-renewable resources:
4. Natural resources and associated problems

UNIT-II (11 Hrs.)

1. Forest Resources; b) Water Resources; c) Mineral Resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

UNIT-III (12 Hrs.)

1. Ecosystems
2. Concept of an ecosystem.
3. Structure and function of an ecosystem.
4. Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT- IV (11 Hrs.)

1. Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books

1. Y.K. Sing, 'Environmental Science', New Age International Pvt, Publishers, Bangalore.

2. K.C. Agarwal, 'Environmental Biology', Nidi Publ. Ltd. Bikaner, 2001.
3. Bharucha Erach, 'The Biodiversity of India,' Mapin Publishing Pvt. Ltd.
4. R.C. Brunner, 'Hazardous Waste Incineration', McGraw Hill Inc.
5. R.S. Clark, 'Marine Pollution', Clanderson Press Oxford.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 'Environmental Encyclopedia', Jaico Publ. House, Mumbai, 1196p, 2001.
7. A.K. De, 'Environmental Chemistry', Wiley Eastern Ltd.
8. 'Down of Earth', Centre for Science and Environment.

HUMAN ANATOMY AND PHYSIOLOGY LAB.

Subject Code: BPHA1-215

L T P C

0 0 4 2

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

1. Study of compound microscope.
2. Microscopic study of epithelial and connective tissue
3. Microscopic study of muscular and nervous tissue
4. Identification of axial bones
5. Identification of appendicular bones
6. Introduction to hemocytometry.
7. Enumeration of white blood cell (WBC) count
8. Enumeration of total red blood corpuscles (RBC) count
9. Determination of bleeding time
10. Determination of clotting time
11. Estimation of hemoglobin content
12. Determination of blood group.
13. Determination of erythrocyte sedimentation rate (ESR).
14. Determination of heart rate and pulse rate.
15. Recording of blood pressure.

Recommended Books

1. K. Sembulingam and P. Sembulingam, 'Essentials of Medical Physiology' Jaypee Brothers Medical Publishers, New Delhi.
2. Kathleen J.W. Wilson, 'Anatomy and Physiology in Health and Illness', Churchill Livingstone, New York.
3. Best and Taylor, 'Physiological Basis of Medical Practice', Williams & Wilkins Co, Riverview, MI USA.
4. C. Arthur, Guyton and John. E. Hall, 'Text Book of Medical Physiology', Miamisburg, OH, U.S.A.
5. Tortora Grabowski, 'Principles of Anatomy and Physiology', Palmetto, GA, U.S.A.
6. Inderbir Singh, 'Textbook of Human Histology', Jaypee Brother's Medical Publishers, New Delhi.
7. C.L. Ghai, 'Textbook of Practical Physiology', Jaypee Brother's Medical Publishers, New Delhi.
8. K. Srinageswari and Rajeev Sharma, 'Practical Workbook of Human Physiology', Jaypee Brothers Medical Publishers, New Delhi.

PHARMACEUTICAL ORGANIC CHEMISTRY-I LAB.

Subject Code: BPHA1-216

L T P C

0 0 4 2

- A. Systematic qualitative analysis of unknown organic compounds like
- Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and
 - unsaturation, etc.
 - Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
 - Solubility test
 - Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.
 - Melting point/Boiling point of organic compounds
 - Identification of the unknown compound from the literature using melting point/ boiling point.
 - Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
 - Minimum 5 unknown organic compounds to be analyzed systematically.
- B. Preparation of suitable solid derivatives from organic compounds
- C. Construction of molecular models

Recommended Books

- Morrison and Boyd, 'Organic Chemistry'.
- I.L. Finar, 'Organic Chemistry', Volume-I.
- B.S. Bahl & Arun Bahl, 'Textbook of Organic Chemistry'.
- P.L. Soni, 'Organic Chemistry'.
- Mann and Saunders, 'Practical Organic Chemistry'.
- 'Vogel's Text Book of Practical Organic Chemistry'.
- N.K. Vishnoi, 'Advanced Practical Organic Chemistry'.
- Pavia, Lampman and Kriz, 'Introduction to Organic Laboratory Techniques'.
- Ahluwalia, Chatwal, 'Reaction and Reaction Mechanism'.

BIOCHEMISTRY LAB.

Subject Code: BPHA1-217

L T P C

0 0 4 2

- Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)
- Identification tests for Proteins (albumin and Casein)
- Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)
- Qualitative analysis of urine for abnormal constituents
- Determination of blood creatinine
- Determination of blood sugar
- Determination of serum total cholesterol
- Preparation of buffer solution and measurement of pH
- Study of enzymatic hydrolysis of starch
- Determination of Salivary amylase activity
- Study the effect of Temperature on Salivary amylase activity.
- Study the effect of substrate concentration on salivary amylase activity.

Recommended Books

- Lehninger, 'Principles of Biochemistry'.

2. Robert K. Murry, Daryl K. Granner and Victor W. Rodwell, 'Biochemistry', Harper.
3. Stryer, 'Biochemistry'
4. D. Satyanarayan and U. Chakrapani, 'Biochemistry'.
5. Rama Rao, 'Textbook of Biochemistry'.
6. R.C. Gupta and S. Bhargavan, 'Practical Biochemistry'.
7. David T. Plummer, 'Introduction of Practical Biochemistry', 3rd Edn.
8. Rajagopal and Ramakrishna, 'Practical Biochemistry for Medical Students'.
9. Harold Varley, 'Practical Biochemistry'.

PHYSICAL PHARMACEUTICS-I LAB.

Subject Code: BPHA1-218

L T P C

0 0 4 2

1. Determination the solubility of drug at room temperature
2. Determination of pK_a value by Half Neutralization/ Henderson Hasselbalch equation.
3. Determination of Partition co- efficient of benzoic acid in benzene and water
4. Determination of Partition co- efficient of Iodine in CCl_4 and water
5. Determination of % composition of NaCl in a solution using phenol-water system by CST method
6. Determination of surface tension of given liquids by drop count and drop weight method
7. Determination of HLB number of a surfactant by saponification method
8. Determination of Freundlich and Langmuir constants using activated char coal
9. Determination of critical micellar concentration of surfactants
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method

Recommended Books

1. Alfred Martin, 'Physical Pharmacy'.
2. Eugene, Parott, 'Experimental Pharmaceutics'.
3. Cooper and Gunn, 'Tutorial Pharmacy'.
4. H.A. Liberman, C. Lachman, 'Pharmaceutical Dosage Forms, Tablets', Volume-1 to 3, Marcel Dekkar Inc.
5. H.A. Liberman, C. Lachman, 'Pharmaceutical Dosage Forms, Disperse Systems', Volume 1, 2, 3, Marcel Dekkar Inc.
6. C. Ramasamy and R. Manavalan, 'Physical Pharmaceutics'.
7. C.V.S. Subramanyam, J. Thimma Settee, 'Laboratory Manual of Physical Pharmaceutics'.
8. C.V.S. Subramanyam, 'Physical Pharmaceutics'.
9. Gaurav Jain & Roop K. Khar, 'Text Book of Physical Pharmacy'.

REMEDIAL BIOLOGY LAB.

Subject Code: BPHA1-219

L T P C

0 0 2 1

1. Introduction to experiments in biology
 - a. Study of Microscope
 - b. Section cutting techniques
 - c. Mounting and staining
 - d. Permanent slide preparation
2. Study of cell and its inclusions

3. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications
4. Detailed study of frog by using computer models
5. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower
6. Identification of bones
7. Determination of blood group
8. Determination of blood pressure
9. Determination of tidal volume

Recommended Books

1. S.R. Kale and R.R. Kale, 'Practical Human Anatomy and Physiology'.
2. S.B. Gokhale, C.K. Kokate and S.P. Shriwastava, 'A Manual of Pharmaceutical Biology Practical'.
3. M.J.H. Shafi, 'Biology Practical Manual according to National Core Curriculum', Biology Forum of Karnataka.

PHARMACEUTICAL ORGANIC CHEMISTRY-II

Subject Code: BPHA1-320

L T P C
3 1 0 4

Duration: 45 Hrs.

SCOPE

This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

COURSE OBJECTIVES

Upon completion of the course the student shall be able to

- Write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- prepare organic compounds

Course Content:

- General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained
- To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

UNIT-I (10 Hrs.)

1. Benzene and its derivatives

- Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule B. Reactions of benzene - nitration, sulphonation, halogenation reactivity, Friedel Crafts alkylation- reactivity, limitations, Friedelcrafts acylation.
- Reactions of benzene - nitration, sulphonation, halogenation reactivity, Friedel Crafts alkylation- reactivity, limitations, Friedel Crafts acylation.
- Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction.
- Structure and uses of DDT, Saccharin, BHC and Chloramine.

UNIT-II (10 Hrs.)

1. **Phenols*** - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols

Aromatic Amines* - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts

Aromatic Acids* –Acidity, effect of substituents on acidity and important reactions of benzoic acid.

UNIT-III (10 Hrs.)

Fats and Oils

- Fatty acids – reactions.
- Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.
- Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

UNIT-IV (08 Hrs.)

Polynuclear Hydrocarbons:

- Synthesis, reactions
- Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives

UNIT-V (07 Hrs.)

Cycloalkanes*

Stabilities – Baeyer’s strain theory, limitation of Baeyer’s strain theory, Coulson and Moffitt’s modification, Sachse Mohr’s theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only

Recommended Books

1. Morrison and Boyd, ‘Organic Chemistry’.
2. I.L. Finar, ‘Organic Chemistry’, Volume-I.
3. B.S. Bahl & Arun Bahl, ‘Textbook of Organic Chemistry’.
4. P.L. Soni, ‘Organic Chemistry’.
5. Mann and Saunders, ‘Practical Organic Chemistry’.
6. ‘Vogel’s Text Book of Practical Organic Chemistry’.
7. N.K. Vishnoi, ‘Advanced Practical Organic Chemistry’.
8. Pavia, Lampman and Kriz, ‘Introduction to Organic Laboratory Techniques’.

PHARMACEUTICAL MICROBIOLOGY

Subject Code: BPHA1-321

**L T P C
3 1 0 4**

Duration: 45 Hrs.

SCOPE

Study of all categories of microorganisms especially for the production of alcohol antibiotics, vaccines, vitamins enzymes etc.

COURSE OBJECTIVES

Upon completion of the subject student shall be able to;

1. Understand methods of identification, cultivation and preservation of various microorganisms
2. To understand the importance and implementation of sterilization in pharmaceutical processing and industry
3. Learn sterility testing of pharmaceutical products.
4. Carried out microbiological standardization of Pharmaceuticals.
5. Understand the cell culture technology and its applications in pharmaceutical industries.

Unit-I (10 Hrs.)

1. Introduction, history of microbiology, its branches, scope and its importance.
2. Introduction to Prokaryotes and Eukaryotes
3. Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count).
4. Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.

Unit-II (10 Hrs.)

1. Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC).
2. Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization.
3. Evaluation of the efficiency of sterilization methods.
4. Evaluation of the efficiency of sterilization methods
5. Equipment employed in large scale sterilization.
6. Sterility indicators.

Unit-III (10 Hrs.)

1. Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses.
2. Classification and mode of action of disinfectants
3. Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions
4. Evaluation of bactericidal & Bacteriostatic.
5. Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.

Unit-IV (08 Hrs.)

1. Designing of aseptic area, laminar flow equipment; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.
2. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.

Unit-V (07 Hrs.)

1. Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.
2. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations.
3. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures.
4. Application of cell cultures in pharmaceutical industry and research.

Recommended Books

1. W.B. Hugo and A.D. Russel, 'Pharmaceutical Microbiology', Blackwell Scientific Publications, Oxford London.
2. Prescott and Dunn., 'Industrial Microbiology', 4th Edn., CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, 'Microbiology', Tata McGraw Hill.
4. Malcolm Harris, Balliere Tindall and Cox, 'Pharmaceutical Microbiology'.
5. Rose, 'Industrial Microbiology'.
6. Probisher, Hindsill et al, 'Fundamentals of Microbiology', 9th Edn., Japan.

7. Cooper and Gunn's, 'Tutorial Pharmacy', CBS Publisher and Distribution.
8. Pepler, 'Microbial Technology'.
9. I.P., B.P., U.S.P.
10. Ananthnarayan, 'Text Book of Microbiology', Orient-Longman, Chennai.
11. Edward, 'Fundamentals of Microbiology'.
12. N.K. Jain, 'Pharmaceutical Microbiology', Vallabh Prakashan, Delhi.
13. 'Bergeys Manual of Systematic Bacteriology', Williams and Wilkins-A Waverly Company.

PHARMACEUTICAL ENGINEERING

Subject Code: BPHA1-322

L T P C

Duration: 45 Hrs.

3 1 0 4

SCOPE

This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

COURSE OBJECTIVES

Upon completion of the course student shall be able:

1. To know various unit operations used in Pharmaceutical industries.
2. To understand the material handling techniques.
3. To perform various processes involved in pharmaceutical manufacturing process.
4. To carry out various test to prevent environmental pollution.
5. To appreciate and comprehend significance of plant lay out design for optimum use of resources.
6. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

UNIT-I (10 Hrs.)

1. **Flow of fluids:** Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.
2. **Size Reduction:** Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.
3. **Size Separation:** Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

UNIT-II (10 Hrs.)

1. **Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.
2. **Evaporation:** Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator & Economy of multiple effect evaporator.
3. **Distillation:** Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

UNIT-III (08 Hrs.)

1. **Drying:** Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.
2. **Mixing:** Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier,

UNIT-IV (08 Hrs.)

1. **Filtration:** Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.
2. **Centrifugation:** Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

UNIT-V (07 Hrs.)

1. **Materials of pharmaceutical plant construction, Corrosion and its prevention:** Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and their prevention. Ferrous and nonferrous metals, inorganic and organic non-metals, basic of material handling systems.

Recommended Books:

1. Walter L. Badger & Julius Banchero, 'Introduction to Chemical Engineering'.
2. 'Solid Phase Extraction, Principles, Techniques and Applications'.
3. McCabe Smith, 'Unit Operation of Chemical Engineering'.
4. C.V.S. Subrahmanyam et al., 'Pharmaceutical Engineering Principles and Practices'.
5. Martin, 'Remington Practice of Pharmacy'.
6. Lachmann, 'Theory and Practice of Industrial Pharmacy'.
7. C.V.S. Subrahmanyam et al., 'Physical Pharmaceutics'.
8. S.J. Carter, 'Cooper and Gunn's Tutorial Pharmacy'.

HUMAN ANATOMY AND PHYSIOLOGY-II

Subject Code: BPHA1-323

**L T P C
3 1 0 4**

Duration: 45 Hrs.

SCOPE

This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

COURSE OBJECTIVES:

Upon completion of this course the student should be able to:

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.

4. Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume.
5. Appreciate coordinated working pattern of different organs of each system
6. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Unit-I (10 Hrs.)

1. Nervous system

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)

Unit-II (06 Hrs.)

- 1 Digestive System:** Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.
- 2 Energetics:** Formation and role of ATP, Creatinine Phosphate and BMR.

Unit-III (10 Hrs.)

- 1 Respiratory System:** Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration. Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.
- 2 Urinary System:** Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.

Unit-IV (10 Hrs.)

- 1 Endocrine System:** Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders.

Unit-V (09 Hrs.)

- 1 Reproductive System:** Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition.
- 2 Introduction to Genetics:** Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance.

Recommended Books

- 1 K. Sembulingam and P. Sembulingam, 'Essentials of Medical Physiology', Jaypee Brothers Medical Publishers, New Delhi.
- 2 'Anatomy and Physiology in Health and Illness', Kathleen J.W. Wilson, Churchill Livingstone, New York.
- 3 'Physiological Basis of Medical Practice-Best and Taylor', Williams & Wilkins Co, Riverview, MI USA.
- 4 C. Arthur, 'Text Book of Medical Physiology', Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
- 5 Tortora Grabowski, 'Principles of Anatomy and Physiology', Palmetto, GA, U.S.A.

- 6 Inderbir Singh, 'Textbook of Human Histology', Jaypee Brothers Medical Publishers, New Delhi.
- 7 Textbook of Practical Physiology by C.L. Ghai, Jaypee Brothers Medical Publishers, New Delhi.
- 8 K. Srinageswari and Rajeev Sharma, 'Practical Workbook of Human Physiology', Jaypee Brother's Medical Publishers, New Delhi.

Reference Books:

- 1 'Physiological Basis of Medical Practice-Best and Taylor', Williams & Wilkins Co, Riverview, MI USA.
- 2 C. Arthur, 'Text Book of Medical Physiology', Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
- 3 C.C. Chatterje, 'Human Physiology', Vol. 1, 2, Academic Publishers, Kolkata.

PATHOPHYSIOLOGY

Subject Code: BPHA1-324

L T P C
3 1 0 4

Duration: 45 Hrs.

SCOPE

Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

COURSE OBJECTIVES:

Upon completion of the subject student shall be able to –

- Describe the etiology and pathogenesis of the selected disease states;
- Name the signs and symptoms of the diseases; and
- Mention the complications of the diseases.

Unit-I (10 Hrs.)

1. **Basic Principles of Cell Injury and Adaptation:** Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage), Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia), Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance.
2. **Basic Mechanism involved in the Process of Inflammation and Repair:** Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis.

Unit-II (10 Hrs.)

1. **Cardiovascular System:** Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis).
2. **Respiratory System:** Asthma, Chronic obstructive airways diseases.
3. **Renal System:** Acute and chronic renal failure.

Unit-III (10 Hrs.)

1. **Haematological Diseases:** Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, hereditary acquired anemia, hemophilia
2. **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormones

3. **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.
4. **Gastrointestinal system:** Peptic Ulcer

Unit-IV (8 Hrs.)

1. Inflammatory Bowel Diseases, Jaundice, Hepatitis (A, B, C, D, E, F) alcoholic liver disease.
2. **Disease of Bones and Joints:** Rheumatoid arthritis, osteoporosis and gout.
3. **Principles of Cancer:** Classification, etiology and pathogenesis of cancer.
4. **Diseases of Bones and Joints:** Rheumatoid Arthritis, Osteoporosis, Gout.
5. **Principles of Cancer:** Classification, etiology and pathogenesis of Cancer

Unit-V (7 Hrs.)

1. **Infectious Diseases:** Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections
2. **Sexually Transmitted Diseases:** AIDS, Syphilis, Gonorrhoea

Recommended Books

1. Vinay Kumar, Abul K. Abas, Jon C. Aster, 'Robbins & Cotran Pathologic Basis of Disease', South Asia Edn., Elsevier, India, **2014**.
2. Harsh Mohan, 'Text Book of Pathology', 6th Edn., Jaypee Publications, India, **2010**.
3. B. Laurence, C. Bruce, K. Bjorn, 'Goodman Gilman's The Pharmacological Basis of Therapeutics', 12th Edn., McGraw-Hill, New York, **2011**.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological Basis of Medical Practice; 12th Edn., United States.
5. William and Wilkins, Baltimore, **1991** [1990 printing].
6. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston, 'Davidson's Principles and Practice of Medicine', 21st Edn., ELBS/Churchill Livingstone, London, **2010**.
7. A. Guyton, John E. Hall, 'Textbook of Medical Physiology', 12th Edn., W.B. Saunders Company, **2010**.
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey, 'Pharmacotherapy: A Pathophysiological Approach', 9th Edn., McGraw-Hill Medical, London, **2014**.
9. V. Kumar, R.S. Cotran and S.L. Robbins, 'Basic Pathology', 6th Edn., WB Saunders Company, Philadelphia, **1997**.
10. Roger Walker, Clive Edwards, 'Clinical Pharmacy and Therapeutics', 3rd Edn., Churchill Livingstone Publication, London, **2003**.

Recommended Journals

1. The Journal of Pathology. ISSN: 1096-9896 (Online)
2. The American Journal of Pathology. ISSN: 0002-9440
3. Pathology. 1465-3931 (Online)
4. International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171 (Online)
5. Indian Journal of Pathology and Microbiology. ISSN-0377-4929.

PHARMACEUTICAL ORGANIC CHEMISTRY-II LAB.

Subject Code: BPHA1-325

L T P C

0 0 4 2

I. Experiments involving laboratory techniques Recrystallization Steam distillation

1. Recrystallization
2. Steam distillation

II. Determination of following oil values (including standardization of reagents)

1. Acid value
2. Saponification value
3. Iodine value

III. Preparation of compounds

1. Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.
2. 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/
3. Acetanilide by halogenation (Bromination) reaction.
4. 5-Nitro salicylic acid/Meta dinitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
5. Benzoic acid from Benzyl chloride by oxidation reaction.
6. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
7. 1-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions.
8. Benzil from Benzoin by oxidation reaction.
9. Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction
10. Cinnamic acid from Benzaldehyde by Perkin reaction
11. P-Iodo benzoic acid from P-amino benzoic acid

PHARMACEUTICAL MICROBIOLOGY LAB.

Subject Code: BPHA1-326

L T P C

0 0 4 2

1. Introduction and study of different equipment and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals.
9. Bacteriological analysis of water
10. Biochemical test

PHARMACEUTICAL ENGINEERING LAB.

Subject Code: BPHA1-327

L T P C

0 0 4 2

- 1 Determination of radiation constant of brass, iron, unpainted and painted glass.
- 2 Steam distillation – To calculate the efficiency of steam distillation.
- 3 To determine the overall heat transfer coefficient by heat exchanger.
- 4 Construction of drying curves (for calcium carbonate and starch).
- 5 Determination of moisture content and loss on drying.
- 6 Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.

MRSPTU B. PHARMACY SYLLABUS 2016 BATCH

- 7 Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
- 8 Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.
- 9 Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
- 10 Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.
- 11 Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity)
- 12 To study the effect of time on the Rate of Crystallization.
- 13 To calculate the uniformity Index for given sample by using Double Cone Blender.

HUMAN ANATOMY AND PHYSIOLOGY LAB.

Subject Code: BPHA1-328

L T P C

0 0 4 2

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

1. To study the integumentary and special senses using specimen, models, etc.,
2. To study the nervous system using specimen, models, etc.,
3. To study the endocrine system using specimen, models, etc.
4. To demonstrate the general neurological examination
5. To demonstrate the function of olfactory nerve
6. To examine the different types of taste.
7. To demonstrate the visual acuity
8. To demonstrate the reflex activity
9. Recording of body temperature
10. To demonstrate positive and negative feedback mechanism.
11. Determination of tidal volume and vital capacity.
12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
13. Recording of basal mass index.
14. Study of family planning devices and pregnancy diagnosis test.
15. Demonstration of total blood count by cell analyser
16. Permanent slides of vital organs and gonads

PHARMACEUTICAL ORGANIC CHEMISTRY –III

Subject Code – BPHA1-429

T L P C

1 3 0 4

Duration – 45 Hrs.

SCOPE:

This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Course Objectives:

At the end of the course, the student shall be able to

1. Understand the methods of preparation and properties of organic compounds.
2. Explain the stereo chemical aspects of organic compounds and stereo chemical reactions.
3. Know the medicinal uses and other applications of organic compounds.

Note: To emphasize on definition, types, mechanisms, examples, uses/applications
UNIT-I (10 Hrs.)

Stereo isomerism

Optical isomerism –

Optical activity, enantiomerism, diastereoisomerism, meso compounds

Elements of symmetry, chiral and achiral molecules

DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers

Reactions of chiral molecules

Racemic modification and resolution of racemic mixture.

Asymmetric synthesis: partial and absolute

UNIT-II (10 Hrs.)

Geometrical isomerism

Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems)

Methods of determination of configuration of geometrical isomers.

Conformational isomerism in Ethane, n-Butane and Cyclohexane.

Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.

Stereospecific and stereoselective reactions

UNIT-III (10 Hrs.)

Heterocyclic Compounds:

Nomenclature and classification

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrrole, Furan, and Thiophene

Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene

UNIT-IV (8 Hrs.)

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrazole, Imidazole, Oxazole and Thiazole.

Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine

Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives

UNIT-V (7 Hrs.)

Reactions of Synthetic Importance

Metal hydride reduction (NaBH_4 and LiAlH_4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.

Oppenauer-oxidation and Dakin reaction.

Beckmanns rearrangement and Schmidt rearrangement.

Claisen-Schmidt condensation

Recommended Books

1. I.L. Finar, 'Organic Chemistry', Vol.-I & II.
2. Arun Bahl, B.S. Bahl 'A Text Book of Organic Chemistry'.
3. Raj K. Bansal, 'Heterocyclic Chemistry'.
4. Morrison and Boyd, 'Organic Chemistry'.
5. T.L. Gilchrist, 'Heterocyclic Chemistry'.

MEDICINAL CHEMISTRY – I

Subject Code – BPHA1-430

T L P C
1 3 0 4

Duration – 45 Hrs.

SCOPE:

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

COURSE OBJECTIVES:

Upon completion of the course the student shall be able to

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structural Activity Relationship (SAR) of different class of drugs
4. Write the chemical synthesis of some drugs

Course Content:

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

UNIT- I (10 Hrs.)

Introduction to Medicinal Chemistry

History and development of medicinal chemistry

Physicochemical properties in relation to biological action

Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.

Drug metabolism

Drug metabolism principles- Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II (10 Hrs.)

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine,

Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline,

Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.

□□ Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine.

□□ Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.

Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT-III (10 Hrs.)

Cholinergic Neurotransmitters:

Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic Agents: SAR of Parasympathomimetic agents

Direct Acting Agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible):

Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorophate, Echothiophate iodide, Parathione, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

UNIT-IV (8 Hrs.)

Drugs Acting on Central Nervous System

A. Sedatives and Hypnotics:

Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturates: SAR of barbiturates, Barbitol*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital

Miscellaneous:

Amides & imides: Glutethimide.

Alcohol & their carbamate derivatives: Meprobamate, Ethchlorvynol.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

Phenothiazines: SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.

Fluoro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action

Barbiturates: Phenobarbitone, Methobarbital. **Hydantoins:**

Phenytoin*, Mephénytoin, Ethotoin **Oxazolidine diones:**

Trimethadione, Paramethadione **Succinimides:**

Phensuximide, Methsuximide, Ethosuximide* **Urea and**

monoacylureas: Phenacemide, Carbamazepine*

Benzodiazepines: Clonazepam

Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

UNIT-V (7 Hrs.)

Drugs Acting on Central Nervous System

General Anaesthetics:

Inhalation Anaesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbiturates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

MEDICINAL CHEMISTRY – I LAB.

Subject Code – BPHA1-434

T L P C
0 0 4 2

Duration – 4 Hours/Week

I. Preparation of drugs/ intermediates

- 1,3-pyrazole
- 1,3-oxazole
- Benzimidazole
- Benztriazole
- 2,3- diphenyl quinoxaline
- Benzocaine
- Phenytoin
- Phenothiazine
- Barbiturate

II. Assay of drugs

- Chlorpromazine
- Phenobarbitone
- Atropine
- Ibuprofen
- Aspirin
- Furosemide

III. Determination of Partition coefficient for any two drugs

Recommended Books

1. 'Wilson and Giswold's Organic Medicinal and Pharmaceutical Chemistry'.
2. 'Foye's Principles of Medicinal Chemistry'.
3. 'Burger's Medicinal Chemistry', Vol I to IV.
4. Smith and Williams, 'Introduction to Principles of Drug Design'.
5. 'Remington's Pharmaceutical Sciences'.
6. 'Martindale's extra Pharmacopoeia'.
7. I.L. Finar, 'Organic Chemistry', Vol. II.
8. Lednicer, 'The Organic Chemistry of Drug Synthesis', Vol. 1-5.
9. 'Indian Pharmacopoeia'.
10. A.I. Vogel, 'Text Book of Practical Organic Chemistry'.

PHARMACOLOGY-I

Subject Code – BPHA1-431

**T L P C
1 3 0 4**

Duration – 45 Hrs.

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SCOPE:

The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

COURSE OBJECTIVES:

Upon completion of this course the student should be able to

1. Understand the pharmacological actions of different categories of drugs
2. Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
4. Observe the effect of drugs on animals by simulated experiments
5. Appreciate correlation of pharmacology with other bio medical sciences.

UNIT-I (8 Hrs.)

General Pharmacology

1. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non-competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.
2. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition, kinetics of elimination.

UNIT-II (12 Hrs.)

General Pharmacology

1. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein-coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.
2. Adverse drug reactions.
3. Drug interactions (pharmacokinetic and pharmacodynamic)
4. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

UNIT-III (10 Hrs.)

Pharmacology of Drugs Acting on Peripheral Nervous System

1. Organization and function of ANS.
2. Neurohumoral transmission,co-transmission and classification of neurotransmitters.
3. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.
4. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).
5. Local anesthetic agents.
6. Drugs used in myasthenia gravis and glaucoma.

UNIT-IV (8 Hrs.)

Pharmacology of Drugs Acting on Central Nervous System

1. Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.
2. General anesthetics and pre-anesthetics.
3. Sedatives, hypnotics and centrally acting muscle relaxants.
4. Anti-epileptics
5. Alcohols and disulfiram

UNIT-V (7 Hrs.)

Pharmacology of drugs acting on central nervous system

1. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.
2. Drugs used in Parkinsons disease and Alzheimer's disease.
3. CNS stimulants and nootropics.
4. Opioid analgesics and antagonists
5. Drug addiction, drug abuse, tolerance and dependence.

PHARMACOLOGY-I LAB.

Subject Code – BPHA1-430

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

Duration – 4Hrs./Week

1. Introduction to experimental pharmacology.
2. Commonly used instruments in experimental pharmacology.
3. Study of common laboratory animals.
4. Maintenance of laboratory animals as per CPCSEA guidelines.
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.
6. Study of different routes of drugs administration in mice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on ciliary motility of frog oesophagus
9. Effect of drugs on rabbit eye.
10. Effects of skeletal muscle relaxants using rota-rod apparatus.
11. Effect of drugs on locomotor activity using actophotometer.
12. Anticonvulsant effect of drugs by MES and PTZ method.
13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14. Study of anxiolytic activity of drugs using rats/mice.
15. Study of local anesthetics by different methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and video.

Recommended Books

1. H.P. Rang, M.M. Dale, J.M. Ritter, R.J. Flower, Rang and Dale's Pharmacology, Churchil Livingstone, Elsevier.
2. B.G. Katzung, S.B. Masters, A.J. Trevor, 'Basic and Clinical Pharmacology', Tata Mc Graw Hill.
3. Goodman and Gilman's, 'The Pharmacological Basis of Therapeutics'.
4. Marry Anne K.K., Lloyd Yee Y., K.A. Brian, L.C. Robbin, G.B. Joseph, A.K. Wayne, R.W. Bradley, 'Applied Therapeutics, The Clinical use of Drugs', The Point Lippincott Williams & Wilkins
5. M.J. Mycek, S.B. Gelnet and M.M. Perper, 'Lippincott's Illustrated Reviews- Pharmacology'.

6. K.D. Tripathi, 'Essentials of Medical Pharmacology', JAYPEE Brothers Medical Publishers (P) Ltd., New Delhi.
7. H.L. Sharma, K.K. Sharma, 'Principles of Pharmacology', Paras Medical Publisher.
8. Charles R. Craig & Robert, 'Modern Pharmacology with Clinical Applications'.
9. M.N. Ghosh, 'Fundamentals of Experimental Pharmacology', Hilton & Company, Kolkata.
10. S.K. Kulkarni, 'Handbook of Experimental Pharmacology', Vallabh Prakashan.

PHYSICAL PHARMACEUTICS-II

Subject Code – BPHA1-432

T L P C
1 3 0 4

Duration – 45 Hrs.

SCOPE:

The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

COURSE OBJECTIVES:

Upon the completion of the course student shall be able to

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

UNIT-I (7 Hrs.)

Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization & protective action.

UNIT-II (10 Hrs.)

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers

Deformation of Solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus

UNIT-III (10 Hrs.)

Coarse Dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, micro emulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

UNIT-IV (10 Hrs.)

Micromeretics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

UNIT-V (10 Hrs.)

Drug Stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the

MRSPTU B. PHARMACY SYLLABUS 2016 BATCH

chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention.

PHYSICAL PHARMACEUTICS- II LAB.

Subject Code – BPHA1-436

T L P C

Duration – 4 Hrs./week

0 0 4 2

1. Determination of particle size, particle size distribution using sieving method
2. Determination of particle size, particle size distribution using Microscopic method
3. Determination of bulk density, true density and porosity
4. Determine the angle of repose and influence of lubricant on angle of repose
5. Determination of viscosity of liquid using Ostwald's viscometer
6. Determination sedimentation volume with effect of different suspending agent
7. Determination sedimentation volume with effect of different concentration of single suspending agent
8. Determination of viscosity of semisolid by using Brookfield viscometer
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order
11. Accelerated stability studies

Recommended Books

1. Alfred Martin, 'Physical Pharmacy', 6th Edn.
2. Eugene, Parott, 'Experimental Pharmaceutics'.
3. Cooper and Gunn, 'Tutorial Pharmacy'.
4. Stocklosam J. 'Pharmaceutical Calculations', Lea & Febiger, Philadelphia.
5. H.A. Liberman, C. Lachman, 'Pharmaceutical Dosage Forms', Tablets, Vol. 1-3, Marcel Dekkar Inc.
6. H.A. Liberman, C. Lachman, 'Pharmaceutical Dosage Forms. Disperse Systems', Vol. 1,2,3. Marcel Dekkar Inc.
7. C. Ramasamy and R. Manavalan, 'Physical Pharmaceutics'.

PHARMACOGNOSY AND PHYTOCHEMISTRY-I

Subject Code – BPHA1-433

T L P C

Duration – 45 Hrs.

1 3 0 4

SCOPE:

The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

COURSE OBJECTIVES:

Upon completion of the course, the student shall be able

1. to know the techniques in the cultivation and production of crude drugs
2. to know the crude drugs, their uses and chemical nature
3. know the evaluation techniques for the herbal drugs
4. to carry out the microscopic and morphological evaluation of crude drugs

UNIT-I (10 Hrs.)

Introduction to Pharmacognosy:

- a) Definition, history, scope and development of Pharmacognosy

- b) Sources of Drugs – Plants, Animals, Marine & Tissue culture
c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs

Quality control of Drugs of Natural Origin:

Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.

Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT-II (10 Hrs.)

Cultivation, Collection, Processing and Storage of Drugs of Natural Origin:

Cultivation and Collection of drugs of natural origin

Factors influencing cultivation of medicinal plants.

Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of Medicinal Plants

UNIT-III (7 Hrs.)

Plant Tissue Culture:

Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance.

Applications of plant tissue culture in pharmacognosy.

Edible vaccines

UNIT-IV (10 Hrs.)

Pharmacognosy in various systems of medicine:

Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

UNIT-V (8 Hrs.)

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:

Carbohydrates: Acacia, Agar, Tragacanth, Honey

Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).

Lipids (Waxes, fats, fixed oils): Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax

Marine Drugs:

Novel medicinal agents from marine sources

PHARMACOGNOSY AND PHYTOCHEMISTRY-I LAB.

Subject Code – BPHA1-437

T L P C
0 0 4 2

Duration – 4 Hrs./Week

1. Analysis of crude drugs by chemical tests: (i) Tragacanth, (ii) Acacia, (iii) Agar, (iv) Gelatin, (v) starch, (vi) Honey, (vii) Castor oil.
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and palisade ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming

Recommended Books

1. W.C. Evans, Trease and Evans, 'Pharmacognosy', 16th Edn., W.B. Saunders & Co., London, 2009.
2. V.E. Tyler, L.R. Brady and J.E. Robbers, Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. T.E. Wallis, 'Text Book of Pharmacognosy'.
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. C.K. Kokate, Purohit, Gokhlae, 'Text Book of Pharmacognosy', 37th Edn., Nirali Prakashan, New Delhi, 2007.
6. R.D. Choudhary, 'Herbal Drug Industry', 1st Edn, Eastern Publisher, New Delhi, **1996.**
7. 'Essentials of Pharmacognosy', S.H. Ansari, 2nd Edn., Birla Publications, New Delhi, 2007.
8. C.K. Kokate, Purohit, Gokhlae, 'Practical Pharmacognosy'.
9. M.A. Iyengar, 'Anatomy of Crude Drugs'.