

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

## B. PHARMACY COURSE STRUCTURE (2016-17)

## II YEAR I SEMESTER

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

\*MC – Mandatory Course

## PS301: PHARMACEUTICAL ORGANIC CHEMISTRY - III

B. Pharm II Year I Sem

L	T	P	C
4	1	0	4

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

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

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

### UNIT - I

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

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

### UNIT - II

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

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

### UNIT - III

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

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

### UNIT - IV

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

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

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

## **UNIT - V**

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

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

### **TEXT BOOKS:**

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

### **REFERENCES**

1. Jerry March, Advanced Organic Chemistry 4<sup>th</sup> Ed.
2. Solomons, Organic Chemistry

## PS302: PHARMACEUTICAL UNIT OPERATIONS- I

B. Pharm II Year I Sem

L T P C  
4 1 0 4

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

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

### UNIT - I

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

#### **b. Dehumidification and Humidity control**

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

### UNIT - II

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

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

### UNIT - III

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

### UNIT - IV

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

### UNIT - V

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

**TEXT BOOKS**

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

**REFERENCES**

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

## PS303: HOSPITAL AND COMMUNITY PHARMACY

B. Pharm II Year I Sem

L T P C

3 1 0 3

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

know various drug distribution methods;

know the professional practice management skills in hospital pharmacies;

provide unbiased drug information to the doctors;

know the manufacturing practices of various formulations in hospital set up;

appreciate the practice based research methods;

and appreciate the stores management and inventory control.

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

### UNIT - I

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

### UNIT – II

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

### UNIT - III

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

### UNIT - IV

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

## **UNIT - V**

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

### **TEXT BOOKS: (latest editions)**

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

### **REFERENCES**

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

## PS304: PHARMACOGNOSY – I

### B. Pharm II Year I Sem

L	T	P	C
3	1	0	3

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

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

#### UNIT - I

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

#### UNIT II

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

#### UNIT - III

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

#### UNIT - IV

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

#### UNIT - V

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

**TEXT BOOKS:**

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

**REFERENCES:**

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

## PS305: PHARMACEUTICAL ANALYSIS –I

B. Pharm II Year I Sem

L T P C

4 1 0 4

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

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

### UNIT - I

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

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

### UNIT - II

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

### UNIT - III

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

### UNIT - IV

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

- Column chromatography; Adsorption and partition theory, preparation, procedure, methods of detection.
- Thin layer chromatography: theoretical consideration, preparation, procedure, detection of compounds.
- Paper Chromatography: theory of partition, different techniques employed filter papers used, quantitative and quantitative detection.

**UNIT - V**

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

**TEXT BOOKS:**

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

**REFERENCES:**

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

**I. Synthesis of some simple heterocyclic compounds.**

- a. 3, 5-Dimethylpyrazole from Acetylacetone.
- b. 3, 5-Dimethylisoxazole from Acetylacetone.
- c. 4, 5-Diphenylimidazole from Benzil.
- d. Benzoxazole from o-Aminophenol.
- e. 2, 5-Dioxopiperazine from Glycine.
- f. Oxazolone from Benzoylglycine.

**II. Molecular rearrangements and named reactions**

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

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

**REFERENCES:**

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

## PS307: PHARMACOGNOSY – I LAB

### B. Pharm II Year I Sem

L	T	P	C
0	0	3	2

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

### REFERENCES:

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

**PS308: PHARMACEUTICAL ANALYSIS – I LAB**

**B. Pharm II Year I Sem**

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

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

## MC309ES: ENVIRONMENTAL STUDIES

B.Pharm. II Year I Sem.

L	T	P	C
3	0	0	0

### Course Objectives:

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

### Course Outcomes:

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

### UNIT - I

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

### UNIT - II

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

### UNIT - III

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

### UNIT - IV

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

of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

#### **UNIT-V**

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

#### **TEXT BOOKS:**

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

#### **REFERENCE BOOKS:**

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

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

## B. PHARMACY COURSE STRUCTURE (2016-17)

## II YEAR II SEMESTER

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

\*MC – Mandatory Course

## PS401: PHARMACEUTICAL UNIT OPERATIONS – II

B. Pharm II Year II Sem

L T P C  
4 1 0 4

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

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

### UNIT - I

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

### UNIT - II

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

### UNIT - III

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

### UNIT - IV

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

### UNIT - V

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

### TEXT BOOKS:

- B S.J. Carter, Cooper and Gunn's Tutorial Pharmacy, 6<sup>th</sup> ed., CBS publisher, Delhi.
- C CVS Subramanyam, Pharmaceutical Engineering.
- D K. Samba Murthy, Pharmaceutical Engineering

### REFERENCE BOOKS:

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

## BS402: BIOCHEMISTRY

**B. Pharm II Year II Sem**

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

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

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

### UNIT - I

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

### UNIT - II

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

### UNIT - III

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

### UNIT - IV

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

### UNIT - V

#### 9. Metabolism of Lipids:

Biochemistry of lipids, Alpha, Beta, Gamma & Omega oxidations of fatty acids, bio-synthesis of fatty acids, cholesterol, ketogenesis.

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

**TEXT BOOKS**

4. Harper's Biochemistry
5. A.L. Lehninger, Principles of Biochemistry.
6. Satyanarayana, Text Book of Biochemistry

**REFERENCES**

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

## PS403: PHARMACEUTICAL JURISPRUDENCE

B. Pharm II Year II Sem

L T P C  
4 1 0 4

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

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

### UNIT - I

#### Introduction

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

#### An elaborate study of the following

4. Pharmacy Act 1948
5. Drugs and Cosmetics Act 1940 and Rules 1945

### UNIT - II

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

### UNIT - III

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

### UNIT - IV

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

### UNIT - V

A. study of the salient features of the following.

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

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

#### TEXT BOOKS:

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

**REFERENCE BOOK:**

Bare Acts and Rules Publ by Govt of India/state Govt from time to time.

AIR – reported judgments of Supreme Court of India and other High Courts

## PS404: PHYSICAL PHARMACY – II

B. Pharm II Year II Sem

L T P C  
4 1 0 4

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

### UNIT - I

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

### UNIT - II

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

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

### UNIT - III

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

### UNIT - IV

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

### UNIT - V

**Coarse Dispersions:** Suspensions: Types of suspensions, interfacial properties of suspended particles, stability evaluation, settling in suspensions, formulation of suspensions. Emulsions: Theories of emulsification, physical stability of emulsions, preservation of emulsions, rheological properties of emulsions and suspensions.

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

### TEXT BOOKS

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences 5<sup>th</sup> Edition
- c) CVS Subhramanyam, Physical Pharmacy, Vallabh prakashan.
- d) L. Lachman, H. Lieberman The Theory And Practice Of Industrial Pharmacy J. L Kaniz Lee & Febiger Philadelphia, USA

### REFERENCE

- c) Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
- d) M.E. Aulton, Pharmaceutics –The science of dosage form design, 2<sup>nd</sup> edn

## HS405: INTELLECTUAL PROPERTY RIGHTS

(Open Elective)

**B. Pharm II Year II Sem**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>

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

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

### UNIT - I

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

### UNIT - II

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

### UNIT - III

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

### UNIT - IV

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

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

### UNIT - V

- d) a. Patent filing procedure under PCT, advantages, patent search and literature
- e) Patent search, literature and prior art search
- f) Non- infringement techniques and design around strategies

**TEXT BOOKS**

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

**REFERENCE BOOKS**

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

## PS405: HERBAL DRUG TECHNOLOGY

(Open Elective)

B. Pharm II Year II Sem

L	T	P	C
3	1	0	3

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

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

### UNIT - I

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

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

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

### UNIT - II

#### Excipients:

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

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

### UNIT - III

#### Manufacturing:

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

### UNIT - IV

#### Herbal drug Standardization:

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

### UNIT - V

- a) Name of the different companies' manufacturing different herbal extracts, standardized extracts with concentration of marker compounds, active principles and claims regarding their uses.
- c) **Herbal drug regulatory Affairs:** Introduction, objectives of Herbal Drug Regulation, Current Status of Herbal Drug Regulatory Affairs.

**TEXT BOOKS:**

- c) Textbook of Pharmacognosy by G.E.Trease, W.C.Evans, ELBS
- d) Textbook of HPTLC by P.D. Seth.
- e) Herbal Perfumes and cosmetics by Panda

**REFERENCES:**

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

## BS405: GREEN CHEMISTRY

(Open Elective)

B. Pharm II Year II Sem

L	T	P	C
3	1	0	3

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

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

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

### UNIT - I

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

### UNIT – II

Green chemical processes.

### UNIT - III

Introduction to microwave synthesis.

### UNIT - IV

Design and selection of safer chemicals and solvents.

### UNIT - V

Use of catalytic reagent.

### TEXT BOOKS:

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

### REFERENCES:

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

## PS406: PHARMACEUTICAL UNIT OPERATIONS - II LAB

**B. Pharm II Year II Sem**

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

### **List of Experiments:**

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

**BS407: BIOCHEMISTRY LAB**

**B. Pharm II Year II Sem**

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

**List of Experiments:**

- d) To prepare standard buffers (citrate, phosphate & carbonate) and measure the pH.
- e) Titration curve for amino acids.
- f) Separation of amino acids by two dimensional paper chromatography & gel electrophoresis.
- g) The separation of lipids by T.L.C.
- h) Identification of carbohydrates
- i) Identification of amino acid.
- j) Identification of lipids.
- k) Estimation of glucose in urine.
- l) Estimation of creatinine in urine.
- m) Estimation of urea in blood.
- n) Estimation of creatinine in blood.
- o) Estimation of Serum protein.
- p) Estimation of bile pigments in serum.
- q) Estimation of alkaline phosphatase in serum
- r) Effect of temperature on the activity of alpha- amylase

**List of Experiments:**

- d) Determination of bulk density, true density and percentage of porosity.
  - e) Effect of particle size and effect of glidant on angle of repose.
  - f) Microscopic size analysis, plotting of the graphs, calculation of geometric mean, diameter etc.
  - g) Determination of particle size by andreason pipette.
  - h) Determination of CMC of a surfactant.
  - i) Adsorption Isotherm consturctions.
  - j) Partition coefficient determination.
  - k) Determination of sedimentation volume and degree of flocculation.
  - l) Determination of order of reaction – zero order
  - m) Determination of Order of reaction – First order.
  - n) Determination of Second order reaction rate constant.
  - o) Effect of temperature on solubility of solid in liquid.
  - p) Effect of addition of Salt/pH/cosolvent on the solubility
  - q) Surface tension determination using Stalagmometer.
  - r) HLB value estimation of surfactants.
  - s) Viscosity – by Ostwald Viscometer, Brookfield viscometer
- 17. Preparation of Multiple emulsions - Demonstration.
  - 18. Preparation of Micro emulsion - Demonstration.
  - 19. Determination of Zeta potential - Demonstration.
  - e) Determination of granular density
  - f) Preparation of emulsion, identification and evaluation

## MC409HS: GENDER SENSITIZATION LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	0

### Course Objectives:

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

### Course Outcomes:

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

### UNIT-I

#### UNDERSTANDING GENDER

**Gender:** Why Should We Study It? (*Towards a World of Equals*: Unit -1) **Socialization:** Making Women, Making Men (*Towards a World of Equals*: Unit -2) Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

### UNIT-II

#### GENDER AND BIOLOGY

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

**Gender Spectrum:** Beyond the Binary (*Towards a World of Equals*: Unit -10) Two or Many? Struggles with Discrimination.

### UNIT-III

#### GENDER AND LABOUR

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

"My Mother doesn't Work." "Share the Load."

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

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

## **UNIT-IV**

### **ISSUES OF VIOLENCE**

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

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

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

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

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

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

## **UNIT-V**

### **GENDER: CO - EXISTENCE**

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

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.

Additional Reading: Rosa Parks-The Brave Heart.

### **TEXTBOOK**

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

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

### **REFERENCE BOOKS:**

- c) Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
- d) Abdulali Sohaila. "I Fought For My Life...and Won." Available online at:  
<http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/>