

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

III Year B.Pharm - II Sem

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### (R60022) MEDICINAL CHEMISTRY - I

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

#### UNIT I

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

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

#### UNIT II

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

- a. Hypnotics and Anxiolytics:** Phenobarbital, diazepam, alprazolam, glutethimide
- Anti-psychotics:** Chlorpromazine, haloperidol, clozapine, oxyptentine.
- Anti-epileptics:** Phenytoin, valproic acid, carbamazepine, ethosuximide.
- Anti-depressants:** Imipramine, fluoxetine, doxepine.

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

#### UNIT III

- a. Adrenergic agents and adrenergic blockers.** Isoproterenol, atenolol, hexoxybenzamine, amphetamine, ephedrine, salbutamol.
- b. Cholinergic agents and acetyl cholinesterase inhibitors**
- Cholinergics:** Carbachol, bethanichol.





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**(R60023) PHARMACEUTICAL TECHNOLOGY – II**

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

**UNIT I****a) Tablets: Formulation and evaluation of tablets:**

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

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

**UNIT II**

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

**UNIT III**

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

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

**UNIT IV****Parenteral Products**

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- Preformulation factors, routes of administration, water for injection, treatment apyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment.
- Formulation details, container and closures and selection.
- Prefilling treatment, washing and sterilization of containers and closures, preparation of solution and suspensions, filling and closing of ampules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large-scale manufacture and evaluation of

parenteral products.

## UNIT V

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

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

## TEXT BOOKS

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

## REFERENCES

1. Sagarian & MS Balsam, Cosmetics Sciences & Technology, Vol.1, 2 & 3.
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
3. E.A.Rawlkins Bentley's Text Book of Pharmaceutics, Elbs publ.
4. S.H. Willing, M.M Tucherman and W.S. Hitchings IV, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, 2<sup>nd</sup> ed, Marcel Dekker, Inc., New York 1998.
5. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, IVth ed, marcel dekker, USA, 2005.
6. Yiew chien, novel drug delivery systems, 2<sup>nd</sup> ed, marcel dekker 2003.
7. Robert. A. Nash, Pharmaceutical Process Validation, 3<sup>rd</sup> Ed Marcel Dekker, 2003.
8. Good Manufacturing Practices – Schedule M. Read With The Drugs and Cosmetic Rules 1945 M.E. Aulton, Pharmaceutics- The science of Dosage form Design 2<sup>nd</sup> ed.

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**(R60024) PHARMACOLOGY – II**

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

**UNIT I****Pharmacology of drugs acting in cardiovascular diseases**

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

**UNIT II**

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

**UNIT III****Autacoids**

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

**UNIT IV**

- Drugs acting on the respiratory system.  
Anti-asthmatic drugs.  
Anti-tussives and expectorants.  
Respiratory stimulants. [www.universityupdates.in](http://www.universityupdates.in)
- Bioassays: Applications, Principles and Methods of Bioassays.
- Study of bioassay methods for the following drugs.  
a. Digitalis, b. D – tubocurarine, c. Oxytocine d. HCG.

**UNIT V****Drugs acting on Endocrine system**



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### (R60025) CHEMISTRY OF NATURAL PRODUCTS

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

#### UNIT I

##### Poly Functional Natural Products

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

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

#### UNIT II

##### Amino Acids and Proteins

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

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

#### UNIT III

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

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

#### UNIT IV

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##### a. Alkaloids

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



## **b.Purine and Xanthine Derivatives**

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

### **UNIT V**

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### **Steroids**

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

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

### **TEXT BOOKS**

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

### **REFERENCE BOOKS**

1. R.T. Morrison and R.N. Boyd, **Organic Chemistry**, Allyn and Bacon, Inc., Boston.
2. **Burger's Medicinal Chemistry, M.E.** – Wolff, Ed., John Wiley & Sons, New York.
3. F.G.Mann & B. Saunders, **Practical Organic Chemistry** Longmans Green & Co. Ltd., U.K .
4. R. M. Acheson, **An Introduction to the Chemistry of Heterocyclic Compounds**, Interscience NY.
5. **The Chemistry of Organic Medicinal Products** by Jenkins.
6. **Elements of Pharmacoinformatics** by Duraih Anand.
7. **Structure based drug design** by Veerapandian.
8. **Chemistry of natural products; A laboratory handbook**, second edition, N R Krishna Swami.
9. **Biosynthesis of Natural products** by Paolo Manitto-Wiley India publisher.

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### (R60026) PHARMACEUTICAL JURISPRUDENCE

**Objective:** 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.

#### UNIT I

##### Introduction

- Pharmaceutical Legislations - A brief review
- Drugs & Pharmaceutical Industry - A brief review
- Pharmaceutical Education - A brief review.
- Pharmaceutical ethics & policy

##### An elaborate study of the following

Pharmacy Act 1948.

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.

- Prevention of Cruelty to animals Act 1960.
- AP State Shops & Establishments Act 1988 & Rules 1990.
- Factories Act 1948. [www.universityupdates.in](http://www.universityupdates.in)
- WTO, GATT and The Indian Patents Act 1970
- Pharmaceutical Policy 2002.

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

## 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.

## TEXT BOOKS

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

## REFERENCE BOOK

1. Bare Acts and Rules Publ by Govt of India/state Govt from time to time.
2. AIR – reported judgments of Supreme Court of India and other High Courts.
3. Pharmaceutical policy of India.
4. Notification from NPPA.
5. Vijay Malik, Drugs & Cosmetics act 1940 and Rules, Eastern Law House Co. Delhi, Kolkata.
6. K.Sampath, Pharmaceutical Jurisprudence (Forensic Pharmacy).

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**(R60069) ADVANCED COMMUNICATION SKILLS (ACS) LAB****Introduction**

The introduction of the Advanced Communication Skills Lab is considered essential at 3<sup>rd</sup> year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

**Objectives:**

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

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

**Syllabus:**

The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) Lab:

**1. Activities on Fundamentals of Inter-personal Communication and**[www.universityupdates.in](http://www.universityupdates.in)[www.universityupdates.in](http://www.universityupdates.in)

- Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
- Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.  
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  - Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing* – planning for writing – improving one's writing.
  - Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ e-mails/assignments etc.
  - Activities on Group Discussion and Interview Skills** Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

#### Minimum Requirement:

The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 35 students in the lab:

- **Spacious room with appropriate acoustics.**
- **Round Tables with movable chairs**
- **Audio-visual aids**
- **LCD Projector**
- **Public Address system**
- **P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ**
- **T. V, a digital stereo & Camcorder**
- **Headphones of High quality**

**Prescribed Lab Manual:** A book titled **A Course Book of Advanced Communication Skills (ACS) Lab** published by Universities Press,

Hyderabad.

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### Suggested Software:

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

- **Oxford Advanced Learner's Compass**, 7<sup>th</sup> Edition.
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech.
- **TOEFL & GRE**( KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
- **The following software from 'train2success.com'**
  - **Preparing for being Interviewed**
  - **Positive Thinking**
  - **Interviewing Skills**
  - **Telephone Skills**
  - **Time Management**

### Books Recommended

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. Advanced Communication, Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. Technical Communication, by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
4. Business and Professional Communication: Keys for Workplace Excellence. Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications. 2011.
5. The Basics of Communication: A Relational Perspective. Steve Duck & David T. McMahan. Sage South Asia Edition. Sage Publications. 2012.
6. English Vocabulary in Use series, Cambridge University Press 2008.
7. Management Shapers Series by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.
8. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
9. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
10. Handbook for Technical Writing by David A McMurrey & Joanne

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Buckely CENGAGE Learning 2008.

11. Job Hunting by Colm Downes, Cambridge University Press 2008.
12. Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
13. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.
14. Books on TOEFL/GRE/GMAT/CAT/ IELTS by Barron's/DELTA/ Cambridge University Press.
15. International English for Call Centres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009. [www.universityupdates.in](http://www.universityupdates.in)

### **DISTRIBUTION AND WEIGHTAGE OF MARKS:**

#### ***Advanced Communication Skills Lab Practicals:***

1. The practical examinations for the ACS Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned, by inviting the External Examiner from outside. In case of the non-availability of the External Examiner, other teacher of the same department can act as the External Examiner.

#### **Mini Project: As a part of Internal Evaluation**

1. Seminar/ Professional Presentation
  2. A Report on the same has to be prepared and presented.
- \* *Teachers may use their discretion to choose topics relevant and suitable to the needs of students.*
  - \* *Not more than two students to work on each mini project.*
  - \* *Students may be assessed by their performance both in oral presentation and written report.*

#### **Outcomes**

- ☛ Accomplishment of sound vocabulary and its proper use contextually.
- ☛ Flair in Writing and felicity in written expression.
- ☛ Enhanced job prospects.
- ☛ Effective Speaking Abilities.

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**(R60070) MEDICINAL CHEMISTRY – I LAB**

**I. Synthesis of some medicinal compounds and their analogues.**

- a. Barbituric acid from Diethyl Malonate.
- b. Phenyntion from Benzoin or Benzil.
- c. Paracetamol from *para*-nitro phenol or *para*-aminophenol.
- d. 1,4- di hydro pyridine from ethyl aceto acetate.
- e. Quinazolinone from anthranilic acid via benzoxazinone.
- f. Synthesis of Finofibrat
- g. Isoniazid from  $\gamma$ -picoline.
- h. Antipyrine from ethyl aceto acetate.
- i. Benzocaine from *para*-nitro benzoic acid.

**II. Qualitative estimation of some functional groups.\***

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

**REFERENCES**

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

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**(R60071) PHARMACEUTICAL TECHNOLOGY – II LAB**

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

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**(R60072) PHARMACOLOGY – II LAB**

**1. Introduction to Experimental Pharmacology**

Preparation of different solutions for experiments.

Drug dilutions, use of molar and w/v solutions in experimental Pharmacology.

Common laboratory animals and anesthetics used in animal studies.

Commonly used instruments in experimental pharmacology.

Some common and standard techniques.

Bleeding and intravenous injection, intragastric administration.

**2. Experiments on intact preparations:**

Study of different routes of administration of drugs in mice/rats.

**3. Experiments in Central Nervous system:**

Recording of spontaneous motor activity, stereotype, analgesia, anticonvulsant activity, anti-inflammatory activity.

**4. To study the effect of autonomic drugs on rabbit's eye**

**5. Experiments on Isolated Preparations:**

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

a) To record the concentration response curve (CRC) of acetylcholine using rectus abdominus muscle preparation of frog.

b) To study the effects of physostigmine and d-tubocurarine on the CRC of acetylcholine using frog rectus abdominus muscle preparation of frog.

c) To record the CRC of 5-HT on rat fundus preparation.

d) To record the CRC of histamine on guinea pig ileum preparation.

II. a. To study the inotropic and chronotropic effects of drugs on isolated frog heart.

b. To study the effects of drugs on normal and hypodynamic frog heart.

**6. Experiments pertaining to analgesia, anti-convulsant activity, anti-inflammatory activity (Only demonstration).**

Experimental Pharmacology, M.C. Prabhakar.

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**(R60073) CHEMISTRY OF NATURAL PRODUCTS LAB**

1. Preparation of different alkaloid testing reagents like Dragendroff, Mayer' Wagner's, etc. and testing some alkaloids and plant extracts using these reagents.
2. Identification of alkaloids by specific colour tests.
3. Tests for steroids, steroidal glycosides and cardiac glycosides. Liberman- Burchard test, Salkowski' reaction, Kedde reaction, etc.
4. Tests for flavanoids and their glycosides. Shinoda test (Mg /Hcl test), Fecl<sub>3</sub> test.
5. TLC end examination of alkaloids, steroids, steroidal glycosides and cardiac glycosides.
6. Identification of natural products.
7. Extraction of caffeine from tea leaves.
8. Extraction of lactose from milk.
9. Extraction of nicotine from tobacco.
10. Extraction of piperine from black pepper.
11. Extraction of lycopene from tomatoes.
12. Extraction of beta - carotene from carrots.
13. Volatile oil production by steam distillation (**Demonstration only**)

**TEXT BOOKS**

1. Indian Pharmacopoeia – 1996.
2. Weagners, Phyto Chemical Methods of Drug Analysis.
3. C.K. Kokate, Practical Pharmacognosy.

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