

**Regulations**  
**for Courses affiliated to the**  
**Kerala University of Health Sciences**  
**Thrissur 680596**



**Bachelor of Pharmacy – B.Pharm(Ay.)**

**Course Code: 010**

**(2016-17 Academic year onwards)**

**2016**

## 2. COURSE CONTENT

### 2.1 Title of course:

Bachelor of Pharmacy (Ayurveda) – B.Pharm.(Ay.)

### 2.2 Objectives of course

- To provide specially trained personal
- To provide technical experts to the Ayurvedic manufacturing industry
- To create capability to identify, collect and process the raw materials used in Ayurvedic drugs, and formulations.
- To be conversant with modern drugs manufacturing techniques and standards including G.M.P, G.L.P. etc.
- To provide expertise to control and maintain the quality of Ayurvedic drugs.
- To be conversant with modern drug presentation techniques.
- To be conversant with drugs and cosmetics act and regulations.
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### 2.3 Medium of instruction:

Medium of instruction shall be English.

### 2.4 Course outline

Degree courses in Pharmaceutical aspects of Ayurveda of four years duration, leading to the award of degree of B.Pharm(Ay). Details of subjects dealt with are as per clause No.2.6

### 2.5 Duration

The duration of the course shall be four academic years

### 2.6 Syllabus

The course of study for B.Pharm (Ay) I, II, III and final years shall include the respective theory and practical subjects as given below.

FIRST B.PHARM (Ay)

| Subject code | Subject                                     | Hours theory per week | Hours for practical per week |
|--------------|---------------------------------------------|-----------------------|------------------------------|
| 1-1          | Basic Principles of Ayurveda & Sanskrit     | 3                     | -                            |
| 1-2          | Sareera Vijnanam                            | 4 (2+2)               | 3                            |
| 1-3          | Pharmaceutical Chemistry                    | 3                     | 3                            |
| 1-4          | Pharmaceutical Analysis I                   | 2                     | 6                            |
| 1-5          | Pharmaceutical Biology                      | 4                     | 3                            |
| 1-6          | Basic Electronics and Computer Applications | 2                     | 3                            |
|              | <b>Total no. of hours/week</b>              | <b>18</b>             | <b>18</b>                    |

### SECOND B.PHARM (Ay)

| Subject Code | Subject                              | Hours theory per week | Hours for practical per week |
|--------------|--------------------------------------|-----------------------|------------------------------|
| 2-1          | Dravyaguna<br>Vijnanam I             | 2                     | -                            |
| 2-2          | Dravyaguna<br>Vijnanam II            | 3                     | 3                            |
| 2-3          | Physical pharmacy                    | 2                     | 3                            |
| 2-4          | Pharmaceutical<br>Engineering        | 3                     | 3                            |
| 2-5          | Pharmacognosy I                      | 3                     | 6                            |
| 2-6          | Biochemistry and<br>Patho Physiology | 3                     | 3                            |
| 2-7          | Pharmaceutical<br>Jurisprudence      | 2                     | -                            |
|              | <b>Total no. hours / week</b>        | <b>18</b>             | <b>18</b>                    |

### THIRD B.PHARM. (Ay)

| Subject Code | Subject                                     | Hours theory per week | Hours for practical per week |
|--------------|---------------------------------------------|-----------------------|------------------------------|
| 3-1          | Rasasastra I                                | 3                     | 3                            |
| 3-2          | Bhaishayja kalpana I                        | 3                     | 3                            |
| 3-3          | Chemistry of Natural products               | 2                     | 3                            |
| 3-4          | Pharmaceutical Microbiology & Biotechnology | 2                     | 3                            |
| 3-5          | Pharmacology I                              | 2                     | 3                            |
| 3-6          | Pharmacognosy II                            | 2                     | 3                            |
| 3-7          | Industrial Pharmacy I                       | 2                     | 3                            |
|              | <b>Total no. of hours/ week</b>             | <b>16</b>             | <b>21</b>                    |

### FINAL B.PHARM. (Ay)

| Subject Code          | Subject                              | Hours theory per week | Hours for practical per week |
|-----------------------|--------------------------------------|-----------------------|------------------------------|
| 4-1                   | Rasasasthra – II                     | 3                     | 4                            |
| 4-2                   | Bhaishajyakalpana –II                | 3                     | 4                            |
| 4-3                   | Pharmaceutical analysis II           | 3                     | 4                            |
| 4-4                   | Pharmacology II                      | 2                     | 3                            |
| 4-5                   | Industrial Pharmacy II               | 5                     | 3                            |
| 4-6                   | Pharmaceutical Industrial Management | 2                     | -                            |
| Total No. of Hrs./ wk |                                      | 18                    | 18                           |

After the completion of IV year examination the students should undergo compulsory practical Industrial training for a period of 2 months

The concept of health care counselling shall be incorporated in all relevant areas

#### 2.7 Total number of hours

Refere clause: 2.6

#### 2.8 Branches if any with definition

NA

#### 2.9 Teaching learning methods

- Lecturer and practical classes
- Hands on training



## 2.10 Content of each subject in each year

### 1:1 BASIC PRINCIPLES OF AYURVEDA & SANSKRIT

#### Avatarnakrama of Ayurveda

Eight Angas. Agni, Prakriti, Kosta, Tridosha, Karma of Dhatus. Rasa Guna, Veerya, Vipaka, Prabhava of Dravya. Rithu charya, Dinacharya, Vega Vidharana, Chikitsa – chatushpada, Sadhya Sadhyata, Dravyagata Vibhinna Varga –jala- saka – simbi – dhanya varga sadrisya, roga – rogabhedha, dosha samsodhana kala, dosha, dhatu mala vridhi kshya lekshana; dosha prakopa according to Rsithu, sapthavidha aharakalpana, virudha ahara, traya upasthambha, Roga owing to atimatrophyoga of ahara, roga – rogee pareeksha.

#### BASIC KNOWLEDGE OF SANSKRIT

##### I - Sabdamanjari – Sidharoopam

1. The alphabet - Classification of letters
2. The usage of cases
3. Sabdarooapa
  - a. Ajantha Pullinga, Napusakalinga and streelinga

i) 'Rema', 'Hari', 'Guru', 'Go'

ii) 'Phalam', 'Madhu'

iii) 'Rema', 'Mathi', 'Nadee'

##### b) Halantha

'Rajan', 'Mahat', 'Pums'

- c) Pronoun  
'Ushmad', 'Asmad', 'Tat'
- II. Conjugation of verbs  
a) Brief introduction of 'Dashalakaras' with reference to present, past and future.  
b) Dhathu roopa  
'Bhu', 'As', 'Kru', 'Vand'
- III. Translation of simple sentences from Sanskrit to Malayalam and vice versa
- IV. Sandhi, Avyaya and voice be taught with the appropriate textual context .
- V. Sree Ramodantham – Balakandam
- VI. Twenty lines of Sbhashitha related with Ayurveda – First chapter of vaidyakeeya subhashitham

**REFERENCE**

1. Ashtangahrudaya soothrasthanam I – Sanskrit
2. Sabdamanjari , Sidharoopam – R.S. Vadhyar
3. First Chapter of vadiyakeeya subhashitham – Chaukamba publication

**1:2: SAREERA VIJNANAM**

**SAREERA RACHANA VIJNANAM**

1. Sareerupakrama, Sareera Sastra Paribhasha, Abhinivriti sareera, Garbha sareera, Pramana Sareera.
2. Asthi sareera, Sandhi sareera, Siradhamani- Leseekapesi sareera.
3. Marma Sareera
4. Kosta and Asaya sareera, grandhi sareera, Kala sareera, twak Sareera.
5. Uttamangeeya nadee samsthana sareera, Thantra sareera,
6. Comprehensive study of following system.  
Nervous system, Respiratory system, Cardiovascular system , Gastro intestinal , Genito Urinary System, Endocrine system.

## Practicals

Demonstration and Identification and surface anatomy of soft organs bones with in the limits of prescribed theory topics.

## References :

1. Relevant portions from Bruhatrayee - Sareera stana

2. Human Anatomy Vol I , II and III – B.D. Chaurasya

3. Human Anatomy , Tortora

## SAREERA KRIYA VIJNANAM

1. Concepts of following Physiological factors with its definition, constitution, classification and functions.

Dosha, Dhatu, Mala, Srothas , Upadhatu , Ojas , Siradhamani, Indriya, Pravruthi.

2. Comprehensive study of following systems.

Nervous system, Respiratory system, Cardiovascular system , Digestive System , Geneto Urinary Endocrine system, Reproductive system.

3. Physiology of Special senses.

## Practicals

Routine examination of Blood and Urine.

### **1:3. PHARMACEUTICAL CHEMISTRY**

#### **PHARMACEUTICAL CHEMISTRY – ORGANIC**

##### **1. Atomic and molecular structure**

Molecular orbitals, SP<sup>3</sup>, SP<sup>2</sup> and SP hybridization. Ionic bond, covalent bond, multiple bond, polarity of bond, hydrogen bond.

##### **2. Alkanes, Alkenes and Alkynes.**

- a) Nomenclature
- b) General methods of preparation and reactions of alkanes, alkenes and alkynes (Emphasis on mechanism).
- c) Free radical substitution of alkane and mechanism.
- d) Carbonium ions – formation, stability and electrophilic addition mechanism.
- e) Inductive effect and hyper conjugation.

##### **3. Alicyclic compounds.**

General methods of preparation and reaction. Stability of ring compounds, Dyes strain theory, structure of cyclohexane. Diacyclic compounds – nomenclature. Properties and uses of cyclopropane.

##### **4. Aromatic Hydrocarbons**

- a. Structure of benzene including (Kakule and Dewar structures)

- aromatic character, resonance theory.



b. Electrophilic aromatic substitution. Friedal craft's alkylation and acylation.

Activating and deactivating groups and orientation in nitration, halogenation and sulphonation. Effect of orientation of substitution, steric effects.

#### 5. Alkyl halides and Aryl halides.

Their general methods of preparation and reactions.

#### 6. Alcohols and Phenols.

Nomenclature- general methods of preparation and reactions of primary, secondary and tertiary alcohols. Mechanism of esterification, acidity of alcohols and phenols. Effect of substituents on acidity of phenol.

#### 7. Carbonyl compounds (aldehydes and ketones)

Structure and nomenclature : General methods of preparation and reaction.

Nucleophilic addition, reaction, oxidation and reduction, carbonation, aldol condensation, Cannizzaro reactions.

Identification and characterisation of aldehydes and ketones.

#### 8. Carboxylic acids.

Mono and dicarboxylic acids. Nomenclature, different methods of preparation and reactions. Acidity and effect of substitution on acidity. Conversion to acid chlorides, anhydrides, amides and esters and reactions of these.

#### 9. Nitro compounds.

General methods of preparation and reactions.

#### 10. Amines and Diazonium salts.

Structure and nomenclature, Basicity of amines. General methods of preparation and reactions, diazonium chlorides.

## 11. Spectroscopic analysis of organic compounds.

An elementary study of UV, IR and NMR spectra and their applications in the study of structure of above mentioned class.

### **PRACTICAL WORK**

Identification of simple organic compounds by systematic qualitative analysis based on tests for elements and functional groups, solubility, melting or boiling point and preparations of derivative.

Preparation of at least 10 organic compounds of pharmaceutical importance involving processes like hydrolysis, oxidation, reduction, halogenation, nitration, sulphonation, accelerations, esterification etc.

### **PHARMACEUTICAL CHEMISTRY – INORGANIC.**

- a) Metals and minerals occurrence properties , reactions and important compounds of Iron , Calcium , Aluminum , Copper , Gold , Silver , Mercury, Arsenic , Sulfur, Magnesium, Zinc, sodium and potassium.
- b) Ammonium chloride – preparation, assay and uses.
- c) Borax – preparation, assay and uses.
- d) Reactivity of metal
- e) Limit test for arsenic, chloride, iron and heavy metals.
- f) Pre- pharmaceutical processing of metals and minerals.

### **Practicals**

Relevant practicals of the above



## 1:4 PHARMACEUTICAL ANALYSIS

### Theory

1. Significance of quantitative analysis in quality control, different techniques of analysis, Preliminaries and definitions, significant figures, Rules for retaining significant digits, Types of errors, Mean deviation, standard deviation, statistical treatment of small data sets, selection of sample, precision and accuracy, fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.
  2. Acid Base titrations: Acid base concepts, Role of solvent, mass action, Common – ion effect, Ionic products of water,  $P^H$ , hydrolysis of salts, Henderson – Hossolbach equation, Buffer solutions, Neutralization curves, Acid – base indicators, theory of indicators, mixed indicators, polyprotic system, polyamine and amine acid systems, Amine acid titration, applications in assay of  $H_3PO_4$ ,  $NaOH$ ,  $CaCO_3$  etc.
  3. Oxidation Reduction Titrations: Concepts of oxidation and reduction, Redox reactions, strengths and equivalent weights of oxidizing and reducing agents, theory of redox titrations, redox indicators, cell representations, measurement of electrode potential, Oxidation – reduction curves, iodimetry and iodometry, titrations involving Ceric sulphate, potassium iodate, potassium bromate, potassium permanganate, titanous chloride and sodium 2, 6- dichlorophenol Indophenol.
- Precipitation titrations: Precipitation reactions, Solubility products, Effect of acids, temperature and solvent upon the solubility of a precipitate.
- Argentometric titrations and titrations involving Ammonium or potassium

thiocyanate nitrate, and barium sulphate indicators, Gay lussac method; Mehr's method, Volhard's method and Fajan's method.

4. Gravimetric analysis: Precipitation techniques, solubility products; the colloidal state, Supersaturational co-precipitation post- precipitation, Digestional washing of the precipitate, Filtration, Filter papers and crucibles, ignition, thermo-gravimetric curves, specific examples  
like barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, organic precipitants.
5. Theoretical considerations, and application in drug analysis and quality control of the following analytical techniques will be discussed.
6. Non – aqueous titrations
7. Complexometric titrations
8. Miscellaneous methods of analysis such as :  
Diazotisation titrations, Kjeldahl method of nitrogen estimation, Ksri  
Fischertitration, Oxygen flask combustion, gasometry.

#### **Practicals 6 hrs /week**

The students should be influenced by the main analytical tools through demonstrations. They should have a clear understanding of a typical analytical balance, the requirement of a good balance, weights, care and use of balance, methods of weighing and errors in weighing. The students should also be acquainted with the general apparatus required in various analytical procedures.

1. Standardisation of analytical weights and calibrating of volumetric apparatus.
2. Acid Base Titrations :



Preparation and Standardization of acid bases; some exercises related with determination of acids and bases separately or in mixture form, some official assay procedures eg. Boric acid should also be covered.

### 3. Oxidation reduction Titrations:

Preparation and standardization of some redox titrants eg. Potassium permanganate, potassium dichromate, iodine, sodium thiosulphate, etc. Some exercises relate to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, titanous chloride, sodium 2, 6 – dichlorophenol indophenol, and ceric ammonium sulphate.

### 4. Precipitation Titrations:

Preparation and standardization of titrants like silver nitrate and , ammonium thiocyanate, Titrations according to Mohr's, Volhard's and Fajen's methods.

### 5. Gravimetric Analysis:

Preparations of Gooch crucible for filtration and use of standard glass crucible, determination of water of hydration, some exercises related to gravimetric analysis should be covered.

## 1.5 : PHARMACEUTICAL BIOLOGY

### Section A 50 marks

#### Botany

1. Method of classification of plant kingdom with brief account of plant nomenclature and taxonomy.
2. General morphology and anatomy of plants with special reference to flowers, fruits, roots , leaves, stem (bark, wood), seed.
3. Classification of plant and study of the following families with special reference to medicinally important plants:
  - Ranunculaceae
  - Menispermaceae
  - Cruciferae
  - Cappardidaceae
  - Malvaceae
  - Rutaceae
  - Leguminosae (Pappilonaceae, Caesalpinaceae, Mimosae)
  - Umbelliferaceae
  - Compositae
  - Apocynaceae
  - Solanaceae
  - Convolvulaceae
  - Euphorbiaceae



- Liliaceae
- Zingiberaceae

4. Structure of typical plant cell and its important inclusions. Structure and function of some important plant tissues like parenchyma, Sclerenchyma, xylem, Phloem. Etc.

#### **PRACTICAL**

1. Care Use and type of microscope .
2. Morphology of plants and plant parts indicated in theory.
3. Plant tissues like parenchyma, Collenchyma, Sclerenchyma, Xylem , Phloem etc.
4. Anatomy of dicot and monocot stem, root and leaf.
5. Epidermal structure of leaf with special reference to stomata and trichomes.
6. Cell contents like starch grains, Calcium oxalate and calcium carbonate crystals.
7. Preparation of 25 herbariums belonging to the families mentioned in Theory.

#### **Section B**

#### **ZOOLOGY**

**50 marks**

1. Animal Kingdom – general information and classification with brief account of binomial nomenclature.
2. Invertebrates :  
Characteristics features and Ayurvedic importance of animals of different species as sources of drugs.
3. Protozoa (Plasmodium, Leishmania), Malarial Parasites, Trypanosoma, Entamoeba, Giardia, Trichomonas, Porifera (Sponges) , Coelenterates (Corals),
4. Parasitic Nematodes (Taenia solium, Fasciola hepatica, Ascaris), Host Parasite



relationships.

5. Annelida (Earthworm & Leech), Arthropoda (Honey bee etc.), Mollusca, (Snails, Cuttle fish)
6. Chordata : Medicinal importance of animals belonging to classes mentioned below.

Pieces : Fishes & Fish oil

Amphibia : Frogs & Toads

Reptilia : Snake & Snake venom, Tortoise & Turtle shell.

Aves : Peacock, Hen

Mammals : Cow, Musk deer, Goat, Civet cat etc.

Study of raw materials of drugs of animal origin:

- Milk and its products
- Skin products
- Organ products
- Glandular secretions & Bile
- Animal secretion
- Ectodermal outgrowth (nail, horns, shell etc)
- Excretory / Coprophagous products as medicine from medicated animals.

#### **PRACTICAL :**

Demonstration of preserved specimens, charts & Identification of medicinally



useful animals (Invertebrates & Chordates) with systematic approach.

## **1:6 BASIC ELECTRONICS AND COMPUTER APPLICATIONS**

### **Theory**

1. Basic Electronics : Semiconductors, p-n function diode, LEO photodiode and its uses Rectifiers (half wave, full wave, with filters)
2. Computers: 2-1 Introduction to computers.
  - History of computer development and respective generation:
  - Abacus, Napier, Bonar, Slide rule, PASCAL'S calculator. Need to use computers, applications in pharmacy and in general.
  - Computer classification: Mainframe, Mini and Micro Computers, comparison of Analogue & digital computers, Hardware and software, calculator and computer.
  - Operating system: Introduction to types of operating systems, UNIX, MS-DOS, etc.
  - RAM, Virtual Memory etc.
  - Types of languages: Conventional languages, their advantages, limitations, C, PASCAL, FORTRAN, Programming of these languages.
  - Introduction to Computer Networks: Architecture of seven layers of communications.
  - Introduction to Data Structure: Like Queue, list, trees, binary trees algorithms, flow charts, structured systems, analysis and development, Ingress –SQL, Gateways etc. Statistics, methodologies.
  - Basic languages: Constants and variables: character set, constants,

variables, Naming the variable, getting data into memory, LET, INPUT, READ, DATA, Print statement.

- Expressions: Arithmetic expression, Hierarchy of operations, Rules of arithmetic, Evaluation of operations, Rules of Arithmetic, Evaluation of expressions, relational expressions, logical operations, Library functions.
- Printer control: Comma and semicolon control, the TAB function, PRIINT, LPRINT. Functions and subroutines: User defined functions, subroutines, subscripted variables.
- Computer Graphics
- Computer application in pharmaceutical and clinical studies.
- MS- Office
- Relevant modification

### Practicals

Exercises based on the following area to be dealt

1. Computer operating systems like UNIX, Ms-dos, etc
2. Programming of languages –C,
3. MS Office

## **2:1 DRAVYA GUNA VIGNANAM I**

1. Dravya guna sastra lekshana, sapta padartha, Dravya lekshana, pancha bhoutika, dravya pradhanyata.
2. Dravya Vargeekaranam.  
Chetana – achetana, Karya Karana, Yonibhedha, Prabhava bhedha, Soumyagneya, Rasa skandhas, Vanaspatika Vargeekarana.
3. Samyakjnana of Guna, Rasa, Vipaka, Veerya, Prabhava and Karma.
4. Niroopana of Oudbhita gana according to Akriti – guna – Karma – Karya Prasadhi Sadharmya.
5. Adhara of Dravya namakarana and paryay Vachi.
6. Vividha asudhis of dravya, sodhana Kritrima dravya, Prasastha oushadhas, Yojya anga. Dravya guna sastra ithihasa and nighantus.

## **2:2 DRAVYA GUNA VIJANAM II**

### **I. Detailed study of the following drugs**

- |                |                     |                 |
|----------------|---------------------|-----------------|
| 1. Agaru       | 23. Karanja         | 45. Tuvarka     |
| 2. Agni mandha | 24. Karaveera       | 46. Trivrittha  |
| 3. Ajamoda     | 25. Karkkada Sringi | 47. Twak patra  |
| 4. Ativisha    | 26. Karpura         | 48. Dhanti      |
| 5. Aparajita   | 27. Kakamachi       | 49. Dadima      |
| 6. Apamarga    | 28. Kakodumbara     | 50. Daruharidra |
| 7. Aralu       | 29. Kanchanara      | 51. Chandana    |

|                |                  |                  |
|----------------|------------------|------------------|
| 8. Arka dwaya  | 30. Karavellaka  | 52. Chitraka     |
| 9. Arjuna      | 31. Kalamegha    | 53. Chopacheeni  |
| 10. Asoka      | 32. Kirata tikta | 54. Jadamamsi    |
| 11. Aswagandha | 33. Kudaja       | 55. Jatee        |
| 12. Ankola     | 34. Kupeelu      | 56. Jateephala   |
| 13. Amalaki    | 35. Kumari       | 57. Jeevanthi    |
| 14. Aragwadha  | 36. Kulatha      | 58. Jyothishmati |
| 15. Udumbara   | 37. Kusta        | 59. Taleesa      |
| 16. Usheera    | 38. Khadira      | 60. Jeerakadwaya |
| 17. Eranda     | 39. Gambhari     | 61. Devadaru     |
| 18. Eladwaya   | 40. Guggulu      | 62. Dhatura      |
| 19. Kaduka     | 41. Gudoochi     | 63. Dhanyaka     |
| 20. Kandakari  | 42. Gokshura     | 64. Nagakesara   |
| 21. Kapikachu  | 43. Tumburu      | 65. Nimba        |
| 22. Kampillaka | 44. Tulasi       | 66. Nirgundee    |

सर्वं भवन्तु सुखिनः

|                    |                    |                   |
|--------------------|--------------------|-------------------|
| 67. Palasa         | 85. Mandooka parni | 103. Sanghupushpi |
| 68. Padala         | 86. Madhuka        | 104. Sadi         |
| 69. Pada           | 87. Maricha        | 105. Satapusha    |
| 70. Pippli         | 88. Mustha         | 106. Satavari     |
| 71. Punarnava      | 89. Yavani         | 107. Salapurni    |
| 72. Pushkara moola | 90. Yavasa         | 108. Sigrudwaya   |
| 73. Prisniparni    | 91. Rasona         | 109. Sireesha     |
| 74. Balapanchaka   | 92. Rasna          | 110. Salmali      |
| 75. Bakuchi        | 93. Rohitaka       | 111. Syonaka      |
| 76. Vibheetaka     | 94. Lodra          | 112. Sadapushpa   |
| 77. Vilwa          | 95. Vacha          | 113. Sapta vakra  |
| 78. Beejaka        | 96. Valsanabha     | 114. Sapta parna  |
| 79. Brahmi         | 97. Giri Parppada  | 115. Sarpagandha  |
| 80. Brihati        | 98. Varuna         | 116. Sariba       |
| 81. Bhallataka     | 99. Varahi         | 117. Haridra      |
| 82. Bharngi        | 100. Vidanga       | 118. Hareetaki    |
| 83. Bringaraja     | 101. Vasa          | 119. Hingu        |
| 84. Manjishta      | 102. Vidari        |                   |

## II. NON-DETAILED STUDY OF 100 PLANTS

- 
- |                     |                  |                    |
|---------------------|------------------|--------------------|
| 1. Atasi            | 45. Tailaparni   | 92. Sarja          |
| 2. Amlavetasa       | 46. Damanaka     | 93. Sallaki        |
| 3. Ashmantaka       | 47. Durva        | 94. Sahadevi       |
| 4. Amaravalli       | 48. Draksha      | 95. Soorana        |
| 5. Akshota          | 49. Dronapushpi  | 96. Saireyaka      |
| 6. Akarakarabha     | 50. Dhanyayasa   | 97. Swarnapatri    |
| 7. Akhuparni        | 51. Dhataki      | 98. Suvarnaksheeri |
| 8. Amra             | 52. Dhamargava   | 99. Himsra         |
| 9. Amragandhi       | 53. Nalikera     | 100. Haritamanjari |
| haridra             | 54. Neeli        |                    |
| 10. Avrtaki         | 55. Patola       |                    |
| 11. Ingudi          | 56. Parushaka    |                    |
| 12. Indravaruni     | 57. Padmakam     |                    |
| 13. Irimeda         | 58. Parnayavani  |                    |
| 14. Ishwari         | 59. Palandu      |                    |
| 15. Upakunchika     | 60. Patalagarudi |                    |
| 16. Erandakarkati   | 61. Pashanabheda |                    |
| 17. Kaukushta       | 62. Parijatam    |                    |
| 18. Katphala        | 63. Parisha      |                    |
| 19. Kataka          | 64. Pitu         |                    |
| 20. Kadali          | 65. Putranjiva   |                    |
| 21. Kamalam         | 66. Punnaga      |                    |
| 22. Karpasam        | 67. Puga         |                    |
| 23. Kasani          | 68. Priyangu     |                    |
| 24. Kasamarda       | 69. Bakula       |                    |
| 25. Kusa            | 70. Badara       |                    |
| 26. Kushmanda       | 71. Babbul       |                    |
| 27. Krishnabeeja    | 72. Bimbi        |                    |
| 28. Ketaki          | 73. Bhanga       |                    |
| 29. Kebukam         | 74. Madana       |                    |
| 30. Kokilaksham     | 75. Madayantika  |                    |
| 31. Gunja           | 76. Mamsaroshini |                    |
| 32. Gandhaprasarini | 77. Mayaphala    |                    |
| 33. Garjaram        | 78. Mashaparni   |                    |
| 34. Chakramardam    | 79. Mudgaparni   |                    |
| 35. Chandrasura     | 80. Musali       |                    |
| 36. Chempakam       | 81. Murva        |                    |
| 37. Chirabilva      | 82. Mulaka       |                    |
| 38. Jayapala        | 83. Methika      |                    |
| 39. Jimutaka        | 84. Meshassingi  |                    |
| 40. Tagara          | 85. Rajika       |                    |
| 41. Tamalam         | 86. Rohisa       |                    |
| 42. Tavaksheeram    | 87. Lajjalu      |                    |
| 43. Talamuli        | 88. Laigali      |                    |
| 44. Tila            | 89. Vata         |                    |
|                     | 90. Vikankata    |                    |
|                     | 91. Vrikshamla   |                    |

III. Janthava dravya parichaya and its guna karma jnanam

IV. Guna karma jnanam of annapana upayoogi dravya

V. Jala – Dugdha – Madhu – Ikshu – Taila – Madya – Mutra – Sooka dhanya -  
simbidhanya – Phala Varga – Saka varga – mamsa varga – levana varga –  
Ahraopayoga Varga dravya jnanam.

#### PRACTICALS

Relevant practicals of the above

### **2:3 PHYSICAL PHARMACY**

#### **Theory**

##### 1. Solubility and Distribution Phenomena

General principles – solvent – solute interactions – Solubility of Gases. Liquid and Non – ionic solids in liquids – Distribution of solutes between immiscible solvents.

##### 2. Diffusion and Dissolution.

Diffusion – Fick's Laws – Principles in Biologic systems – Dissolutions – Drug release.

##### 3. Surface and interfacial Phenomena:

Liquid interfaces – adsorption at liquid interfaces  
adsorption of solid interfaces – electrical properties of interfaces – surface tension – its determination – classification of surfactants – detergency – wetting agents – foaming agents – deflocculating agents- pharmaceutical application of surfactants.

##### 4. Colloids

Introduction – types of colloidal systems optical properties, kinetic properties of

colloids – solubilisation, Electrical properties of colloids.

## 5. Coarse dispersions

Suspensions – interfacial properties of suspension – setting of suspensions – emulsification – physical stability – preservation and rheological properties of emulsion – phase equilibria and emulsion formulation – special emulsion systems – semisolids and gels.

## 6. Rheology :

Types of flow – viscosity – Newtonian and non Newtonian fluids – Thixotropy – Viscometers.

## 7. Kinetics

Orders and rates of reaction – factors influencing the reactions – decomposition and stabilization pharmaceuticals – Kinetics of solids state – accelerated stability analysis kinetics of drug transportation.

## 8. Micrometrics

Particle size – Size distribution determination of particle size- shape surface area – pore size – particle volume – permeability – adsorption.

## 9. Introduction of Polymer Science

Polymer solutions – molecular weight averages- Molecular weight determination from solution viscosity – Thickening Properties – Gel formation, conservation, Microencapsulation – pharmaceutical applications- Future trends in pharmaceutical and Biomedical uses.

### Practicals

1. Determination of interfacial properties – surface tension – CMC power of surfactants
2. Experiments of viscosity – effect of viscosity on sedimentation rate.
3. Determination of rate of reaction.
4. Particle size distribution analysis and determination of particle size.
5. Study of suspensions by controlling flocculations and stability evaluation.
6. Study of flow properties of powders – Angle of response.
7. Study colloids: Preparation and stability study with addition of electrolytes.
8. Study of emulsions: stability and globule analysis.
9. Experiments pertaining to other theory chapters

### 2:4: PHARMACEUTICAL ENGINEERING

#### 1. Fluid mechanics:

Fluid statics – Mano meters.

Fluid dynamics -- Types of flow, Reynold's number, viscosity, concept of boundary layer, basic equations of fluid flow, valves, Flow meters.

#### 2. Material handling.

Liquid handling - Different types of pumps, Reciprocating, rotary, centrifugal and diaphragm pumps.

Gas handling - Various types of fans, blowers and compressors.

Solid handling – Storage bins, hoppers and conveyers.



### 3. Heat transfer.

Sources and uses of heat in pharmacy

Conduction – Fourier's Law of heat conduction through variable area like Pipes.

Spheres etc.

Convection – Natural and forced convection. Flow of heat through liquids and equation for rate of heat transfer, concept of individual film coefficient, overall heat transfer

coefficient, log mean temperature difference.

Radiation – Kirchoff's Law, Stefan Boltzman Law, Black body , Gray body , Net heat transfer between two non black bodies by radiation

### 4. Mechanical separations.

#### a. Filtration and centrifugation.

Theory of filtration, Filter media, filter aids, industrial filters including filter press, filter leaf, rotary filter, edge filter etc.

Principles of Centrifugation – Industrial centrifugal filters and centrifugal sedimenters.

#### b. Size Reduction and size separation:

Definition, objectives of size reduction, factors effecting size reduction, laws governing energy and power requirements of a mill, types of mills including ball mill, hammer mill, fluid energy mill etc.

### 5. Evaporation

Factors affecting evaporation – types of evaporators – short tube, forced circulation and film evaporators. Single effect and multiple effect evaporators.



#### 6. Distillation.

Raoult's Law, Volatility, Simple, Steam and Flash distillation. Principles of rectification, McCabe Thiele method for calculation of number of theoretical plates, azeotropic and extractive distillation.

#### 7. Drying

Moisture content and mechanism of drying, rate of drying and time drying. Classification and types of dryers tray, Vacuum, tunnel, rotary, fluidized bed, spray and drum dryers. Principles of freeze-drying.

#### 8. Humidification

Basic concepts and definition. Wet bulb and adiabatic saturation temperature, Humidity chart and measurement of humidity. Equipments for dehumidification operations.

#### 9. Crystallization

Principles of crystallization, nucleation mechanism and crystal growth, study of various types of crystallizers, tank, agitated batch, Swenson Walker, vacuum, circulating magma and crystal crystallizer, caking of crystals and its prevention.

#### 10. Mixing

Theory of mixing, mixers for powders, pastes and liquids.

#### 11. Material of construction

General study of composition corrosion, resistant, properties and applications of the materials of construction with special reference to stainless steel and glass.

#### 12. Industrial hazards and safety precautions

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

#### 13. Automatic process Control Systems:



### Practicals

1. Determination of rate of filtration and study of factors affecting filtration including filter aids.
2. Determination of humidity – use of dry bulb and wet bulb thermometers and psychrometric charts.
3. Determination of overall heat transfer coefficients.
4. Experiments based on simple steam and azeotropic distillation equilibrium moisture content .
5. Screen analysis of powders.
6. Sedimentation in liquids.

### **2:5:PHARMACOGNOSY**

#### Theory

1. Methods of classification of plants.
2. Gneral structure and life history of insects like mosquito, housefly, mites and silkworm.
3. Definition, history, scope and development of pharmacognosy.
4. Sources of drugs: Biological, marine, mineral and plant tissue cultures as sources of drugs.
5. Classification of drugs: E.g. alphabetical, morphological, taxonomical, chemical and pharmacological.
6. Cultivation, collection, processing and storage of crude drugs:

Factors influencing cultivation of medical plants. Types of soils and fertilizers of

common use, pest management and natural pest control agents plant hormone and their applications, Polyploidy, Mutation and hybridization with reference to medical plants.

11. Quality control of crude drugs:

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

of evaluation.

12. An introduction to active constituents of drugs:

Their isolation, classification and properties.

13. Systematic pharmacognostic study of following:

- a) Carbohydrates and derived products: Agar, Guar gum, Acacia, Honey, Isobagol, Pectin, Starch, Sterculia and Tragacanth.
- b) Lipids: Bees wax, castor oil, cocoa butter, Cod – Liver oil, hydnocarpus oil, kokum butter, hard, Linseed oil, Rice- bran oil, shark liver oil and wool fat.

14. Study of drugs containing reins and resin combinations:

Colophony, Podophyllum, Jalap, Cannabis, Capsicum, Myrrha, Asafoetida, balsam of Tolu, balsam of Peru, Benzoin, Turmeric, Ginger.

15. Study of tannins and tannin containing drugs like Cambiar, black catechu, gall and myrobalan.

16. Volatile Oils:

General methods of obtaining volatile oils from plants, study of volatile oils of mentha, coriyander, Cinnamon, Cassia, Lemon Peel, orange peel, Lemon grass, Citronsllle, Caraway, Dill, spearmint, Clove, Fennel, Nutmeg, Eucaluptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandal wood.

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17. Phytochemical screening.

- a. Preparation of extracts.
- b. Screening of alkaloids, saponins, cardenolides and bufadienolides, flavenoids and leucoanthocyanidins, tannins and polyphenols, anthraquinones, cynogenetic glycosides, aminoacids in plant extracts.

18. Study of fibers used in pharmacy such as cotton, silk, wool, nylon, glass wool, polyester and asbestos.

19. Study of pharmaceutical acids like talc, diatomite, kaolin, bentonite, gelatin and natural colors.

Practical

6 hrs / Week

1. Microscopic measurements of cells and cell contents: starch grains, calcium oxalate crystals and phloem fibres.
2. Determination of leaf constants such as stomatal index, stomatal number, vein – islet number, vein termination number and palisade ratio.
3. Identification of crude drugs belonging to carbohydrates and lipids.
4. Preparation of herbarium sheets.
5. Identification of crude drugs mentioned in theory.
6. Study of fibres and pharmaceutical acids.
7. Microscopic studies of 7 – selected crude drugs and their powders mentioned under the category of volatile oils in theory and their chemical tests.

8. General chemical tests for alkaloids, glycosides, steroids, flavenoids and tannins.

## **2:6 BIOCHEMISTRY AND PATHO PHYSIOLOGY**

### Theory

1. Biochemical organization of the cell and transport processes across cell membrane.
2. The concept of free energy, determination of change in free energy from equilibrium constant and reduction potential, bioenergetics, production of ATP and its biological significance.
3. Enzymes: Nomenclatures, enzymes kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis.
4. Co- enzymes: Vitamins as co- enzymes and their significance, metals as co-enzymes and their significance.
5. Carbohydrates metabolism: Conversion of polysaccharide to glucose 1-phosphate, Glycolysis and fermentation and their regulation, Gluconeogenesis and glycogenolysis metabolism of galactose and galactosomia, Role of sugar nucleotides in biosynthesis, and pentosephosphatic pathway.
6. The Citric Acid Cycle: Significance reactions and energetic of the cycle Amphibolic role of the cycle and Glyoxalic acid cycle.
7. Lipid Metabolism : Oxidation of fatty acids,  $\beta$ -oxidation & energetic  $\alpha$ -oxidation,  $\gamma$ -oxidation, Biosynthesis of ketone bodies and their utilization, Biosynthesis of ketone bodies and their utilization, control of lipid metabolism, Essential fatty acids & Gicosanoids (Prostaglandins, thromboxanes). Phospholides and Spingolipides.
8. Biological oxidation reduction Redox- potential enzymes and co- enzymes



involved in oxidation reduction & its control, The respiratory chain, its role in energy capture and its control, energetic of oxidative phosphorylation, Inhibitors of respiratory chain and oxidative phosphorylation, mechanism of oxidative phosphorylation.

9. Nitrogen & Sulphur cycle: Nitrogen fixation, ammonia assimilation, nitrification and nitrate assimilation sulphate reduction, Incorporation of Sulphur in organic compounds. Release of sulphur from organic compounds.
10. Metabolism of ammonia and Nitrogen Containing Monomers.
11. Nitrogen balance, Biosynthesis of amino acids, catabolism of amino acids, conversion of amino acids to specialized products, Assimilation ammonia, Urea cycle, metabolic disorders of Urea cycle, Metabolism biosynthesis, Purine nucleotide inter conversion, Purine biosynthesis, and formation of deoxyribonucleotides.
12. Biosynthesis of Nucleic Acids: Brief introduction of genetic organization of the mammalian genome, alteration and rearrangements of genetic material, Biosynthesis of DNA, and its replication, Mutation, Physical & Chemical mutagenesis carcinogenesis, DNA repair mechanism, Biosynthesis of RNA.
13. Regulation of gene expression.
14. Formation of Bile pigments, Hyperbilirubinemia.

### Pathophysiology

#### 1. Basic Principles of cell injury and adaptation

Causes of cellular injury, pathogenesis, morphology of cell injury. Intercellular alteration in lipids, proteins and carbohydrates. Cellular adaptation, atrophy,



hypertrophy.

2. Basic Mechanism involved in the process of inflammation and repair.

Alterations in vascular permeability and blood flow, migration of WBC, acute and chronic inflammation, mediators of inflammation, brief outline of the process of repair.

3. Patho Physiology of Common Diseases.

Rheumatoid arthritis, gout, epilepsy, psychosis, depression, mania, hypertension, angina, CCF, arteriosclerosis, myocardial infarction, diabetes, peptic ulcer, asthma, ulcerative colitis, hepatic disorders, acute and chronic renal failure, tuberculosis, urinary tract infections, sexually transmitted diseases, anemia and common types of neoplasms – wherever applicable the molecular basis should be discussed.

#### Practicals

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of  $p^H$ .
2. Titration curve for amino acids.
3. Separation of amino acids by two-dimensional paper chromatography and gel electrophoresis.
4. The separation of lipids by TLC.
5. Separation of serum proteins by electrophoresis cellulose acetate.
6. Quantitative estimation of amino acids
7. . Quantitative estimation of proteins.
8. The identification of c- terminal amino acids of protein
9. The determination of glucose by means of the enzymes glucose oxidase.
10. The isolation and assay of glycogen from the liver and skeletal muscle of rats.

11. Enzymatic hydrolysis of glycogen by alpha – and beta – amylase.
12. The isolation and determination of RNA and DNA.
13. Effect of temperature on the activity of alpha – amylase.
14. Estimation of SGOT, SGPT, ALP and BUN in the serum.

## **2:7 PHARMACEUTICAL JURISPRUDENCE**

1. Definition and scope of Forensic pharmacy. Pharmacists role in drug treatment and drug usage. Pharmacist as a member of the Health Care Scheme.
2. Pharmaceutical Legislation in India. Historical developments of pharmaceutical Education in India. Professional ethics in pharmacy practice. Legal and ethical responsibilities of pharmacists.

### **3 Drugs and Cosmetic Act 1940.**

General study of the drugs and Cosmetic Act and rules there under. Study of the terms “Drugs” and “cosmetics”-Definitions, Provisions applicable to import, sale and manufacture of drugs of Ayurvedic drugs . Qualification, duties and responsibilities of Drug inspectors, sampling procedure, requirements and formalities for establishing manufacturing units, distribution houses, retail shops. Important schedules applicable to their establishment.

Study of Schedule X and Y.

Detail study of schedules relating to Ayurvedic drugs –Schedule E (1),Schedule T

3. Laws relating to use of alcohol in pharmaceutical preparations with references to Medicinal and Toilet preparations (Excise duties) Act 1955 and rules 1956.

4. Drug dependence, misuse and abuse. Medico legal analysis with special references to Narcotic drugs and psychotropic substances Act 1985.
5. Advertisement of Drugs and Cosmetics – Prohibited and exempted advertisements. Drugs and Magic remedies ( objectionable advertisements) Act 1955.
6. Brief study of the following Acts.
  - a. Prevention of Food adulteration Act 1954 and Rules 1955.
  - b. Factories Act 1948.
  - c. Prevention of cruelty to animal's Act 1960.
  - d. Patent Act 1970
  - e. States shops & Establishment Act 1948.
  - f. Insecticides Act 1968.
  - g. Minimum Wages Act 1948.
  - h. AICTE Act 1987.
9. Assignments.

Topics, Trade names, Combination, Preparation ,Banned drugs, Bannable drugs, newly introduced and out dated drugs. Drug tragedies, Committee reports on drug accidents, important case decisions published in drug cases relating to various topics covered in the subjects.

### **3:1: RASA SASTRA I**

1. Derivation of word 'Rasa' its Philosophy and literature difference between Rasa and Rasayana. History of Rasasastra. Development, Darsana & Raseswara darsana. Rasasidhas and their contributions.



2. Rasa sala nirmana, Yantra – musha- puda – paribhasha jnanam..
3. Detailed study of Maharasa –Uparasa – Sadharana Maharasa –, Lohas -upa lohas.- Ratna – Uparatna- Vishopavisha-sudhavarga, Sodhana, jarana, marana, gunas, and prayoga vidhi.
4. Standardisation and quality control techniques metals and mineral preparations

#### Practicas

1. Identification of Rasa drugs.
2. Preparation of various rasa drugs – Sodhana, Marana.
3. Standardisation and quality testing of various dosage forms

### **3:2. BHAISHAJYA KALPANA I**

1. History of development of Bhaishajya kalpana.  
Adharabhooda Sidhantha, Bheshajagara and its niyamas.
2. Yantras used for Bhaishajya Kalpana.  
Mana paribhasha, Ardra- Sushka dravya sangraha niyamas. Saveeryavadhi.
3. Preparation of Ayaskriti Arka, Avaleha
4. Study of  
shnodaka – Oushada Yusha – Oushadha Sidha paneeya – Mamsarasa – Kalka – Kwatha – Ksharakalpna – Ksheerapaka – Khalweeya rasa – Guggulu kalpana – Gudika – Choorna – Dhoopana– Dhoopapana – Pramadhya – Phanda – Malahara – Mashee - Mandoora- Lavana – Laksharasa – Louha – Varti Kalpanas.
5. Preparation of various Kwathas, Swarasas.



6. Choornas, Gudikas, Lehyas, Vartis and their different quality testings.

7. Sodhana of various drugs.

8 Swarasa -Vasa Swarasa,Tulasi Swarasa

Kalka -Lasuna Kalka

Kwatha-\_\_\_\_\_Rasna Panchakam\_\_\_\_\_,Rasnairandadi\_\_\_\_\_,Padoladi\_\_\_\_\_,Nagaradi  
,Punaranavastaka Sahacharadi Astavarga

Others----Elaneer Kuzhambu\_\_\_\_\_,Kurinji Kuzhambu\_\_\_\_\_,Ajamamsarasayana, ,Kooshmanda  
rasayana \_\_\_\_\_,Chavanaprasa \_\_\_\_\_,Manibhadragula \_\_\_\_\_,Vilwadigulika \_\_\_\_\_,Avipathy choorna \_\_\_\_\_,Taleesa  
patradi \_\_\_\_\_,Vaiswanara \_\_\_\_\_,Ashtachoorana \_\_\_\_\_,Saptamrita Lauha \_\_\_\_\_,Phalavarti \_\_\_\_\_,Dasangadhoopa.

#### Practicals

Preparation of various, Kwathas, Gudikas, Choornas Rasayanas, their  
Standardization and quality testing.

### **3.3 .CHEMISTRY OF NATURAL PRODUCTS**

#### Theory

The following topics will be discussed with special reference to official natural  
produce and allied semi synthetic derivatives.

1. Discussion of naturally occurring biomolecules of the following types with the  
special references to their configuration.

Stereochemistry Biological importance (carbohydrates, Hormones, steroids,  
vitamins, and Alkaloids)

2. Carbohydrates of higher plant origin of pharmaceutical importance.

Classification, nomenclature, method of preparation structure, characterisation, general reaction of identification of amyloam, amylopectin, cyclo dextrins, cellulose derives, rhamnose, cymarose, deoxy sugars, gentobios – steraptase, sterptobiose.

3. Peptides and proteins, properties, simple and derived proteins, conjugated proteins, a study of their chemical nature, reactions.

Elementary study of nucleic proteins, nucleosides, nucleotides and nucleic acids of pharmaceutical/ biological importance.

#### 4. Alkaloids

General Extraction, general methods of determination of a structure, classification and chemical nature and medicinal uses of official alkaloids, structural elucidation and synthesis of ephedrine, Atropine.

5. Enzymes: Definition, classification, Enzymatic activity in biological and industrial applications .

#### 6. Vitamins

Classification, study of chemical nature of vitamins especially in I.P. constitution and synthesis of Thiamine, Riboflavin, Ascorbic acid and Vit .D.

#### 7. Steroids

Nomenclature, test for steroids, methods of isolation, structural features, chemistry of cholesterol, irradiation products and chemistry of ergosterol, chemistry of stigmasterol, Lanosterol and chemistry of bile acids/ salts.

#### 8. Hormones

1. Estrogens, interrelationship of estrone, estradiol, estrone, constitution of estrone, synthesis and preparation and medicinal uses of synthetic nonsteroidal estrogenic compounds. eg . Estrone, Estradiol, Estrone, diepisterol, stilbestrol,



chlortrianisane.

2. Progestrones : Skeletal structure and synthesis of Progestrones, progesterone derivatives used as oral contraceptives.
3. Androgens : Skeletal structure and synthesis of testosterone and synthetic anabolic steroids.
4. Adrenal Cortex hormones: Classification, chemical nature of cortisone , hydrocortisone, synthesis of cortisone from naturally occurring sapogenine, skeletal structure of important synthetic, corticosteroid analogues such as prednisone, prednisolone, fluomethalone, betamethasone and dexamethasone, prodnisolone, fluomethalone, betamethasone and dexamethasone of and triamecinalone, structure, activity, relationship with their medicinal uses.
5. General introduction of protienaceous, hormones eg: Insulin, oxytocin, vasopressin and their biological importance and chemistry of thyroxine.
6. Saponin  
Chemical nature, test for sapogenins, structure and uses of diosgenin, sarsapogenine.
7. Prostaglandins  
A preliminary discussion, introduction on the nature of these compounds and their biological importance.
8. Glycosides  
  
Definition, introduction, structural elucidation, test, chemistry and synthesis of Amygdalin.

A general study of cardiac glycosides of digitalis purpurea and lanata, strophathus and squill with the importance of a glycene and glycone part with their SAR.

#### 9. Purines.

Constitution and synthesis of uric acid and caffeine, interrelationship of caffeine, theophylline, theobromine and their medicinal importance.

#### 10. Terpenes

Introduction, basic isoprene rule, classification – mono, di, tri, sequi terpenes, structure and constitution of geraniol, camphor, alpha – terpineol, structure and interrelationship of limonene, dipentene and alpha – terpineol, terpineol hydrate, cineol and carvone, constitution of menthol and thymol.

Synthesis of terpenes (Alpha and Beta)

#### 11. Carotenoids

Introduction, source, occurrence, skeletal structure of carotenes, conversion of Beta-carotene and Vitamin A. Constitution and synthesis of Vitamin A.

### PRACTICALS

1. Degradation of Natural products – atleast 4 compounds.
2. Test for purity of some official compounds belonging to the class of natural products, atleast five compounds of the pharmacopoeia.
3. Assay of pure natural products and finished preparations source materials and finished preparations of I.P. atleast 10 preparations.
4. Qualitative analysis of natural products – identification of 10 unknown compounds to be practiced.
5. Enzyme catalyzed simple reactions, dehydroxylation, hydroxylation, methylation,

demethylation (Selected simple eg)

### **3:4: PHARMACEUTICAL MICROBIOLOGY**

#### **& BIOTECHNOLOGY**

##### **a) Microbiology**

#### **Theory**

1. Introduction to the scope of microbiology
2. Structure of bacterial cell.
3. Classification of microbes and their taxonomy, Actinomycetes bacteria, rickettsiae, spirochaetes viruses and Fungi.
4. Identification of Microbes stains and types of staining techniques, electron microscopy.
5. Nutrition, cultivation, isolation of bacteria, actinomycetes, fungi, viruses, etc.
6. Microbial genetics and variations.
7. Control of microbes by physical and chemical methods.
  - a. Disinfection, factors influencing disinfectants, Dynamics of Disinfectants and antiseptic and their evaluation.
  - b. Sterilization, different methods, validation of sterilization methods & equipments.
8. Sterility testing of all pharmaceutical products.

9. Immunity, Primary and secondary defensive mechanism of body, microbial resistance, interferon.
10. Microbial assays of antibiotics, Vitamins & amino acids.

### **b)Biotechnology**

#### **Theory**

##### **1. Immunology and immunological preparations**

Principles antigens and haptens, immune system, cellular, humoral immunity, immunological tolerance, antigen – antibody reactions and their applications.

Hypersensitivity, Active and passive immunization, vaccines, their preparations, standardization and storage.

##### **2. Genetic Recombination**

Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications. Development of hybridoma for monoclonal antibodies, study of drugs produced by biotechnology such as Actovase, Humulin, Humatrope, HB etc.

##### **3. Antibiotics.**

Historical development of antibiotics, Antimicrobial spectrum and methods used for standardization. Screening of soil for organisms producing antibiotics, fermenter, its design, control of different parameters, isolation of mutants, factors influencing rate of mutation, design of fermentation processes. Extraction of fermentation products with special references to penicillins, streptomycins, tetracycline and vitamin B12 .

##### **4. Microbial Transformation**



Introduction: Types of reactions mediated by micro organisms, design of biotransformation processes, selection of organisms, biotransformation processes and its improvements with special reference to steroids.

#### 5. Enzyme immobilization.

Techniques of immobilization of enzyme: Factors affecting enzyme kinetics, study of enzymes such as hyalureidase, pencillinase, streptokinase and streptodernase, amylase and proteasas etc. Immobilization of bacteria and plant cells.

#### Practicals

Experiments devised to prepare various types of culture media, sub culturing of common aerobic and anaerobic bacteria, a fungus and yeast, various staining methods, various sterilization techniques and their validation of sterilizing techniques, evaluation of antiseptic and disinfectants, testing the sterility of pharmaceutical products as per I.P requirements. Microbial assay of antibiotics and vitamins etc.

### 3:5:PHARMACOLOGY

#### Theory

#### 1. General Pharmacology.

##### a. Introduction

History of pharmacology, definitions of Therapeutics, Posology, Pharmacokinetics, Pharmacodynamics, toxicology, sources of drugs.

##### b. Routes of drug administration and factors influencing the effect of drugs.

##### c. Pharmacokinetics

Adsorption of drugs, distribution and storage of drugs in the body



Biotransformation of drugs, extraction of drugs.

d. Pharmacodynamics

The dose – effect relationship, introduction to LD 50, E.D – 50 and therapeutic index. Mechanism of drug action, structure – activity relationship, drug receptors, drug receptor theories, drug – receptor antagonism, factors modifying drug action, drug interactions.

e. Toxicology

General study of toxicology with special reference to acute, sub acute and chronic toxicity, various types of toxicity, poisoning by the various drugs and measures to overcome them.

f. Development of new drugs

Evaluation in animals, toxicity studies, evaluation in humans.

g. Bio assays.

Principles of bioassays, different types of bioassays, bioassays of insulin, digitalis, adrenaline, acetylcholine, histamine, oxytocine, d-tubocurarine.

Radio immune assay

Principles and applications

h. Drug dependence

Habituation, addiction, treatment.

II. Pharmacology of the following drugs with emphasis on Classification. Mechanism of

action. Pharmacokinetics. Adverse effects. Contra indications. Drug interactions. Clinical uses.

Preparation and dosages.

A. Drugs acting on automatic nervous system and somatic nervous system.

Neuro humeral transmissions and receptors.



Adrenorgic drugs and adrenergic blocking drugs.

Cholinergic drugs, antimuscarine drugs, anticholine.

Esterases, ganglionic stimulants and blockers,

Neuro muscular blocking drugs.

B. Drugs acting on eye.

Mydriatics, Miotics and drugs used in glaucoma.

C. 1. Hormones

Pituitary hormones, thyroid and antithyroid hormones and drugs, estrogen and progesterone , androgens and anabolic steroids, adrenocortical steroid hormones.

2. Fertility control and oral contraceptives.

D. Antacids and their antagonists.

Histamine. Antihistamines.

5 – hydroxy tryptamine.

Anti- 5- hydroxy tryptamines.

Angiotensins, Kinins, Enkephalins, prostaglandins and other polypeptides. Allergy and allergens.

E. Immunosuppressants and Immunostimulants.

F. Pharmacology of Vitamins.

G. Heavy metal and heavy metal antagonists.

H. Enzymes in therapy – Hyaluronidase, alpha chymotrypsin, L- Asparaginase, digestive enzymes – pepsin, papain, diastase.

I. drugs acting on uterus.



## J. Drugs affecting respiratory system.

Antitussives.

Antiasthmatics. Therapeutic

gases.

Oxygen, Helium, Carbondioxide, water vapour.

### Practicals

1. Study of various apparatus, physiological solution and recording devices used in experimental pharmacology.
2. some common and standard techniques – Bleeding and intravenous injection, intra gastric administration, procedures for rendering animals unconscious – stunning of rodents, pithing of frogs , chemical euthanasia.
3. Effect of drug – route of administration – qualitative and quantitative.
4. To study the dose – response relationship of Acetylcholine on rectus abdominis muscle.
5. To study the dose – response relationship of histamine on guinea pig ileum.
6. To study the dose – response relationship of noradrenaline on rat anccoccygus muscle preparation.
7. To study the action of mydriatics and mictics on rabbit eye.
8. To study the effect of hepatic microsomal enzyme inducers and inhibitors in the pentobarbtone sleeping time in mice and rats.
9. Test for undue toxicity.

10. Determination of LD- 50 in mice.
11. To demonstrate hydrolysis of acetylcholine by serum choline esterase (frog rectum)
12. To demonstrate the potentiation of acetylcholine action by anticholine esterase agent (frog rectum)
13. To demonstrate the inhibition of acetyl choline action by d- tubocurarine (frog rectum)
14. Effect of drugs on perfused frog heart- cardiac stimulants – adrenaline, Atropine,  $\text{Ca}^{2+}$  cardiac depressants – acetylcholine, propranolol,  $\text{K}^+$ .
15. To study the effect of drugs on normal and hypodynamic frog heart.
16. Determination of the concentrations of sulphacetamide in the blood of rabbits after injection by various routes.

### **3:6 PHARMACOGNOSY II**

#### **Theory**

1. Study of the biological sources, cultivation, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides:

- (i) Saponins liquorices, ginseng, dioscorea, sarsaparilla, and senagas.
- (ii) Cardioactive sterols : Digitalis, squill, strophanthus and thevetia.
- (iii) Anthraquinone cathartics: Aloe, senna, rhubarb and cascara.
- (iv) Others: Psoralea, Ammi majus, Ammi visinaga, gentian, saffron,

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chirata, quassia.

2. Studies of traditional drugs, common vernacular names,

b. Botanical sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulation of following indigenous drugs.

Amla, Kantkari, Satavari, Tylophora, Bhilwa, Kalajiri, Bakuchi, Rasna, Punarnava, Chithraka, Apamarga, Gokshura, Shankhapushpi, Brahmi, Adusa, Arjuna, Ashoka, Methi, Lashuna, Palash, Guggul, Gymnema, Shilajit, Nagarmotha and neem.

3. The holistic concept of drug administration in traditional systems of medicine.

Introduction to Ayurvedic preparations like Arishtas, Asvas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas.

6. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following alkaloid containing drugs:

- a. Pyridine piperidine : Tobacco, areca and lobelia.
- b. Tropane : belladonna, hyoscyamus, datura, dubosia, coca and Withania.
- c. Quinoline and isoquinoline: Cinchona, ipecacuanha.
- d. Indole: ergot, rawolfia, catharanthus, nux-vomica and physostigma.
- e. Imidazole: Pilocarpus.
- f. Steroidal, Veratrum and Kurchi.
- g. Alkaloidal amine: Ephedra and colchicum



- h. Glycoalkaloids: Solanum
  - i. Purines: Coffea, Tea and Coca.
7. Role of medicinal and aromatic plants in national economy.
  8. Biological sources, preparation, identification tests and uses of the following enzymes. Diastase, Papain, Pepsin, Trypsin and Pancreatin.
  9. General techniques of biosynthetic studies and basic metabolic pathways. Brief introduction to biogenesis of secondary metabolites of pharmaceutical importances.
  10. Plant bitters and sweeteners.
  11. Introduction classification and study of different. Chromatographic methods and their applications in evaluation of herbal drugs.

#### Practicals

1. Identification of crude drugs listed in theory.
2. Microscopic study of some important glycoside containing crude drugs is outlined above. Study of powdered drugs.
3. Standardization of some traditional drug formulations.
4. Identification of crude drugs listed above.
5. Microscopic study of characters of 8 – selected drugs given in theory in entire and powdered form.
6. Chemical Evaluation of powdered drugs and enzymes.
7. Chromatographic studies of some herbal constituents.



### **3.7 INDUSTRIAL PHARMACY**

#### **Theory**

##### **1. Powders**

-Advantages and limitations , manufacturing procedures and equipments ,special care and problems in manufacturing powder and granules.

##### **2. Internally administered solution –Diffusible and indiffusible solids**

##### **3Tablets**

a) Formulation of different types of tablets, granulation technology on large scale by various techniques, physics of tablets making different types of tablet compression machinery and the equipments employed, evaluation of tablets.

##### **b) Coating of tablets:**

Types of coating, film forming materials, formulation of coating solution, equipments for coating, coating process, evaluation of coated tablets.

##### **4 .Capsules:**

Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsules, size of capsules, methods of capsule filling, soft gelatin capsule shell and capsule content, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.

##### **5 Liquid dosage forms**

Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilisers, colors, flavors and others, manufacturing, packaging and evaluation of clear liquids,



suspensions and emulsions official in pharmacopoeia.

6 Semisolid dosage forms:

Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selections. General formulation of semisolids, clear gels manufacturing procedure, evaluation and packaging.

7. Extraction and galenical products:

Principles and methods of extraction, preparation of infusion, tinctures, dry, soft liquid extracts.

8 .Pharmaceutical aerosols:

Definitions, Propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications

9 Micro encapsulation:

Types of microcapsules, importance of micro encapsulations in pharmacy, micro encapsulation by phase separation co-acervation multi orifice, spray drying, spray congealing, polymerization complex emulsion air suspension technique, coating pan and other techniques, evaluation of micro capsules

10 Preservatives used in pharmaceutical formulations

Practical Training

Practical training in relevant theory topics.

#### **4:1 RASASASTRA II**

1. **Rasa** :- Definition of Rasa , Synonyms ,Availability of Ores , Naisargika and Kanchuka types of impurities, desirable and undesirable properties of Mercury, Sodhana Karma, Ashtasamskara, Rasagathi, Rasabandhana , Hingulothaparad Rasamoorchana- Jarana.
- 2 Method of preparations , indications , dosage and Anupana of following medicines.  
Kajjali, Rasaparpati , Thamraparpadi, Swarna Parpati, Vijayaparpati, Panchamrithaparpati ,Rasapushapam, Rasakarpuram, Mugdharasam, Rasasindhooram, Magaradwajam, Siddha Magaradwajam ,Mallachandroday
- 3 Different varieties of important Rasa Yogas and its Pareekshana vidhis.
- 4 Preparations of Rasamanikya,, Ananda bhairavarasa, Ichabhedirasa, Lokanadharasa, Hridayarnavarasa, Lekshmivilasarasa, Vasantha kusumakara rasa ,Chinthamani rasa , Amritarnava rasa, Hams pottalirasa, Maha taleswara rasa. Swasakudara rasa. Hinguleswara rasa, Vatagajamgusa rasa, sarwanga sunthara rasa, Talakeswara rasa, Vata vidwamsana rasa
- 4 Standardisation and quality control techniques metals and mineral preparations

#### **Practicals**

1. Preparations of various herbo – mineral preparations.
2. Standardization and quality testing of prepared medicines.



#### **4:2: BHAISHAJYA KALPANA II**

1. Snehabheda Snehapaka Vidhi, Sneha Moorchana, Snehapaka lekshana, Niyama, Prayoga Vidhi, Matra, Upayoga Kala – Jatyadi grita, Sukumaragritha, Brahmi grita, Narayana taila, Murivenna, Bhoonaga taila.
2. Sandhana Kalpana – Madya – Asava – Arista – varuni – sura – surasava- sukta- Kanjika – Tushodaka – seedhu – Souveera Kalpanas., Arjunarista, Asokarista, Takrarista, Dasamoolarista, Draksharishta, Aravindasava, Kumaryasava, Chandanasava.
3. Pathya Kalpana – Anna, Kadvara, Kambalika, Krisara, Takrakalpana, Yavagoo, Peya, Manda, Vilepi, Ragashewda, Vatoyoudana, Vesavara, Yoosha Kalpana, Lepa nirmana and prayoga. Sata dhouta- Sahasradhouta gritha nirmana.
4. Malahara, Upanaha and Sikdha taila nirmana.
5. Drava, Anjana, Aschyotana, Vidalaka, Tarpana, putapaka, Gandoosha, Kabala, Mukhakalpa, Nasya, Pradhamana, Dhumapana, Kalpanas.
6. Study of different Preparations  
Ksheera shadpalagrita, Gulgulutikta grita ,Panchagavyagrita ,Jatyadi grita  
,Ksheerabala taila ,Anutaila ,Asanavilwadi taila ,Karpasastyadi taila ,Gandhka  
taila ,Guggulu Marichadi taila

#### 4:3 PHARMACEUTICAL ANALYSIS

##### Theory

A. Importance of quality control of drugs – Design of quality control laboratories.

Different methods of standardization.

B. Separation techniques:

1 Chromatography :- Fundamental principles of chromatography adsorption, column, paper, liquid & high pressure liquid chromatography. Application, of the above techniques in pharmaceutical analysis.

1. Electrophoresis.

2. Gel filtration.

C. General treatment of the theory & application of the following optical & electrical instrument methods in pharmaceutical analysis.

1. Colorimetry, UV – Visual adsorption spectrophotometer :- Principles, different types of instruments, application in qualitative & quantitative analysis.

2. Infra red spectrophotometry :- Origin of infra red spectra & regions.

Instrumentation. Application in qualitative structure elucidation and quantitative analysis.

3. Nephelometry & Turbidimetry..

4. Flame Photometry :- A discussion about the various instruments & pharmaceutical applications.

e Atomic absorption spectrophotometry :- Principles & applications to pharmaceutical analysis.

f NMR Spectroscopy:- Principles & applications to pharmaceutical analysis. g

Mass Spectroscopy- Principles & applications to pharmaceutical analysis.

h Polarography :- Introduction, theoretical considerations organic polarography, dropping mercury electrode, basic principles of polarographic instrumentation, polarographic methods of analysis, pharmaceutical applications. Amperometric titrations.

i Fluorimetry :- Fluorescence, fluorimetry & spectrofluorimetry, analytical factors & applications.

J Polarimetry :- theory, instrumentation & applications.

Thermal analysis of Raw materials and dosage forms:-

Differential scanning calorimetric and thermogravimetry.

D Good Manufacturing Practises (GMP) as per WHO, Good laboratory practices (GLP),

#### Practical Work -

- Standardization of various Ayurvedic dosage forms and proprietary medicines – churna , kashaya, avelha. Asava –arista. Malahara , vati , gutika, taila & ghrita , bhasmas etc
- Chromatographic study of various formulations

#### Books recommended

1. Text book of pharmaceutical analysis. K.A.Cannors.
2. Pharmaceutical chemistry, Vol. I & II, L.G.CHATTON.
3. Practical pharmaceutical Chemistry, Vol I & II, A.B. Backet & J.B.Stenlake.

4. Quantitative inorganic analysis. A.I.Vogel.
5. Instrumental methods of analysis, Willards.
6. Quantitative pharmaceutical chemistry, Jenkins et al.
7. Isolation & identification of drugs, E.G.Clark.
8. Remington's pharmaceutical Sciences.
9. Official books like I.P., B.P. etc.
10. The Ayurveda Formulary of India .
11. The Ayurveda Pharmacopeia of India .

#### **4:4 PHARMACOLOGY - II**

##### **Theory**

Pharmacology of the following groups of drugs with emphasis on,

Classification ,Mechanism of action ,Pharmacokinetics,Pharmacodynamics ,Adverse effects ,Drug interactions ,Contra indications ,Clinical uses ,Preparations and dosages.

##### **I. Drugs acting on central nervous system**

Neurohumoral transmitters in CNS ,General anesthetics,Sedatives and Hypnotics, Alcohols ,Analgesics – Antipyretics, Narcotic analgesics, anti-inflammatory agents.

Antepileptics ,Drugs used in parkinsonism ,CNS stimulants ,Psychopharmacological agents – antipsychotics, antidepressants, anti anxiety agents, hallucinogens. ,Antigout remedies.

## II. Local anaesthetics

## III. Drugs acting on the gastro – intestinal tract.

Appetisers, digestants, carminatives, appetitesuppressants, Emetics, antiemetic, antidiarrhoeals. ,Cathartics ,Antacids ,Drugs used in the treatment of peptic ulcer.

## IV .Drugs affecting renal function

Metabolism of sodium, potassium, hydrogen ions and water, Diuretics and antidiuretics.

## V. Cardiovascular drugs

Cardiac glycosides Antiarrhythmic drugs. ,Vasodilators and antianginal drugs.

,Antiatherosclerotic drugs ,Anti hypertensive drugs

## VI. Drugs acting on the blood and blood forming organs

- Drugs effective in Iron deficiency anaemia
- Drugs Effective in megaloblastic anaemia, aplastic anaemia.
- Drugs affecting coagulation of blood – coagulants, anticoagulants, thrombolytic agents, drugs affecting platelet function.

## VII. Chemotherapy

- History, bacterial resistance , mode of action of antimicrobials

- Sulphonamides, quinolones, Penicillin's, Cephalosporins, Tetracyclines, Chloramphenicol, Polypeptide antibiotics, Macrolide antibiotics, Aminoglycoside antibiotics.
- Chemotherapy of fungal infections
- Chemotherapy of viral infections
- Chemotherapy of leprosy and tuberculosis
- Chemotherapy of malaria
- Chemotherapy of protozoal infections, leishmaniasis, Giardiasis, Trichomoniasis, Trypanosomiasis, Balantidiasis.
- Chemotherapy of helminthiasis.
- Antineoplastic agents
- Antiseptic and Disinfectants
- Sclerosing, melanising and depigmenting agents, drugs used in skin diseases.

#### Practical work

##### 1. Study of local anesthetic property of procaine and lignocaine by

- Surface anesthesia (Corneal Reflex – rabbit)
- Infiltration anesthesia (Guinea pig)

- Plexes anesthesia (Lumbar plexes of frog)

## 2. .Study of analgesic activity

3. Method of measuring motor activity

4. Actophotometer method

5. Ciliary movements and modification by drugs ( frog)

6. Effect of drugs on isolated frog heart and identification of their mode of action.

7. Effect of drugs on isolated rabbit intestine and identification of their mode of action.

8. Effect of drugs on isolated rat fundus.

9. Effect of oxytocin on rat uterus.

10. To study the diuretic activity of a compound in rats.

11. Test for pyrogens.

12. Drugs acting on blood vessels.

13. Effect of drugs on the blood pressure of anaesthetized dog, rat, cat demonstration.

14. Bioassay of Acetylcholine (Frog rectus)

15. Bioassay of histamine in guineapig ileum.

16. Bioassay of digitalis.

#### **4:5 INDUSTRIAL PHARMACY**

##### **Theory**

1 Cosmeteology and cosmetic preparations:

Fundamental of cosmetic science, structures and functions of skin and hair, dentifrice and manicure preparations like nail polish, lipsticks, eyelashes, baby care products etc.

2. Suppositories:

Ideal requirements, bases, manufacturing procedure, packaging and evaluation.

3 Ophthalmic Preparations:

Requirements, formulations, methods of preparation containers, evaluation.

3. Basic knowledge of parenteral dosage forms

4. Surgical products.

Definitions, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc..

Bandages, adhesive tape, protective cellulosic hemostatics, official dressings, absorbable and non-absorbable sutures, ligatures and catguts. Medical prosthetics and organ replacement materials.

5. Sustained release formulation

6. Novel drug delivery system

7. Pilot plant scale up

8. Preformulations

9. Packaging of pharmaceutical products: Packaging components, types specifications and methods of evaluation, stability aspects of packaging. Packaging equipments, factors influencing choice of containers, legal and other official requirements for containers, package testing.

10 Stability Studies of pharmaceutical formulations.

#### Practicals

Practicals relevant to the theory topics.

### **4:6: PHARMACEUTICAL INDUSTRIAL MANAGEMENT**

1. Accountancy

Principles of accountancy – ledgers – Balance sheet – cheque – Bills of exchange – treatment, Bank account.

2. Economics

Principles of economics with special reference to demand and supply laws demand schedule – demand curves. Labour distribution – Labour problem, general conditions of labour demand – supply – labour welfare- trade unions.

Inland and foreign trade – Procedure for export and import of goods – international trade.

Principles of insurance – general fire, and marine insurance.

### 3. Pharmaceutical marketing

Functions : buying – selling – transportation, storage- finance – feed back information  
channels of distribution- wholesale – retail departmental – multiple shope – mail order  
business.

### 4 .Salesmanship

Principles of sales promotion, advertising ethics of sales – merchentising – literature  
detailing.

### 5. Market research

Recruitment, training, evaluation, compensation – consumer redressal.

### 6.Management.

Administrative management : Planning organization – staff – directing &  
controlling. Operative management: Anticipation of problems – preventive  
measures – in the management of personnel materials, finace – marketing- time,  
space, margin morale. Principles of management: Co – ordination, communication  
,motivation, decision - making, leader ship – innovation creativity – delegation of  
authority responsibility ,record keeping.

Identification of key points: Maximum thrust for development and perfection

Personnel and Material Management: Eligibility – Efficiency Evaluation of recruitment

– service conditions – termination – performance evaluations – prizes ,awards – insensitive

– visible & invisible inputs – methodology of activities performance evaluation techniques – process flow process know how.

#### 7.factory organization and management

General study of patent and trademarks act, laws of contracts – factory and shops- establishment laws.

**2.11 No: of hours per subject**

As given under clause 2.6

**2.12 Practical training**

As given under clause 2.6

**2.13 Records**

Relevant records are to be maintained

**2.14 Dissertation: As per Dissertation Regulations of KUHS**

NA

**2.15 Speciality training if any**

NA

**2.16 Project work to be done if any**

Each candidate studying in the Final B.Pharm(Ay) class will carryout a project work in any branch of Pharmaceutical Sciences. The project work is intended to initiate the student into research work and the candidate is expected to conduct literature survey, analysis of data etc. under the

supervision of a teacher. At the end of the year, the project work is certified by the supervising teacher of the institution will be submitted to the Head of Institution will constitute a panel of Professor/ Reader comprising one member each from Rasasastra, Bhaishaja Kalpana and Dravya guna Dept. The panel will evaluate the project work on the basis of seminars and / or Viva – Voce and marks will be sent to the University by the Head of the Institution. There is no minimum mark for a pass in the project work.

**2.17 Any other requirements [CME, Paper Publishing etc.]**

NA

**2.18 Prescribed/recommended textbooks for each subject**

As given under clause “Content of each subject in each year “

**2.19 Reference books**

As prescribed by the HOD

**2.20 Journals**

List of Journals

1. Journal of Ayurveda – National Institute of Ayurveda, Department of AYUSH, Madhav Vilas Palace, Amer Road, Jaipur – 302002. Chief Editor – Prof. Mahendra Singh Meena, Director.
2. AYU - An International Quarterly Journal of Research in Ayurveda The Executive Editor- AYU, Room No.412, 4th Floor, New Institute for Post Graduate Teaching and Research in Ayurveda building, Gujarat Ayurved University, [www.ayujournal.org/](http://www.ayujournal.org/) Chief Editor Prof. P.K. Prajapati Director, IPGT & RA, Gujarat Ayurved University, Jamnagar
3. JRAS - JOURNAL OF DRUG RESEARCH IN AYURVEDA AND SIDDHA. *Journal of Research in Ayurveda and Siddha* [ccras.nic.in/publication/JournalofResearchinAyurvedaSiddha.htm](http://ccras.nic.in/publication/JournalofResearchinAyurvedaSiddha.htm)

*Chief Editor* – Prof. Vd. K.S.Dhiman, Director General, CCRAS, New Delhi.

4. Journal of Research in Ayurveda and Siddha, *Chief Editor* – Prof. Vd. K.S.Dhiman, Director General, CCRAS, New Delhi.
5. Journal of Indian Medical Heritage, *Chief Editor* – Prof. Vd. K.S.Dhiman, Director General, CCRAS, New Delhi.
6. Arya Vaidyan – Chief Editor, Dr. M.R. Raghava Varrier, Department of Publications, Aryavaidyasala, Kottakkal.
7. *Ancient Science Life*, Official publication of AVP Research Foundation, Coimbatore, India. [www.ancientscienceoflife.org/](http://www.ancientscienceoflife.org/)
8. *HEALTH SCIENCES* - [healthsciences.ac.in/](http://healthsciences.ac.in/)Open Access Peer Reviewed E-Journal. kerala University of Health Sciences, Thrissur.
9. Journal of Indian Systems of Medicine. Editor – Dr. K.S.R. Prasad, Datta Megha Institute of Medical Sciences, Wardha – 442004, Maharashtra
10. J-AIM – Journal of Ayurveda and Integrative Medicine. Editor in Chief – Bhushan Patwardhan, FRLHT, P.O. Attur, Via Elahanka, Bangalore – 560064
11. Ayurveda Vikas – Editor, Ayurveda Vikas, Dabur Tower, Kaushambi, Shahidabad, Gaziabad Dist., U.P. 201010
12. Dhanwantari – Managing Editor, Amrita Danwantari, PNNM Ayurveda College, Cheruthuruthy, Shornur, Kerala. – ISSN 2349 – 123x
13. IJAR – International Journal of Ayurveda Research, AYUSH, Govt. of India, Ministry of Health & Family Welfare, Red Cross Building, New Delhi – 110001.
14. IJNPR - Indian Journal of Natural Products & Resources, CSIR – NISCAIR
15. IJTK - Indian Journal of Traditional Knowledge, National Institute of Science Communication and Information Resources, Dr K.S. Krishnan Marg, (Near Pusa Gate), New Delhi – 110012
16. PROBE, The Editor, Scientific Publications Divisions, The Himalaya Drug Company, Makali, Bangalore – 562123.
17. International Journal of Research in Ayurveda and Pharmacy (IJRAP), dr. Shalini Sharma, Administrative Office, Moksha Publishing House, 42-A, Anand kunj, Tilak Nagar Colony, Rampur – 244901, UP.
18. Glitters of Ayurveda, Publication Division, SNIASR, Puthoor, Kollam. E-mail: [snayurveda@gmail.com](mailto:snayurveda@gmail.com)

## 2.21 Logbook

A log book should be maintained in each academic year for all academic activities and should get approved by concerned HOD.

### 3.EXAMINATIONS

#### 3.1 Eligibility to appear for exams

There should be 80% attendance in all subjects (theory and practical separately) and a candidate must obtain 35% of marks in internal assessment in all subjects to be eligible to write the university examination. The class average of internal assessment marks should not exceed 75%. No improvement for internal examinations.

#### 3.2 Schedule of Regular/Supplementary exams

- A. The university examination for a subject shall be conducted twice in a year at an interval of 4-6 months, as notified by the university from time to time.
- B. The supplementary examination will be held within 6<sup>th</sup> months of regular examination and failed students shall be eligible to appear in its supplementary examinations as the case may be.
- C. Partial appearance The students is permitted appear of examinations partially is he/she got required attendance in all subjects. The student who registers for exam and fails to write the exam that shall not be considered as a chance. The next appearance shall be counted as his/her regular appearance..

#### 3.3 Scheme of examination showing maximum marks and minimum marks

##### Distribution of Marks:

-

##### Distribution of marks for 1<sup>st</sup> year B Pharm Ayurveda

| Subject | Theory<br>Total | Pass<br>Min(T) | Practical | Viva | Total | Pass<br>Min(P+V) | Subject<br>Total(T+P+V) | Pass<br>Min(T+<br>P+V) |
|---------|-----------------|----------------|-----------|------|-------|------------------|-------------------------|------------------------|
|---------|-----------------|----------------|-----------|------|-------|------------------|-------------------------|------------------------|

|                                                   |     |    |     |    |     |    |      |     |
|---------------------------------------------------|-----|----|-----|----|-----|----|------|-----|
| Basic concepts<br>Ayurveda &<br>Sanskrit          | 100 | 45 | --- | 50 | 50  |    | 150  | 75  |
| Sareera<br>vijnanam                               | 100 | 45 | 60  | 40 | 100 | 45 | 200  | 100 |
| Pharmaceutical<br>chemistry                       | 100 | 45 | 60  | 40 | 100 | 45 | 200  | 100 |
| Pharmaceutical<br>analysis                        | 100 | 45 | 60  | 40 | 100 | 45 | 200  | 100 |
| Pharmaceutical<br>biology                         | 100 | 45 | 60  | 40 | 100 | 45 | 200  | 100 |
| Basic<br>electronics &<br>Computer<br>application | 100 | 45 | 60  | 40 | 100 | 45 | 200  | 100 |
| Total                                             |     |    |     |    |     |    | 1150 | 575 |

### B Pharm II<sup>nd</sup> year

| Subject                         | Theory | Pass<br>Min(T) | Practical | viva | Total(P<br>+V) | Pass<br>Min(P+<br>V) | Total(T+P+<br>V) | Pass<br>Min(T+<br>P+V) |
|---------------------------------|--------|----------------|-----------|------|----------------|----------------------|------------------|------------------------|
| Dravya guna I                   | 100    | 45             | ---       | ---  | ---            |                      | 100              | 45                     |
| Dravya guna II                  | 100    | 45             | 60        | 40   | 100            | 45                   | 200              | 100                    |
| Physical<br>Pharmacy            | 100    | 45             | 60        | 40   | 100            | 45                   | 200              | 100                    |
| Pharmaceutical<br>engineering   | 100    | 45             | 60        | 40   | 100            | 45                   | 200              | 100                    |
| Pharmacognosy<br>I              | 100    | 45             | 60        | 40   | 100            | 45                   | 200              | 100                    |
| Biochemistry<br>Pathophysiology | 100    | 45             | 60        | 40   | 100            | 45                   | 200              | 100                    |
| Pharmaceutic<br>Jurispudence    | 100    | 45             | --        | --   |                |                      | 100              | 45                     |
| Total                           |        |                |           |      |                |                      | 1200             | 590                    |

### B Pharm III<sup>rd</sup> year

| Subject                                    | Theory | Pass Min(T) | Practical | Viva | Total(P+V) | Pass Min (P+V) | Subject Total(T+P+V) | Pass Min(T+P+V) |
|--------------------------------------------|--------|-------------|-----------|------|------------|----------------|----------------------|-----------------|
| Rasasastra I                               | 100    | 45          | 60        | 40   | 100        | 45             | 200                  | 100             |
| Bhaishajya Kalpana I                       | 100    | 45          | 60        | 40   | 100        | 45             | 200                  | 100             |
| Chemistry of Natural prodts                | 100    | 45          | 60        | 40   | 100        | 45             | 200                  | 100             |
| Pharmaceutical Microbiology& Biotechnology | 100    | 45          | 60        | 40   | 100        | 45             | 200                  | 100             |
| Pharmacology I                             | 100    | 45          | 60        | 40   | 100        | 45             | 200                  | 100             |
| Pharmacognosy II                           | 100    | 45          | 60        | 40   | 100        | 45             | 200                  | 100             |
| Industrial pharmacy-1                      | 100    | 45          | 60        | 40   | 100        | 45             | 200                  | 100             |
| Total                                      |        |             |           |      |            |                | 1400                 | 700             |

### B Pharm IV<sup>th</sup> Year

| Subject                    | Theory | Pass Min(T) | Practical | Viva | Total(P+V) | Pass Min (P+V) | Subject Total | Pass Min |
|----------------------------|--------|-------------|-----------|------|------------|----------------|---------------|----------|
| Rasasatra II               | 100    | 45          | 60        | 40   | 100        | 45             | 200           | 100      |
| Bhaishajya Kalpana II      | 100    | 45          | 60        | 40   | 100        | 45             | 200           | 100      |
| Pharmaceutical Analysis II | 100    | 45          | 60        | 40   | 100        | 45             | 200           | 100      |
| PharmacologyII             | 100    | 45          | 60        | 40   | 100        | 45             | 200           | 100      |
| Industrial Pharmacy II     | 100    | 45          | 60        | 40   | 100        | 45             | 200           | 100      |

|                                            |     |    |    |    |    |  |      |     |
|--------------------------------------------|-----|----|----|----|----|--|------|-----|
| Pharmaceutical<br>Industrial<br>Management | 100 | 45 | -- | -- | -- |  | 100  | 45  |
| Total                                      |     |    |    |    |    |  | 1100 | 545 |

### 3.4 Papers in each year

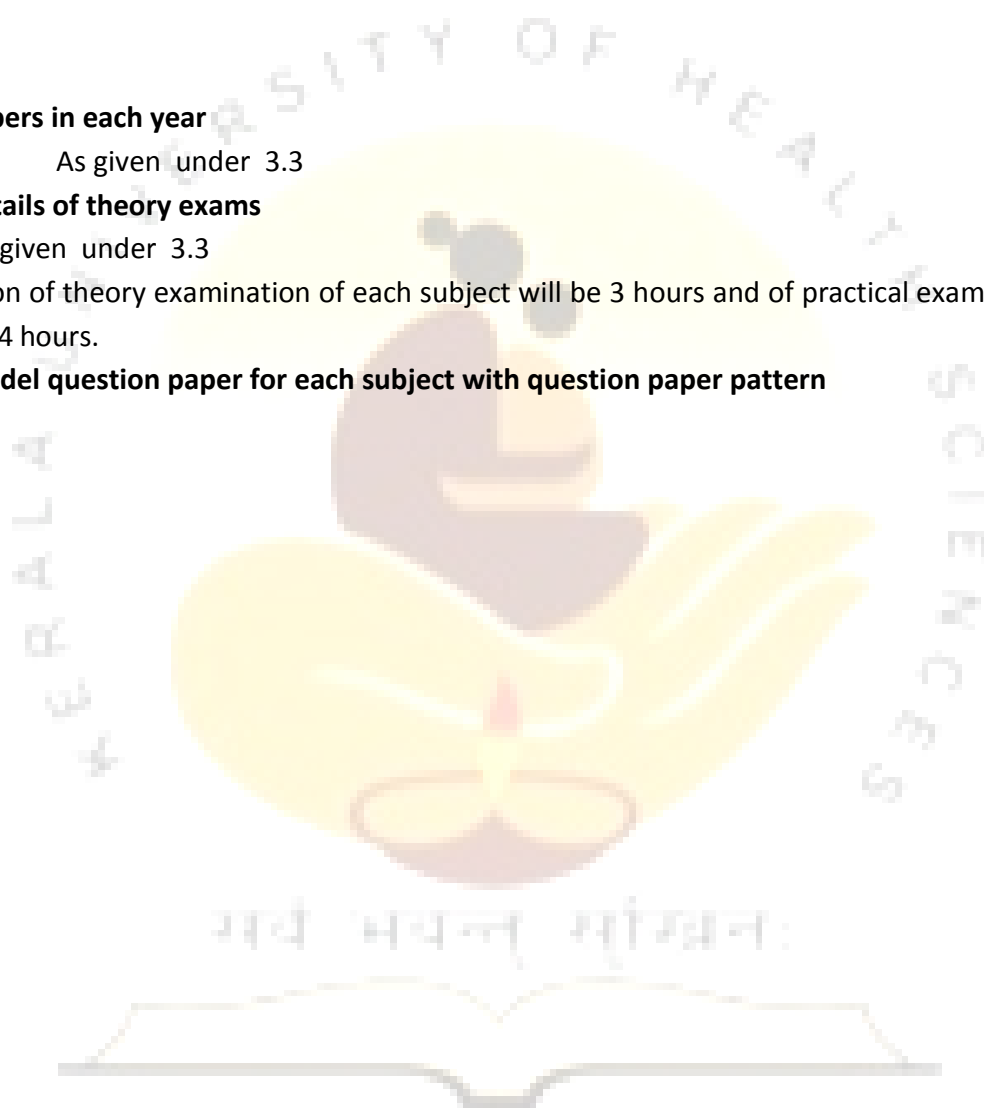
As given under 3.3

### 3.5 Details of theory exams

As given under 3.3

Duration of theory examination of each subject will be 3 hours and of practical examination will be 4 hours.

### 3.6 Model question paper for each subject with question paper pattern



## 1 Year B.Pharm (Ayurveda)

(Model Question Paper)

Part I- Biological Sciences

### Paper 1: Basic Concepts of Ayurveda and Sanskrit

Time-3 Hours

Max Marks: 100

Answer any **Two**

1. What are adharanceeya vegas? Mention the diseases occurring due to Avarodha of Mootra vegas.
2. Different sthanas of Vata, Pitta and Kapha. Explain functions of Panchavidha Pitta.
3. Write in brief Mootra varga. Which is the best in them and why? What are the characteristics of lavana varga. (2x10)

Answer any **Eight**

1. What are the saptavidha ahara kalpanas?
2. Explain the features of Adhana kala
3. Mention Manodosha and its general line of treatment.
4. In brief, explain vyayama
5. What is Alasaka?
6. Define Vishoochika and mention its treatment.
7. Gunas of Ghritam.
8. Explain the features of uttarayana
9. What is Anupana? Give examples.
10. Properties of Diwaswapna and its contraindications.

(8x5)

Answer any **Five**

1. Mention types of Dravyas.
2. What is Anupana?
3. What is Ritu-sandhi?
4. Features of Rasa kshay and Rakta kshay.
5. What is Viruddha Ahara?
6. What is Alasaka?

(5x3)

PART – B

(Sanskrit)

I. अन्वयार्थ स्वमातृभाषया लिखत ।

- 1) एकं शास्त्रं वैद्यमध्यात्मकं वा सौख्यं चैकं यत्सुखं वा तपं वा  
वन्द्यश्चैको भूपतिर्वा यतिर्वा हृदेकं कर्म श्रेयसं वा यशो वा. 5
- 2) आत्मांशौष्ठ सुराः सर्वे भूमौ वानररूपिणः ।  
जायेरन् मम सादाय्यं कर्तुं रावणनिग्रहे ॥ 4
- 3) यातुधानस्ततः सर्वे रसातलनिवासिनः ।  
दशाननं समाश्रित्य लङ्कायां सुखमावसन् । 4
- 4) ततः सुमन्त्रवचनाद् कव्यशृङ्गं स भूपतिः ।  
आनीय पुत्रकामेष्टिमारेभे सपुरोहितः ॥ 4

II. शब्दानां सप्तविभक्तिषु रूपाणि लिखत :

- 1) इकारान्तः स्त्रीलिङ्गः "मति" शब्दः 4
- 2) हलन्त पुल्लिङ्गः "महद्" शब्दः 4

## 1 Year B.Pharm (Ayurveda)

(Model Question Paper)

Part I- Biological Sciences

Paper II: Sareera Vijnanam

Time-3 Hours

Max Marks: 100

Answer any **Two**

1. What is bone? What are the parts of hip bone with diagram?
2. Define Garbha as per Sushrut and modern. Explain garbhotpadaka bhavas.
3. What are blood cells. Explain erythropoeises and write about the function of RBC.

(2x10)

Answer any **Ten**

1. What is the joint? Explain the ligaments of knee joint with figure.
2. What is Shadangatva?
3. Explain the parts of Humerus with diagram.
4. Write the internal features of Kidney.
5. Explain the formation of Urine.
6. What are the functions of Spinal cord.
7. Describe the Cardiac cycle.
8. What are the enzymes secreted from the stomach and its role in digestion?
9. Define shareera and its importance.
10. Explain respiratory mechanism.
11. What are functions of bile juice?

(10x5)

Write short notes on (Any **Ten**)

1. Blood supply to spleen.
2. Oja dhatu
3. Functions of skin
4. Greater omentum.
5. Pitta dosha prakara
6. Agni
7. Pituitary gland
8. Physiology of Eye
9. Kosta
10. Sweda
11. Basalic vein

(10x3)

## 1 Year B.Pharm (Ayurveda)

(Model Question Paper)

### Part II- Pharmaceutical Chemistry

### Paper III: Pharmaceutical Chemistry

Time - 3 Hours

Max Marks: 100

Answer any **Two**

1. Explain the resonance theory of Benzene. Explain Friedal craft's acylation of Benzene.
2. Write any three chemical reactions of alcohols. How will you distinguish between primary, secondary and tertiary amines?
3. Explain the following reactions of aldehydes
  - i) Oxidation reaction
  - ii) Nucleophilic addition reactionExplain any two general methods of preparation of Ketones. (2x10)

Answer any **Ten**

1. Explain Baeyer's strain theory.
2. Explain inductive effect.
3. Explain the following
  - i) Carbylamine reaction
  - ii) Anti-Markonikov addition
4. Write notes on Covalent bond and Sp<sup>2</sup> hybridization
5. Write any two general methods of preparation of nitro compounds.
6. Explain acid and alkali hydrolysis of ester.
7. Explain any two identification tests for aldehydes.
8. Explain mechanism of esterification.
9. Write notes on Hydrogen bond and Hyperconjugation.
10. Explain Satzeff's rule with an example.
11. Explain ozonolysis of alkenes. (5x10)

Answer the following (Any **Ten**)

1. Write short note on Boiling point
2. Explain with reaction mechanism Halogenation of benzene
3. Draw the structural formula for
  - i) 2-Methyl-1-butene
  - ii) 1-Chloro-2-methylpropane
4. Write short note on Melting point

5. Draw the structural formula for

i) 5-Oxohexanoic acid

ii) 2-Chloro-3methylpentane

6. Explain with reaction mechanism Sulphonation of benzene.

7. Write short notes on Rosenmund reduction.

8. Write short notes on SN2 mechanism.

9. What is hydrogen bonding.

10. Write notes on Saponification

11. Write notes on Transesterification.

(3x10)



## 1 Year B.Pharm (Ayurveda)

(Model Question Paper)

### Part II- Pharmaceutical Chemistry

#### Paper IV: Pharmaceutical Analysis

Time - 3 Hours

Max Marks: 100

Answer any **Two**

1. Explain the types of errors and methods avoiding errors in pharmaceutical analysis in detail.
2. Enlist various steps in gravimetry. Explain each step in brief.
3. Explain the titration curve for ferrous ammonium sulphate Vs ferric ammonium sulphate.

(2x10)

Answer any **Ten**

1. Explain the theories of acid base indicators in brief.
2. Classify redox indicators with suitable examples.
3. Explain the term significant figure. Give the rules for retaining significant figure.
4. Enlist the advantages of cerimetry over permanganometry.
5. Give the requirements for an ideal primary standard with suitable examples.
6. Explain the principle of Karl Fischer titration with suitable examples.
7. List the advantages of organic precipitants.
8. Classify solvents used in non aqueous titrations.
9. Give the requirements of ideal primary standard. Give suitable examples.
10. Explain Fajan's method for the estimation of halides.
11. Give conditions for successful iodometry.

(5x10)

Answer any **Ten**

1. Define the term indicators. Classify them with suitable examples.
2. Write about any three metal ion indicators.
3. Explain in brief gasometric assay of carbon dioxide.
4. Write note on Kjeldhal method for nitrogen estimation.
5. Write about diazotization method.
6. Explain principle of modified Mohr's method.
7. Write the principle involved in the assay of hydrogen peroxide IP.
8. Explain preparation and standardization of 0.1N Sodium thiosulphate solution.
9. Under what circumstances back titrations in complexometry.
10. Write and explain terms in Nernst's equation.
11. Explain the principle for the assay of drugs estimated using titanous chloride. (3x10)

## 1 Year B.Pharm (Ayurveda)

(Model Question Paper)

### Part III- Pharmaceutical Biology

#### Paper V: Pharmaceutical Biology

Time - 3 Hours

Max Marks: 100

Answer any **Two**

1. Define fleshy fruits. Classify and explain them with example. With the help of neat labeled diagram explain the anatomy of dorsiventral leaf.
2. With the help of neat labeled diagram explain the life cycle of malarial parasite. Explain the three different classes of phylum porifera.
3. Define root with the help of neat labeled diagram explain the different regions of the root system. Explain the different types of leaf apex. (2x10)

Answer any **Ten**

1. Write short notes on Trichomes and Conducting tissue.
2. Write short notes on organ products as a raw material of drugs of animal origin.
3. Describe classes, characteristics and examples of Phylum Arthropoda.
4. Write short notes on Snail and Leishmania.
5. Draw a neat labeled diagram of plant cell and explain various organelles present in it.
6. Describe the diagnostic characters of family Liliaceae with examples.
7. Write a brief account on method of classification of plant kingdom.
8. Bring out the difference between frog and toads.
9. With the help of neat labeled diagram explain fasciola hepatica as a parasitic nematode.
10. Write short note on Stomata and Dehiscent capsular fruits.
11. Explain Parenchyma and False fruits. (5x10)

Answer any **Ten**

1. Write notes on Entamoeba.
2. Write differences between Hypogynous and perigynous flower.
3. Write a note on Corals
4. Write source, active constituents and uses of a medicinal plant belonging to family Compositae.
5. Write four characters of phylum Chordata.
6. Write note on Porifera.
7. Write the difference between Sclerenchyma and Collenchyma.
8. Write unique features of phylum Mollusca.
9. Draw a labeled diagram of Liver fluke.
10. Write difference between endospermic and non endospermic seeds
11. Write a note on Seedless fruits. (3x10)

**1 Year B.Pharm (Ayurveda)**

**(Model Question Paper)**

**Part IV- Basic electronics and computer application**

**Paper VI**

Time - 3 Hours

Max Marks: 100

Answer any **Two**

1. Explain the types of conventional languages along with its advantages and disadvantages.
2. Explain different extrinsic semiconductors with proper examples.
3. Explain major classifications of memory in detail with examples. **(2x10)**

Answer any **Ten**

1. Write a note on MS Office.
2. Explain the need for computers in pharmacy.
3. Explain logical and arithmetic operators.
4. Explain Half wave Rectifier with neat labeled diagram.
5. Distinguish between intrinsic and extrinsic semiconductors. Give one example for each.
6. Explain RAM and ROM.
7. Explain any 5 internal and 5 external DOS commands.
8. Define data structures. Explain the abstract data types with its characteristics.
9. Write a note on different types of computers and its uses.
10. Define trees. Discuss its usage in different applications.
11. What is character set? Write rules for naming the variables. **(5x10)**

Write short notes: (Any **Ten**)

1. Photodiode
2. Print control statements
3. Arithmetic and relations expressions
4. Parts of MS Word and MS Excel windows
5. Unix operating system
6. Features of C programming language
7. Analogue and digital computers
8. PASCAL and FORTAN
9. Ordered list and linked list
10. Abacus and PASCAL's calculator
11. LET, INPUT, READ, DATA AND Print statements. **(3x10)**

### 3.7 Internal assessment component

A. Theory : Three sessional examinations (evently spared) shall be conducted during the academic year. Of which the final exam mantaory and University model exam The average marks of best two examinations shall be computed out of a maximum of 40 marks and constitute the sessional in theory.

B. Practical : Students are expected to perform the number of experiments listed in respective syllabus. Students are required to maintain practical records for each of the practical subjects and should be produced at the time of examination. Marks shall be awarded out of maximum of 10 to each of the practical exercises and an average of those shall be computed out of a maximum of 40 marks. While awarding the sessional marks for practical experiments, the following consideration should be taken into account.

Marks for practical experiments shall be awarded on the basis of :

- Preparedness of the candidate.
- Manipulative skill
- Results
- Knowledge of the experiments and
- Viva- voce

A regular record of theory and practical sessional marks shall be maintained for

each student in the institution. The remaining 10 marks of practical sessional mark will be on the basis of a practical sessional examination conducted at the end of the academic year.

Candidates who have registered for the university examination of a class will be eligible for promotion to the next higher class. But he/she will be eligible to appear for the examination of the higher class only after passing in all subjects in the lower class.

#### **IMPROVEMENT OF SESSIONAL MARKS**

Candidates who could not pass an examination can improve the sessional marks in theory of the subject in which he/she failed. For improving the sessional marks, two sessional examinations will be conducted and their average will be taken into account. Such improvement is allowed for a maximum of two times for a particular subject.

Candidates who have secured the minimum required for a pass in a subject shall be exempted from appearing of subsequent examination in such subject. A subject includes both theory & practical.

#### **3.8 Details of practical/clinical practicum exams to include Duration Marks Types of cases/questions**

As given under clause 3.3

#### **3.9 Number of examiners needed (Internal & External) and their qualifications**

A teacher should possess minimum 3 years of post teaching experience in the

concerned subjects. No person other than Regular/Retired teacher having concerned or allied Post Graduate degree and having one year teaching experience in the concerned subject shall be considered eligible for an examiner.

Eligible qualifications for examiners

Pharmaceutical Chemistry - M.Pharm(Ayu), M.Pharm (Pharmaceutical Chemistry)

Pharmaceutical Analysis - M.Pharm M.D. (RS & BK)

Pharmacognosy - M.Pharm(Ayu)

Pharmaceutics - M.Pharm(Ayu), M.Pharm (Pharmaceutics) M.D. (RS & BK)

Pharmacology - M.Pharm(Ayu), M.Pharm (Pharmacology). M.D. (RS & BK)

Rasasastra & Bhaishajyakalpana - MD (RS & BK), M.Pharm(Ay)  
Dravyaguna - MD(Dravyaguna), M.Pharm(Ay)

### 3.10 Details of viva

As given under clause 3.3

## 4. INTERNSHIP

### 4.1 Eligibility for internship/Practical training

Students will be eligible to do practical training only after passing all the theory papers and practical examinations.

### 4.2 Details of internship

After the completion of IV year examination the students should undergo compulsory practical Industrial training for a period of 2 months.

#### **4.3 Model of Internship Mark lists**

Not applicable

**Internship Completion certificate:** Issued from the concerned Institution

#### **4.4 Extension rules**

Not applicable

#### **4.5 Details of training given**

##### **Practical Training**

Every candidate shall undergo practical training in a GMP Certified Ayurvedic Manufacturing Unit attached to an Ayurvedic College recognized by any University of India or recognized by Kerala University of Health Sciences or Pharmaceutical Co-operation of Kerala and Imcops Adayar . The Pharmaceutical Company should have GMP certified manufacturing unit having not less than 2000 Sq.feet area. The annual vacation period after Second Year, Third year or Final Year may be utilized for this. B.Pharm(Ay) Degree will be awarded only after the training certificate from the training institute, of having undergone the training successfully is forwarded to the University by the Principal of the college.

### **5.ANNEXURES**

**5.1 Check Lists for Monitoring:** Log Book, Seminar Assessment etc. to be formulated by the curriculum committee of the concerned Institution.