

**UTTARAKHAND TECHNICAL UNIVERSITY DEHRADUN**  
**STUDY AND EVALUATION SCHEME**  
**[Effective from the session: 2009-10]**

**Course: B.Pharm.**

**Year – II, Semester - III**

S.N.	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR- 301	Organic Chemistry-II	3	0	15	05	20	80	100	3
2	PHR- 302	Unit Operations-II	3	0	15	05	20	80	100	3
3	PHR- 303	Physical Pharmacy	3	0	15	05	20	80	100	3
4	PHR- 304	Pharmacognosy-I	3	0	15	05	20	80	100	3
5	PHR- 305	Anatomy, Physiology and Path Physiology- III	3	0	15	05	20	80	100	3
<b>Practical Day to Day Evaluation</b>										
6	PHR- 301P	Organic Chemistry-II	0	4	--	--	20	80	100	2
7	PHR- 302P	Unit Operations-II	0	4	--	--	20	80	100	2
8	PHR- 303P	Physical Pharmacy	0	4	--	--	20	80	100	2
9	PHR- 304P	Pharmacognosy-I	0	4	--	--	20	80	100	2
			15	16	--	--	180	720	900	

**T.A. – Teacher Assessment, ESE – End Semester Examination, CT – Cumulative Test**

**Note: - Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively**

**0.6 Credits – Sessional**

**2.4 Credits - ESE**

**UTTARAKHAND TECHNICAL UNIVERSITY DEHRADUN**  
**STUDY AND EVALUATION SCHEME**  
**[Effective from the session: 2009-10]**

**Course: B. Pharm.**

**Year – II Semester - IV**

**T.A. – Teacher Assessment, ESE – End Semester Examination, CT – Cumulative Test**

S.N.	Course Code	Subject Name	Period (Hours)		Sessional			Exam	Subject Total	Credits
			L	P	CT	TA	Total	ESE		
1	PHR- 401	Pharmaceutical Analysis-II	3	0	15	05	20	80	100	3
2	PHR- 402	Advance Mathematics	3	0	15	05	20	80	100	3
3	PHR- 403	Anatomy, Physiology and Path physiology- IV	3	0	15	05	20	80	100	3
4	PHR- 404	Pharmacognosy -II	3	0	15	05	20	80	100	3
5	PHR- 405	Chemistry of Natural Products	3	0	15	05	20	80	100	3
6	PHR- 406	Pharmaceutical Jurisprudence & Ethics	3	0	15	05	20	80	100	3
<b>Practical Day to Day Evaluation</b>										
7	PHR- 401P	Pharmaceutical Analysis-II	0	4	--	--	20	80	100	2
8	PHR- 402P	Pharmacognosy -II	0	4	--	--	20	80	100	2
9	PHR- 405P	Chemistry of Natural Products	0	4	--	--	20	80	100	2
			18	12	--	--	180	720	900	-

**Note: - Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively**

**0.6 Credits – Sessional**

**2.4 Credits - ESE**

**SEMESTER-III**

**PHR-301**

**ORGANIC CHEMISTRY-II  
(PHARMACEUTICAL CHEMISTRY-III)**

**UNIT-I:**

**METHODS OF PREPARATION WITH MECHANISM, PROPERTIES AND MECHANISM OF NAME REACTION ASSOCIATED WITH: -**

- (i) Active methylene compounds (acetoacetic ester and malonic ester) and their synthetic importance.
- (ii)  $\alpha$ ,  $\beta$ -unsaturated carbonyl compounds.
- (iii) Polynuclear hydrocarbons-Napthalene, anthracene and phenantherene.
- (iv) Polymers and polymerisation. (8)

**UNIT-II:**

Carbohydrate: Monosaccharide:- Glucose (mutarotation, ring structure of glucose,) configuration of monosaccharides), (08)

**UNIT-III:**

Disaccharides (Sucrose and maltose), Polysaccharides (Starch and cellulose) (08)

**UNIT-IV:**

**HETEROCYCLIC COMPOUNDS:** Nomenclature, Chemistry, preparation, properties of- 5-membered heterocycles with one hetero atom (Pyrrole, Furan and Thiophene),5-membered heterocycles with two hetero atom ( Imidazole, Thiazole, Oxazole, Pyrazole) (08)

**UNIT-V:**

Nomenclature, Chemistry, preparation, properties of 6-membered heterocycles with one hetero atom (Pyridine, Pyran),6-membered heterocycles with two hetero atoms (Pyrimidine, Piperazine) Benz fused heterocycles (Quinoline, Isoquinoline, Indole) (08)

**PHR-301P**

**ORGANIC CHEMISTRY-II  
(PHARMACEUTICAL CHEMISTRY-III) LAB.**

**PRACTICAL**

1. Identification of organic compounds and their mixture with derivatization. (Not more than two)
2. Synthesis of Organic Compounds involving two steps.

**BOOKS RECOMMENDED:-**

1. March Jerry, Advance organic Chemistry 4th ed. A Wiley
2. Jenkins, The Chemistry of Organic Medicinal Products 4<sup>th</sup> Ed, Pharma Medpress
3. Finar I.L. Organic chemistry, Pearson education, New Delhi
4. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/Longman, London.
5. Furniss B A, Hannaford A J, Smith P W G and Tatehell A R, Vogel's Textbook of Practical Organic
6. Chemistry, The ELBS/ Longman, London.
7. Morrison, R.T., and Boyd R.N., **Organic Chemistry**, Prentice Hall of India Pvt. Ltd, New Delhi.
8. Joule J.A., Mills K. and . Smith G.F, Hetrocyclic Chemistry, Staanely Thornes Ltd., U.K.

**UNIT OPERATIONS - II**

**UNIT-I:**

- a) Selection of plant and equipments in unit operations
- b) A study of the following Valves – Plug Cocks, Globe, Gate, Diaphragm, QO, Check valves
- c) A study of the following Pumps- Air lift, Jet, Piston, Plunger, Diaphragm, Reciprocating, Rotary, Centrifugal pumps. (08)

**UNIT-II:**

**HUMIDITY, VENTILATION AND AIR CONDITIONING SYSTEMS (HVAC):-** Basic concepts & definitions, Wet bulb & Dry bulb thermometer, Adiabatic saturation temperature, Psychometric charts & Measurement of humidity, Application of humidity measurement in pharmacy, Equipment for dehumidification operations.

Principles, Materials of constructions and Applications of Refrigeration and Air-conditioning. (08)

**UNIT-III:**

**DRYING:** - Moisture content , Equilibrium relative humidity & Mechanism of drying, Rate of drying & time of drying calculations, Classifications of dryers, Principle , material of construction, applications advantages and disadvantages of tray , fluidized bed , Rotary , Drum , Vacuum ,Spray and Freeze dryer.

**EVAPORATION:** - Basic concepts of phase equilibrium, Factors affecting evaporation, principle, materials of construction, Applications, advantages and disadvantages of Climbing and falling film evaporators , Evaporating pan , Vacuum evaporators, Horizontal and Vertical evaporators. (08)

**UNIT-IV:**

**DISTILLATION:-** Raoult's law, Phase diagrams, Simple, Steam, & Flash distillation, Principle of McCabe Thiele method of calculation of number of theoretical plates, Equipment for rectification, Azeotropic, Extractive & molecular distillation . (08)

**UNIT-V**

**CRYSTALLIZATION:** Characteristics of Crystals- purity, size, shape, geometry, habit, forms and factors affecting them. Miers super-saturation theory & caking of crystals and its prevention Classification of crystallizers, Principle, Materials of construction, applications, advantages and disadvantages of Swenson Walker, Agitated batch, Vacuum, Tank and Krystal Crystallizer.

(08)

**PHR-302P**

**UNIT OPERATIONS-II**

Experiments based on drying, distillation, evaporation, crystallization, and humidity charts to be performed.

**BOOKS RECOMMENDED:-**

1. D V Derle, Essentials of Pharmaceutical Engineering, PharmaMed Press
2. McCabe W.L, Smith J.C. & Peter Harriot. Unit operations of chemical engineering. 5<sup>th</sup> Ed.
3. International student addition, McGraw hills international book co. New Delhi. 1993.
4. Cooper J.W. & Gunn G., Tutorial Pharmacy, CBS Publisher & distributors New Delhi
5. Perry R.H. & Don Green, Chemical engineering's hand book, McGraw hill book company, New Delhi.
7. 4. Walter. I. Badger & Julius. T. Banchero, Introduction to chemical engineering, McGraw hill book Company, New Delhi.
9. 5. Subramanian C.V.S, Pharmaceutical engineering, Vallabh Prakashan, Delhi.
10. 6. Remington's Pharmaceutical Sciences, Vol. I & Vol. – II, Mack Publishing Co., U.S.A

**PHR- 303****PHYSICAL PHARMACY-II  
(PHARMACEUTICS-III)****UNIT-I:**

**MICROMERETICS AND POWDER RHEOLOGY:** Average particle size, Particle size distribution, number and weight distribution, particle number; methods for determining particle size – optical microscopy, sieving, sedimentation , particle volume measurement , shape, specific surface; methods for determining surface area- air permeability, adsorption; derived properties of powders- porosity, packing arrangement, densities, bulkiness and flow properties, pore size. **(08)**

**UNIT-II:**

**RHEOLOGY:** Newtonian systems-Newton's Law, kinematics viscosity, effect of temperature; non- Newtonian systems- plastic ,pseudo plastic, dilatant; thixotropy- thixotropy in formulation; determination of viscosity- choice of viscometer ,capillary, falling sphere, cup & bob ,plate & cone viscometers, application of rheology in pharmacy. **(07)**

**UNIT-III:**

**SURFACE AND INTERFACIAL PHENOMENON :** Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions(capillary rise method, drop number method, drop weight method, Wilhelm plate method), spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid gas and solid- liquid interfaces, complex films, electrical properties of interface. **(08)**

**UNIT-IV:****DISPERSION SYSTEMS:**

(a) **COLLOIDAL DISPERSIONS:** Definition, types, properties of colloids-optical, kinetics , electrical; protective colloids, applications of colloids in pharmacy.

(b) **SUSPENSIONS:** Interfacial properties of suspended particles, settling in suspensions- theory of Sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation Parameters; wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations, stability.

(c) **EMULSIONS:** Types, theories of emulsification, physical stability, preservation, rheological properties, pharmaceutical applications of emulsions, microemulsions. **(10)**

**UNIT-V:**

**STABILITY:** Decomposition of medicinal agents- Influence of light, temperature and medium, half life, shelf life; stabilization of medicinal agents , accelerated stability and stress testing, ICH guidelines . **(07)**

**PHR- 303P****PHYSICAL PHARMACY-II  
(PHARMACEUTICS-III) LAB.**

Practicals based on the above mentioned theory topics.

**BOOKS RECOMMENDED:**

1. Martin Alfred, Physical Pharmacy, 5th ed. B.I. Waverly Pvt. Ltd., New Delhi.
2. Modern Dispensing Pharmacy, N K Jain/J D Gupta, PharmaMed Press
3. Rawlins E.A, Bentley's textbook of Pharmaceutics 8th ed. Bailliere Tindall, London.
4. Gennaro A.R, Remington Pharmaceutical Sciences and practice of Pharmacy, vol. I & II, 20th Ed.
5. Lippincott, William and Wilkins, Philadelphia.
6. Aggarwal S.P., Khanna Rajesh, Physical Pharmacy, CBS Publishers & Distributors, New Delhi.

**Unit-I:**

A) The origin of Pharmacognosy, Present status and scope.

**B) Sources of Drug:** Biological and geographical sources of drugs.

**C). Classification of Drugs:** Alphabetical, Morphological, taxonomical, chemical & Pharmacological, chemo taxonomical. (08)

**Unit-II :**

**Plant Taxonomy:** - Study of the following families with special reference to medicinally important plants: Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, leguminosae, Rubiaceae, Liliaceae, Graminae, Labiatae, Cruciferae, and Papaveraceae, Compositae. (08)

**Unit-III :**

**Cultivation, Collection, Processing & Storage of crude drugs :**

**A.-** Factors influencing cultivation of medicinal plants, humidity,rainfall,irrigation,Type of Soils & fertilizers ,fertilization,pest and pest control.

**B.-** Plant growth regulators. (08)

**Unit-IV :**

**Adulteration and Quality Control of crude drugs:**

**A.-** Causes and types of Adulteration, Organoleptic, Microscopic, Biological, Chemical and Physical method of evaluation.

**B. –**WHO and current Indian Pharmacopoeial guidelines for the standardization of medicinal plants. (08)

**Unit-V :**

**Systematic Pharmacognostic Study of the Following:**

**a)** Carbohydrates and derived products: Agar, Guar gum,Xanthum gum, Acacia, Honey, Isabgol, Pectin, Starch, Sterculia, Tragacanth, Alginates, and Katir. (08)

1. Study of Plants belonging to families Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, leguminosae, Rubiaceae, Liliaceae, Graminae, Labiatae, Cruciferae, and Papaveraceae, Compositae
2. Microscopical measurement of , starch grains(wheat ,maize,starch,potato ),
3. Various types of calcium-oxalate crystals, their study and microscopical measurements (Rhubarb, Senna, Liquorice etc.)
- 4.Determination of leaf constant such as Stomatal index, Stomatal numbers, Veinlet numbers, Vein termination numbers and Palisade ratio
5. Chemical Tests of Agar, Acacia, Sterulia and Tragacanth.,Pectin, Starch and Honey.
6. Swelling factor and average wt. of Isapaghula husk.
7. Physical characteristics of fixed oils.
8. Preparation of herbarium sheets.

**BOOKS RECOMMENDED:**

1. Trease. GE & Evans WC, Pharmacognosy, Bailliere tindall East bourne. UK.

2. Wallis. TE, Text book of Pharmacognosy,JA ChurchillLtd.
3. Wallis, Practical Pharmacognosy 4<sup>th</sup> Ed, PharmaMed Press
4. Sengar, Text Book of Pharmacognosy, PharmaMed Press
5. Kokate. CK, Practical Pharmacognosy, Vallabh Prakashan, Delhi.
6. Wallis. T.E, Analytical Microscopy, J & A Churchill Limited London.
7. Brain,KR and Turner ,TD ,The practical evaluation of phyto pharmaceutical, Wright, Scientehnica- Bristol.
8. Kokate, CK, Pharmacognosy, Nirali Prakashan. Pune.
9. Schewar,PJ, Marine Natural Products, Academic press, London.
10. . United States Pharmacopoeia (National Formulary). (latest edition)
11. Pharmacopoeia of India, The Controller of Publications, Delhi. (latest edition)
12. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge. (latest edition)





**ANATOMY, PHYSIOLOGY AND  
PATHOPHYSIOLOGY – III**

**Unit -I**

**Digestive system** –Parts of digestive system, their structure and functions. Various gastrointestinal secretions & their role. (08)

**Unit -II**

Pathology of disorders related to digestive system Peptic Ulcer, Ulcerative colitis, Crohns disease, Zollinger- Ellison syndrome, Amoebiasis, typhoid, Hepatitis, Cirrhosis of liver, Pancreatitis. (08)

**Unit-III**

**Central Nervous System** : Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, specialized functions of the brain. Cranial nerves and their functions. (08)

**Unit-IV**

**Autonomic Nervous System** : Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission the A.N.S. (08)

**Unit-V**

**Demography and Family Planning**, Medical termination of pregnancy.  
**First Aid** : Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods. (08)

**BOOKS RECOMMENDED**

1. Tortora, Principles of Anatomy & Physiology, Wiley
2. Chaurasia B.D, Human Anatomy, Regional & Applied Part I, II & III, CBS Publishers & Distributors, New Delhi.
3. Guyton AC, Hall JE., Text book of Medical Physiology, WB Saunders Company.
4. Chatterjee C.C. Human Physiology, Medical Allied Agency, Calcutta.
5. Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone.
6. Zdanowich Martin, Essentials of Pathophysiology for Pharmacy, CRC
7. Parmar N.S., Health Education & Community Pharmacy CBS Publishers, Delhi.
8. Shalya Subhash, Human Physiology, CBS Publishers & Distributors.
9. Keele, C.A., Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.
10. Dipiro JL, Pharmacotherapy – A Pathophysiological Approach, Elsevier.
11. Robbins SL, Kumar V, Basic Pathology, WB Saunders.
12. Ranade VG, Text Book of Practical Physiology, Pune Vidyarthi Griha Prakashan, Pune.

## **B.Pharm II (IV Semester)**

**PHR-401**

### **PHARMACEUTICAL ANALYSIS-II**

Theoretical considerations and application in drug analysis and quality control by the following analytical techniques (assays included in the latest edition of Indian Pharmacopoeia).

#### **UNIT-I:**

- A. Non-aqueous titration
- B. Diazotisation titrations (08)

#### **Unit-II :**

Miscellaneous methods of analysis:, Karl-Fischer titration, Oxygen flask combustion, Kjeldahl method of nitrogen estimation. (08)

#### **Unit-III :**

Principle, Instrumentation and Applications of: Potentiometry, Conductometry, Polarography, Amperometry, Electrophoresis. (08)

#### **Unit-IV :**

Theory, Instrumentation and Applications of: Atomic absorption spectroscopy, Flame Photometry. (08)

#### **Unit-V :**

Principle, instrumentation and pharmaceutical applications of chromatography such as Paper column, Chromatography, TLC. (08)

**PHR-401P**

### **PHARMACEUTICAL ANALYSIS-II LAB**

1. Non-aqueous titrations: Preparation and standardization of perchloric acid. Estimation of some pharmacopoeial products.
2. Exercises based on paper, column and thin- layer chromatography.
3. Exercises involving diazotization, Karl-Fischer methods.
4. Determination of Sodium, Potassium and Calcium ion by Flame Photometry.

#### **BOOKS RECOMMENDED:**

1. Connors KA, A text book of Pharmaceutical Analysis, Wiley
2. Vidya Sagar, Basics of Drug Analysis, PharmaMed Press
3. Beckett, A H and Stenlake, J.B, Practical Pharmaceutical Chemistry, Vol I and II, The Athlone Press of the University of London.
4. Y Anjaneyulu, A Textbook of Analytical Chemistry, PharmaMed Press
5. Pharmacopoeia of India, published by The Controller of Publications, Delhi.
6. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.
7. Mendham J. Denny RC Barnes, J.D. Thomas M.J.K. "Vogel's Text Book of Quantitative Chemical
8. Analysis" Pearson Education Asia.



***ADVANCE MATHEMATICS***

**UNIT-I:**

Definition and information of different equations, equation of first order and first degree. Variable separable homogenous and linear differential equation and equation reducible to such types. **(08)**

**UNIT-II:**

Linear differential equation of order greater than one with constant coefficients, complimentary function and particular integral, simultaneous, pharmaceutical applications. **(08)**

**UNIT-III:**

BIOMETRICS: Significant digits and rounding off numbers, data collection, random and non-Random sampling methods, sample size, data organization diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams measures of central tendency, measures of dispersion, standard deviation and standard error of means, coefficient of variation, confidences (fiducial) limits, correlation, regression analysis. **(08)**

**UNIT-IV:**

STATISTICAL INFERENCE: Kurtosis and Skewness ,Chi Square test as test of independence of Attributes, test of goodness of Fit in testing of significance in biological/pharmaceutical experiments and elements of ANOVA in one variable.

**(08)**

**UNIT-V:**

PROBABILITY AND DISTRIBUTION: Bayer's theorem, probability distribution, elements of binomial and Poisson distribution with curve and properties. **(08)**

**BOOKS RECOMMENDED**

1. Daniels, Biostatistics: Basic Concepts and Methodology for the Health Sciences, 9ed Wiley
2. Khan, Fundamentals of Biostatistics, Ukaaz Publications
3. Gupta S.P. Statistical Methods, Sultan Chand and Co., New Delhi.
4. Greval B.S., Higher Engineering Mathematics, Khanna Publication, New Delhi.
5. Bolton's Pharmaceutical Statistics, Practical and Clinical Application, Marcel Dekker, N.Y.
6. Khan, Biostatistics for Pharmacy, Ukaaz Publications

**ANATOMY PHYSIOLOGY AND PATHOPHYSIOLOGY –IV**

**Unit-I –**

**Respiratory System** – Anatomy & function of respiratory structures, Mechanism of respiration, regulation of respiration, pathophysiology of Asthma, Pneumonia, Bronchitis, Emphysema, Tuberculosis. (08)

**Unit-II –**

**Cardiovascular System** – Functional Anatomy of heart, conducting system of heart, cardiac cycle, ECG (Electro cardiogram). Pathophysiology of hypertension, Angina, CHF, myocardial infarction, cardiac arrhythmias, Ischaemic heart disease, Arteriosclerosis. (08)

**Unit-III –**

**Cell injury & Adaptation** – Courses of cell injury, pathogenesis & morphology of cell injury. **Cellular Adaptation** – Atrophy, hypertrophy, aplasia, metaplasia, & dysplasia, intracellular accumulation & pathophysiology of Neoplasm. (08)

**Unit IV –**

Basic mechanisms involved in the process of inflammation and repair Alterations in vascular permeability and blood flow, migration of WBC's , mediators of inflammation. Brief outline of the process of repair (08)

**Unit-V-**

Pathophysiology of Joints disorder – Arthritis, gout, myasthenia gravis, spasticity,tetany, fatigue. Pathophysiology of anaemia, AIDS, hypersensitivity, allergic conditions, psychosis, epilepsy, Parkinson & Alzheimer's diseases pathophysiology of cataract, glaucoma etc. (08)

**BOOKS RECOMMENDED**

1. Tortora GJ, & Anagnostikos NP, Principles of Anatomy & Physiology, Wiley
2. Mc Corry, Essentials of Human Physiology for Pharmacy, 2<sup>nd</sup> Ed, CRC
3. Chaurasia B.D, Human Anatomy, Regional & Applied Part I, II & III, CBS Publishers & Distributors, New Delhi.
4. Guyton AC, Hall JE., Text book of Medical Physiology, WB Saunders Company.
5. Chatterjee C.C. Human Physiology, Medical Allied Agency, Calcutta.
6. Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone.
7. Parmar N.S., Health Education & Community Pharmacy CBS Publishers, Delhi.
8. Shalya Subhash, Human Physiology, CBS Publishers & Distributors.
9. Keele, C.A., Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.
10. Dipiro JL, Pharmacotherapy – A Pathophysiological Approach, Elsevier.

**Unit-I –**

STUDY OF THE SOURCES, PHYSICAL AND CHEMICAL TEST OF IDENTITY, SALIENT MICROSCOPIC FEATURES AND USES OF THE FOLLOWING:

a) Fibres: Wool, Cotton wool, Jute, Silk, Nylon, Terylene and Polyesters. Pharmaceutical aid: Talc, Asbestos, Bentonite, Kaolin and Prepared Chalk.

b) Fixed oil, Fats and Waxes: Almond, Castor oil, Cotton seed oil, Sesame oil, Olive oil, Cod liver oil, Arachis oil, Chaulmoogra oil, Neem oil, Fish liver oil, Lard, Lanolin, Bees wax, Lard, Cocoa butter, Kokum butter and wool fat. (08)

**Unit-II –**

PHYTOCHEMICAL SCREENING:

(a) Preparation of extract

(b) Screening of alkaloids, saponins, cardenolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and poly phenols, anthraquinones, cyanogenic glycoside, amino acid in plant extracts. (08)

**Unit-III –**

SYSTEMATIC PHARMACOGNOSTIC STUDY OF THE FOLLOWING DRUGS: Resins: Colophony, Podophyllum, Jalap, Cannabis, Capsicum, Myrrh, Asafoetida, Balsam of tolu, Balsam of peru, Benzoin, Turmeric, Ginger, Guggule, myrrh, storax. (08)

**Unit-IV –**

Utilization and role of aromatic plant in national economic Volatile oil: Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandalwood, cumin, jatamansi. Cellulose and Cellulose derivative. (08)

**Unit-V –**

Tannins: Gambir, Black & Pale catechu, Gall, Myrobalam, Bahera, Arjuna, Tannic Acid, Amla, Ashoka Bark and Terocarpus. (08)

1. Study of fibers, along with chemical test.
2. Morphology and Microscopic evaluation of some medicinal crude drugs and their powders mentioned in theory with their chemical test.
3. General chemical test for alkaloids, glycosides, steroids, flavonoids and tannins.
4. To prepare a report on an allotted topic.
5. Study and chemical test of pharmaceutical aids

**BOOKS RECOMMENDED:**

1. Trease. GE & Evans WC, Pharmacognosy, Bailleire tindall East bourne. UK
2. Fischer, Modern Phytochemical Methods, Springer
3. Wallis. TE, Text book of Pharmacognosy, JA Churchill Ltd.
4. Kokate. CK, Practical Pharmacognosy, Vallabh Prakashan, Delhi.
5. Wallis. TE, Analytical Microscopy, J & A Churchill Limited London.

6. Brain, KR and Turner, TD, The practical evaluation of phyto pharmaceutical, Wright, Scientechica- Bristol.
7. Kokate, CK, Pharmacognosy, Nirali Prakashan. Pune.
8. Harborne. JB, Phytochemical method, Chapman & Hall international edition, London.
9. Atal. CK, & Kapoor. BM, Cultivation & Utilization of medicinal plants, RRL, Jammu.
10. Tyler. VE, Pharmacognosy, Le & Febiger, Philadelphia.

**CHEMISTRY OF NATURAL PRODUCTS**

Different techniques of extraction and isolation of natural compounds. Introduction, classification and chemistry of the mentioned compounds.

**UNIT-I:**

**A:-**Glycosides: Salicin, amygdalin, digitalis & stropanthus (Structural features)

**B: -** Alkaloids: Atropine, Nicotine, Quinine. Structural features of morphine & reserpine. **(10)**

**UNIT-II:**

Steroids: Structural elucidation of cholesterol & Vit D, Structural features of corticoids, sex hormones, ergosterol, and saponin. **(08)**

**UNIT-III**

**B:-**Lipids and fatty acids: Physiochemical properties and significance of lipids and fats, Determination of acid, saponification, ester and iodine value and their significance in pharmacy. **(06)**

**UNIT-IV**

Terpenoids : Citral, menthol and camphor. **(08)**

**UNIT-V**

Amino acids, proteins: Preparation, properties and end group analysis. Protein structure (Primary, Secondary, tertiary and quaternary polypeptides) **(08)**

**PHR-405P****CHEMISTRY OF NATURAL PRODUCTS**

1. Isolation of natural organic compounds from medicinal plants (Isolation of caffeine from Tea leaves,
2. Isolation of piperine from Black Pepper, Isolation of Hesperidin from Orange Peel, Isolation of Clove oil from clove, Isolation of Caraway oil from caraway, Isolation of cumin oil from cumin.)
3. Extraction of essential oils
4. Analysis of fixed oils (acid value, saponification value, ester value, and iodine value)
5. Identification test of cholesterol.

**BOOKS RECOMMENDED:**

1. Manitto, Biosynthesis of Natural Products, Wiley India
2. Praveen Kumar, Natural Products a Practical Manual, PharmaMed Press
3. Finar I.L, Organic chemistry, Vol. II,., Pearson Education Pvt Ltd, New Delhi,2002.
4. Agarwal O.P., Chemistry of Natural Products, Vol. I & II, 7th ed., Goel Publishing House, Meerut, 1983.
5. Indian Pharmacopoeia (Latest Edition)
6. 4.Morrison, R.T., and Boyd R.N., **Organic Chemistry**, Prentice Hall of India Pvt. Ltd, New Delhi.





## PHARMACEUTICAL JURISPRUDENCE & ETHICS

### UNIT-I:

#### INTRODUCTION:

- a) Pharmaceutical Legislations – A brief review.
- b) Drugs and Pharmaceutical Industry – A brief review.
- c) Pharmaceutical Education – A brief review.
- d) Pharmaceutical Ethics – A brief review.
- e) Pharmacy Act 1948. (08)

### UNIT-II:

#### AN ELABORATE STUDY OF THE FOLLOWING:

- a) Drugs and Cosmetics Act 1940 and rules 1945- Manufacturing , distribution and marketing , approval of manufacturing and quality control chemist, schedules .
- b) Drugs Price Control Order 1995. (08)

### UNIT-III :

#### AN ELABORATE STUDY OF THE FOLLOWING:

- a) Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.
- b) Drugs and Magic remedies (Objectionable Advertisements) Act 1954. (08)

### UNIT-IV:

#### A BRIEF STUDY OF THE FOLLOWING WITH SPECIAL REFERENCE TO THE MAIN PROVISIONS.

- a) Medicinal & Toilet preparations (Excise duties Act 1955)- relevant to drug and pharmaceuticals
- b) Poisons Act 1919.
- c) Medical termination of Pregnancy Act 1970 & Rules 1975.
- d) Prevention of Cruelty to Animals Act 1961.
- e) A.I.C.T.E. Act 1987. (08)

### UNIT-V:

- a) Patents Act 1970, Trade mark and copyrights acts.- main provisions.
- b) U.S Food and Federal D&C Act – CFR -21, CGMP; EuGMP, WHO, Orange book (08)

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

#### BOOKS RECOMMENDED:

1. CK Kokate, Text Book of Forensic pharmacy, PharmaMed Press
2. Mittal B.M, Textbook of Forensic Pharmacy, National Book Centre, Dr. Sundari Mohan Avenue, Calcutta.
3. Relevant Acts & Rules Published by the Govt. of India.
4. Jain N.K, A Textbook of Forensic Pharmacy, Vallabh Prakashan, New Delhi.
5. Singh, Harkishan “History of Pharmacy in India – Vol. I, II & III” Vallabh Prakashan.
6. Relevant websites.