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

**Course: B.Pharm.**  
**Year – II, Semester - III**

<table>
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<tr>
<th>S.N.</th>
<th>Course Code</th>
<th>Subject Name</th>
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**Practical Day to Day Evaluation**

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<th>S.N.</th>
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**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**
Course: B. Pharm.

Year – II Semester - IV

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

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<td>Pharmaceutical Jurisprudence &amp; Ethics</td>
<td>3</td>
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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) α, β-unsaturated carbonyl compounds.
(iii) Polynuclear hydrocarbons-Napthalene, anthracene and phenantherene.
(iv) Polymers and polymerisation.

UNIT-II:

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

UNIT-III:

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

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, Thiazone, Oxazole, Pyrazole)

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)

PHR-301P

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

PRACTICAL
1. Identification of organic compounds and their mixture with derivatization. (Not more then two)

BOOKS RECOMMENDED:-
3. Finar I.L. Organic chemistry, Pearson education, New Delhi
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.

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.  

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.

UNIT-IV:

DISTILLATION:- Rault’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.

UNIT-V


PHR-302P

UNIT OPERATIONS-II

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

BOOKS RECOMMENDED:-
2. McCabe W.L, Smith J.C. & Peter Harriot. Unit operations of chemical engineering. 5th Ed.
4. Cooper J.W. & Gunn G., Tutorial Pharmacy, CBS Publisher & distributors New Delhi
PHR- 303

PHYSICAL PHARMACY-II
(PHARMA CETICS-III)

UNIT-I:

MICROMERETRICS 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.

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.

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, detergenty, adsorption at solid interfaces, solid gas and solid-liquid interfaces, complex films, electrical properties of interface.

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.

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.

PHR- 303P

PHYSICAL PHARMACY-II
(PHARMACEUTICS-III) LAB.

Practicals based on the above mentioned theory topics.

BOOKS RECOMMENDED:
5. Lippincott, William and Wilkins, Philadelphia.
PHR-304

PHARMACOGNOSY-I

Unit-I:

A) The origin of Pharmacognosy, Present status and scope.
B) Sources of Drug: Biological and geographical sources of drugs.

(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:

(08)

PHR-304P

PHARMACOGNOSY-I LAB.

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, Veinislet numbers, Veintermination 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, Bailleire tindall East bourne. UK.
PHR-305

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
6. Zdanowich Martin, Essentials of Pathophysiology for Pharmacy, CRC
12. Ranade VG, Text Book of Practical Physiology, Pune Vidyarthis 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 Pharmacopeia).

**UNIT-I:**

A. Non-aqueous titration  
B. Diazotisation titrations  

**Unit-II :**


**Unit-III :**


**Unit-IV :**

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

**Unit-V :**

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

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**PHR-401P**

**PHARMACEUTICAL ANALYSIS-II LAB**

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:**

2. Vidya Sagar, Basics of Drug Analysis, PharmaMed Press  
5. Pharmacopoeia of India, published by The Controller of Publications, Delhi.  
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 binominal 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
5. Bolton’s Pharmaceutical Statistics, Practical and Clinical Application, Marcel Dekker, N.Y.
6. Khan, Biostatistics for Pharmacy, Ukaaz Publications
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 – Atropy, hypertropy, 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, physhosis, epilepsy, Parkinson & Alzheimer’s diseases pathophysiology of cataract, glaucoma etc. (08)

BOOKS RECOMMENDED

1. Tortora GJ, & Anagnodokos NP, Principles of Anatomy & Physiology, Wiley
2. McCorry, Essentials of Human Physiology for Pharmacy, 2nd Ed, CRC
Unit I –

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


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

Unit II –

PHYTOCHEMICAL SCREENING:

(a) Preparation of extract

(b) Screening of alkaloids, saponins, cardinolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and poly phenols, anthrquinones, cynogentic glycoside, amino acid in plant extracts.

Unit III –

SYSTEMATIC PHARMACOGNOSTIC STUDY OF THE FOLLOWING DRUGS: Resins: Colophony, Podophyllum, Jalap, Canabis, Capsicum, Myrrh, Asafoetida, Balsam of tolu, Balsam of peru, Benzoin, Turmeric, Ginger, Guggle, myrrh, storax.

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, Cardamam, Valerian, Musk, Palamarosa, Gaultheria, Sandalwood, cumin, jatamansi. Cellulose and Cellulose derivative.

Unit V –

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

PHR-404P

PHARMACOGNOSY-II LAB

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 Eastbourne, UK
2. Fischer, Modern Phytochemical Methods, Springer
Different techniques of extraction and isolation of natural compounds. Introduction, classification and chemistry of the mentioned compounds.

UNIT-I:
A:-Glycosides: Salicin, amygdalin, digitalis & strophanthus (Structural features)
B: - Alkaloids: Atropine, Nicotine, Quinine. Structural features of morphine & reserpine. (10)

UNIT-II:
Steriods: Structural elucidation of cholesterol & Vit D, Structural features of corticoids, sex harmones, 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
5. Indian Pharmacopoeia (Latest Edition)
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.  

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. 

UNIT-III:

AN ELABORATE STUDY OF THE FOLLOWING:
b) Drugs and Magic remedies (Objectionable Advertisements) Act 1954. 

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.

UNIT-V:

b) U.S Food and Federal D&C Act – CFR -21, CGMP; EuGMP,WHO,Orange book

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.
6. Relevant websites.