## UTTARAKHAND TECHNICAL UNIVERSITY DEHRADUN
### STUDY AND EVALUATION SCHEME

#### [New Syllabus]

<table>
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<tr>
<th>S.N.</th>
<th>Course Code</th>
<th>Subject Name</th>
<th>Period (Hours)</th>
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### Practical Day to Day Evaluation

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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**
UTTARAKHAND TECHNICAL UNIVERSITY DEHRADUN
STUDY AND EVALUATION SCHEME
[New Syllabus]

Course: B. Pharm.

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Year – III Semester - VI

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
B.Pharm III (V Semester)

PHIR-501

PHARMACEUTICAL CHEMISTRY-V
(BIOCHEMISTRY)

Unit-I:
b. **Co-enzymes**: Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance.

[08]

Unit-II
a. **Carbohydrate metabolism**: Glycolysis, Gluconeogenesis and Glycogenolysis.
   Metabolism of galactose.

[08]

Unit-III
a. Role of sugar nucleotides in biosynthesis and pentose phosphate pathway.
b. The citric acid cycle, significance, reactions and energetics of the cycle.

[08]

Unit-IV
a. **Lipid metabolism**: Oxidation of fatty acid & energetics, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, regulation of lipid metabolism, essential fatty acids.
b. **Biological Oxidation**: The respiratory chain, its role in energy capture & control, energetics of oxidative phosphorylation, mechanism of oxidative phosphorylation.

[08]

Unit-V
a. **Protein metabolism**: Biosynthesis of amino acids, metabolism of amino acids and conversion of amino acids to specialized products, biosynthesis of purine and pyrimidine, formation of deoxyribonucleotides.
b. Biosynthesis of RNA, DNA replication, Biochemical aspects of Carcinogenesis & DNA repair mechanism.

[08]

**PHARM- 501P**

PHARMACEUTICAL CHEMISTRY-V
(BIOCHEMISTRY) PRACTICAL

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Titration curve for amino acids.
4. Separation of lipids by TLC.
6. Determination of glucose by means of the enzyme glucose oxidase.
7. Enzymatic hydrolysis of glycogen by α & β amylase.
13. Qualitative analysis of inorganic as well as organic constituents of Urine.

BOOKS RECOMMENDED:
2. Boyer, modern experimental biochemistry,Pearson education
3. Sharad chand bose,Biochemistry,a practical manual, PharmaMed Press,Hyderabad
5. Moore, Biochemistry and physiology of plants,
PHR-502

PHARMACEUTICS
(PHARMACEUTICAL TECHNOLOGY -I)

Unit-I: Preformulation studies:
Study of physical properties of drug like physical form, polymorphism, particle size, shape, density, wetting, dielectric constant, dissociation constant, distribution coefficient Solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability. [08]

Unit-II: Liquid Dosage Forms: Introduction, types of permissible additives, formulation, manufacturing, evaluation and packaging of clear liquids, suspensions permissible and emulsions. [08]

Unit-III: Semisolid Dosage Forms: Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection, permissible additives, manufacturing procedure, evaluation and packaging and general formulation of semisolids, clear gels, permissible additives [08]

Unit-IV: Suppositories: Ideal requirements, bases, manufacturing procedure, evaluation and packaging [08]

Unit-V:
Pharmaceutical Aerosols: Definition, Propellants, general formulation and evaluation, manufacturing and packaging methods, pharmaceutical applications.

Cosmetology and cosmetic Preparations: Formulation of cold cream, vanishing cream, cleansing cream, all purpose cream, sunscreen lotion, antiperspirants, deodorant. Shampoos, Conditioner, Shaving and after shaving products, Dentifrice Lipstick, Nail lacquer. [08]

PHR-502P

PHARMACEUTICS
(PHARMACEUTICAL TECHNOLOGY-I)
PRACTICAL

1. Preformulation studies of API. (As per pharmacopoeial requirements)
2. Preparation, evaluation and packing of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, eye drops, eye ointments etc.

BOOKS RECOMMENDED
5. Harrys Cosmetology
10. Drugs and Cosmetics Act and Rules
11. Poucher “Cosmetics”,pharmamed press,hyderabad

PHR-503

PHARMACEUTICAL CHEMISTRY-VI
(MEDICINAL CHEMISTRY –I)

Unit-I: Basic Principles of Medicinal Chemistry: Physicochemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action. Drug-receptor interaction including transduction mechanism, concept of prodrug. [08]

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic and assay procedures of individually mentioned drugs only) included in the latest edition of pharmacopoeia.

Unit-II: Drugs acting at Synaptic and neuro-effector junction sites:
Cholinergic, Anticholinergic & Anticholinesterases- Neostigmine, Physostigmine, Pilocarpine, Atropine. Adrenergic Drugs- Ephedrine, Salbutamol, Adrenaline. [08]

Unit-III: Drugs acting on the Central Nervous System:
General Anaesthetics-Thiopental, Ketamine
Local Anaesthetics- Lignocaine, Benzocaine.
Sedatives and Hypnotics- Phenobarbitone, Alprazolam.
Opioid Analgesics-Pethidine, Methadone, Pentazocine. [08]

Unit-IV:
Anticonvulsants-Phenytoin, Carbamazepine, Ethosuximide, Valproic Acid.
Antiparkinsonism drugs- Carbidopa, Levodopa.
CNS Stimulants-Caffeine, Nikethamide. [08]

Unit-V: Psychopharmacological Agents:
Antianxiet drugs- Diazepam, chlordiazepoxide.
Antidepressants – Imipramine, Amitriptyline Fluoxetine.
Skeletal muscle Relaxants– Gallamine Mephenesin,
Antipsychotic- Chlorpromazine, Haloperidol. [08]

PHR -503P

PHARMACEUTICAL CHEMISTRY-VI
(MEDICINAL CHEMISTRY-I)

PRACTICAL
1. Synthesis of atleast five drugs from the course content involving two or more steps. eg Benzocaine, Phenytoin, Barbituric acid, Nikethamide etc
2. Establishing the pharmacopoeial standards of the drugs synthesized.

BOOKS RECOMMENDED:
6. Rama rao nadendla, Medicinal chemistry, PharmaMed Press, Hyd,
8. Wermuth C G. The practice of Medicinal Chemistry-III, Academic press an imprint of Elsevier
9. Pharmacopoeia of India, Ministry of Health, Govt. of India 2010
**PHR-504**

**PHARMACOLOGY – I**

**Unit-I: General Pharmacology** – Introduction to pharmacology, routes of drug administration, combined effect of drugs, factors modifying drug action. [07]

**Unit-II: Basic Concepts of Pharmacokinetics**
Absorption, Distribution, Metabolism, Excretion
Pharmacodynamics, Principles of drug action, Mechanism of drug action, Receptors, Dose Response curve, Therapeutics index -LD 50 & ED50,. [07]

**Unit-III: Pharmacology of ANS**
Drug acting on autonomic nervous system

1. **Cholinergic system**
   - Parasympathomimetic (Cholinergic) drugs.
   - Parasympatholytic (anti-Cholinergic) drugs.
   - Drug acting on autonomic ganglia (Stimulants and blocking agents)

2. **Adrenergic system**
   - Sympathomimetic (Adrenergic) drugs
   - Sympatholytic (Anti-adrenergic) drugs [08]

**Unit-IV: Pharmacology of CNS**
General Anaesthetics, Alcohols & disulfiram, Sedative hypnotics,
Psychopharmacological agents-anti anxiety agents, antipsychotics, antidepressants, Antiepileptic drugs, Antiparkinsonism drugs, Analgesics & antagonists. [12]

**Unit-V: Drugs acting on PNS**
Local anesthetics
Skeletal muscle Relaxants Peripherally and centrally acting muscle Relaxants [06]

**PHR-504P**

**PHARMACOLOGY- I PRACTICAL**

Use of computer simulated CDs or Video cassettes for pharmacology practical where possible.


2. Study of different routes of administration of drugs in mice/rats. Practical related to DRC

**BOOKS RECOMMENDED:**

10. Turner, Screening Methods in pharmacology, Elsiver

PHR-505

PHARMACEUTICAL MICROBIOLOGY

Unit-I:
Introduction to the scope of microbiology and microscopy
Structure of bacterial cell.
Classification of microbes and their taxonomy: Bacteria, fungi and viruses. [08]

Unit-II:
Identification of Microbes: Stains and types of staining techniques.
Nutrition, cultivation, isolation and purification of bacteria, fungi & viruses.
Different culture media and their classification-
Microbial growth and their curve, measurement of microbial growth, factor influencing Microbial growth [08]

Unit-III:
Control of microbes by physical and chemical methods.
Disinfection, factors influencing disinfectants, dynamics of disinfection, Disinfectants and antiseptics and their evaluation.
Preservative efficacy [08]

Unit-IV:
Sterilization, different methods, validation of sterilization methods & equipments.
Sterility testing as per I.P. Isolation and identification of contaminants in sterile and non-sterile Products, Microbiological standards of non-sterile products, Equilibrium related to humidity (ERH) in microbiological testing. [08]

Unit-V:
Microbial assays as per I.P. of antibiotics and vitamins. [08]

PHR-505P

PHARMACEUTICAL MICROBIOLOGY

PRACTICAL


BOOKS RECOMMENDED:
2. Malathi, Manual of Practical Microbiology,PharMAmED Press, Hyderabad
3. Tortora, Microbiology An Introduction, 9TH Ed, Pearson education
PHARmaceutical Biotechnology

Unit-I: Immunology and Immunological Preparations:
Principles, Antigen and haptns, immune system, Cellular, and humoral immunity, immunological tolerance, antigen-antibody reactions and their applications, standardization and storage of BCG. Complementary system, Immunological disorder, Hypersensitivity reaction, Immunosuppression, Autoimmune disorders, immunodeficiency disorders

Unit-II: Genetic Recombination
Genetic Code and inhibition of protein synthesis. Regulation of gene expression (Prokaryote and Eukaryote) 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 Human Insulin, Somatotropin, Streptokinase, Urokinase. Isolation and uses of mutants and factors affecting mutation and genetic analysis of mutants

Unit-III:
Microbial Transformation:
Introduction, types of reactions mediated by microorganisms, Design of Bio-transformation process, selection of organisms, biotransformation processes and its improvements with special reference to steroids

Unit-IV:
Enzyme immobilization:
Techniques of immobilization of enzymes, factors affecting enzyme kinetics, multistep immobilized enzyme system. Application and future of enzyme engineering

Unit-V:
Antibiotics:
Historical development of antibiotics, Screening of soil for organisms producing antibiotics Antimicrobial spectrum and methods used for their standardization. Fermentor, its design and control of different parameters

BOOKS RECOMMENDED:
3. Thieeman, introduction to biotechnology, Pearson education.
5. Crueger W. & Crueger A, Biotechnology-A Textbook of Industrial Microbiology,
7. IP (Latest edition)
8. BP (Latest edition)
9. USP (Latest edition)

**PHR-602**

**PHARMACEUTICS-VII**

(PHARMACEUTICAL TECHNOLOGY - II)

**Unit-I: Tablets:** (A) Formulation of different types of tablets, granulation technology on large-scale by various techniques, physics of tablets making, machinery and tooling and the equipments employed, evaluation of tablets including stability testing as per ICH guidelines.  
(B) **Coating of Tablets:** Types of coating, film forming materials, formulation of coating solution, equipments for coating process, evaluation of coated tablet.  

**Unit-II: 1. Capsules:** Introduction to capsules as a dosage form, hard and soft gelatin capsules, formulation and evaluation, machinery, packaging, stability testing and storage.  
2. **Micro-encapsulation:** Types of microcapsule, importance of micro-encapsulation in pharmacy, micro-encapsulation techniques, evaluation of micro capsules.  

**Unit-III: (A)** Approaches to Sustained and controlled release dosage forms. In-vitro methods of evaluation.  

**Unit-IV: Parenteral Products:** Preformulation factors, routes of administration, water for injection, pyrogenicity, nonaqueous vehicles. Formulation and evaluation, equipments, containers and closures and their selection.  

**Unit-V:**  
(A) Sterile products (ISI/ BS specification)  
(B) Formulation and evaluation of Ophthalmic, Nasal and Ear products.  

**PHR-602P**

**PHARMACEUTICS-VII**

(PHARMACEUTICAL TECHNOLOGY - II)

**PRACTICAL**

1. Experiments to illustrate preparation, stabilization and evaluation of pharmaceutical products as per the theory syllabus  
2. Evaluation of Materials used in pharmaceutical packaging (ISI/ BS specification)

**BOOKS RECOMMENDED**

3. H.C. Ansel, Introduction to Pharmaceutical Dosage Forms, Lippincott William Wilkins  
4. Herbert A. Lieberman & Leon Lachman, Theory & Practice of Industrial Pharmacy,  
5. Manohar A.Potdar,’ CGMP for Pharmaceuticals”.PharmaMed Press,Hyderabad
6. Augsburger Larry L. "Pharmaceutical Dosage Forms: tablets"
   3rd edition Informa healthcare
7. IP (Latest edition)
8. BP (Latest edition)
9. USP (Latest edition)
10. Tutorial Pharmacy by Cooper and Gunn, CBS Publisher do
11. Senger, A primer on dosage form design, PharmaMed Press, Hyd,

**PHR –603**

**PHARMACEUTICAL CHEMISTRY-VII**
(MEDICINAL CHEMISTRY - II)

**Unit-I: Drug Design**
Basic concept of drug design, Introduction to Analogues based drug design, Structure based drug design, and Introduction to QSAR & Computer aided drug design. [08]

**Unit- II Mode of action, uses, SAR of the following classes of drugs included in latest edition of pharmacopoeia (synthetic procedures and assay of individually mentioned drugs only)**
Cardiac glycosides & drug used for CHF- Digitoxin
Antiarrhythmic drugs- Propranolol, Procainamide
Antianginal drugs- Isosorbide mononitrate
Antihypertensive drugs- Captopril, methyldopa, Nifedipine. [08]
Anticoagulants- Heparin, warfarin
Antihyperlipidemics- Lovastatin, Clofibrate

**Unit-III**
Antispasmodic and Antiulcer drugs- Dicyclomine, Ranitidine, Omeprazole.
Antitussives- Dextromethorphen.

**Unit-IV: Analgesics and Antipyretics** – Aspirin, Mefanamic Acid, Ibuprofen, Diclofenac, Paracetamol [08]

**Unit-V: Diuretics** – Acetazolamide, Chlorthiazide; Furosemide, Spironolactone. [08]

**PHR-603P**

**PHARMACEUTICAL CHEMISTRY - VII**
(MEDICINAL CHEMISTRY-II)

**PRACTICAL**
1. Synthesis of atleast five selected drugs from the course content involving two or more steps.
2. Establishing the pharmacopoeial standards of the drugs synthesized.
3. Simple experiment demonstrating microwave assisted synthesis

**BOOKS RECOMMENDED:**
4. Shri ram./ Yogeeswari, medicinal chemistry, 2nd. Ed, Pearson education
6. Korolkovas, Essentials of medicinal chemistry, Wiley India
7. 8. Wermuth C G. The practice of Medicinal Chemistry-III, Academic press an imprint
of Elsevier
9 Pharmacopoeia of India 2010, Ministry of Health, Govt. of India.
12. Latest edition of B.P.

**PHR-604**

**PHARMACOLOGY-II**

**Unit-I:**
**Pharmacology of CVS:** Cardiac glycosides, Antihypertensive drugs, Antianginal drugs, Antiarrhythmics, Antihyperlipidemics

**Unit-II:**
**Drugs Acting on Haemopoietic System**
Haematinics, Vit. K & anticoagulants, Fibrinolytics & antiplatelet drugs, Plasma Volume expanders

**Drugs Acting on Respiratory System**
Anti-asthmatic drugs, Anti-tussives & Expectorants, Respiratory Stimulants

**Unit-III: NSAIDS & Anti-gout Drugs. Diuretics**

**Unit-IV: Autocoids:** Histamine, 5HT and their antagonists, Prostaglandins, Thromboxane, Leukotrienes, Angiotensin and Bradykinin

**Unit-V: Drugs acting on GIT**
Antacids and Antiulcer drugs, Laxatives and anti diarrhoeal Agents, Emetics and antiemetics

**PHR-604P**

**PHARMACOLOGY-II**

**PRACTICAL**

1. Relevant experiments based on theory syllabus

**BOOKS RECOMMENDED:**
3. Laurence, DR & Bannet PN; Clinical Pharmacology, Churchill Livingstone.
4. Rang MP, Date MM, Riter JM, Pharmacology Churchill Livingstone.
8. Turner, Screening methods in pharamacology, PharmaMed Press, Hyderabad
PHR–605

PHARMACOGNOSY – III

Unit-I: (A) Study of the biological sources, Commercial varieties cultivation, collection adulterants, uses, diagnostic macroscopic and microscopic features and chemical constituents, substitutes and specific chemical tests of following groups of drugs containing.

Glycosides:
1. Saponins: Liquorice, Ginseng, Dioscorea, Coleus species. [04]
2. Cardioactive sterols: Digitalis, Squill, & Thevetia [03]
3. Anthraquinone Cathartics: Aloe, Senna, Rhubarb & Cascara. [03]

Unit-II: Others: Psoralea, majus, Ammi visnaga, Gentian, Saffron, Quassia and Andrographis paniculata. [03]

(B) Production and Utilization of phytoconstituents such as calcium sennsoides, Diosgenin, Solasodine & Podophyllotoxins [03]

Unit- III: Studies on traditional drugs: Common Vernacular name, Biological sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and toxicological activity of marketed formulations of following indigenous drugs: Amla, Kantkari, Satavari, Bhilwa, Vach, Rasna. [08]

Unit- IV: Punarnava, Chitrak, Apamarg, Gokhru, Shankhpushpi, Brahmi, Methi, Lehsun, Guggul, Gymnema, Shilajit, Tulsi and Neem. [08]

Unit-V: Brief Introduction and principles of Ayurvedic, Unani, Siddha and Homeopathic systems of medicines. Introduction to Herbal Pharmacopoeia, study of Arishtas, Asavas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas. [08]

PHR-605 P

PHARMACOGNOSY - III

PRACTICAL 11

1. Identification of at least 10 crude drugs mentioned in theory
2. Powder microscopic study of at least 5 drugs
3. Evaluation and standardization of at least 3 marketed Ayurvedic formulations

BOOKS RECOMMENDED:
10. Indian Ayurvedic Pharmacopoeia, Govt. of India.
11. Kokate CK, Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Prakashan
12. Indian Pharmacopoeia.
15. Harborne J.B.- “Phytochemical methods” Springer International
16. WHO guidelines
17. BP (Latest edition)
18. Standard botanicals by P. Mukharejee

**PHR-606P**

**PROFESSIONAL COMMUNICATION-II**

**Unit-I**
1. Written skills:
   - Proposal writings format
   - Report writings
   - Business letters
   - Applications
   - Covering letters
   - Curriculum Vitae Designing

**Unit-II**
2. Productivity, Time Management simulation exercise
3. Leadership Skills.
4. Team work ‘BSC’ – Boss, Subordinates & Colleagues

**Unit-III**
5. Group Discussions (G.D)
   - Tips
   - GD

**Unit-IV**
6. Corporate behaviors, corporate expectation, office etiquettes.
7. Extempore

**Unit-V**
8. Interview Tips:-
   - What student is supposed to do before the interview, during the interview, after the interview & on the day of interview.
   - Various questions that may be asked in an interview.
   - Model interview (Video-shooting & displaying optional)
9. Exit Interview

**BOOKS RECOMMENDED:**
1. Eliah, A handbook of English for professional, BS Publications, Hyderabad
2. Rubi Gupta, Basic technical communication, Foundation/BookWorld, Dehradun
4. Disanza, Business an professional communications, Pearson education.