

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., Act. No. 30 of 2008)
ANANTHAPURAMU – 515 002 (A.P.) INDIA.

Course Structure for B.Pharmacy-R15 Regulations

B.Pharmacy

B.Pharm III-I Semester

S. No.	Course Code	Subject	L	T	P	C
1.	15R00501	Medicinal Chemistry-I	3	1	-	3
2.	15R00502	Pharmacology-I	3	1	-	3
3.	15R00503	Pharmaceutical Technology-II	3	1	-	3
4.	15R00504	Pharmaceutical Biotechnology	3	1	-	3
5.	15R00505	MOOCS - I (Application of spectroscopic methods in molecular structure Determination) / Conventional/ Self study	3	1	-	3
6.	15R00506	Medicinal Chemistry-I Laboratory	-	-	4	2
7.	15R00507	Pharmacology-I Laboratory	-	-	4	2
8.	15R00508	Pharmaceutical Technology-II Laboratory		-	4	2
9.	15R00509	Pharmaceutical Biotechnology Laboratory	-	-	4	2
10.	15A99501	Audit course –Social Values & Ethics	2	0	2	
Total:			17	5	18	23

Note: MOOC-I- NPTEL (<http://nptel.ac.in>) Chemistry & Biochemistry and Biotechnology

B.Pharm III-II Semester

S. No.	Course Code	Subject	L	T	P	C
1.	15R00601	Pharmacology-II	3	1	-	3
2.	15R00602	Pharmaceutical Analysis-II	3	1	-	3
3.	15R00603	Biopharmaceutics & Pharmacokinetics	3	1	-	3
4.	15R00604	Pharmaceutical Jurisprudence	3	1	-	3
5.	15R00605 15R00606 15R00607	CBCC-I 1. Pharmacy Administration 2. Clinical Trials 3. Cosmetic Technology	3	1	-	3
6.	15R00608	Pharmacology-II Laboratory	-	-	4	2
7.	15R00609	Pharmaceutical Analysis-II Laboratory	-	-	4	2
8.	15R00610	Biopharmaceutics & Pharmacokinetics Laboratory		-	4	2
9.	15A52602	Advanced English Language Communication Skills (AELCS) Laboratory (Audit Course)	-	-	2	-
10.	15R00611	Comprehensive Online Exam - II	-	-	-	1
Total:			15	5	16	22

B.Pharm IV-I Semester

S. No.	Course Code	Subject	L	T	P	C
1.	15R00701	Novel Drug Delivery Systems	3	1	-	3
2.	15R00702	Pharmacology -III	3	1	-	3
3.	15R00703	Clinical and Hospital Pharmacy	3	1	-	3
4.	15R00704	Medicinal Chemistry-II	3	1	-	3
5.	15R00705 15R00706 15R00707	CBCC-II 1.Chemistry of Natural Products 2. Computer Aided Drug Design 3. Pharmacovigilance.	3	1	-	3
6.	15R00708	Novel Drug Delivery Systems Laboratory	-	-	4	2
7.	15R00709	Clinical and Hospital Pharmacy Laboratory	-	-	4	2
8.	15R00710	Medicinal Chemistry-II Laboratory		-	4	2
Total:			15	5	12	21

B.Pharm IV-II Semester

S. No.	Course Code	Subject	L	T	P	C
1.	15R00801	MOOCS -II (Biostatistics and Design of Experiments) / Conventional/ Self study	3	1	-	3
2.	15R00802	MOOCS - III (Intellectual Property Rights) / / Conventional/ Self study	3	1	-	3
3.	15R00803	Comprehensive viva voice	-	-	4	2
4.	15R00804	Technical Seminar	-	-	4	2
5.	15R00805	Project Work	-	-	24	13
Total:			06	02	32	23

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	MEDICINAL CHEMISTRY – I	Code	15R00501
Course year	B. Pharm III year	Semester	I
Theory	3 hrs/week	Tutorial	1 hr / week
End Exam	70 Marks	Internal marks	30 Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn medicinal chemistry information about the drugs. In this subject student will be able to understand the properties and its biological activity of the drugs.

Objectives: Upon completion of the subject student shall be able to

1. Understand various drugs structure, their properties and biological activities.
2. Correlate and apply the knowledge.
3. Influence of chemical structure on biological activities.

Outcomes:

1. Acquire skill in the structure of drugs and their biological activities.
2. Acquire the knowledge of synthesis of chemical compounds.
3. Assay of some official compounds.

UNIT I

Physico chemical properties of drug molecules in relation to biological activity –

Solubility, partition-coefficient, Ionization, hydrogen bonding, Chelation, redox potential and surface activity, Bioisosterism and steric features of drugs, drug distribution and protein binding. Types of receptor and its relation with biological activity.

Enzyme stimulation, Enzyme inhibition. Theories of drug action (Ferguson's, Dale's, perturbation and occupation). Drug metabolism: Introduction to Biotransformation, concept of soft and hard drug, phase I & II (With one drug example). Introduction, basic concepts and clinical importance of Prodrug.

UNIT II

Drugs acting on ANS

Adrenergic and antiadrenergic agents: **Adrenergic agonist:** Chemistry and metabolism of neurotransmitters, Dopamine, Ephedrine*, Isoprenaline*, Oxymetazoline*, Salbutamol, **Adrenergic antagonist:** Classification, Phenoxybenzamine*, Prazosin*, Propranolol, Atenolol, Metoprolol. SAR Sympathomimetics (Catecholamines)

Cholinergic and anti-cholinergic agents: Cholinergic receptor and neuro chemistry and concept of neuromuscular blocking agents. Succinylcholine*, pilocarpine,

Physostigmine, Malathion, Pralidoxime, Nicotine, Dicyclomine*, Biperiden*. SAR- Cholinergic agonists, Anti-cholinergics, Neuro muscular blockers.

UNIT III

Drugs acting on CNS

Depressants and Central dopaminergic signalling agents

Anxiolytics, Sedatives and Hypnotics: Benzodiazepines (Diazepam*, Oxazepam, Midazolam, Alprazolam), Barbiturates (Phenobarbital*), Glutethimide*, Meprobamate*, SAR- Benzodiazepines, Barbiturates.

Anti-Psychotics: Phenothiazines (Chlorpromazine*, Thioridazine), thioxanthines (Thiothixene*), Butyrophenones (Haloperidol*, Droperidol), Miscellaneous- Lithium salts, Clozapine and Olanzapine. SAR- Phenothiazines, Butyrophenones.

Anti-convulsants: Phenytoin*, Valproic acid, Carbamazepine*, Ethosuximide. SAR- Hydantoins, Oxazolidinediones, Succinimides.

Anti-parkinsonism: Levodopa*-Carbidopa, Amantidine*, Selegiline, Apomorphine, Ropinirole, Entacapone, Tolcapone.

UNIT IV

Analeptics: Picrotoxin, Doxapram*, Methyl xanthines (Caffeine, Theophylline, Theobromine) Psychomotorstimulant: Dextro amphetamine*, Methamphetamine, Phenfluramine, Sibutramine, Methylphenidate.

Anti-depressants: Types, Phenelzine, Tranylcypromine*, Tricyclic anti-depressants: Imipramine*, Desipramine, Fluoxetine*, Newer agents: Venlafaxine, Bupropion. SAR- Tricyclic antidepressants, MAOIs.

Miscellaneous: Psilocybin, Dimethyltryptamine, Mescaline, Lysergic acid and Tetrahydrocannabinol.

UNIT V

Anaesthetics:

General anaesthetics: Chemical classification, Inhaled and Injectable, Meyer-Overton theory, Halothane*, Propofol, Ketamine, Thiopental sodium*.

Local anaesthetics: Cocaine, Lignocaine*. Adjuvant to local anaesthetics. SAR- Esters and amides.

NOTE: Introduction, definition, chemical classification with structure, nomenclature, synthesis (only for *marked drugs), mechanism of action, SAR including stereo chemical aspects, metabolites (including its ADR) and therapeutic uses of the following classes of drugs from UNIT II to UNIT V.

Text Books:

1. William O. Foye, *Textbook of Medicinal Chemistry*, Lea Febiger, Philadelphia.
2. JH Block & JM Beale (Eds), *Wilson & Giswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry*, 11th Ed, Lipcolt, Raven, Philadelphia, 2004

Reference Books:

1. Hansch, *Comprehensive medicinal chemistry*, Vol 1 – 6 Elsevier pergmon press, Oxford
2. D. Abraham (Ed), *Burger Medicinal chemistry ad Drug discovery*, Vol. 1 & 2. John Wiley & Sons, New York 2003, 6th Ed.
3. M. Atherden, Bentley and Driver's *Textbook of Pharmaceutical Chemistry* Ed: I. Oxford University Press, Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACOLOGY – I	Code	15R00502
Course Year	B.Pharmacy III year	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope:

This subject provides an insight to know the class and mode of action of drugs, their unwanted effects and therapeutic actions.

Objectives: Upon completion of the subject student shall be able to

1. Understand various pharmacological aspects like pharmacokinetics, side effects, drug interactions, contraindications and indications of drugs falling under below mentioned chapters.
2. Correlate and apply the knowledge.

Outcomes:

1. Acquire the knowledge in basic mechanism of action of drugs.
2. Therapeutic uses of drugs of the following chapters.

UNIT I**General Pharmacology:****a. Introduction**

Definition, historical development and scope of pharmacology. Sources of drugs and routes of administration. Principles of discovery and development of new drugs, phases of clinical trials.

b. Pharmacodynamics

Mechanism of action with special emphasis on receptors, drug-receptor interaction theories, factors modifying drug action.

c. Pharmacokinetics

Drug absorption, distribution, metabolism and excretion. Factors affecting/modifying Pharmacokinetic parameters.

UNIT II**Pharmacology of Peripheral Nervous System**

- a. Neurohumoral transmission (autonomic and somatic), cholinergic receptors and adrenergic receptors.
- b. Parasympathomimetics, parasympatholytics, sympathomimetics and sympatholytics.
- c. Ganglionic stimulants and blocking agents.
- d. Neuromuscular blocking agents and local anesthetic agents.

UNIT III**Pharmacology of Central Nervous System: I**

- a. Neurohumoral transmission in the C.N.S with special emphasis on dopamine, GABA and 5-HT neurotransmission.
- b. General anesthetics, sleep cycle, sedatives, hypnotics and anti-anxiety agents.
- c. CNS stimulants and centrally acting muscle relaxants.
- d. Alcohols and disulfiram. Drug addiction, abuse, tolerance and dependence.

UNIT IV**Pharmacology of Central Nervous System: II**

- a. Pharmacology of drugs used in affective/mood disorders like depression and mania and behavioral disorders like psychosis.
- b. Pharmacology of drugs used in neurodegenerative disorders like Parkinsonism and Alzheimer's disease.
- c. Pharmacology of drugs used in epilepsy

UNIT V

- a. Analgesics, Antipyretics, and Anti-inflammatory drugs.
- b. Narcotic analgesics and antagonists.

Text Books:

1. H.P Rang, M. M. Dale & J.M. Ritter, Pharmacology, Churchill Livingstone, 4th Ed.
2. J.G. Hardman and Lee E. Limbird, Goodman & Gilman, The Pharmacological basis of therapeutics, McGraw-Hill, Health Professions Division.

Reference Books

1. Bertram. G. Katzung, Basic and clinical pharmacology, 9th Edn; Prentice Hall International
2. Sathoskar, Pharmacology and pharmacotherapeutics Vol. 1 & 2, Published by Popular Prakashan, Mumbai.
3. Tripathi, Essentials of Medical Pharmacology, Jaypee Brothers, Latest Edition

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACEUTICAL TECHNOLOGY –II	Code	15R00503
Course Year	B.Pharmacy III year	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn about the formulation, evaluation and manufacturing of various types of tablets, capsules and also provide insights about aseptic area and parenteral.

Objectives: Upon completion of the subject student shall be able to

1. Understand various formulation aspects of tablets and capsules and also provide knowledge about selection of excipients in the preparation of same.
2. Provide knowledge on packaging materials used in pharmaceutical products.

Outcomes:

1. Acquire skill in preparation of different types of tablets.
2. Demonstrate the handling of equipment for evaluation of various dosage forms.
3. Acquire the knowledge of processing of dosage form on large scale that suit pharma industry.
- 4.

UNIT I

Tablets: Introduction to different types of tablets, Formulation of tablets, direct compression, Granulation technology on large-scale by various techniques and equipments. Tablet processing problems and their remedy. Types of tablet compression machinery and the equipments employed and evaluation of tablets.

Coating of Tablets: Types of coating, coating materials and their selection, formulation of coating solution, equipment for coating, coating processes, evaluation of coated tablets. Tablet coating defects and their remedy.

UNIT II

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

UNIT III

Microencapsulation: Types of microencapsulation and importance of microencapsulation in

Pharmacy, microcapsulation by coacervation phase separation, multi orifice centrifugal separation. Spray drying, spray congealing, polymerization complex emulsion, air suspension technique, and pancoating techniques, evaluation of microcapsules.

UNIT IV**Parenteral Products**

- a. Preformulation factors, routes of administration, water for injection, treatment of apyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment.
- b. Formulation details, containers, closures and their selection.
- c. Prefilling treatment, washing and sterilization of containers and closures, preparation of solutions and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large-scale manufacture and evaluation of parenteral products.
- d. Aseptic techniques, sources of contamination and methods of prevention. Design of aseptic area, laminar flow benches, Environmental control monitoring.

UNIT V**Packaging of Pharmaceutical products:**

Packaging components, types, specifications and methods of evaluation as per I.P. Factors influencing choice of containers, package testing, legal and other official requirements for containers, package testing. Methods of packing of solid, liquid and semi-solid dosage forms, Factors influencing packaging material, stability aspects of packaging.

Text Books:

1. L. Lachman, H.A. Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy, Lea & Febiger, Philadelphia Latest Edn.
2. L. V. Allen Jr., N. G. Popovich, H. C. Ansel. Ansel's pharmaceutical dosage forms and drug delivery systems. Lippincott Williams & Wilkins, 2005.

Reference Books:

1. M. E. Aulton Pharmaceutics. The science of dosage form design. - 2nd ed. Churchill-Livingstone, 2002
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
3. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, Elbs publ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACEUTICAL BIOTECHNOLOGY	Code	15R00504
Course Year	B.Pharmacy III year	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: To study the Fermentation, Recombinant and Enzyme Technology

Objective: To know the various technologies types, design, preparation and operation

Outcome: The Student has to know the Application of below mentioned technologies and uses of immunological preparations.

UNIT I

Fermentation Technology: Isolation, Selection, Screening of Industrially important microbes, Strain improvement. Types, design & operation of Bioreactor. Types of fermentations, optimization of fermentation process, Principle and Procedure involving in downstream process and effluent treatment. **Specific Fermentations:** Selection of organism, fermentation & purification of antibiotics (penicillin, streptomycin, tetracycline, and erythromycin), vitamins (riboflavin and cyanocobalamine), lactic acid, alcohol and acetone.

UNIT II

Recombinant DNA Technology: Introduction to r-DNA technology and genetic engineering, steps involved in isolation of enzymes, vectors, recombination and cloning of genes. Production of bio technology derived therapeutic proteins like humulin, humatrop, activase, intron a, monoclonal antibodies by hybridoma technique, recombinax HB (hepatitis b). Stem cells and their applications.

UNIT III

Immunology & Immunological Preparations: Principles of Immunity, Humoral immunity, cell mediated immunity, antigen – antibody reactions, hypersensitivity and its applications. Active & passive immunizations vaccine preparation, standardization & storage of BCG, cholera, smallpox, polio, typhus, tetanus toxoid, immuno serum & diagnostic agents.

UNIT IV

Enzyme Technology: Techniques of immobilization of enzymes, factors affecting enzyme kinetics, advantages of immobilization over isolated enzymes. Study of

enzymes such as hyaluronidase, penicillinase, streptokinase, streptodornase, amylase, protease etc. immobilization of bacteria & plant cells.

UNIT V

Introductory study & applications of bioinformatics, proteomics and genomics, Nanobiotechnology, Gene therapy.

Text Books:

1. Wulf Crueger and Anneliese Crueger, Biotechnology, 2 nd Ed, Publ- Panima publication cooperation, New Delhi.
2. P. F. Stanbury & A. Whitaker, Principles of fermentation technology, Pergamon Press. J. D. Watson, Recombinant DNA technology. 2 nd Edition, W.H. Freeman1992.
3. S.P.Vyas and Dixit, Pharmaceutical Biotechnology, CBS Publishers New Delhi.

Reference Books:

1. Prescott and Dunne, "Industrial Microbiology" MC Graw Hill Book Company.
2. K. Kielslich "Biotechnology" Vol 6, Verlagchemic, Switzerland.
3. PF Standury& A. Whitaker, "Principles of fermentation Technology" Pergamon Press, Oxford. Wiseman, Handbook of enzyme biotechnology. A. 3rdEdition Elis Horwood.
4. Alexande M Moo-young, Comprehensive Biotechnology, Pergamon Press, New York.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	(MOOCS-I) APPLICATION OF SPECTROSCOPIC METHODS IN MOLECULAR STRUCTURE DETERMINATION	Code	15R00505
Course Year	B.Pharmacy III year	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30 Marks
Credits	3		

Objectives:

1. Introduction, Modern approaches in Bioanalysis and Bioassays.
2. Spectroscopic techniques: UV-Visible spectroscopy, Fluorescence spectroscopy, IR spectroscopy, CD spectroscopy, and Mass spectroscopy.

Out comes:

1. Chemists are molecule makers; whenever a new molecule is synthesized it is essential to determine its structure using spectroscopic techniques.
2. This course is all about practical applications of spectroscopic methods for the determination of organic molecules.

UNIT-I

UV-Vis spectroscopy - Electronic transitions in organic molecules, selection rules, application of Beer Lambert law, qualitative and quantitative analysis by UV-Vis spectroscopy.

UNIT-II**Electrophoresis Techniques**

Electrophoresis; Principle, Design of horizontal and vertical gel electrophoresis apparatus, performing electrophoresis techniques, application of electrophoresis in analyzing macromolecules.

UNIT-III

NMR spectroscopy – Nuclear magnetic resonance spectroscopy (NMR), spin $\frac{1}{2}$ nuclei, ^1H and ^{13}C -NMR spectroscopy. Chemical shifts, spin-spin coupling, spin-spin splitting pattern recognition for structure elucidation, coupling constants.

UNIT-IV

Mass Spectrometry – various ionization methods – EI, CI, ESI and MALDI methods, fragmentation patterns of simple organic molecules, Use of HRMS. Infra-red spectroscopy – basic concepts, experimental methods, functional group analysis and identification using IR spectroscopy, structural effects on vibrational frequency.

UNIT-V**Introduction & Bioanalytical Spectroscopic techniques**

Introduction, Modern approaches in Bioanalysis and Bioassays, Spectroscopic techniques: UV-Visible spectroscopy and IR spectroscopy.

Sources: NPTEL

1. <http://nptel.iitm.ac.in> Biotechnology (Bioanalytical Techniques and Bioinformatics)
2. <http://nptel.ac.in> Chemistry and Biochemistry (Application of Spectroscopic methods in molecular structure determination)

Text Books

1. Spectroscopy, D. L. Pavia, G. M. Lampman, G. S. Kriz, J. R. Vyvyan, Cengage Learning (Indian Edition), 2007.
2. Organic Spectroscopy, William Kemp, 3rd Edition, 1991, Macmillan (Indian Edition).
3. NMR Spectroscopy, H. Gnther, second edition, John Wiley and sons, 1998

References:

1. GA. Manz, N. Pamme and D. Iossifidis, Bioanalytical Chemistry, World Scientific Publishing Company, 2004
2. Baxevanis, B. F. F. Ouellette, Bioinformatics -A practical Guide to the analysis of Genes and Proteins, 2nd Ed, John Wiley and Sons Inc., 2001.
3. T. Lengauer; Bioinformatics - From Genomes to Drugs, Vols 1 & 2, Wiley-VCH, 2002.
4. Live Cell Imaging: A Laboratory Manual R. D. Goldman, J. R. Swedlow and D. L. Spector Cold Spring.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	MEDICINAL CHEMISTRY – I LABORATORY	Code	15R00506
Course year	B. Pharm III year	Semester	I
Practical	4hrs/week	Tutorial	Nil
End Exam	70Marks	Internal marks	30Marks
Credits	2		

Scope: This subject will provide an opportunity for the student on synthesis of various compounds.

Objectives: Upon completion of the subject student shall be able to

- Synthesis various chemical compounds.
- Provide knowledge on monograph analysis of some chemical compounds.

Outcomes:

- Acquire skills in synthesis various chemical compounds.
- Demonstrate of stereo models of some drugs relevant to theory.
- Acquire skills of extraction of drugs from different dosage forms.

I. EXPERIMENTS

- Synthesis of Barbituric acid from Diethyl Malonate
 - Synthesis of Phenyton from Benzoin or Benzil
 - Synthesis of Diphenyl quinoxaline from o-phenylene diamine and benzil
 - Synthesis of phenothiazine from o-phenylene diamine
 - Synthesis of Benzocaine from Para amino benzoic acid
 - Synthesis of Dibromo succinic acid from malic acid
 - Synthesis of Benzoxazine from Anthranilic acid
 - Monograph analysis of Caffeine
 - Monograph analysis of Phenytoin
 - Monograph analysis of Barbituric acid
 - Monograph analysis of Benzocaine
 - Monograph analysis of carbamazepine citrate
- (Literature, Journal reported lead compounds synthesis relevant to theory can also be Included)

II Demo/Workshop

- Stereo models of some drugs relevant to theory.
- Extraction of drugs from different dosage forms

III Seminar/Assignment/Group discussion

Photochemistry as a green synthetic method, novel methods for the separation of optical isomers, highly selective metalation reactions, QSAR, high throughput screening, combinatorial chemistry, In silico drug design.

References:

1. A.I. Vogel, Text Book of Practical Organic Chemistry, 5th Edition. Pearson Prentice Hall.
2. F.G. Mann & B.C. Saunders, Practical Organic Chemistry, 4th Edition. Pearson Publishers.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Water bath
2. Suction pumps
3. Analytical/physical balance
4. Triple beam balance
5. Reflux flask with condenser
6. Hot plates
7. Refrigerator
8. Mechanical and magnetic stirrer with thermostat
9. Distillation unit
10. Oven
11. Adequate glass wares

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACOLOGY – I LABORATORY	Code	15R00507
Course Year	B.Pharmacy III year	Sem	I
Practical	4hrs/week	Tutorial	NIL
End exam	70 Marks	Internal exam	30 Marks
Credits	2		

Scope:

- To find out the agents suitable for clinical use.
- Study the toxicity and mechanism of Action and Site of action
- Study the actions of drugs in Preclinical

Objectives:

To know and understand pharmacological investigation techniques applied in the research

Outcomes:

- Knows to administration of drugs to experiments rats by various routes.
- Have insight fundamental difference between agonists and antagonists
- Enlightened with basic equipments, anesthetics, lab animals that are to be handled in the pharmacology lab

1.EXPERIMENTAL PART**(To use appropriate softwares for animal experimentation)****1. Introduction to Experimental Pharmacology**

- Preparation of different solutions for experiments.
 - Drug dilutions, use of molar and % w/v solutions in experimental Pharmacology.
 - Common laboratory animals and anaesthetics used in animal studies.
 - Commonly used instruments in experimental pharmacology.
 - Different routes of administration in animals
 - Collection of blood samples from animals
2. Study the effect of autonomic drugs on rabbit's eye
 3. Record the concentration response curve (CRC) of acetylcholine using rectus abdominus muscle preparation of frog.
 4. Record the CRC of 5-HT on rat fundus preparation.
 5. Record the CRC of histamine on guinea pig ileum preparation.

6. To study the inotropic and chronotropic effects of drugs on isolated frog heart.
7. To study the effects of various agonists and antagonists and their characterisation using isolated preparations like frog's rectus abdominus muscle and isolated ileum preparation of rat & guinea pig.

II. DEMO/ WORK SHOP

Arterial and venous cannulations, organ isolation and its application in research.

III. SEMINAR/ ASSIGNMENT/ GROUP DISCUSSION

1. Isolation, characterization and nomenclature of receptors.
2. Metabolic disorders and their complications
3. Novel targets for the treatment of various disorders

References:

1. Practicals in pharmacology By Dr.R.K.Goyal
2. Handbook of experimental pharmacology By S.K.Kulakarni
3. Experimental pharmacology By M.N.Ghosh
4. EXPO – Experimental pharmacology software.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACEUTICAL TECHNOLOGY – II LABORATORY	Code	15R00508
Course Year	B.Pharmacy III year	Sem	I
Practical	4hrs/week	Tutorial	NIL
End exam	70 Marks	Internal exam	30 Marks
Credits	2		

Scope: This subject will provide an opportunity for the student to learn manufacturing of dosage forms such as tablets, capsules and parenteral.

Objectives: Upon completion of the subject student shall be able to

- Manufacture the various types of tablets.
- Evaluate the finished pharmaceutical products.

Outcomes:

1. Acquire skills in manufacture the various types of tablets.
2. Learn how to evaluate the tablets.
3. Acquire skills of manufacturing and evaluation of parental dosage forms.

I. EXPERIMENTS:

1. Manufacturing of tablets:

- a. Ordinary compressed tablets by wet granulation.
- b. Tablets prepared by direct compression
- c. Soluble tablets/dispersible granules
- d. Chewable tablets
- e. Effervescent tablets.

2. Evaluation of tablets (Weight variation, hardness, friability, disintegration and dissolution)

3. Formulation and filling of hard gelatin capsules.

4. Parenteral:

- a. Manufacturing of parenterals (Ampoule sealing (Pull sealing and tip sealing)
- b. Evaluation of parenterals (Clarity test, and leaking test).

II. DEMO/ WORKSHOP

Coating of tablets (sugar/film/enteric)

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION

1. Advances in granulation technology.
2. Multifunctional excipients.
3. Excipients and their commercial names.

Text Books:

1. L. Lachman, H.A. Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy, Lea &Febieger, Philadelphia Latest Edn.
2. L. V. Allen Jr., N. G. Popovich, H. C. Ansel. Ansel's pharmaceutical dosage forms and drugdelivery systems. Lippincott Williams & Wilkins, 2005.

Reference Books:

1. M. E. Aulton Pharmaceutics. The science of dosage form design. - 2nd ed. Churchill-Livingstone, 2002
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
3. E.A.Rawlkins, Bentley's Text Book of Pharmaceutics, Elbspubl

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACEUTICAL BIOTECHNOLOGY LABORATORY	Code	15R00509
Course Year	B.Pharmacy III year	Sem	I
Practical	4hrs/week	Tutorial	Nil
End exam	70 Marks	Internal exam	30Marks
Credits	2		

I.EXPERIMENTS:

1. Isolation of antibiotic producing microorganism from soil.
2. Enzyme immobilization by Ca-alginate method.
3. Determination of minimum inhibitory concentration of the given antibiotic.
4. Standardization of Cultures.
5. Microbiological assay of Antibiotics / Vitamins.
6. Production of alcohol by fermentation techniques.
7. Comparison of efficacy of immobilized cells.
8. Isolation of mutants by gradient plate technique.
9. Preparation of bacterial vaccine.
10. Preparation of blood products / Human normal immunoglobulin injection
11. Extraction of DNA and RNA and their estimations by colorimetry.
12. Separation techniques: Various types of Gel Electro Phoresis, Centrifugation.

II.DEMO/WORKSHOP:

Production of Antibiotics by Fermentation, Development of a Simple Biosensor.

III.ASSIGNEMENT/SEMINAR/GROUP DISCUSSION:

Monoclonal antibodies and Diagnosis, New Drug Targets and Vaccine Development, Stem cells and their applications.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Micropipettes
2. Eppendorf's tubes
3. Ultra centrifuge
4. Dessicators
5. Gel electrophoresis unit
6. Small scale bioreactor
7. Syringes
8. laminar flow bench
9. Autoclave

10. Hot air oven
11. BOD incubator
12. Rotary shaker
13. Anerobic jar
14. Colorimeter
15. Adequate glassware

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Pharmacy III-I Sem.

L	T	P	C
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15A99501 SOCIAL VALUES & ETHICS (AUDIT COURSE)

*(Common to all Branches)***UNIT - I**

Introduction and Basic Concepts of Society: Family and Society: Concept of family, community, PRIs and other community based organizations and society, growing up in the family – dynamics and impact, Human values, Gender Justice.

Channels of Youth Moments for National Building: NSS & NCC: History, philosophy, aims & objectives; Emblems, flags, mottos, songs, badge etc.; Organizational structure, roles and responsibilities of various NSS functionaries. **Nehru Yuva Kendra (NYK):** Activities – Socio Cultural and Sports.

UNIT – II

Activities of NSS, NCC, NYK:

Citizenship: Basic Features Constitution of India, Fundamental Rights and Fundamental Duties, Human Rights, Consumer awareness and the legal rights of the consumer, RTI.

Youth and Crime: Sociological and psychological Factors influencing youth crime, Peer Mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice

Social Harmony and National Integration: Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building.

UNIT – III

Environment Issues: Environment conservation, enrichment and Sustainability, Climate change, Waste management, Natural resource management (Rain water harvesting, energy conservation, waste land development, soil conservations and afforestation).

Health, Hygiene & Sanitation: Definition, needs and scope of health education, Food and Nutrition, Safe drinking water, Sanitation, Swachh Bharat Abhiyan.

Disaster Management: Introduction to Disaster Management, classification of disasters, Role of youth in Disaster Management. Home Nursing, First Aid.

Civil/ Self Defense: Civil defense services, aims and objectives of civil defense, Need for self defense training – Teakwondo, Judo, karate etc.,

UNIT – IV

Gender Sensitization: Understanding Gender – Gender inequality – Role of Family, Society and State; Challenges – Declining Sex Ratio – Sexual Harassment – Domestic

Violence; Gender Equality – Initiatives of Government – Schemes, Law; Initiates of NGOs – Awareness, Movements;

UNIT - V

Physical Education : Games & Sports: Health and Recreation – Biological basis of Physical activity – benefits of exercise – Physical, Psychological, Social; Physiology of Muscular Activity, Respiration, Blood Circulation.

Yoga: Basics of Yoga – Yoga Protocol, Postures, Asanas, Pranayama: Introduction of Kriyas, Bandhas and Mudras.

TEXT BOOKS:

1. NSS MANUAL
2. SOCIETY AND ENVIRONMENT: A.S.Chauha, Jain Brothers Publications, 6th Edition,
3. 2006
4. INDIAN SOCIAL PROBLEM: G.R.Madan, Asian Publisher House
5. INDIAN SOCIAL PROBLEM: Ram Ahuja, Rawat Publications
6. HUMAN SOCIETY: Kingsley Davis, Macmillan
7. SOCIETY: Mac Iver D Page, Macmillan
8. SOCIOLOGY – THEMES AND PERSPECTIVES: Michael Honalambos, Oxford University Press
9. CONSTITUTION OF INDIA: D.D.Basu, Lexis Nexis Butterworth Publishers
10. National Youth Policy 2014 (available on www.yas.nic.in)
11. TOWARDS A WORLD OF EQUALS: A.Suneetha, Uma Bhargudanda, Duggirala Vasantha, Rama Melkote, Vasudha Nagraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu
12. LIGHT ON YOGA : B.K.S.Iyengar, Penguin Random House Publishers

www.un.org

www.india.gov.in

www.yas.nic.in

<http://www.who.int/countries/ind/en/>

<http://www.ndma.gov.in>

<http://ayush.gov.in/event/common-yoga-protocol-2016-0>

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACOLOGY – II	Code	15R00601
Course Year	B.Pharmacy III year	Sem	II
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn pharmacological information about the drugs. In this subject drugs acting on cardiovascular system, drugs acting on hematopoietic system, drugs acting on renal system, drugs acting on respiratory system and drugs acting on autacoids will be taught.

Objectives: Upon completion of the subject student shall be able to

- Understand various pharmacological aspects like mechanism of action, pharmacokinetics, side effects, drug interactions, contraindications and indications of drugs falling under below mentioned chapters.
- Correlate and apply the knowledge.
- Handle the animals and carry out the experiments on animals

Outcomes:

- Acquire the knowledge in basic mechanism of action of drugs.
- Therapeutic uses of drugs of the following chapters.

UNIT I**Drugs acting on cardiovascular System**

- Pharmacology of drugs used in hypertension and CHF
- Pharmacology of drugs used in coronary artery diseases (Atherosclerosis, Angina and MI)
- Pharmacology of drugs used in arrhythmias
- Shock and treatment of different types of shock

UNIT II Drugs acting on hematopoietic system

- Coagulants, anticoagulants
- Fibrinolytics, antifibrinolytics, antiplatelet drugs
- Hematinics and plasma expanders

UNIT III**a. Drugs acting on urinary system**

- i) Diuretics and antidiuretics

b. Drugs acting on respiratory system

- i) Antiasthmatics
- ii) Antitussives, expectorants and respiratory stimulants

UNIT IV**Autacoids**

- a. Amine autacoids- Histamine and 5-HT
- b. Lipid derived autacoids-Prostaglandins, thromboxanes and leukotrienes.
- c. Peptide autacoids- Angiotensin, bradykinin

UNIT V**Hormones and hormone antagonists**

- a. Insulin, Oral hypoglycaemics agents
- b. Thyroid and antithyroid drugs
- c. Adrenocortical steroids and their analogues
- d. Uterine stimulants and relaxants

Text Books:

1. H.P Rang, M. M. Dale & J.M. Ritter, Pharmacology, Churchill Livingstone, 4th Ed.
2. J.G. Hardman and Lee E. Limbird, Goodman & Gilman, The Pharmacological basis of therapeutics, McGraw-Hill, Health Professions Division.
3. Illustrated Pharmacology by Lippincott

References:

1. Tripathi, Essentials of Medical Pharmacology, Jaypee Brothers, Latest Edition
2. Satoskar, Pharmacology and pharmacotherapeutics Vol. 1 & 2, Published by Popular Prakashan, Mumbai.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACEUTICAL ANALYSIS- II	Code	15R00602
CourseYear	B.Pharmacy III year	Sem	II
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn about the spectroscopic and chromatographic techniques.

Objective:

- The course is designed to explore the knowledge in modern analytical instrumental techniques i.e., both spectroscopy and chromatography.
- The course helps to assess the process for identification, determination, quantification and purification of a substance and separation of the components of a solution or mixture.

Outcome:

1. To gain knowledge on basic fundamentals of modern analytical instrumental techniques.
2. Analyze the drug structure, identification, purity determination, and quantification of the drug substance.

UNIT I

a) Study of separations, introduction to chromatography, classifications, types, various stationary and mobile phase in the following techniques and their applications in pharmacy (IP 2010 and 2014).

b) **Column chromatography:** Adsorption and partition theory, concept of theoretical plates, HETP, adsorbents used, preparation, procedure and methods of detection.

c) **Paper Chromatography:** Theory, different techniques employed, filter papers used, qualitative and quantitative detection.

e) **Thin layer chromatography:** Principle, 1D and 2D techniques, preparation of plates, R_f, R_x, R_m values and detection techniques. Concept of HPTLC.

f) **Ion Pair Chromatography,** Ion suppression and Ion Exchange Chromatography, Introduction to Theory and Principle, Instrumentation. Advantages and limitations. Pharmaceutical and other Applications.

g) **Size exclusion chromatography:** Introduction, principle, instrument. Column packing, Applications.

UNIT-II

Gas Chromatography: Principle, adsorption isotherm and its relation to tailing and fronting, Instrumentation - carrier gas, flow regulators, injectors columns, detectors. Various parameters used in GC analysis. Brief note on GC-MS.

UNIT III

a) Basic Principles (exothermic and endothermic reactions), Instrumentation and applications of the following: Differential Scanning Colorimetry (DSC), DTA, & TGA in analysis of Pharmaceuticals,

b) Quality Assurance

Concept of Quality control and Quality Assurance, ISO 9000, TQM, QC, Vs QA, Concepts of ICH, GMP and GLP, Calibration of UV and IR, Validation of analytical methods as per ICH guidelines.

UNIT IV

HPLC: Principle, Instrumentation- mobile phase, degassing, pumps, injectors, columns, detectors. Normal Phase Vs Reverse Phase HPLC, Isocratic and gradient elution in RP-HPLC. Various parameters in chromatogram of HPLC.

UNIT V

Optical Rotatory dispersion: Principle of optical activity, optical purity, concept of Optical Rotatory dispersion (ORD).

XRD: Production X-ray, types of X-rays, Braggs law, Octant rule, Cotton effect, XRD pattern in identification and comparison of polymorphs with examples.

Radio Immuno Assay & Enzyme Linked Immuno Sorbate Assay: Principle and procedure of RIA, Principle, Types, Procedures of ELISA and application of RIA and ELISA in various diagnosis.

Text books:

1. Willard HH, Merritt LL, Dean JA and Settle FA. (2001). *Instrumental Methods of Analysis*, 7th ed., CBS Publishers and Distributors, Delhi, ISBN: 9788123909431.
2. Douglas A. Skoog, F. James Holler and Stanley R. Crouch. (2006). *Principles of Instrumental Analysis*, Cengage Learning; 6th edition, ISBN-10: 0495012017

References:

1. Settle, *Handbook of Instrumental Techniques for Analytical Chemistry*. Prentice Hall.
2. Robert M Silverstein. *Spectrometric Identification of Organic compounds*. Sixth edition, John Wiley & Sons, 2004.
3. B.K. Sharma, *Instrumental Chemical Analysis*, Goel Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	BIOPHARMACEUTICS AND PHARMACOKINETICS	Code	15R00603
Course Year	B. Pharmacy III year	Sem	II
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn about the Biopharmaceutics and pharmacokinetic.

Objective:

- The course is designed to explore the knowledge in ADME.
- The course helps to learn significance of plasma drug concentration measurement.

Outcomes:

1. Graduate will acquire knowledge on the factors influencing absorption, distribution, protein binding and also on pharmacokinetic models.
2. Able to calculate the pharmacokinetic parameters based on plasma level-time data & urine data.
3. Understand the importance of clinical pharmacokinetics and the bioavailability and bio equivalence studies.

UNIT – I

Biopharmaceutics, Pharmacokinetics and Pharmacodynamics. Structure of GI membrane. Routes of drug administration and absorption from different routes.

Drug Absorption. Mechanisms of GI absorption, physico-chemical, biological and dosage form factors influencing absorption.

Drug distribution. Factors affecting drug distribution, physiological barriers of drug diffusion, apparent volume of distribution, drug binding to blood, tissues, protein binding – factors affecting, significance and kinetics of protein binding.

UNIT – II

Drug Metabolism: Pathways of drug metabolism. Phase-I (oxidative, reductive and hydrolytic reactions). Phase II reactions (conjugation) Enzyme induction and inhibition, hepatic clearance, pharmacological activity of metabolites, first pass effect.

Drug excretion. Glomerular filtration, tubular secretion and reabsorption, effect of pH and other drugs. Clearance concept, excretion through bile, feces, lungs and skin in brief.

UNIT – III

Bioavailability and bioequivalence: concept of equivalents, Definitions of various types of equivalents, types of Bioavailability studies, measurement of Bioavailability, plasma level and urinary excretion studies. Bioequivalence study design, IVIVC.

UNIT – IV

Pharmacokinetics. Basic considerations, compartment modeling, one compartment open model - i.v. bolus and extra vascular administration, urinary excretion studies. Apparent volume of distribution, elimination rate constant, biological half life, area under the curve and clearance. Calculation of pharmacokinetic parameters. Method of residuals, Wagner and Nelson method, excretion rate method, sigma minus method. Solving of simple problems

UNIT – V

Nonlinear kinetics. Non compartmental models, reasons for non linearity, concepts of linearity and non linearity, Michaelis- Menten equation and its significance.

Text Books:

1. L. Shargel and ABC Yu, textbook of applied biopharmaceutics & Pharmacokinetics, 4th edn, Appleton – century – crofts, Connecticut, 2004.
2. Milo Gibaldi, Biopharmaceutics and clinical pharmacokinetics 4/Edn. Pharma Book
3. Syndicate.Hyderabad.
4. DM Brahmanekar and SB Jaiswal, biopharmaceutics and pharmacokinetics- a treatise, Vallabh Prakasham, Delhi.

Reference Books:

1. Ronald & Trueter. Clinical pharmacokinetics concepts & applications. 3rd ed, Wolterskluwer Pvt Ltd., 2007.
2. Robert E Notari, Biopharmaceutics and pharmacokinetics – an introduction, Marcel Dekker Inc., NY
3. Basic pharmacokinetics by Hedaya, CRC press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACEUTICAL JURISPRUDENCE	Code	15R00604
Course Year	B.Pharmacy III year	Sem	II
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to review Pharmaceutical Legislations, Pharmaceutical ethics & policy.

Objectives:

- The course is designed to explore the knowledge Pharmaceutical Education.
- The course helps to learn various laws and acts in pharmacy.

Outcomes:

1. Graduate will acquire knowledge on Pharmaceutical Education.
2. Able to understand drugs & pharmaceutical industry.
3. Understand the importance of Pharmacy Acts.

UNIT I**Introduction**

- a. Pharmaceutical Legislations - A brief review
- b. Drugs & Pharmaceutical Industry - A brief review
- c. Pharmaceutical Education - A brief review.
- d. Pharmaceutical ethics & policy
- e. Pharmacy Act 1948

UNIT II

Drugs and Cosmetics Act 1940 and Rules 1945

UNIT III

Narcotic Drugs & Psychotropic Substances Act 1985

UNIT IV

Drugs (Prices Control) Order 1995.

Medicinal & Toilet Preparations (Excise Duties) Act 1955

Drugs and Magic Remedies (Objectionable Advertisements) Act 1954 and Rules 1955.

UNIT V

Study of the salient features of the following.

- a. Prevention of Cruelty to animals Act 1960.
- b. Medical termination of pregnancy act 1970 and rules 1975
- c. Factories Act 1948.
- d. WTO, GATT and The Indian Patents Act 1970

Text Books:

- 1. B.M. Mithal, Text book of Forensic Pharmacy, publ by Vallabh Prakashan
- 2. Suresh.B, Text book of Forensic Pharmacy
- 3. C.K. Kokate & S.B. Gokhale, Textbook of Forensic Pharmacy, Pharmabook, Syndicate.
- 4. N.K. Jain. Textbook of Forensic Pharmacy. 7thed, Vallabh prakashan, 2007.

Reference Books:

- 1. Bare Acts and Rules Publ by Govt of India/state Govt from time to time.
- 2. Pharmaceutical policy of India
- 3. Notification from NPPA
- 4. Vijay Malik, Drugs & Cosmetics act 1940 and Rules, Eastern Law House Co. Delhi, Kolkata.
- 5. K. Sampath, Pharmaceutical Jurisprudence (Forensic Pharmacy) Jai Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACY ADMINISTRATION (CBCC-I)	Code	15R00605
Course Year	B.Pharmacy III year	Sem	II
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn about the Organization of Distribution and Marketing, Principles of drug store and community pharmacy administration.

Objectives:

- To learn Manufacturing Management, work study insurance in pharma industry.
- To gain knowledge on drug store planning and layout.

Outcome:

1. To gain knowledge on basic fundamentals of management and administration in pharma industry.
2. To acquire knowledge on organization of distribution and marketing.
(organization =correct spelling)

UNIT – I***Features of Business Organizations & New Economic Environment:***

Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Changing Business Environment in Post-Liberalisation scenario.

Manufacturing Management: Goals of Production Management and Organization– Production, Planning and Control – Plant location - Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production).

UNIT – II

Work Study -Basic procedure involved in Method Study and Work Measurement- Statistical Quality Control: \bar{X} chart, R chart, c chart, p chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.

Organization of Distribution and Marketing: Functions of Marketing, Marketing Strategies based on Product Life Cycle., Channels of distribution – Factors influencing channels of distribution, sales organization and sales promotion.

UNIT - III

Pharma Industry: Growth of Pharma Industry in India – current status and its role in building national economy and national health – Structure of Pharma Industry in India – PSUs in Pharma Industry –Progress in the manufacture of basic drugs, synthetic and drugs of vegetable origin. Export and import of drugs and pharmaceuticals – Export and import Trade.

UNIT – IV

Insurance and Pharma: Various types of insurance including marine and health insurance.

UNIT – V

Principles of drug store and community pharmacy administration:

Drug store planning and layout, sales promotion and salesmanship in drug store. Accounting records in drug stores.

Text Books

1. Aryasri and Subbarao, Pharmaceutical Administration, TMH.
2. Smarta, Strategic Pharma Marketing
3. G.Vidya Sagar, Pharmaceutical Industrial Management. PBS/BS Publication 2005.

References

1. Subbarao Chaganti, Pharmaceutical Marketing in India – Concepts and Strategy Cases, Pharma Book Syndicate.
2. O.P.Khanna, Industrial Management, Dhanpatrai, New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	CLINICAL TRIALS (CBCC-I)	Code	15R00606
Course year	B. Pharmacy III year	Semester	II
Theory	3 hrs/week	Tutorial	1 hr / week
End Exam	70 Marks	Internal marks	30 Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn about the Introduction to clinical trials.

Objective:

- To learn Phase I, II and III levels of clinical trials.
- To gain knowledge on statistical approaches for various endpoints.

Outcome:

1. To gain knowledge on clinical trials.
2. To acquire knowledge on Phase I, II, III toxicity studies and dosage calculations.
3. To learn the selection of volunteers for clinical trials.

UNIT –I**Overview of clinical trials**

Introduction to clinical trials, Issues in modern clinical trials, Study population.

UNIT –II**Phase I trials:**

Up-and-down design, Single patient per cohort design, Titration design.

Phase II trials:

Randomized dose ranging design, Randomized titration design, Two-stage phase II designs, Multistage design, Bayesian design, Randomized phase II design, Multiple outcomes design.

UNIT –III**Phase III trials:**

Randomized controlled clinical trials, Uncontrolled trials, Historical controls, Crossover designs, Withdrawal studies, Factorial designs, Group allocation designs, Studies of equivalency.

Randomization methods: Simple randomization, Replacement randomization, Random permuted blocks, Blinded studies.

UNIT –IV

Baseline assessment, subgroup analysis, recruitment, multicenter trials: Use of baseline data, Analysis of baseline comparability, Balance and imbalance, Difficulties of subgroup analysis, Recruitment of study subjects, Multicenter trials

UNIT –V

Statistical approaches for various endpoints: t-test, chisquare test, Fisher's exact test, analysis of variance, regression analysis, longitudinal analysis, nonparametric statistics

Text Books

1. Chow SC, Liu JP. Design and Analysis of Clinical Trials: Concepts and Methodologies. New York, NY: Wiley; 1998.
2. Geller N, Chow SC. Advances in Clinical Trial Biostatistics. New York, NY: Marcel Dekker; 2004.

Reference Books

1. *Interdisciplinary Statistics*. New York, NY: Chapman & Hall; 1997.
2. Jennison C, Turnbull BW. *Group Sequential Methods with Applications to Clinical Trials*. New York, NY: Chapman & Hall; 2000.
3. Machin D, Day S, Green S, Everitt B, George S. *Textbook of Clinical Trials*. New York, NY: Wiley; 2004.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	COSMETIC TECHNOLOGY (CBCC-I)	Code	15R00607
Course year	B. Pharmacy III year	Semester	II
Theory	3 hrs/week	Tutorial	1 hr / week
End Exam	70 Marks	Internal marks	30 Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn about Cosmetics, scientific background technology and its future.

Objectives: Upon completion of the subject student shall be able to

- Understand various formulation aspects of cosmetic preparations.
- Provide knowledge on excipients & its applications in cosmetics.

Outcomes:

- Acquire skill in preparation of different types of cosmetics.
- Demonstrate the handling of equipment for evaluation of various cosmetics.
- Acquire the knowledge of processing of cosmetic, selection of materials for containers.

UNIT – I

Introduction of Cosmetics: Purposes of Cosmetics meaning of Cosmetics and cosmeceuticals. Classification of Cosmetics Quality characteristics and Quality Assurance Development Process of Cosmetics. Scientific background technology and its future.

UNIT – II**Excipients & its applications in cosmetics.**

a. Oily Materials: Introduction, Oils and Fats, Wax, Hydrocarbons, Higher Fatty Acids, Higher Alcohols, Esters, Silicones.

b. Surface Active Agents: Introduction Anionic Surfactant, Cationic, Surfactants, Amphoteric Surfactant, Non-ionic, Surfactant. Other Surfactants.

c. Humectants: Introduction, Choice of Humectants Unusual Humectants, Special Uses of Humectants.

d. Antioxidants: Introduction, General Oxidative theory, Measurement of Oxidation and Assessment of Oxidant efficiency, Choice of Antioxidant.

UNIT – III

Safety of Cosmetics: Basic Concept of Cosmetic Safety, Safety test items & Evaluation method: Skin irritation, sensitization, Testing on Human (Patch test, Usage test)

UNIT – IV

Cosmetics Containers: Introduction, Characteristics required by Cosmetic Containers-Quality Maintenance functional Design, Optimum Packaging.

Types of Cosmetic Containers:- Narrow Mouth bottles, Wide Mouth Bottles (Containers), Tubes, tubular Containers, Powders Containers, Compact containers, Stick containers, pencil containers Applicator containers.

UNIT – V

Material of construction for containers: Types of Material Forming and processing methods. Container design procedure. Material test methods & Specifications. Trends in Container materials

Text Books

- 1) New Cosmetic Science by Takeo Mitsui
- 2) Harry's Cosmetology.

Reference Books

- 1) Cosmetic Science & Technology by Sagarin C.B.
- 2) Hand book of Cosmetic science & Technology by Marc paye, Andre O. Barel.
- 3) Cooper & Gunn Dispensing for Pharmaceutical Students.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACOLOGY – II LABORATORY	Code	15R00608
CourseYear	B. Pharmacy III year	Sem	II
Lab	4hrs/week	Tutorial	Nil
End exam	70 Marks	Internal exam	30Marks
Credits	2		

Scope:

- To find out the drugs that is beneficial in clinics.
- Study the mechanism of Action and Site of action and their toxicities.
- Study the actions of drugs existing in Preclinicals

Objectives:

To know and understand pharmacological investigation techniques applied in the research

Outcomes:

- Acquires ability to apply experimental approaches in characterization of drugs.
- Able to use the knowledge to screen novel drugs in different animal models.

A. EXPERIMENTAL PART

- Experiments on Isolated Preparations:
 - Calculate the PA_2 value of atropine using acetylcholine as an agonist on rat ileum preparation.
 - Calculate the PA_2 value of chlorpheniramine using histamine as an agonist on guinea pig ileum preparation.
 - Find out the strength of the given sample (e.g. Acetylcholine, Histamine, 5-HT, Oxytocin etc.) using a suitable isolated muscle preparation by
 - Interpolation bioassay
 - Matching or bracketing bioassay
 - Three point bioassay
 - Four point bioassay

2. Experiments on intact animals like

- a. Study of drug induced catatonia in rats
- b. Study of muscle relaxant activity (rotarod apparatus)
- c. Study of antipsychotic activity (pole climb response apparatus)
- d. Study of antianxiety activity (elevated plus maze)
- e. Study of analgesic activity (analgesiometer)
- f. Study of anti-inflammatory activity (plethysmometer)
- g. Study of antidepressant activity (swim test & tail suspension test)
- h. Study of anticonvulsant activity (electroconvulso meter)

i. Study of spontaneous motor activity and locomotor activity (actophotometer)

B. DEMO/ WORK SHOP

- a. Screening of antiulcer activity
- b. Invitro antioxidant activity
- c. Screening of antihistaminic activity (histamine chamber)

C. SEMINAR/ ASSIGNMENT/ GROUP DISCUSSION

- a. BABE studies
- b. Invitro-in vivo correlation studies
- c. Pharmacovigilance
- d. Biostatistics and its application

REFERENCES

- 1. Practicals in pharmacology By Dr.R.K.Goyal
- 2. Handbook of experimental pharmacology By S.K.Kulakarni
- 3. Experimental pharmacology By M.N.Ghosh
- 4. Experimental Pharmacology and Toxicology By Dr.B.M.VrushabendraSwamy and Prof.K.N.Jayaveera, S.Chand& Co.,

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACEUTICAL ANALYSIS-II LABORATORY	Course Code	15R00609
Course Year	B. Pharmacy III Year	Semester	II
Lab	4 Hrs/ Week	Tutorial	NIL
End Exam	70 Marks	Internal Exam	30 marks
Credits	2		

Scope:

This subject will provide an opportunity for the student on handling of modern analytical instruments or equipment.

Objective:

- The course is designed to explore the knowledge in handling of modern analytical instruments or equipment.
- The course helps to understand the instrumental or equipment operational procedures

Outcomes:

- Analyze the drug compound independently by using the instrument.
- Design and deepen their practical skills so as to be capable of performing the analysis in a good manner.
- Compare the results in determination of percent purity of drug performed by self with monographs.

I. Experiments

1. Determination of λ - max of KMnO_4
2. Determination of λ - max of any one drug
3. Determination of isobestic point of any 2 drugs.
4. Estimate the unknown concentration of Paracetamol by UV Spectrophotometric method.
5. Estimate the unknown concentration of ciprofloxacin in the ciprofloxacin injection by colorimetric method.
6. Estimate the unknown concentration of Riboflavin by fluorimetric method.
7. Assay of Ibuprofen (any one drug) by UV-spectrophotometric method using calibrative curve method.
8. Assay of Paracetamol (any one drug) by UV-spectrophotometry-A (1%, 1 cm) method.

9. Assay of Pheniramine Maleate by UV-spectrophotometry-A (1%, 1 cm) method.
10. Study of quenching effect of quinine by Fluorimetry.
11. Determination of Na/K ions by Flame photometry.
12. Interpretation of UV Spectra.
13. Interpretation of IR Spectra
14. Interpretation of Mass Spectra
15. Interpretation of NMR Spectra

II. Demo/ Work Shop

1. Demonstration of UV instrumentation of single and double beam spectrophotometer.
2. Demonstration of IR instrumentation including KBr pressed pellet technique, ATR, liquid film technique.

III. Seminar/Assignment/Group Discussion

1. Determination of two drugs simultaneously by using UV spectrophotometer.
2. Reagent mechanisms: Ninhydrin, FC, MBTH, PDAC, PDAB (at least two)

LIST OF MINIMUM INSTRUMENTS/EQUIPMENTS REQUIRED

1. Fluorimeter
2. UV-Spectrophotometer
3. Digital balance
4. IR Spectrometer
5. Digital Colorimeter
6. Flame photometry
7. Hot air oven
8. Adequate glassware

REFERENCES:

1. Monographs: Indian Pharmacopoeia, British Pharmacopoeia, United States of Pharmacopoeia, European Pharmacopoeia, Japanese Pharmacopoeia.
2. AH Beckett & Stenlake, Text book of Practical Pharmaceutical chemistry, Vol. II Continuum International Publishing Group, Althone.
3. Martindale: The Complete Drug Reference. 34th and 35th editions.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	BIOPHARMACEUTICS AND PHARMACOKINETICS LABORAOTORY	Code	15R00610
Course Year	B. Pharmacy III year	Sem	II
Lab	4hrs/week	Tutorial	Nil
End exam	70 Marks	Internal exam	30Marks
Credits	2		

Scope: This subject will provide an opportunity for the student to learn about the Biopharmaceutics and pharmacokinetic.

Objective:

- The course is designed to analysis of biological samples for drug content.
- The course helps to estimation of the pharmacokinetic parameters.

Outcomes:

1. Graduate will acquire knowledge on analysis of biological samples for drug content.
2. Able to calculate the pharmacokinetic parameters based on plasma level-time data & urine data.
3. Understand the statistical treatment of pharmaceutical data.

I. EXPERIMENTS

1. Analysis of biological samples for drug content and estimation of the pharmacokinetic parameters.
2. *In vitro* evaluation of tablet/capsule for drug release
3. Drug-protein binding studies.
4. Statistical treatment of pharmaceutical data.
5. Problems related to pharmacokinetics – determination of PK Parameters
6. Problems related to bioavailability and bioequivalence.

II. DEMO/ WORKSHOP

1. Absorption studies – *in vitro*.
2. Experiments designed for the estimation of various pharmacokinetic parameters.

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION

Chronopharmacokinetics.

Text Books:

1. L. Shargel and ABC Yu, textbook of applied biopharmaceutics & Pharmacokinetics, 4th edn, Appleton – century – crofts, Connecticut, 2004.
2. Milo Gibaldi, Biopharmaceutics and clinical pharmacokinetics 4/Edn. Pharma BookSyndicate.Hyderabad.
3. DM Brahmarkar and SB Jaiswal, biopharmaceutics and pharmacokinetics- a treatise, vallabh prakasham, Delhi.

Reference Books:

1. Ronald & trouser. Clinical pharmacokinetics concepts & applications. 3rd ed, wolterskluwer Pvt Ltd., 2007.
2. Robert E notary, Biopharmaceutics and pharmacokinetics – an introduction, marcel dekker inc., NY
3. Basic pharmacokinetics by Hedaya, CRC press.

B. Pharmacy III-II Sem.

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**15A52602 ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS
(AELCS) LAB (Audit Course)**

1. INTRODUCTION

With increased globalization and rapidly changing industry expectations, employers are looking for the wide cluster of skills to cater to the changing demand. The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

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

- Gathering ideas and information and to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Taking part in social and professional communication.

2. OBJECTIVES:

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

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

3. SYLLABUS:

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

UNIT-I: COMMUNICATION SKILLS

1. Reading Comprehension
2. Listening comprehension
3. Vocabulary Development
4. Common Errors

UNIT-II: WRITING SKILLS

1. Report writing
2. Resume Preparation
3. E-mail Writing

UNIT-III: PRESENTATION SKILLS

1. Oral presentation
2. Power point presentation
3. Poster presentation

UNIT-IV: GETTING READY FOR JOB

1. Debates
2. Group discussions
3. Job Interviews

UNIT-V: INTERPERSONAL SKILLS

1. Time Management
2. Problem Solving & Decision Making
3. Etiquettes

4. LEARNING OUTCOMES:

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

5. MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infra-structural facilities to accommodate at least 60 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system

- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

6. SUGGESTED SOFTWARE:

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

1. **Walden Infotech: Advanced English Communication Skills Lab**
2. **K-VAN SOLUTIONS-Advanced English Language Communication Skills lab**
3. **DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.**
4. **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
5. **Train2success.com**

7. BOOKS RECOMMENDED:

1. **Objective English for Competitive Exams**, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, O U Press 3rd Edn. 2015.
3. **Essay Writing for Exams, Audrone Raskauskiene, Irena Ragaisiene & Ramute Zemaitiene, OUP, 2016**
4. **Soft Skills for Everyone**, Butterfield Jeff, Cengage Publications, 2011.
5. **Management Shapers Series** by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. **Campus to Corporate**, Gangadhar Joshi, Sage Publications, 2015
7. **Communicative English**, E Suresh Kumar & P.Sreehari, Orient Blackswan, 2009.
8. **English for Success in Competitive Exams**, Philip Sunil Solomon OUP, 2015

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	NOVEL DRUG DELIVERY SYSTEMS	Code	15R00701
Course year	B. Pharm IV year	Semester	I
Theory	3 hrs/week	Tutorial	1hr/week
End exam	70 marks	Internal exam	30 marks
Credits	3		

Scope: The novel drug delivery systems course provide the knowledge about various novel and targeted systems- formulation, evaluation and applications

Objectives: To learn the novel technologies in drug delivery systems

Outcomes: Student must able to formulate the drug delivery systems for drugs.

UNIT I

Concepts of controlled release, sustained release, extended release, timed release and delayed release. Rationale behind the design of above delivery systems. Factors influencing the design and performance of sustained and controlled release dosage forms.

UNIT II

Oral Control Drug Delivery Systems: Fundamentals, Dissolution Controlled, Diffusion Controlled, Ion Exchange Resins, Osmotic based systems, pH Independent Systems, altered density systems and use of polymers in controlled drug delivery.

UNIT III

Targeted Drug Delivery Systems: Fundamentals and applications, formulation and evaluation of nano particles, resealed erythrocytes and liposomes and niosomes.

UNIT IV

Transdermal Drug Delivery Systems: Fundamentals, permeation of drugs across the skin, types of TDDS, Materials employed and Evaluation of TDDS.

UNIT V

Mucoadhesive Delivery Systems: Mechanism of bioadhesion, mucoadhesive materials, formulation and evaluation of Buccal and Nasal drug delivery systems.

Text Books:

1. Robinson JR and Vincent HL lee. Controlled drug delivery fundamentals and applications, 2ed, marcel dekker 2005.
2. YiewChien, Novel drug delivery systems, 2nded, marcel dekker 2003.

Reference Books:

1. N.K. Jain, Advances in Control & Novel drug delivery, CBS Publishers.
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
3. E.ARawilkins, Bentley's Text Book of Pharmaceutics, Elbspubl

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACOLOGY – III	Code	15R00702
Course Year	B.Pharmacy IVyear	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn pharmacological information about the drugs. In this subject drugs acting on gastrointestinal system, chemotherapeutic agents, principles of toxicology and bioassays will be taught.

Objectives: Upon completion of the subject student shall be able to Understand various pharmacological aspects like mechanism of action, pharmacokinetics, sideeffects, drug interactions, contraindications and indications of drugs falling under below mentioned chapters.

Outcomes:

- Correlate and apply the knowledge.
- Handle the animals and carry out the experiments on animals
- Understand the chemotherapy of various diseases

UNIT I. Drugs acting on the gastrointestinal tract

- Anti-ulcers Drugs
- Laxatives and anti-diarrhoeal drugs
- Emetics and anti-emetics
- Appetite Stimulants and Suppressants

UNIT II. Chemotherapeutic agents and their applications

- General principles of chemotherapy.
- Sulphonamides, co-trimoxazole and β -lactam antibiotics
- Tetracyclines, aminoglycosides, chloramphenicol, macrolides, quinolones, fluoroquinolones and polypeptide antibiotics

UNIT III.

- Chemotherapy of tuberculosis & leprosy
- Chemotherapy of malignancy and immunosuppressive agents.

UNIT IV.

- Chemotherapy of fungal and viral diseases
- Chemotherapy of protozoal diseases and helminthic infections

UNITV. Principles of toxicology & Principles of bioassays.

- a. Definition of poison, general principles of treatment of poisoning
- b. Treatment of barbiturate, opiod, organophosphorous and atropine poisoning.
Heavy metals and heavy metal antagonisits. LD₅₀, ED₅₀ and therapeutic index
- c. Principles of bioassays and errors in bioassys.
- d. Study of bioassay methods for the following drugs
 - i. Digitalis ii. d-tubocurarine, iii. Oxytocin iv. Insulin v. HCV

Text Books:

1. H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, Churchill living stone, 4th Ed.
2. J.G. Hardman and Lee E. Limbard, Good Mann & Gilmann, The Pharmacological basis of therapeutics, Mc Grawhill, Health Professions Dvn.
3. Illiterated Pharmacology by Lippincotts

REFERENCES

1. Tripathi, Essentials of Medical Pharmacology, Jaypee Brother's, Latest Edition
2. Sathoskar, Pharmacology and pharmaco therapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	CLINICAL AND HOSPITAL PHARMACY	Code	15R00703
CourseYear	B.Pharmacy IV year	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: To acquire the Knowledge about Clinical Procedures and study of case reports.

Objectives: Patient counseling and Dispensing of Drugs and identification of drug interactions in Prescriptions.

Outcomes: To council the patients about usage of drugs and drug interactions

UNIT I**Introduction to clinical pharmacy:**

- Prospects and perspectives of clinical pharmacy in national and international scenario, scope of clinical pharmacy
- Therapeutic Drug Monitoring.
- Clinical Pharmacokinetics and individualization of Drug Therapy.
- Concept of Essential Drugs and Rational Drug use.

UNIT II**Introduction to daily activities of Clinical pharmacist**

- Drug therapy monitoring (Medication chart review)
- Adverse Drug Reactions & Drug Interactions
- Patient counseling
- Drug and poison information.
- Ward round participation.

UNIT III**Clinical laboratory tests and interpretation of test results.**

- Hematological (complete blood picture)
- Pulmonary function tests
- Tests associated with cardiac disorders
- Liver, Renal function tests

UNIT IV**Hospital Management**

Organization of a hospital and hospital pharmacy (drug store), responsibilities of a hospital pharmacist, pharmacy and therapeutic committee. Hospital formulary,

purchase and inventory control, role of Pharmacist in community health care and education.

UNIT V

Drug distribution and records

Procedural manual, drug distribution, dispensing to out-patients, in-patients and ambulatory patient dispensing of ancillary and controlled substances. Prescription filling, drug profile.

Text Books:

- a. A Textbook of clinical pharmacy practice: Essential concepts and skills. Dr G Parthasarathi et al. Orient Longman Pvt Ltd. ISBN: 8125026
- b. Leon Shargel, Comprehensive pharmacy review, Latest Edition
- c. Health Education and Community Pharmacy, Gupta AK, CBS, Publ. and Distributors New Delhi – (2010).

Reference Books:

1. J.G. Hardman and Lee E. Limbard, Good Mann & Gilman, The Pharmacological basis of therapeutics, Mc Grawhill, Health Professions Divn.
2. Health Education and Community Pharmacy, NK Jain, CBS, Publ. and Distributors New Delhi.
3. *Hospital pharmacy by Hassan.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	MEDICINAL CHEMISTRY-II	Code	15R00704
CourseYear	B.Pharmacy IV year	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn medicinal chemistry information about the drugs. In this subject student will be able to understand the properties and its biological activity of the drugs.

Objectives: Upon completion of the subject student shall be able to

1. Understand various drugs structure, their properties and biological activities.
2. Correlate and apply the knowledge.
3. Influence of chemical structure on biological activities.

Outcomes:

1. Acquire skill in the structure of drugs and their biological activities.
2. Acquire the knowledge of synthesis of chemical compounds.
3. Assay of some official compounds.

UNIT I

Drugs acting on renal system Renin-Angiotensin system inhibitors: Captopril*, Enalapril*, Losartan*.

Diuretics: Acetazolamide, Hydrochlorthiazide*, Furosemide*, Ethacrynic acid*, Spironolactone, Amiloride, Triamterene and Mannitol. SAR- Carbonic anhydrase inhibitors, Thiazides, Loop diuretics.

UNIT II

Drugs acting on CVS

Anti anginal agents & vasodilators: Nitroglycerin*, Isosorbide dinitrate*. Ion channel blockers- Verapamil, Diltiazem, Nifedipine, Amlodipine*.

Antithrombotic agents- Aspirin, Dipyridamole, Clopidogrel*

Antiarrhythmic drugs: Quinidine, Procainamide*, Lidocaine, Mexiletine*, Amiodarone, Sotalol.

Antihypertensive agents: classification, Reserpine, Prazosin, Clonidine, Hydralazine, Sildenafil citrate, Minoxidil, Amrinone,. SAR- beta-blockers.

Antihyperlipidemic agents: Fenofibrate*, Dextrothyroxine, Colestipol, Nicotinic acid, β -Sitosterol, Probucol, Ezetimibe, Simvastatin, Atorvastatin, Rosuvastatin. SAR-HMG CO-A inhibitors

UNIT III

Drugs acting on Blood, hypoglycemic agents and thyroid.

Anticoagulants: Factors, Warfarin sodium*, Dicumarol

Synthetic hypoglycemic agents: Tolbutamide*, Tolazamide, Glipizide, Glimepiride, Gliclazide, Pioglitazone, Metformin*, Miglitol.

Thyroid and antithyroid drugs: Levothyroxine, Liothyronine, Propylthiouracil.

UNIT IV

Analgesic, antipyretic and anti-inflammatory agents

Opioids: Morphine, Levorphanol, Pentazocine, Meperidine*, Methadone, Tramadol*, Buprenorphine. Opioid antagonist: Naltrexone, Naloxane, Methylnaltrexone.

NSAIDs: A note on prostaglandins and leukotrienes. Aspirin, Indomethacin, Sulindac*, Ketorolac, Ibuprofen, Naproxen, Mefenamic acid, Diclofenac*, Piroxicam, Celecoxib, Paracetamol*.

Management of Gout and Hyperuricemia: Allopurinol*, Sulfinpyrazole.

Antimigraine drugs: Sumatriptan, SAR – Salicylates, Aryl propionic acids.

UNIT V

Antibiotics β - Lactams: Penicillin G, Ampicillin*, Amoxicillin. β - Lactamase inhibitors: Clavulanate potassium, Sulbactam.

Cephalosporins: Cephalexin*, Cefixime. SAR-Penicillins and Cephalosporin

Aminoglycosides and Tetracyclines: Streptomycin, Gentamicin, Tobramycin, Tetracycline, Doxycycline. SAR- Aminoglycosides and tetracyclines

Macrolides and Lincomycins: Erythromycin, Azithromycin, Clindamycin.

Miscellaneous: Chloramphenicol,

NOTE: Introduction, definition, chemical classification with structure, nomenclature, synthesis (only for * marked drugs), mechanism of action, SAR including stereo chemical aspects, metabolites (including its ADR) and therapeutic uses of the following classes of drugs from UNIT I to UNIT V.

Text Books

1. William O. Foye, Textbook of Medicinal Chemistry, Lea Febiger, Philadelphia.
2. An Introduction to Medicinal Chemistry by Graham. L. Patrick, Oxford University publishers.

3. JH Block & JM Beale (Eds), Wilson & Giswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry, 11th Ed, Lipcolt, Raven, Philadelphia, 2004
4. Rama Rao Nadendla, Medicinal Chemistry; Mc Millan Publishers.

Reference Books:

1. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, Oxford
2. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003, 6th Ed.
3. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Ed: I.Oxford University Press, Delhi.
4. Daniel lednicer, Strategies for Organic Drug Synthesis and Design, John Wiley, N. Y. 1998. 5. D. Lednicer, Organic drug synthesis, Vol, 1 – 6, J.Wiley N.Y.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	CHEMISTRY OF NATURAL PRODUCTS (CBCC-II)	Code	15R00705
Courseyear	B. PharmIV year	Semester	I
Theory	3 hrs/week	Tutorial	1hr/week
End exam	70 marks	Internal exam	30 marks
Credits	3		

Scope: To Study the Phytochemical evaluation and Synthesis of natural Products

Objectives: To identify the structure and screening of the natural products

Outcomes: Acquire the skills in determination of structure, mechanism of action and uses of Natural products.

UNIT I

Phytochemical Screening: Preparation of extracts, screening of alkaloids, saponins, cardiac

glycosides, flavonoids, tannins and anthraquinones in plant extracts. Identification and estimation of various phytoconstituents.

Plant tissue culture: History, types, media requirements, methodology for establishment of cell cultures; growth measurements, viability measurements and applications. Micropropagation, immobilization, hairy root culture.

Cosmeceuticals:

General introduction to cosmeceuticals, role of herbs in cosmetics. Study of the following cosmeceuticals- Amla, Henna, Cyperus, Soap Nut, Aloe Vera, Turmeric, Sandal Wood and Bitter Orange Peel.

Neutraceuticals: Definition, introduction and study of Garlic, Spirulina, Soya and Royal jelly.

Introduction and importance of trade in herbal medicine, herbal cosmetics and Indian herbal drug industry.

UNIT II

General structural elucidation of natural products

Chemical methods for determination of active hydrogen, methoxy, hydroxyl, N-methyl and degradation (Hoffmann, Edmann etc) techniques for the determination of ring size. Structural elucidation of Ephedrine, Atropine, Morphine, Papaverine.

UNIT III

Alkaloids

Definition of alkaloids, pseudoalkaloids and protoalkaloids. General methods of extraction, isolation, Properties and tests for alkaloids.

Opium alkaloids: Structural features of Morphin molecule – Peripheral groups. Modification of structure and effect on analgesic activity – SAR of morphine and morphine-like analgesics.

Narcotic antagonists: Nalorphine, Levallorphan. Anti-tussive agents: Noscapine, Dextromethorphan.

Smooth muscle relaxants: Papaverine and related compounds like ethaverine, Dioxylone. Structures and uses of these compounds.

Tropane alkaloids: Structures of Atropine/hyoscyamine, Hyoscyne, Hydrolytic products of these – Tropine and Scopine. Relationship between tropine & pseudotropine. Biological actions and uses of tropane alkaloids. Homatropine.

Rauwolfia alkaloids: Structures and uses of Reserpine, Rescinnamine, Deserpidine, ajmaline, syrosingapine. Hydrolysis of reserpine and rescinnamine. Mechanism of action of reserpine.

Ergot alkaloids: Classification, structures, hydrolytic products, pharmacological actions, therapeutic uses and toxicity. Synthetic derivatives: Methyl ergonovine (Methyl ergometrine), LSD, Ethysergide.

UNIT IV

Terpenes & Terpenoids:

Introduction to Volatile oils, terpene vs terpenoids, Classification, isoprene, special isoprene and gem-dialkyl rules. Sources and structures, general extraction procedure for Citral, citral-a (Geranial), citral-b (Neral). Alpha-terpeniol, Carvone, Menthol, Menthone, 1,8-Cineole, Camphor. Chemical transformation and interconversion of citral to citronellal, citronellol, geraniol, nerol, geranic acid, p-cymene, alpha-terpeneol and ionones. Conversion and interconversion of camphor into camphoric acid, camphoric acids, p-cymene, Borneol, isoborneol.

UNIT V

Steroids: Introduction, nomenclature and classification of steroids. Stereochemistry of Cholesterol. Uses of Bile acids, steroidal hormones. Different Sources of steroidal drugs like diosgenin, cholesterol, stigmasterol and ergosterol.

Synthetic oestrogens like diethylstilbesterol, hexosterol, 17-alpha ethinyloestradiol, Interconversions of Estrone, Estril, Estradiol. Chemistry of keto and non-keto adrenocorticoids. Anabolic steroids (Structures and uses).

Cardiac glycosides: Structures of glycosides from Digitalis, Strophanthus, Squill and Bufa. Enzymatic and acid hydrolytic reactions of the glycosides. Mechanism of action, SAR, therapeutic uses and toxicity.

TextBooks:

1. IL Finar, Organicchemistry, Vol. 1 &2, the Englishlanguagebooksociety, London, NewDelhi.
2. O.P. Agarwal, Naturalproductsby. Vol.1 &2, Goelpublications– Meerut.
3. Kokate CK, PurohitA.P. &Gokhale;PharmacognosyNiraliPrakashan, New Delhi.

ReferenceBooks:

1. RTMorrison and R.NBoyd, Organic chemistry, AllynandBacon,inc., boston
2. Me–Wolf,ed., Burger’smedicinalchemistry,J. Wiley&sons, NY.
3. F.G. Mann &B. Saunders,PracticalOrganicchemistryLongmansgreen&Co. Ltd., UK.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	COMPUTER AIDED DRUG DESIGN (CBCC- II)	Code	15R00706
CourseYear	B.Pharmacy IV year	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Objectives:

1. CADD course covers the key areas of computational chemistry methods as applied to the modelling of biological processes and to rational drug design, building on students' knowledge of theoretical chemistry.
2. This course also deals with cheminformatics, relations between thermodynamic properties and protein-ligand binding by structure.

Outcomes:

1. Describe the use of lead candidates and database representations
2. Explain the drug development pipeline and understand where computational chemistry fits in chemistry
3. Apply how to use software in structure prediction, ligand design methods, docking programs etc.,

UNITI

Introduction to computer aided drug design: Introduction, types of enzyme inhibition, how drugs are discovered, and the basics of mechanistic drug design, important techniques **UNITII**

Uses of computer graphics in computer aided drug design: Computer graphics displays, Computed molecular models, Molecular modeling systems for drug design, uses of computer-assisted drug design, extending molecular modeling.

UNITIII

Molecular mechanics and molecular dynamics: Potential energy function, Non-bonded energy terms, electrostatic energy, hydrogen bonds, energy minimization, applications of theoretical techniques to drug design.

UNITIV**Computer-Aided Drug Design**

EARLY METHODS: Statistical Prediction of Pharmacological Activity, Molecular descriptors based on lipophilicity (Partition coefficient 'logP', substituent hydrophobicity

constant ' π '), polarizability (Molar refractivity, Molar volume), steric (Taft's Steric Factor 'Es', Charton's steric parameter r_v , Verloopparameters), electrostatics (Hammett substitution constant ' σ ', ionization 'pKa') and quantum mechanical (Partial atomic charges, dipolemoment, HOMO/LUMO)

NEWER METHODS: Forces Involved with Drug–Receptor Interactions, Optical Isomerism and Biological Activity, conformational analysis, Comparative/Homology modeling, Molecular Docking, Pharmacophore modeling, Quantitative Structure–Activity Relationships, Structural alerts, Database Searching and Mining, Isosterism.

UNITY

Inhibitors of Dihydrofolate Reductase: The enzyme, enzyme – inhibitor interactions, inhibitor design. **Approaches to antiviral drug design:** Rhinovirus as a drug receptor, Designing Antiviral drugs. **Conformational Biological activity relationships for Receptor-selective, conformationally constrained Opioid peptides:** Design of conformationally constrained Delta and μ Opioid Receptor-selective peptides, Problems and prospects for rational design of Receptor-selective peptides.

Text Books:

1. **Computer aided drug design** Methods and Applications by Thomas J. Perun, C.L. Propst; Marcel Dekker, 2010.
2. Wilson and Gisvold's **Text book of Organic Medical and Pharmaceutical Chemistry** by John M. Beale, John H. Block; Lippincott Williams & Wilkins, 12th Edition, 2011.
3. **Molecular Modelling: Principles and Applications** by Andrew R. Leach, Published by Pearson Education EMA, January 2001.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACOVIGILANCE (CBCC- II)	Code	15R00707
CourseYear	B.Pharmacy IV year	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: To study Adverse effects and monitoring of adverse Drug Reactions

Objectives: To Identify the Adverse drug reactions and surveillance of Reports.

Outcomes: Should have the Knowledge about the terminology of adverse medication related events, roles and responsibilities in Pharmacovigilance.

UNIT –I**Introduction to Pharmacovigilance**

- History and development of Pharmacovigilance
- Importance of safety monitoring / Why Pharmacovigilance

National and international scenario

- Pharmacovigilance in India
- Pharmacovigilance global perspective
- WHO international drug monitoring programme

UNIT –II**Basic terminologies used in Pharmacovigilance**

- Terminologies of adverse medication related events
- Information resources in Pharmacovigilance

Establishing Pharmacovigilance programme

- Establishing in a hospital
- Establishment & operation of drug safety department in industry
- Establishing a national programme
- SOPs – Types, designing, maintenance and training
- Roles and responsibilities in Pharmacovigilance
- Licence Partners, Contract Research Organisations (CROs) and Market Authorisation Holders (MAH)

UNIT –III

- Pharmacovigilance methods
- Passive surveillance – Spontaneous reports and case series
- Stimulated reporting
- Active surveillance – Sentinel sites, drug event monitoring and registries
- Comparative observational studies – Cross sectional study, case control study and cohort study

UNIT –IV

- Adverse drug reaction reporting
- Introduction to reporting systems
- Spontaneous reporting system
- Reporting to regulatory authorities
- Guidelines for reporting ADRs in biomedical literature

UNIT –V

- Communication in Pharmacovigilance
- Effective communication in Pharmacovigilance
- Communication in Drug Safety Crisis management
- Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media, Doctor Letters to Healthcare Professionals

TEXTBOOKS

1. Textbook of Pharmacovigilance by S.K. Gupta, Jaypee brothers.
2. Pharmacovigilance by Ronald D. Mann, Elizabeth B.Andrews, 2nd edition.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	NOVEL DRUG DELIVERY SYSTEMS LABORATORY	Code	15R00708
Course year	B. Pharm IV year	Semester	I
Lab	4 hrs/week	Tutorial	NIL
End exam	70 marks	Internal exam	30 marks
Credits	2		

Scope: This subject will provide an opportunity for the student to learn about preparation and evaluation of Novel Drug Delivery Systems.

Objectives: Upon completion of the subject student shall be able to

- Understand various Novel Drug delivery systems and their preparations.
- Provide knowledge on filing of various regulatory agencies.

Outcomes:

- Acquire skill in preparation and evaluation of various Novel formulations.
- Acquire the knowledge of Product development and filing to various regulatory agencies.

I. EXPERIMENTS:

- Preparation and evaluation of Matrix Tablets
- Preparation and evaluation of Transdermal Drug Delivery Systems.
- Formulation and evaluation of Mucoadhesive Delivery Systems.
- Evaluation of Market Sustained Release Formulations.
- Preparation and evaluation of microspheres.
- Assignment on Product development and filing to various regulatory agencies, FDA, TGA, Etc (Ref.: www.fda.gov)

II. Demo/ Workshop

Floating drug delivery system.

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION

Advances in novel drug delivery.

Text Books:

1. N.K. Jain, Advances in Control & Novel drug delivery, CBS Publishers.
2. NK Jain, Pharmaceutical product development, CBS publishers.
3. L. Lachman, H.A. Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy by, Lea &Febieger, Philadelphia Latest Edn.

Reference Books:

1. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, IVthed, marcel dekker,usa, 2005.
2. Controlled drug delivery systems by Robinson.
3. YiewChien, novel drug delivery systems, 2nded, marcel dekker 2003.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	CLINICAL AND HOSPITAL PHARMACY LABORATORY	Code	15R00709
Course year	B. Pharm IV year	Semester	I
Lab	4 hrs/week	Tutorial	NIL
End exam	70 marks	Internal exam	30 marks
Credits	2		

Scope: This subject will provide an opportunity for the student to learn about various parental preparations.

Objectives: Upon completion of the subject student shall be able to Underst and various Sterilization techniques and parenteral preparations. Provide knowledge on Role of Pharmacist in patient counseling.

Outcomes:

1. Acquire skill in preparation parenteral Preparations.
2. Acquire the knowledge on First Aid treatment and improving patient Compliance.

I. EXPERIMENTS:

1. Preparation of water for injection IP
2. Test for pyrogens on water for injection IP
3. Determination of suitability of NaCl for preparation of transfusion fluid by flame photometer
4. Hydrolytic resistance test on glass used for transfusion fluids
5. Preparation of 5% W/V dextrose IV infusion IP
6. Preparation of 0.9% W/V NaCl IV infusion IP
7. Preparation of Compound NaCl injection (Ringers solution) IP
8. Preparation of NaCl& dextrose injection IP
9. Preparation of sodium bicarbonate intravenous infusion BP
10. Determination of sinking time and water holding capacity of absorbent cotton wool IP
11. Demonstration: Sterilization of surgical instruments, syringes, needles, rubber gloves, hospital fabrics and surgical dressings

II. ASSIGNMENT

1. Assignment 1: Study of role of pharmacist in first aid treatment
2. Assignment 2: Study of role of pharmacist in improving patient compliance

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	MEDICINAL CHEMISTRY-II LABORATORY	Code	15R00710
Course Year	B.Pharmacy IV year	Sem	I
Lab	4hrs/week	Tutorial	NIL
End exam	70 Marks	Internal exam	30 Marks
Credits	2		

Scope: This subject will provide an opportunity for the student on synthesis of various compounds.

Objectives: Upon completion of the subject student shall be able to

- c. Synthesis various chemical compounds.
- d. Provide knowledge on monograph analysis of some chemical compounds.

Outcomes:

1. Acquire skills in synthesis various chemical compounds.
2. Demonstrate of stereo models of some drugs relevant to theory.
3. Acquire skills of extraction of drugs from different dosage forms.

EXPERIMENTS:

1. Synthesis of Paracetamol from p-amino phenol
2. Synthesis of Cinnamic acid from benzaldehyde
3. Synthesis of Benzotriazole from o-phenylene diamine
4. Synthesis of 1-phenyl-3-methyl-5-pyrazolone from hydrazine hydrate
5. Synthesis of 7-Hydroxy-4-methyl coumarin from resorcinol and ethyl acetoacetate
6. Synthesis of Salicylaldehyde from phenol
7. Identification and test for purity for Aspirin tablet as per IP
8. Identification and test for purity for Acetazolamide tablet as per IP
9. Identification and test for purity for propranolol tablet as per IP
10. Identification and test for purity for Diclofenac sodium tablet as per IP
11. Identification and test for purity for Paracetamol tablet as per IP

II. DEMO/WORKSHOP: Microwave assisted organic synthesis, Purification of synthesized compounds (Column chromatography), Demo on Thin layer chromatography.

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION Antibiotic discovery in the twenty-first century: Current trends and future perspectives, Current Trends in β -Lactam based β -Lactamase inhibitors and CVS agents.

References:

1. A.I. Vogel, Text Book of Practical Organic Chemistry, 5th Edition. Pearson, Prentice Hall.
2. F.G. Mann & B.C. Saunders, Practical Organic Chemistry, 4th Edition, Pearson Publishers.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Water bath
2. Suction pumps
3. Analytical/physical balance
4. Triple beam balance
5. Reflux flask with condenser
6. Hot plates
7. Refrigerator
8. Mechanical and magnetic stirrer with thermostat
9. Distillation unit
10. Oven
11. Adequate glass wares

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	MOOCS -II (Biostatistics and Design of Experiments) / Conventional/ Self study	Code	15R00801
Course Year	B.Pharmacy IV year	Sem	II
Lab	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30 Marks
Credits	3		

SCOPE: Biostatistics is the application of statistics to different topics in biology including medicine, pharmacy, public health science, agriculture and fishery. It involves the analysis of data from experiments; its interpretation and drawing conclusion from the results. It involves the application of statistical theory to real-world problems, the practice of designing and conducting biomedical experiments and clinical trials. Design of experiments is planning experimental strategy, screening a large number of parameters and selecting the important ones, determining the minimum number of experiments and deciding on the mode and manner in which experiment have to be conducted. The course encompasses topics such as distribution of data, sample size, tests of significance, data reduction, regression analysis, comparison of performance of drugs in clinical trials, design of experiments, screening and second order designs.

UNIT I

Introduction to Statistics

Various Distributions: Normal Distribution, sample and Population, Z distribution.

UNIT II

Test of Significance, t- test, F test, ANOVA.

UNIT III

2 test/odds ratio, Non-Parametric test, other tests.

UNIT IV

Design of Experiments: Introduction to design of experiments, screening designs – Data Analysis.

UNIT V

Higher order Designs - Data analysis

Regression Analysis – Data reduction

REFERENCES:

1. 'Biostatistics', KS Negi, AITB Publishers, Delhi.
2. 'Fundamentals of Biostatistics', Irfan Ali Khan, Ukaaz Publications
3. 'Biostatistics for Pharmacy', Khan and Khanum, Ukaaz Publications
4. 'Basic statistics and Pharmaceutical applications', J.E, Demuth, Mercel & Dekker.
5. 'Applied statistics' by S.C.Gupta & V.K.Kapoor
6. 'Fundamentals of mathematical statistics' by S.C.Gupta & V.K.Kapoor

NPTEL: <http://nptel.ac.in/courses/102106051/>

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	MOOCS – III (Intellectual Property Rights) // Conventional/ Self study	Code	15R00802
Course Year	B.Pharmacy IV year	Sem	II
Lab	3hrs/week	Tutorial	1 hr/week
End exam	70 Marks	Internal exam	30 Marks
Credits	3		

SCOPE: The course is designed to introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries. The course introduces all aspects of the IPR Acts. It also includes case studies to demonstrate the application of the legal concepts in Science, Engineering, Technology and Creative Design.

UNIT I**OVERVIEW OF INTELLECTUAL PROPERTY**

Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR in abroad, Some important examples of IPR

UNIT II**PATENTS AND UTILITY MODELS**

PATENTS: Patent document, searching a patent, Drafting of a patent, Filing of a patent Macro-economic impact of the patent system, Patent and kind of inventions protected by a patent, Granting of patent, Rights of a patent Protecting your inventions – extension in patent protection The different layers of the international patent system (national, regional and international options)

UTILITY MODELS: Differences between a utility model and a patent, Trade secrets and know-how agreements.

UNIT III**COPYRIGHTS, TRADEMARKS AND GEOGRAPHICAL INDICATIONS**

COPYRIGHTS: Copyright, things covered by copyright, period of copyright, Rights covered by copyrights and protection of copyrights.

RELATED RIGHTS: Related rights, Distinction between related rights and copyright

TRADEMARKS: Trademark –Rights, kind of signs, types and function of trademarks Registration, period, extension and protection of trademark.Well-known marks and their protection, Domain name and its relation to trademarks.

GEOGRAPHICAL INDICATIONS

Geographical indication - its protection, reasons for protection

UNIT IV**INDUSTRIAL DESIGNS AND NEW PLANT VARIETIES**

INDUSTRIAL DESIGNS: Protection, kinds of protection, needs for protection

NEW PLANT VARIETIES: New varieties of plants – protection and extension

Breeder – Rights and protection

UNIT V**UNFAIR COMPETITION AND ENFORCEMENT OF INTELLECTUAL PROPERTY RIGHTS**

UNFAIR COMPETITION: Unfair competition, Relationship between unfair competition and intellectual property laws.

ENFORCEMENT OF INTELLECTUAL PROPERTY RIGHTS: Infringement of intellectual property rights, Enforcement Measures and Emerging Issues in Science and technologies.

Overview of Biotechnology and Intellectual Property Rights in Biotechnology Research. Management - Licensing and Enforcing Intellectual Property, Commercializing Biotechnology Invention and Case studies of Biotechnology. Case studies of patents in other areas – Pharmaceutical Research

TEXT BOOKS

1. T. M Murray and M.J. Mehlman, Encyclopedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley & Sons 2000

REFERENCES

1. P.N. Cheremisinoff, R.P. Ouellette and R.M. Bartholomew, Biotechnology Applications and Research, Technomic Publishing Co., Inc. USA, 1985
2. D. Balasubramaniam, C.F.A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman, Concepts in Biotechnology, University Press (Orient Longman Ltd.), 2002
3. Bourgaize, Jewell and Buiser, Biotechnology: Demystifying the Concepts, Wesley Longman, USA, 2000.
4. AjitParulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India Ltd , 2006.
5. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
6. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi , 2010

NPTEL: <http://nptel.ac.in/syllabus/syllabus.php?subjectId=110999906>