

**R15**

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

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**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	<b>MOOCS - I</b> (Application of spectroscopic methods in molecular structure Determination) / <b>Conventional/ Self study</b>	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	
<b>Total:</b>			17	5	18	23

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

**R15**
**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

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

**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,

**R15**

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 and Bupropion. SAR- Tricyclic antidepressants, MAOIs.

Miscellaneous: Psilocybin, Dimethyltryptamine, Mescaline, Lysergic acid and Tetrahydro cannabinol.

**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.

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**R15****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 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.

**R15**
**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

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

**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.

**R15****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 living stone, 4th Ed.
2. J.G. Hardman and Lee E. Limbard, Good Mann & Gilman, The Pharmacological basis of therapeutics, Mc Grawhill, Health Professions Dvn.

**Reference Books**

1. Bertram. G. Katzung, Basic and clinical pharmacology, 9th Edn; Prentice Hall International
2. Sathoskar, Pharmacology and pharmaco therapeutics Vol. 1 & 2, Publ by PopularPrakashan, Mumbai.
3. Tripathi, Essentials of Medical Pharmacology, Jaypee Brother"s, Latest Edition

**R15**
**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

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

**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.

**R15****UNIT III**

**Microencapsulation:** Types of microencapsulation and importance of microencapsulation in

Pharmacy, microencapsulation 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**

- Preformulation factors, routes of administration, water for injection, treatment of apyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment.
- Formulation details, containers, closures and their selection.
- 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.
- 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:**

- L. Lachman, H.A. Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy, Lea & Febiger, Philadelphia Latest Edn.
- 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:**

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



**R15**
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<b>Subject</b>	<b>PHARMACEUTICAL BIOTECHNOLOGY</b>	<b>Code</b>	<b>15R00504</b>
<b>Course Year</b>	<b>B.Pharmacy III year</b>	<b>Sem</b>	<b>I</b>
<b>Theory</b>	<b>3hrs/week</b>	<b>Tutorial</b>	<b>1hr/week</b>
<b>End exam</b>	<b>70 Marks</b>	<b>Internal exam</b>	<b>30Marks</b>
<b>Credits</b>	<b>3</b>		

**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, recombivax 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

**R15**

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<sup>nd</sup> 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<sup>nd</sup> Edition, W.H. Freeman 1992.
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. Kielsch "Biotechnology" Vol 6, Verlagchemie, Switzerland.
3. P. F. Stanbury & A. Whitaker, "Principles of fermentation Technology" Pergamon Press, Oxford. Wiseman, Handbook of enzyme biotechnology. A. 3<sup>rd</sup> Edition Ellis Horwood.
4. Alexandre M Moo-young, Comprehensive Biotechnology, Pergamon Press, New York.

**R15**
**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

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

**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,  $^1\text{H}$  and  $^{13}\text{C}$ -NMR spectroscopy. Chemical shifts, spin-spin coupling, spin-spin splitting pattern recognition for structure elucidation, coupling constants.

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R15**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, 3<sup>rd</sup> 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. Baxeavanis, 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.

**R15**
**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

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

**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

**R15****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

**R15****JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

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

**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.

**R15**

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.



**R15****JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

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

**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)

**R15****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

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

**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.ASSIGNMENT/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

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**R15**

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

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**B. Pharmacy III-I Sem.**

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2	0	2	0

**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

**R15**

Violence; Gender Equality – Initiatives of Government – Schemes, Law; Initiatives 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](http://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](http://www.un.org)

[www.india.gov.in](http://www.india.gov.in)

[www.yas.nic.in](http://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>