

**SRI VENKATESWARA UNIVERSITY: TIRUPATI**  
**SVU COLLEGE OF PHARMACEUTICAL SCIENCES**  
**DEPARTMENT OF PHARMACY**



**Course**

**M. PHARMACY PHARMACOLOGY**

**Choice Based Credit System (CBCS)**

**Academic Year 2017 – 18**

### **Vision**

1. To impart quality and value embedded education and research in Pharmaceutical Sciences.
2. To create technologically superior and ethically strong global manpower, in the arena of drug innovation.
3. Carving the youth as dynamic, competent, valued and knowledgeable Professionals in the field of Pharmacology.

### **Mission**

1. Transforming Students into Full-fledged Pharmacists and participate actively in the field of Pharmacy.
2. Promoting Quality Research in Emerging Areas of Pharmaceutical Sciences.
3. To instill scientific zeal and develop skilled human resource to meet contemporary challenges in Pharmacy Profession.
4. To facilitate young adult learners with opportunities to hone their ethics and leadership potential.
5. Imparting technical education that encourages Independent thinking, develops strong domain of knowledge, hones contemporary skills and Positive attitudes towards holistic growth of young minds.
6. Evolving the Institution into a Center of Academic and Research Excellence in Pharmaceutical Education and lead the field of pharmaceutical sciences and pharmacy practice with the mission of strengthening the healthcare of the country.

### **Programme Objectives**

1. To uphold all laws, regulations, safety and ethical standards that apply to the experimental procedures in animals and the environment
2. To impart adequate hands-on training in various animal models and determine the effects of drugs using animal models
3. To provide practical inputs in pharmacokinetic studies of various drugs and formulations in animals to establish in-vitro and in-vivo correlations
4. Acquire practical knowledge in various analytical techniques used in molecular biology
5. To train students in using suitable statistical methods for interpretation of results
6. To prepare the students in teamwork, lifelong learning and continuous improvement

### **Programme Outcomes**

After the completion of the M.Pharm Pharmacology Programme the students will be able to,

1. Produce Pharmacy graduates with strong basics and high technical knowledge to cater the various areas of Drug Development
2. Develop an understanding for the need of pharmaceutical sciences and technology towards giving quality life to people in society through the quality of drugs.
3. Apply the knowledge and skills gained through education to gain recognition in professional course and society.
4. Act efficiently as a leader in the diverse areas of the profession to demonstrate the ability to plan and implement professional activities.
5. Develop ability for in-depth information and critical thinking in order to identify, formulate and solve the issues related to Pharmaceutical Industry, Regulatory Agencies, Hospital Pharmacy & clinical Pharmacy for better services to the community.
6. Identify the goals and regulations involved in the drug discovery and development, manufacture, distribution and sale of medicines and develop problem-based learning approach and analytical thinking in his/her academic and professional life.
7. Update the knowledge through continuous learning to face the challenges for better services to the community.

8. Design and develop process to perform experiments in various pharmaceutical areas like Pharmacognosy, Pharmaceutical Chemistry including Analytical Chemistry, Pharmaceutical Biotechnology, Pharmacology, Formulation and Development.
9. Fill the gap with other health care communities to provide innovative solutions for the purpose of maintain public health.
10. Develop team spirit for the development of student profession to the social needs and professional ethics.
11. Understand, analyze and communicate the value of their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).
12. Create a talent pool by involving students in research projects and to make students to undertake research projects under faculty guidance for publication.

#### **Programme Specific Outcomes**

At the end of successful completion of programme, a Post graduate will

1. Have adequate knowledge and scientific information regarding basic principles of Pharmacology, and Pharmacognosy including herbal medicines.
2. Be able to develop new dosage regimens including those of herbal origin as per standards of official books.
3. Be able to perform experimental procedures as per laboratory standards in the area of Pharmacology.
4. Be able to counsel the patients leading to physical and social well being and work as a team member of clinical trial.
5. Be able to perform research on various medical aspects and implement the Pharmaceutical knowledge in formulating the best suitable dosage form to provide high quality medicines to the society.

**SRI VENKATESWARA UNIVERSITY**  
**M.Pharmacy (Pharmaceutics/Pharmacology)**  
Choice Based Credit System (CBCS)-Syllabus: w.e.f. 2016-17.

Semester	Course code	Title of the course	Instruction hours / per week	No.of credits	Internal marks	Semester end marks	Total marks
<b>FIRST SEMESTER</b>							
Core Paper-1	MPH 101A (Pharmacology)	General & Systemic Pharmacology	6	4	20	80	100
	MPH 101B (Pharmaceutics)	Advanced Pharmaceutical Technology					
Core Paper -2	MPH 102 A (Pharmacology)	Clinical Pharmacology & Toxicology	6	4	20	80	100
	MPH 102 B (Pharmaceutics)	Advanced Pharmaceutics					
Core Paper-3	MPH 103	Practical 1	6	4	-	100	100
Core Paper-4	MPH 104	Practical 2	6	4	-	100	100
Compulsory Foundation Paper-5	MPH 105	Modern Analytical Techniques and biostatistics	6	4	20	80	100
Elective Foundation Paper-6	MPH 106	Human values and Professional ethics-I	6	4	20	80	100
	MPH 107	Comprehensive Viva	-	2	-	50	50
<b>SECOND SEMESTER</b>							
Core Paper-1	MPH 201A (Pharmacology)	Molecular Pharmacology	6	4	20	80	100
	MPH 201B (Pharmaceutics)	Industrial Pharmacy					
Core Paper -2	MPH 202 A (Pharmacology)	Methods in Drug Evaluation	6	4	20	80	100
	MPH 202 B (Pharmaceutics)	Process Validation & CGMP.					
Core Paper-3	MPH 203	Practical 1	6	4	-	100	100
Core Paper-4	MPH 204	Practical 2	6	4	-	100	100
Compulsory Foundation Paper-5	MPH 205	Bio-Pharmaceutics & Pharmacokinetics	6	4	20	80	100
Elective Foundation Paper-6	MPH 206	Human values and Professional ethics-I I	6	4	20	80	100
	MPH 207	Comprehensive Viva	-	2	-	50	50

**THIRD SEMESTER**

<b>Core Paper-1</b>	<b>MPH 301</b>	<b>Mid-Term Evaluation of Research project.</b>	-	8	-	200	200
<b>Open Elective to others</b>  <b>(For other department students)</b>	<b>A</b> <b>General Pharmacology</b>		6	4	20	80	100
	<b>B</b> <b>Industrial Pharmacy</b>						

**FOURTH SEMESTER**

<b>Core Paper-1</b>	<b>MPH 401</b>	<b>Project thesis submission &amp; presentation</b>	-	10	-	250	250
		<b>Project Viva voce</b>	-	2	-	50	50
<b>Open Elective to others</b>  <b>(For other department students)</b>	<b>A</b> <b>Molecular Pharmacology</b>		6	4	20	80	100
	<b>B</b> <b>Drug Regulatory Affairs</b>						

## FIRST SEMESTER

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 101A(Pharmacology)	General & Systemic Pharmacology	06	04
Sessional Marks : 20		End Semester Examination Marks : 80	

### Objectives:

1. Understand the pharmacological actions of different categories of drugs
2. Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
4. Observe the effect of drugs on animals by simulated experiments
5. Appreciate correlation of pharmacology with other bio medical sciences

### Course Content:

#### UNIT – I

Drug Absorption, Drug distribution, Drug metabolism, Drug Elimination, Bioavailability and bioequivalence studies.

#### UNIT – II

Neurotransmission in CNS and ANS,  
Drug acting on CNS: General anaesthetics, sedatives and hypnotics, Opioid analgesics, NSAIDS, CNS  
Stimulants and depressants, Antipsychotic drugs, Antiepileptic drugs  
Drug acting on ANS: Adrenergic and adrenergic blockers, cholinergic and cholinergic blockers.  
Autocoid pharmacology: study of mechanisms involved in the formation, release & Pharmacological actions & role of histamine, serotonin, prostaglandins and kinins.

#### UNIT – III

Drugs acting on CVS disorders like Cardiac arrhythmias, Angina pectoris, congestive cardiac failure and Hypertension  
Drugs acting on GIT: Emetics, antiemetics, Constipation, Antiulcer drugs  
Antiasthmatic drugs, diuretic and antidiuretic drugs, Antidiabetic drugs.

#### UNIT – IV

Antibiotics and chemotherapeutic agents used in parasitic infections like malaria tuberculosis, amoebiasis and leprosy

**Text Books:**

1. The Pharmacological basis of therapeutics by Joel G. Hardman, Lee E. Limbird and Alfred Goodman Gilman
2. Principles of Medicinal Chemistry by William O. Foye, Tomas L. Lemke and David A. Williams
3. Pharmacology by H.P. Rang, M.M. Dale, J.M. Ritter & P.K. Moore
4. Essentials of Pharmacotherapeutics by F.S.K. Barar
5. Principles of drug action by Golsteins, Aranow and Kalman

**Course Outcomes:**

After Completion of the course the student able to

1. Describe the instruments in experimental pharmacology.
2. Know CPCSEA guidelines and OECD guidelines.
3. Know animal physiology with their biochemical reference values in various animal species.
4. Do collection of blood, body fluids and urine from experimental animals.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	2	2	2	3
CO2	3	3	2	2	2	3	2	2	3	3	2	2
CO3	3	2	1	1	1	2	1	2	1	1	1	2
CO4	3	1	2	2	1	1	2	2	3	2	1	1

3-High, 2- Medium, 3- Low.

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 102A(Pharmacology)	Clinical Pharmacology & Toxicology	06	04
<b>Sessional Marks : 20</b>		<b>End Semester Examination Marks : 80</b>	



**Objectives:**

1. To impart knowledge and skills necessary for contribution to quality use of medicines.
2. To cover briefly pathophysiology and mostly therapeutics of various diseases.
3. To understand the pathophysiology of common diseases and their management.
4. To get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

**Course Content:****UNIT I**

Pathophysiology and treatment of following disorders like schizophrenia, Depression, Anxiety, Epilepsy,, Alzheimer's and Parkinsonism.

**UNIT – II**

Pathophysiology and treatment of CVS disorders like congestive cardiac failure, hyperlipidemia, angina & myocardial infraction, Atherosclerosis, Arrhythmias, Hypertension.

**UNIT – III**

- a) Pathophysiology and treatment of immunological disorders like Hypertensive reaction, Asthma, Inflammation, Rheumatoid arthritis, gout.
- b) Pathophysiology and treatment of adrenal gland disorders, Thyroid and pancreas disorders, & menstrual disorders.
- c) Drug Therapy in infectious diseases and urinary tract infections, Tuberculosis, Leprosy and Pathophysiology and treatment of cancer.

**UNIT – IV**

- a) Toxicology & clinical Pharmacokinetics, ADR, Drug interactions, TDM, Heavy metal poisoning etc.
- b) Drug therapy in Geriatrics, Pediatrics and Pregnancy and lactation.

**REFERENCES:**

1. Clinical Pharmacy and Therapeutics – Roger and Walker, Churchill Livingstone publication.
2. Pharmacotherapy: A Pathophysiologic approach – Joseph T. Dipiro et al. Appleton & Lange.
3. Pathologic basis of disease – Robins SL, W.B. Saunders publication.
4. Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice – Green and Harris, Chapman and Hall publication.
5. Clinical Pharmacy and Therapeutics – Eric T. Herfindal, Williams and Wilkins Publication.
6. Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA
7. Avery's Drug Treatment, 4<sup>th</sup> Edn, 1997, Adis International Limited.

8. Relevant review articles from recent medical and pharmaceutical literature.
9. Pharmacotherapy: A Pathophysiologic approach – Joseph T. Dipiro et al. Appleton & Lange
10. Clinical Pharmacy and Therapeutics – Eric T. Herfindal, Williams and Wilkins Publication
11. Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA

### Course Outcomes:

At completion of this subject it is expected that students will be able to understand –

1. The pathophysiology of selected disease states and the rationale for drug therapy.
2. The controversies in drug therapy.
3. The importance of preparation of combinationed therapeutic plans based on diagnosis.
4. Understanding the concepts of Clinical research; Therapeutic drug monitoring (TDM) ; concepts of Pharmacotherapeutics, Management & Current Good Clinical Practice of various diseases.

### CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	2	1	1	2	2	3
CO2	3	2	1	2	2	3	1	1	2	1	1	3
CO3	2	2	2	1	3	3	2	1	3	2	1	1
CO4	1	2	1	2	2	2	1	1	2	3	1	1

3-High, 2- Medium, 3- Low.

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 103	Practical 1	06	04
<b>Sessional Marks : 00</b>		<b>End Semester Examination Marks : 100</b>	

### Objectives:

1. Understanding the in vivo and in vitro experiments, use of software for the study of preclinical experiments.
2. Understanding the PA2 and PD2 value of drugs using isolated tissue preparations.
3. Understanding the brief idea about statistics, its applications in experimental pharmacology.
4. Understanding to solve problems using various statistical tests

**Course Content:****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 characterization using isolated preparations like frog's rectus abdominus muscle and isolated ileum preparation of rat & guinea pig.**

**Text Books:**

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.

**Course Outcomes:**

After Completion of the course the student able to perform experiments like

1. Recording of concentration response curve (CRC) of acetylcholine

2. Record of the CRC of 5-HT on rat fundus preparation.

3. Record of the CRC of histamine on guinea pig ileum

4. Inotropic and chronotropic effects of drugs on isolated frog heart

## CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	2	2	1	2	2	1	1	3
CO2	1	2	1	1	2	2	1	2	1	1	2	3
CO3	2	2	1	1	2	2	1	2	1	2	1	2
CO4	1	2	1	1	1	1	1	2	1	2	1	1

3-High, 2- Medium, 3- Low.

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 104	Practical-II(MAT)	6	04
<b>End Semester Examination Marks : 100</b>			

### Objectives:

1. Discusses the effect of impurities on the quality of drugs and behavioural pattern of drugs
2. Aids in understanding the SOP and usage of software associated with various analytical instruments
3. Helps in gaining knowledge of interpretation of spectra and of chromatograms.

### Course Content:

1. Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
2. Estimation of dextrose by colorimetry
3. Estimation of sulfanilamide by colorimetry
4. Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
5. Assay of paracetamol by UV- Spectrophotometry
6. Estimation of quinine sulfate by fluorimetry
7. Study of quenching of fluorescence
8. Determination of sodium by flame photometry
9. Determination of potassium by flame photometry
10. Determination of chlorides and sulphates by nephelo turbidometry
11. Separation of amino acids by paper chromatography
12. Separation of sugars by thin layer chromatography

13. Separation of plant pigments by column chromatography

14. Demonstration experiment on HPLC

15. Demonstration experiment on Gas Chromatography

### Course outcomes

1. Explains the importance of modern instrumentation in pharmaceutical analysis
2. Describes the fundamental principles and applications of spectroscopic techniques Viz., UV- Visible, IR, FTIR.
3. Discusses the principle and applications of chromatographic techniques
4. Identify appropriate instrumental techniques for the analysis of drugs in bulk or in various dosage forms

### CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	2	3	2	3	1	2	3
CO2	3	3	3	1	2	3	2	1	2	1	1	2
CO3	2	2	2	1	2	1	1	1	1	1	2	2
CO4	2	1	2	1	2	2	2	3	1	1	2	1

3-High, 2- Medium, 3- Low.

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 105	Modern Analytical Techniques and biostatistics Theory	06	04
<b>Sessional Marks : 20</b>		<b>End Semester Examination Marks : 80</b>	

### Objectives:

1. Explains the importance of modern instrumentation in pharmaceutical analysis
2. Describes the fundamental principles and applications of spectroscopic techniques Viz., UV- Visible, IR, FTIR.
3. Discusses the principle and applications of chromatographic techniques
4. Identify appropriate instrumental techniques for the analysis of drugs in bulk or in various dosage forms.
5. Explains the concepts of Statistics and their applications in pharmacy.

### Course Content:

#### Unit I

**Thermal methods:** Principle, Instrumentation involved in DSC. Glass transition temperature. Sample preparation. Gases used in this method. Plotting graphs of DSC. Interpretation of Graphs of DSC. Applications of DSC.

**X-ray crystallography:** Generation of X-rays. Introduction. Elementary crystallography, miller indices, X-ray diffraction, Bragg's law, X-ray powder diffractometer, sample preparation.

**UV-Visible spectroscopy:** Electromagnetic spectrum. Chromophores and their interaction with electromagnetic radiation. Absorption spectra of organic compounds and its utilization in quantitative and qualitative analysis of drugs. Instrumentation and working of various types of UV-Vis spectrometers. Derivatisation spectrophotometry. Shifts and their effects. Solvent effects.

## **Unit II**

**Chromatographic techniques:** Liquid Chromatography: Principle involved in HPLC. Instrumentation in HPLC, analytical, preparative and micropore columns, normal and reverse phase packing materials, reverse phase HPLC. Gas chromatography: Principle involved in GC. Instrumentation GC.

## **Unit III**

**Nuclear Magnetic resonance spectroscopy:** Fundamental principles of NMR (magnetic properties of nuclei, applied field, precessional frequency, absorption and transition frequency). Chemical shift, isotopic nuclei, reference standards.

**Infra red spectroscopy, Mass spectrometry:** Basic principle and brief outline of instrumentation and working.

## **Unit IV**

**Definition of Statistics:** Concepts, relevance and general applications of statistics in pharmaceutical sciences.

### **Collection, Classification, presentation, analysis and interpretation of data.**

Definition and concept of Degrees of freedom, precision, accuracy, mean error, relative error, significant numbers

**Normal distribution:** Concept and properties, Sampling distribution, Standard error

**Parametric tests:** Z-test, students T test: paired and unpaired. F-Test, ANOVA, Multiple ANOVA

**Course Outcomes:**

1. Explains the importance of modern instrumentation in pharmaceutical analysis
2. Describes the fundamental principles and applications of spectroscopic techniques Viz., UV- Visible, IR, FTIR.
3. Discusses the principle and applications of chromatographic techniques
4. Identify appropriate instrumental techniques for the analysis of drugs in bulk or in various dosage forms.

**CO-PO Mapping**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	2	1	1	2	1	1	2
CO2	2	2	1	1	2	2	2	1	3	1	1	2
CO3	3	3	2	1	1	2	2	2	2	1	2	3
CO4	2	3	2	1	1	1	1	1	2	1	2	3

3-High, 2- Medium, 3- Low.

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 106	Human Values and Professional Ethics-I	06	04
<b>Sessional Marks : 20</b>		<b>End Semester Examination Marks : 80</b>	

**Objectives:**

1. To familiarise students with basic ethical theories.
2. To create ethical awareness to help them in dealing with issues around them.
3. To grasp the traditional ethical theories as well as to help students apply it on the practical front.
4. It is a curriculum which enables students to develop ability for moral reasoning and act with ethical deliberations.

**Course Content:****Unit I**

Definition and Nature of Ethics- Its relation to Religion, Politics, Business, Law, Medicine and Environment. Need and Importance of Professional Ethics- Goals- Ethical Values in various Professions.

**Unit II**

Nature of Values – Good and Bad, Ends and Means , Actual and potential Values, Objective and Subjective Values, Analysis of basic moral concepts- right , ought, duty, obligation, justice,

responsibility and freedom , Good behavior and respect for elders, Character and Conduct.

### Unit III

Individual and Society:

Ahimsa (Non- Violence), Satya (Truth), Brahmacharya (Celibacy), Asteya (Non possession) and Aparigraha (Non- stealing). Purusharthas (Cardinal virtues) – Dharma (Righteousness), Artha (Wealth), Kama (Fulfillment Bodily Desires), Moksha (Liberation).

### Unit IV

Bhagavad Gita- (a) Niskama Karma (b) Buddhism- The Four Noble Truths- Arya astanga marga, (c) Jainism- mahavratas and anuvratas. Values Embedded in various Religions, Religious Tolerance, Gandhian Ethics.

### Unit V

Crime and Theories of punishment (a) Reformative , Retributive and Deterrent. (b) Views on manu and Yajnavalkya.

#### Text Books:

1. John S Mackenjie: A manual of ethics.
2. The Ethics of Management” by Larue Tone Hosmer, Richard .D. Irwin Inc.
3. Management Ethics-integrity at work” by Joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
4. Ethics in management” by S.A.Sherlekar, Himalaya Publishing House.  
Harold H. Titus:Ethics for Today.Maitra,S.K: Hindu Ethics.
5. William Lilly : Introduction to Ethics

#### Course Outcomes:

At completion of this subject it is expected that students will be able to

1. Awareness of ethical issues and basic ethical approaches.
2. Improved writing skills and understanding of ethical conflict.
3. Enables students to develop ability for moral reasoning and act with ethical deliberations.
4. After studying ethics one is equipped with the ethical sensitivity and moral understanding required to solve complex ethical dilemmas.

#### CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	3	1	1	3	1	3	3	3	1
CO2	1	1	3	3	1	1	2	1	3	3	3	1
CO3	1	1	3	3	1	1	2	1	3	3	3	1
CO4	2	2	3	3	1	2	3	2	3	3	3	2

3-High, 2- Medium, 3- Low.



Course Code	Course Title	No of Hours Per week	No of Credits
MPH 107	Comprehensive Viva	00	0
<b>Sessional Marks : 00</b>		<b>End Semester Examination Marks : 50</b>	

## SECOND SEMESTER

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 201A (Pharmacology)	Molecular Pharmacology	06	04
<b>Sessional Marks : 20</b>		<b>End Semester Examination Marks : 80</b>	

### Objectives:

1. To study the mechanisms of drug action at the molecular level through the application of biochemical and molecular biological techniques.
2. To give a structural basis for the physiological and pharmacological properties of the different receptor types
3. To study the molecular details of muscarinic, adrenergic, dopaminergic and excitatory amino acid receptors, neurotransmitter transporters and voltage-gated ion channels.

### Course Content:

#### UNIT – I

Drug Receptor theory, concept of Receptor, Theories of drug receptor interaction, Receptor polymorphism, Dimerization and importance in Drug design.

#### UNIT – II

- a) Endothelin receptors, agonist and antiagonist and their importance in various cardio vascular diseases.
- b) GPCR- Structure & function, signal transduction and termination of receptor activity.
- c) Adrenergic receptor classifications, agonists and antiagonist.
- d) cholinergic receptors classifications, agonists and antiagonist.
- e) Pharmacology of NMDA receptors.
- f) Pharmacology of 5HT receptors, classification & role of 5HT agonist and antagonist in various disorders.
- g) Pharmacology GABA receptors.
- h) Mol. Mechanism of PPAR  $\gamma$  agonist.
- i) Pharmacology of voltage-gated ion channels.

### UNIT – III

- a) Role of Nitric oxide in various physiological functions and its importance in Hypertension, Angina and Erectile dysfunction.
- b) Lipid peroxidation, free radicals & role of antioxidants in various diseases
- c) Leptin in the pathogenesis & treatment of obesity.

### UNIT – IV

#### Immunopharmacology

- a) Role of cytokines, Prostaglandins, bradykinins in various immunological & inflammatory disorders.
- b) Molecular mechanisms of immune disorders with references to AIDS
- c) Molecular mechanism of action of immunomodulation and immune suppressive.

#### REFERENCES:

1. The Cell, A Molecular Approach. Geoffrey M Cooper.
2. Handbook of Cell Signaling (Second Edition) Edited by Ralph A. et.al
3. Goodman and Gillman's The Pharmacological basis of therapeutics 10th edition.
4. Pharmacogenomics: The Search for Individualized Therapies. Edited by J. Licinio and M -L. Wong
5. Molecular Pharmacology: From DNA to Drug Discovery. John Dickenson et.al
6. Current protocols in molecular biology vol I to VI edited by Frederick M. Ausuvel et al
7. Pharmacology 5th edition by H.P. Rang M.M. Dale, J.M. Ritter, P.K. Moore
8. Basic and clinical pharmacology 8th edition edited by Bertram G. Katzung.
9. Essentials of pharmacotherapeutics by F.S.K. Barar
10. Clinical Pharmacology by Molmon and Morelli.
11. Principles of drug action by Golstein, Aranow and Kalman.
12. Reviews of Physiology, Biochemistry and Pharmacology

#### Course Outcomes:

At completion of this subject it is expected that students will be able to

1. Explain the modes of action of drug at the cellular level by describing their interactions with target proteins
2. Explain the receptor signal transduction processes.
3. Explain the molecular pathways affected by drugs.
4. Understanding the applicability of molecular pharmacology and biomarkers in drug discovery process.

## CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	2	1	3	1	1	1	3
CO2	2	2	1	1	2	2	1	3	1	1	1	3
CO3	1	2	1	1	2	2	1	2	1	1	1	3
CO4	2	2	1	1	2	2	1	3	1	1	1	3

3-High, 2- Medium, 3- Low.

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 202 A	Methods in Drug Evaluation	06	04
<b>Sessional Marks : 20</b>		<b>End Semester Examination Marks : 80</b>	

### Objectives:

1. Understand the mechanism of drug action and its relevance in the treatment of different diseases
2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
3. Demonstrate the various receptor actions using isolated tissue preparation
4. Appreciate correlation of pharmacology with related medical sciences

### Course Content:

#### UNIT – I

- a) New drug discovery process, preclinical studies
- b) Guidelines and regulatory agencies – CPCSEA, OECD
- C) Acute, sub acute and chronic toxicity studies, carcinogenesis and mutagenesis, Teratogenicity.

#### UNIT – II

- a) Commonly used laboratory animals, transgenic animals, Techniques of blood collection, anesthesia, euthanasia, various routes of drug administration & maintenances & breeding of laboratory animals.
- b) Evaluation of drugs cvs, respiratory, psychotropic, neurotropics, analgesic, anti inflammatory, antipyretic, immunomodulatory, anti diabetic, anti obesity, anti atherosclerotic, aphrodisiac, antiulcer and antineoplastic agents.

#### UNIT – III

a) Bioassays – Methods, general principles, types and procedures involved in bioassays of ACH, histamine, insulin, oxytoxin, digoxin, d-tubocurarine.

b) General Principles of Immunoassay, ELISA.

#### UNIT – IV

Clinical Trails – Definition, Types, guidelines for Investigational New drug Application (IND).

#### Text Books:

1. Drug discovery and evaluation by Vogel
2. Screening Methods in Pharmacology by Robert A... Turner
3. Goodman and Gillman's The Pharmacological basis of therapeutics 10<sup>th</sup> edition.
4. Pharmacology 5<sup>th</sup> edition by H.P. Rang M.M. Dale, J.M. Ritter, P.K.Moore
5. Basic and clinical pharmacology 8<sup>th</sup> edition edited by Bertram G. Katzung.

#### Course Outcomes:

After Completion of the course the student able to

1. Know the commonly used instruments in experimental pharmacology.
2. describe the animal physiology with their biochemical reference values in various animal species.
3. Study of methods for collection of blood, body fluids and urine from experimental animals.
4. Record the effect of drug on Concentration Response Curves (CRC) using suitable isolated tissue preparations (Synergism and Antagonism).

#### CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	2	2	1	2	1	1	1	3
CO2	2	2	1	1	2	2	1	2	1	1	1	3
CO3	2	2	1	1	3	3	1	1	1	1	1	3
CO4	2	2	1	1	2	2	1	3	1	1	1	3

5. 3-High, 2- Medium, 3- Low.

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 203	Practical 1	06	04
Sessional Marks : 00		End Semester Examination Marks : 100	

### Objectives:

1. Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
2. Comprehend the principles of toxicology and treatment of various poisonings
3. Appreciate correlation of pharmacology with related medical sciences.

### Course Content:

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

### Text Books:

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.,

**Course Outcomes:**

After Completion of the course the student able to perform

1. Calculation of the  $PA_2$  Calculate the  $PA_2$  Value
2. Interpolation bioassay
3. Matching or bracketing bioassay
4. Three point bioassay

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	2	1	3	1	1	1	3
CO2	2	2	1	1	2	2	1	2	1	1	1	3
CO3	2	2	1	1	2	2	1	2	1	1	1	3
CO4	2	2	1	1	2	2	1	2	1	1	1	3

5. 3-High, 2- Medium, 3- Low.

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 204	Practical-II(BPK)	6	04
<b>End Semester Examination Marks : 100</b>			

**Objectives:**

1. Understanding mechanism of drug absorption and various affecting drug absorption.
2. Understanding various biopharmaceutic factors affecting drug bioavailability.

3. Understanding the various method of dissolution testing in vitro in vivo correlation dissolution data
4. Understand basic considerations of Pharmacokinetic models. Understand different compartment model and non-compartment model.

**Course Content:**

1. In vitro dissolution study of compressed tablet
2. In Vitro dissolution study of marketed sustained release tablet
3. Determination of Partition coefficient and dissociation constant
4. Determination of Partition coefficient and dissociation constant of ibuprofen
5. Protein binding study using dynamic dialysis method
6. Determination of protein binding using equilibrium dialysis method.
7. Design and evaluation of transdermal patches containing diclofenac sodium
8. Formulation and evaluation of transdermal patches of ibuprofen
9. Modelling of drug release form delivery system using kinetic software
10. Determination of release for kinetics for the dissolution data.
11. Absorption study for diclofenac sodium.

**Text Books:**

5. Practical book by Hedaya in Bio Pharmacokinetics
6. JC Wagner, fundamentals of clinical Pharmacokinetics
7. Bert N Ladu, Fundamental practical book for drug metabolism and disposition

**Course Outcomes:**

After Completion of the course the student able to perform experiments like

1. Compare and differentiate between compartmental and non compartmental analysis
2. Identify the physiological, Physicochemical and dosage form related factors that affects drug absorption from different dosage forms
3. Examine the absolute and relative bioavailability of drugs form different dosage forms using either plasma or urine data.
4. Compare the bioequivalence of two drug products

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	1	2	2	1	3	1	1	1	3
CO2	2	3	1	1	2	2	1	3	1	1	1	3
CO3	2	3	1	1	2	2	1	3	1	1	1	3
CO4	2	3	1	1	2	2	1	3	1	1	1	3

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 205	BIO-PHARMACEUTICS & PHARMACOKINETICS	06	04
<b>Sessional Marks: 20</b>		<b>End Semester Examination Marks: 80</b>	

**OBJECTIVES:**

1. Define and differentiate between basic concepts of pharmacokinetics and pharmacodynamics, identify the physiological, physicochemical and dosage form-related factors that affect drug absorption.
2. Analyze different compartmental and non-compartmental models of pharmacokinetics and determine the basic linear and non-linear pharmacokinetic parameters that describe drug absorption and disposition.
3. Describe concept and principles of dissolution studies and in vitro-in vivo correlation for different drug products and pharmacokinetic basis of modified release dosage forms of medications.



## **COURSE CONTENT:**

### **Unit I**

**Foundations of pharmacokinetics:** The Birth of compartments: The Rutherford equations, The Benke Equations, The Toerell Equations and Tracer kinetics. Compartmental modelling. Basics of Model building. One Compartmental Model. Two Compartmental Model. Multi Compartmental Model.

### **Unit II**

**Physiological Pharmacokinetic modelling:** Blood flow rate limited models, blood clearance, lung clearance, apparent volume of distribution, non-linear disposition. Membrane limited models. Relationship between Physiologically based models and usual compartment models.

**Non-compartmental analysis:** Non compartmental analysis based on statistical moment theory. Bioavailability, clearance, half-life, absorption kinetics, apparent volume of distribution etc., Steady state.

### **Unit III**

**Non-Linear Pharmacokinetics:** Michaelis Menten Kinetics, Estimation of  $K_m$  and  $V_m$ , Clearance, Half Life, Volume of distribution, steady state, bioavailability etc., Urinary excretion process and other non-linear elimination process. Problems in quantifying non-linear pharmacokinetics.

Multiple Dosing: IV, IV infusion, First order absorption and determination of PK parameters from multiple dosing data

### **Unit IV**

#### **Kinetics of Pharmacologic response:**

- a) Kinetics of directly reversible pharmacologic response.
- b) Kinetics of indirect pharmacologic response.
- c) Kinetics of irreversible pharmacologic response.

Applications of PK principles: Multiple dosing, Dose adjustments in Renal failure, Hemo dialysis, Methods for determination of Individual Patient parameters. Assessing Bio Availability of Drug Delivery systems.

**Modelling in Pharmacodynamics:** Classical Pharmacodynamics, Non-Classical Pharmacodynamics.

**Books recommended:**

- 1) Hedaya, Basic pharmacokinetics.
- 2) Milo Gibaldi, Pharmacokinetics.
- 3) J.C. Wagner, Fundamentals of Clinical Pharmacokinetics.
- 4) Bert.N.Ladu, Fundamentals of drug metabolism and disposition.

**COURSE OUTCOMES:**

After successful completion of the course student will be able to:

1. Understand the concept of ADME of drug in human body.
2. Determine the various pharmacokinetic parameters from either plasma concentration or urinary excretion data for drug
3. Apply the various regulations related to developing BA -BE study protocol for the new drug molecule.

## CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	3	1	1	2	1	1	1	1
CO2	1	2	2	1	1	1	2	3	2	1	2	1
CO3	2	1	3	1	1	3	2	1	1	1	2	1

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 206	Human Values and Professional Ethics-II	06	04
<b>Sessional Marks : 20</b>		<b>End Semester Examination Marks : 80</b>	

**Objectives:**

1. To instill Moral and Social Values and Loyalty
2. To appreciate the rights of others
3. To inculcate the sense of social responsibility.
4. To develop a firm ethical base
5. To make the students realize the significance of ethics in professional environment.

## **Course Content:**

### **Unit I**

Value Education- Definition- relevance to present day- Concept of Human Values- self introspection-Self esteem- Family Values – Components, Structure and responsibilities of family-Neutralization of anger- Adjustability- Treats of family life – Status Of women in family and society- Caring for needy and elderly – Time allotment for sharing ideas and concerns.

### **Unit II**

Medical ethics- Views of Charaka, Sushruta and Hippocrates on moral responsibility of medical practitioners. Code of ethics for medical and Health care professionals. Euthanasia, Ethical obligation to animals, Ethics issues in relation to health care professionals and patients. Social justice in health care, Human cloning, Problems of abortion. Ethical issues in genetic engineering and Ethical issues raised by new biological technology or knowledge.

### **Unit III**

Business ethics- Ethical standards of business- Immoral and illegal practices and their solutions. Characteristics of ethical problems in management, ethical theories, causes of unethical behavior, ethical abuses and work ethics.

### **Unit IV**

Environment ethics- Ethical theory, man and nature- Ecological crisis, Pest control, Pollution and waste, Climate change, Energy and population, Justice and Environmental health.

### **Unit V**

Social ethics- Organ trade, Human trafficking, Human rights violation and social disparities, Feminist ethics, Surrogacy/ pregnancy. Ethics of media- Impact of Newspaper, Television, Movies and Internet.

## **Recommended Books**

1. John S Mackenzie: A manual of ethics.
2. The Ethics of Management” by Larue Tone Hosmer, Richard .D. Irwin Inc.
3. Management Ethics-integrity at work” by Joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
4. Ethics in management” by S.A.Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today.
6. Maitra, S.K: Hindu Ethics.
7. William Lilly: Introduction to Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manu Dharma Sastra or the Institute of Manu : Comprising the Indian System of Duties: Religious and Civil (ed.) G.C. Haughton.
10. Susruta Samhita: Tr. Kaviraj Kunjalal ,Kunjalal Brishagratha, Chowkamba Sanskrit series, Vol I,II and III, Varanasi, Vol 1 OO, 16-20, 21-32 and 74- 77 only.
11. Caraka Samhita: Tr. Dr. Ram Karan Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series Office , Varanasi Vol 100, 16-20,21-32 and 74-77 only.
12. Ethics: Theory and Contemporary Issues., Barbara Mackinnon Wadsworth/ Thomson Learning , 2001.
13. Analysing Moral Issues, Judith A. Boss, Mayfield Publishing Company ,1999.
14. An Introduction to Applied ethics (Ed.) John H.Piet and Ayodhya Prasad, Cosmo Publications.

15. Text Book for Intermediate logic, Ethics and Human Values , board of intermediate Education & Telugu Academic Hyderabad.

**COURSE OUTCOMES:**

At completion of this subject it is expected that students will be able to

1. Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
2. Learn about morals, values & work ethics.
3. Develop commitment
4. Learn about the different professional roles.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	3	2	2	1	1	2	1
CO2	2	1	2	1	3	3	1	2	1	2	1	1
CO3	1	3	1	2	3	2	2	3	2	1	2	1
CO4	1	1	2	1	2	2	3	1	1	2	3	2

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 207	Comprehensive Viva	00	02
<b>Sessional Marks : 00</b>		<b>End Semester Examination Marks : 50</b>	

### THIRD SEMESTER

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 301	Mid-Term Evaluation of Research project	00	08
<b>Sessional Marks : 00</b>		<b>End Semester Examination Marks : 200</b>	

#### **COURSE OBJECTIVE**

After successful completion of this course students will be able to:

1. Work in team and undertake a project in the area of Pharmacy
2. Apply concepts of pharmaceutical sciences for executing the project
3. Apply appropriate research methodology while formulating a project
4. Define specifications, synthesize, analyse, develop and evaluate a project
5. Present, exhibit and document the project work
6. Develop a project report

#### **COURSE OUTCOME**

1. Final Year Projects represent the culmination of study towards the Master of Pharmaceutical sciences degree.
2. Projects offer the opportunity to apply and extend material learned throughout the program.
3. Assessment is by means of a seminar presentation, submission of a thesis, and a public demonstration of work undertaken.
4. In contrast to the majority of courses studied elsewhere in the program, projects are undertaken individually or in small groups.

CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	3	3	2	1	3	2	1	1	3
CO2	1	1	2	1	2	2	3	2	1	1	3	2
CO3	1	2	1	1	2	2	1	1	1	2	1	3
CO4	2	1	2	2	3	1	2	3	2	1	1	2

#### FOURTH SEMESTER

Course Code	Course Title	No of Hours Per week	No of Credits
MPH 401	Project thesis submission & presentation and Project Viva voce	00	12
<b>Sessional Marks : 00</b>		<b>End Semester Examination Marks : 300</b>	

#### COURSE OBJECTIVE

After successful completion of this course students will be able to:

1. Work in team and undertake a project in the area of Pharmacy
2. Apply concepts of pharmaceutical sciences for executing the project
3. Apply appropriate research methodology while formulating a project
4. Define specifications, synthesize, analyse, develop and evaluate a project
5. Present, exhibit and document the project work
6. Develop a project report

#### COURSE OUTCOME

1. Final Year Projects represent the culmination of study towards the Master of Pharmaceutical sciences degree.

2. Projects offer the opportunity to apply and extend material learned throughout the program.
3. Assessment is by means of a seminar presentation, submission of a thesis, and a public demonstration of work undertaken.
4. In contrast to the majority of courses studied elsewhere in the program, projects are undertaken individually or in small groups.

#### CO-PO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2	1	3	3	2	3	1	3	2	3
CO2	1	2	2	1	2	2	1	3	2	3	1	1
CO3	2	3	1	1	1	1	1	2	1	3	1	3
CO4	1	2	1	2	2	1	2	3	1	3	1	2