



# MANIPAL COLLEGE OF PHARMACEUTICAL SCIENCES

MANIPAL

(A constituent unit of MAHE, Manipal)

## DOCTOR OF PHARMACY (PHARM.D)

## FIRST YEAR - COURSE OUTCOMES (COs)

### PHA 1.1T : HUMAN ANATOMY AND PHYSIOLOGY

Upon completion of this course, the student should be able to:

1. Identify the tissues and organs of the human body.
2. Describe the homeostatic mechanisms and their imbalances.
3. Describe the gross anatomical, histological structure and functions of systems and organs of the human body.

### PHA 1.1L : HUMAN ANATOMY AND PHYSIOLOGY LAB

Upon completion of this course, the student should be able to:

1. Identify the body tissues and organs of the different systems of the human body
2. Perform the haematological tests and also record blood pressure, heart rate, pulse and respiratory volumes.
3. Interpret the mechanisms of contraception and conceptions.

### PCE 1.2T: PHARMACEUTICS

Upon completion of this course, the student should be able to:

1. Know the history of profession of pharmacy.
2. Understand the professional way of handling the prescriptions.
3. Comprehend the different pharmaceutical calculation involved in formulation and dispensing of pharmaceutical dosage forms.
4. Understand the formulation aspects of various dosage forms.
5. Know the principles involved in formulation of different dosage forms, their incompatibilities, and surgical dressings.
6. Demonstrate the importance of good stable and effective formulations with their evaluations.

### PCE 1.2L: PHARMACEUTICS LAB

Upon completion of this course, the student should be able to:

1. Know the formulation aspects of different dosage forms.
2. Know and appreciate the principle and procedure involved in the preparation of dosage forms.
3. Know how to pack, label and dispense the dosage forms.

### PBT 1.3T: MEDICINAL BIOCHEMISTRY

Upon completion of this course, the student should be able to:

1. Understand the catalytic activity of enzymes and importance of isoenzymes in diagnosis of diseases.
2. Know the metabolic process of biomolecules in health and illness (metabolic disorders).
3. Understand the genetic organization of mammalian genome, protein synthesis, replication, mutation, and repair mechanism.
4. Know the biochemical principles of organ function tests of kidney, liver and endocrine gland.
5. perform the qualitative analysis and determination of biomolecules in the body fluids.

### PBT 1.3L: MEDICINAL BIOCHEMISTRY LAB

Upon completion of this course, the student should be able to:

1. Perform qualitative and quantitative analysis of various biochemical parameters present in blood and urine and to interpret the clinical relevance based on observation.
2. Carry out experiments to study the factors affecting enzyme activity.
3. Be well versed with preparation of standard buffer solutions and its pH measurements.
4. Understand various lipid profile tests and methods to determine important electrolytes.

### PCH 1.4T: PHARMACEUTICAL ORGANIC CHEMISTRY

Upon completion of this course, the student should be able to:

1. Understand the fundamentals of organic chemistry.
2. Identify and name any given sample of organic compound.
3. Aware of their physical and chemical properties.
4. Understand why and how a chemical reaction occurs.
5. Qualitative and quantitative analysis of organic compounds.

### PCH 1.4L: PHARMACEUTICAL ORGANIC CHEMISTRY LAB

Upon completion of this course, the student should be able to:

1. Develop the practical skills in handling and approaches to prepare any organic compound.
2. Students also learn the techniques to identify the unknown organic sample by following systematic qualitative analysis.
3. Students will understand the concepts of shapes (stereochemistry) of different organic compounds.

### PCH 1.5T: PHARMACEUTICAL INORGANIC CHEMISTRY

Upon completion of this course, the student should be able to:

1. Understand the significance and to learn the various volumetric analysis methods available for inorganic pharmaceuticals.
2. Know the Preparation, purity, storage, and applications of inorganic pharmaceuticals.
3. Appreciate the importance of inorganic pharmaceuticals in preventing and curing the disease.

### PCH 1.5L: PHARMACEUTICAL INORGANIC CHEMISTRY LAB

Upon completion of this course, the student should be able to:

1. Prepare inorganic compounds and carry out pharmacopoeial tests.
2. Select an optimum analytical technique for a given sample.
3. Convert the observations to meaningful results and drawing the inferences.
4. Compare various methods of analysis and their outcomes.

### MAT 1.6T: REMEDIAL MATHEMATICS

Upon completion of this course, the student should be able to:

1. Know trigonometry, analytical geometry, matrices, determinant, integration, differential equation, Laplace transform and their applications.
2. Solve the problems of different types by applying theory.
3. Appreciate the important applications of mathematics in pharmacy.

### PCO 1.6T: REMEDIAL BIOLOGY

Upon completion of this course, the student should be able to:

1. Know the plant kingdom and its classification, general organization of plant, morphology of its various parts/ modifications and pollination process.
2. Understand the physiology and taxonomical characters of the plant.
3. Gain the Knowledge on Fungi, Yeast, Penicillin and Bacteria.
4. Understand the animal cell/ tissues, characters, uses of Pisces, Reptiles, Aves, mammals and poisonous animals.
5. Gain the knowledge on frog physiology.

### PCO 1.6L: REMEDIAL BIOLOGY LAB

Upon completion of this course, the student should be able to:

1. Gain the knowledge on handling microscope, preparation of permanent slides and simple physiological experiments.
2. Understand cell wall constituents, cell inclusions and different parts of the plants and its modifications.
3. Get hands on experience on various parts of plant histology.
4. Gain knowledge on identification of animals and study of frog.





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## SECOND YEAR - COURSE OUTCOMES (COs)

### PPR 2.1T: PATHOPHYSIOLOGY

Upon completion of this course, it is expected that students shall be able to:

1. Describe the etiology and pathogenesis of the selected disease states.
2. Name the signs and symptoms of the diseases.
3. Mention the complications of the diseases.
4. Basic principles involved in cell injury, inflammation and immunity.
5. Most recent updates on pathogenesis of the diseases.

### PBT 2.2T: PHARMACEUTICAL MICROBIOLOGY

Upon completion of this course, the student shall be able to:

1. Know the anatomy, identification, growth factors and sterilization of microorganisms.
2. Know the mode of transmission of disease causing microorganism, symptoms of disease, and treatment aspect.
3. Do estimation of RNA and DNA and there by identifying the source.
4. Do cultivation and identification of the microorganisms in the laboratory.
5. Do identification of diseases by performing the diagnostic tests.
6. Appreciate the behavior of motility and behavioral characteristics of microorganisms.

### PBT 2.2L: PHARMACEUTICAL MICROBIOLOGY LAB

Upon completion of this course, the student shall be able to:

1. Practice aseptic techniques and work in microbiology laboratory
2. Culture, stain, and identify the microorganisms.
3. Perform the microbiological assays of antibiotics.
4. Do sterility test for Pharmaceutical products.
5. Perform diagnostic tests for Widal and malarial parasite

### PCO 2.3T: PHARMACOGNOSY & PHYTOPHARMACEUTICALS

Upon completion of this course, it is expected that students shall be able to

1. Understand the scope of Pharmacognosy, identification, basic principles of cultivation, collection and storage of crude drugs including adulteration.
2. Know the source, active constituents and uses of crude drugs.
3. Appreciate the applications of primary and secondary metabolites of the plant.
4. Gain knowledge on natural pesticides in overcoming the various complication and health hazards of synthetic pesticides.
5. Understand importance of surgical fibers and dressing.

### PCO 2.3L: PHARMACOGNOSY & PHYTOPHARMACEUTICALS LAB

Upon completion of this course, the student should be able to:

1. Identify crude drugs studied in the theory for their morphological and anatomical characters.
2. Perform chemical tests for identification of unorganized drugs and analysis of lipids.

### PHA 2.4T: PHARMACOLOGY-1

Upon completion of this course, the student should be able to:

1. Understanding the pharmacological aspects of drugs falling under the below mentioned systems.
2. Appreciate the importance of pharmacology subject as a basis of therapeutics.
3. Correlate and apply the knowledge theoretically.
4. Apply the learnt drug knowledge to clinical situation.

### PPR 2.5T: COMMUNITY PHARMACY

On completion of the course, the student shall be able to:

1. Know pharmaceutical care service.
2. Know the business and professional practice management skills in community pharmacies.
3. Understand the patient counselling & health screening services to public in community pharmacy.
4. Respond to minor ailments and provide appropriate medication.
5. Show empathy and sympathy to patients.
6. Appreciate the concept of rational drug therapy.

### PPR 2.6T: PHARMACOTHERAPEUTICS-1

Upon completion of the course, the student shall be able to:

1. Therapeutic approach to the management of cardiovascular, endocrine, respiratory and ophthalmic diseases.
2. Treatment objectives for the individual patients and the diseases.
3. Importance of developing individualized therapeutic plans.
4. Prescribing guidelines for the special populations.
5. Patient-specific parameters for selection, initiation and monitoring of drug therapies.
6. Most recent updates in relevant treatment guidelines.

### PPR 2.6L: PHARMACOTHERAPEUTICS-1 LAB

Upon completion of the course, the student shall be able to:

1. Develop individualized therapeutic plans for patients clinical with cardiovascular, endocrine and respiratory diseases.
2. Interpret patient-specific parameters for selection, initiation, and monitoring of drug therapies of individual cases.
3. Apply core concept of case-based learning of pharmacotherapeutics with most recent evidence based consensus guidelines for the management of the cases.





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## THIRD YEAR - COURSE OUTCOMES (COs)

### PHA 3.1T: PHARMACOLOGY-II

Upon completion of the course, the student shall be able to

1. Understand the pharmacological aspects of drugs falling under the below mentioned chapters.
2. Carry out the animal experiments confidently.
3. Appreciate the importance of pharmacology subject as a basis of therapeutics, and
4. Correlate and apply the knowledge therapeutically.

### PHA 3.1L: PHARMACOLOGY-II LAB

Upon completion of the course, the student shall be able to

1. Understand the common laboratory animals used in experimental pharmacology, its handling and regulations governing them including physiological salt solutions, lab appliances employed in experiments.
2. Gain knowledge about bioassays to determine the concentration of unknown samples provided and to appreciate the mechanism of drug action studied in theory.
3. Understand theory, principle and methods involved in screening of different pharmacological activities and interpret results of simulated experiments.

### PQA 3.2T: PHARMACEUTICAL ANALYSIS

Upon completion of the course, the student shall be able to:

1. Understand the cGMP aspects in pharmaceutical industry and responsibilities of QA & QC departments.
2. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis.
3. Understand the chromatographic separation and its applications in pharmaceutical analysis.
4. Understand the principle and applications of electrometric methods of analysis.
5. Understand the principle, instrumentation and applications of polarimetry, X-ray diffraction and thermal methods of analysis.

### PQA 3.2L: PHARMACEUTICAL ANALYSIS LAB

Upon completion of the course, the student shall be able to:

1. Learn the operation of advanced instruments and documentation.
2. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

### PPR 3.3T: PHARMACOTHERAPEUTICS-II

Upon completion of the course, the student shall be able to:

1. Therapeutic approach to the management of infectious disease, renal disorders, musculoskeletal disorders, dermatology & cancer
2. Treatment objectives for the individual patients and the diseases
3. Importance of developing individualized therapeutic plans
4. Prescribing guidelines for the special populations
5. Patient-specific parameters for selection, initiation and monitoring of drug therapies
6. Most recent updates in relevant treatment guidelines

### PPR 3.3L: PHARMACOTHERAPEUTICS-II LAB

Upon completion of the course, the student shall be able to:

1. Develop individualized therapeutic plans for patients with Infectious disease, Renal disease, Musculoskeletal disorder, Cancer and dermatological disorder

2. Interpret patient specific parameters for selection, initiation, and monitoring of drug therapies of individual cases.
3. Apply core concept of case-based learning of pharmacotherapeutics with most recent evidence based consensus guidelines for the management of the cases.
4. Learn skills for carrying our patient counselling and prescription audit.

### PMA 3.4T: PHARMACEUTICAL JURISPRUDENCE

Upon completion of the course, the student shall be able to:

1. Understand the pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
2. Gain the knowledge about various Indian Pharmaceutical Acts and Laws.
3. Understand regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.
4. Have the knowledge of code of ethics during the pharmaceutical practice.

### PCH 3.5T: MEDICINAL CHEMISTRY

Upon completion of the course, the student shall be able to:

1. Understand the principles of modern concepts of rational drug design.
2. Understand the chemistry and mechanism of action of drugs along with their pharmacological activity.
3. Know the SAR of different classes of drugs.
4. Study the chemical synthesis of selected drugs.

### PCH 3.5L: MEDICINAL CHEMISTRY LAB

Upon completion of the course, the student shall be able to:

1. Analyze medicinally important compounds as per pharmacopoeia procedure.
2. Synthesize, purify and characterize medicinally important compounds and intermediates.
3. Evaluate important physicochemical properties and determine drug likeness of compounds.

### PCE 3.6T: PHARMACEUTICAL FORMULATIONS

Upon completion of the course, the student shall be able to:

1. Understand the principle involved in formulation of various pharmaceutical dosage forms.
2. prepare various pharmaceutical formulations.
3. perform evaluation tests of pharmaceutical dosage forms.
4. understand and appreciate the concepts and different types of novel and controlled drug delivery systems.

### PCE 3.6L: PHARMACEUTICAL FORMULATIONS LAB

Upon completion of the course, the student shall be able to:

1. Prepare different types of pharmaceutical dosage forms and carry out the various quality control tests.
2. Prepare commonly used cosmetic products.





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## FOURTH YEAR - COURSE OUTCOMES (COs)

### PPR 4.1T: PHARMACOTHERAPEUTICS-III

**Upon completion of the course, the student shall be able to:**

1. Therapeutic approach to the management of gastrointestinal disorders, hematological disorders, neurological disorders, psychiatric disorders and pain management.
2. Treatment objectives for the individual patients and the diseases.
3. Importance of developing individualized therapeutic plans.
4. Prescribing guidelines for the special populations.
5. Patient-specific parameters for selection, initiation and monitoring of drug therapies.
6. Most recent updates in relevant treatment guidelines.

### PPR 4.1L: PHARMACOTHERAPEUTICS-III LAB

**Upon completion of the course, the student shall be able to:**

1. Understand therapeutic approach for the management of gastrointestinal disorders, hematological disorders, neurological disorders, psychiatric disorders and pain management.
2. Identify the treatment goals for specific disease and able to develop the individualized therapeutic plans.
3. To identify the patient-specific parameters for selection, initiation and monitoring of drug therapies.
4. Provide the feedback regarding the drug related issues to the physicians.

### PPR 4.2T: HOSPITAL PHARMACY

**Upon completion of the course, the student shall be able to**

Know various drug distribution methods.

1. Know the professional practice management skills in hospital pharmacies.
2. Provide unbiased drug information to the doctors.
3. Know the manufacturing practices of various formulations in hospital set up.
4. Appreciate the practice based research methods.
5. Appreciate the stores management and inventory control.

### PPR 4.2L: HOSPITAL PHARMACY LAB

**Upon completion of the course, the student shall be able to**

1. Provide unbiased drug information to the physician.
2. Assess the prescription for drug-drug interaction and its management.
3. Know the manufacturing practice of various formulations in hospital setup.
4. Appreciate the stores management & inventory control.

### PPR 4.3T: CLINICAL PHARMACY

**Upon completion of the course, the student shall be able to**

1. Monitor drug therapy of patient through medication chart review and clinical review.
2. Obtain medication history interview and counsel the patients.

3. Identify and resolve drug related problems.
4. Detect, assess and monitor adverse drug reactions.
5. Interpret selected laboratory results (as monitoring parameter in therapeutics) of specific disease states.
6. Retrieve, analyze, interpret and formulate drug or medicine information.

### PPR 4.3L: CLINICAL PHARMACY LAB

**Upon completion of the course, the student shall be able to**

1. Provide drug information services to the health care professionals and patients.
2. Perform patient medication history interview and counseling as a part of pharmaceutical care.
3. Interpret the clinical laboratory investigational reports and its significance in disease management.

### PPR 4.4T: BIostatISTICS & RESEARCH METHODOLOGY

**Upon completion of the course, the student shall be able to**

1. Various study designs.
2. Development of protocol and biomedical literature search.
3. Understand the application of various statistical analysis in data analysis and interpretation.
4. Writing research paper and presentation of results.

### PPR 4.5T: BIOPHARMACEUTICS & PHARMACOKINETICS

**Upon completion of the course, the student shall be able to**

1. Understand basic concepts of absorption, distribution, metabolism and elimination.
2. Have thorough understanding on pharmacokinetic and bioavailability studies.
3. Understand compartment and non-compartment models.
4. Appreciate the concepts of multiple dosage regimen.
5. Understand the concepts of non-linear kinetics.

### PPR 4.5L: BIOPHARMACEUTICS & PHARMACOKINETICS LAB

**Upon completion of the course, the student shall be able to**

1. Understand the concepts of absorption, distribution and Excretion
2. Apply the pharmacokinetic principles for dosage regimen design and bio-availability studies

### PPR 4.6T: CLINICAL TOXICOLOGY

**Upon completion of the course, the student shall be able to**

1. Learn general principles in the management of poisoning.
2. Know clinical symptoms and management of acute poisoning.
3. Learn clinical symptoms and management of chronic poisoning.
4. Understand toxic effects and general management of snake bite.
5. Learn plant, mushroom and food poisoning and envenomation.
6. Understand substance abuse and treatment of dependence.





### PPR 5.1T: CLINICAL RESEARCH

**Upon completion of the course, the student shall be able to**

1. Know the new drug development process.
2. Appreciate and conduct the clinical trials activities.
3. Manage the trial coordination process.
4. Understand the regulatory and ethical requirements.
5. Know safety monitoring and reporting in clinical trials.

### PPR 5.2T: PHARMACOEPIDEMIOLOGY & PHARMACOECONOMICS

**Upon completion of the course, the student shall be able to**

1. Understand the various epidemiological methods and their applications.
2. Understand the fundamental principles of pharmacoeconomics.
3. Identify and determine relevant cost and consequences associated with pharmacy products and services.
4. Perform key pharmacoeconomics analysis methods.
5. Understand the pharmacoeconomic decision analysis methods and its applications.
6. Describe current pharmacoeconomic method and issues.
7. Understand the applications of pharmacoeconomics to various pharmacy settings.

### PPR 5.3T: CLINICAL PHARMACOKINETICS & PHARMACOTHERAPEUTICS DRUG MONITORING

**Upon completion of the course, the student shall be able to**

1. Design dosage regimen.
2. Understand Pharmacokinetic drug interactions.
3. Learn and apply the concepts of therapeutic drug monitoring.
4. Appreciate the concepts of dosage adjustment in special populations.
5. Understand the concepts of population pharmacokinetics.
6. Learn the concepts of pharmacogenetics and its application in pharmacokinetics.

### PPR 5.4L: CLERKSHIP

**Upon completion of the course, the student shall be able to**

1. Understand the concepts of case assessment and pharmacotherapy.
2. Apply pharmaceutical care plan considering the therapeutic and toxic monitoring plans.

### PPR 5.5P: PROJECT WORK

**Upon completion of the course, the student shall be able to**

1. Undertake literature search, identify topics, design, plan, execute studies, document, compile, analyze and interpret data.
2. Present the results of the project work as a written report, conference presentations and publications in peer reviewed journals.





### **PPR 6.1R: INTERNSHIP**

1. To provide patient care in cooperation with patients, prescribers, and other inter-professional health care teams based upon sound therapeutic principles and evidence-based data.
2. To manage and use the health care system's resources to promote health; to provide, assess, and coordinate safe, accurate, and time-sensitive medication distribution; and improve therapeutic outcomes of medication use.
3. To promote health, wellness, and disease prevention in cooperation with patients, communities, at-risk populations, and other members of an interprofessional team of health care providers.
4. To demonstrate skills in monitoring the national health programs and schemes, oriented to provide preventive and promotive health care services to the community.
5. To develop leadership qualities to function effectively as a member of the health care team organized to deliver the health and family welfare services in the existing socio-economic, political, and cultural environment.
6. To communicate effectively with patients and the community.

