

Program outcomes (PO), Program Specific Outcomes (PSOs) & Course outcomes (COs) for B.Pharm. and M. Pharm. courses run in the Department of Pharmaceutical Sciences

(PO)

Pharmaceutical Sciences is a dynamic and interdisciplinary field that aims to integrate fundamental principles of physical and organic chemistry, engineering, biochemistry, and biology to understand how to optimize delivery of drugs to the body and translate this integrated understanding into new and improved therapies against human disease.

Department of Pharmaceutical Sciences focuses its efforts on creating knowledge through its enterprising spirit to prepare specialists who can contribute to drug manufacture, research and development in drug discovery, pharmaceutical administration/ regulation, environmental issues, develop educators and researchers in pharmaceutical sciences.

The program outcomes (PO) of B. Pharmacy have been well illustrated in the curriculum designed by University as per Pharmacy Council of India guidelines. The curriculum and profession of pharmacy is very dynamic and progressive. This does not restricted to just mere passing the university examination but to produce trained qualified pharmacist who could work in areas of modern pharmaceutical industry, in community, clinical, biotechnology, bioinformatics, biomedical and hospital pharmacies. The course input is for the development of Professional Identity, technical knowledge, planning abilities, professional Communication, Problem analysis/ cognitive ability, entrepreneurship / Leadership skill, Pharmaceutical Ethics, pharmaceutical regulation, social liability, sense of Environment sustainability.

Program Specific Outcomes (PSO's)

PSO 1: Detail understanding of theoretical and practical knowledge of all core and allied subjects of pharmaceutical sciences, which consist of dosage form design, routes of administration of various drugs, their mechanism of action, chemical moiety involved, doses of drugs, patient treatment, patient counseling, drug dispensing, hospital administration, drug manufacturing, QA/QC and regulation etc.

PSO2: Highlight the concepts and operative components of pharmacovigilance, clinical pharmacy, hospital pharmacy, community pharmacy, pharmaceutical care, pharmacovigilance, pharmacoconomics, clinical research, clinical pharmacokinetics and other related areas for the benefit of academicians, hospital/community pharmacists and industry, emphasizing the consequences of the use of medications.

PSO3: Rigorous core course-work in biopharmaceutics, drug transport, pharmacokinetics & pharmacodynamics, drug delivery systems, cell and molecular biology, synthetic and macromolecular chemistry, chemical and biomedical engineering, materials science, physiology and pharmacology.

PSO4: Emphasis on Drug Discovery and Design, Drug Delivery, Drug Action and Clinical Sciences, Drug Analysis, Cost Effectiveness of Medicines (Pharmacoeconomics), Drug Regulatory Affairs etc.

Course outcomes (COs):

YEAR /Sem.	SUBJECT CODE & SUBJECT	OUTCOME
I sem.	BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I	CO1: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.
	BP102T. PHARMACEUTICAL ANALYSIS	CO2: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs.
	BP103T. PHARMACEUTICS-I	CO3: This course is designed to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.
	BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY	CO4: This subject deals with the monographs of inorganic drugs and pharmaceuticals.
	BP105T. COMMUNICATION SKILLS	CO5: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.
	BP 106RBT. REMEDIAL BIOLOGY	CO6: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.
	BP 106RMT. REMEDIAL MATHEMATICS	CO7: This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform.
II sem.	BP 201T. HUMAN ANATOMY AND PHYSIOLOGY-II	CO8: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.
	BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I	CO9: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.
	BP203 T. BIOCHEMISTRY	CO10: Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.
	BP 204T. PATHOPHYSIOLOGY	CO11: Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions

		with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.
	BP205 T. COMPUTER APPLICATIONS IN PHARMACY	CO12: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases.
	BP 206 T. ENVIRONMENTAL SCIENCES	CO13: Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.
III Sem.	BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II	CO14: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.
	BP302T. PHYSICAL PHARMACEUTICS-I	CO15: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.
	BP 303 T. PHARMACEUTICAL MICROBIOLOGY	CO16: Study of all categories of microorganism especially for the production of alcohol antibiotics, vaccines, vitamins enzymes etc.
	BP 304 T. PHARMACEUTICAL ENGINEERING	CO17: This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.
IV sem.	BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III	CO18: This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.
	BP402T. MEDICINAL CHEMISTRY – I	CO19: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.
	BP 403 T. PHYSICAL PHARMACEUTICS-II	CO20: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.
	BP 404 T. PHARMACOLOGY-I	CO21: The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.
	BP 405 T. PHARMACOGNOSY AND PHYTOCHEMISTRY I	CO22: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.
V	BP501T. MEDICINAL	CO23: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on

sem.	CHEMISTRY – II	structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.
	BP 502 T. INDUSTRIAL PHARMACY-I	CO24: Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product
	BP503.T. PHARMACOLOGY-II	CO25: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.
	BP504 T. PHARMACOGNOSY AND PHYTOCHEMISTRY II	CO26: The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. Also this subject involves the study of producing the plants and phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine.
	BP 505 T. PHARMACEUTICAL JURISPRUDENCE	CO27: This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India.
VI sem.	BP601T. MEDICINAL CHEMISTRY – III	CO28: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.
	BP602 T. PHARMACOLOGY-III	CO29: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology and chronopharmacology.
	BP 603 T. HERBAL DRUG TECHNOLOGY	CO30: This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs.
	BP 604 T. BIOPHARMACEUTICS AND PHARMACOKINETICS	CO31: This subject is designed to impart knowledge and skills of Biopharmaceutics and pharmacokinetics and their applications in pharmaceutical development, design of dose and dosage regimen and in solving the problems arised therein.
	BP 605 T. PHARMACEUTICAL BIOTECHNOLOGY	CO32: Biotechnology has a long promise to revolutionize the biological sciences and technology. Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting. Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs. Biotechnology has already produced transgenic crops and animals and the future promises lot more.
	BP606T. PHARMACEUTICAL QUALITY ASSURANCE	CO33: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It deals with the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.
VII sem.	BP701T. INSTRUMENTAL METHODS OF ANALYSIS	CO34: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and

		practical knowledge on modern analytical instruments that are used for drug testing.
	BP 702 T. INDUSTRIAL PHARMACYII	CO35: This course is designed to impart fundamental knowledge on pharmaceutical product development and translation from laboratory to market.
	BP 703T. PHARMACY PRACTICE	CO36: In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. In community pharmacy, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counseling for improved patient care in the community set up.
	BP 704T. NOVEL DRUG DELIVERY SYSTEMS	CO37: This subject is designed to impart basic knowledge on the area of novel drug delivery systems.
VIII sem.	BP801T. BIOSTATISTICS AND RESEARCH METHODOLOGY	CO38: To understand the applications of Biostatistics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel.
	BP 802T. SOCIAL AND PREVENTIVE PHARMACY	CO39: The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.
	BP803ET. PHARMA MARKETING MANAGEMENT	CO40: The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The Knowledge and Know-how of marketing management groom the people for taking a challenging role in Sales and Product management.
	BP804 ET: PHARMACEUTICAL REGULATORY SCIENCE	CO41: This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia, UK etc. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.
	BP 805T. PHARMACOVIGILANCE	CO42: This paper will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance programme in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases and adverse drug reactions.
	BP 806 ET. QUALITY CONTROL AND STANDARDIZATION OF HERBALS	CO43: In this subject the student learns about the various methods and guidelines for evaluation and standardization of herbs and herbal drugs. The subject also provides an opportunity for the student to learn cGMP, GAP and GLP in traditional system of medicines.
	BP 807 ET. COMPUTER AIDED DRUG DESIGN	CO44: This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.
	BP808ET. CELL AND MOLECULAR	CO45: Cell biology is a branch of biology that studies cells – their physiological properties, their structure, the organelles they contain, interactions with their

	BIOLOGY	environment, their life cycle, division, death and cell function. This is done both on a microscopic and molecular level. Cell biology research encompasses both the great diversity of single-celled organisms like bacteria and protozoa, as well as the many specialized cells in multi-cellular organisms such as humans, plants, and sponges.
	BP809ET. COSMETIC SCIENCE	CO46: This subject deals with the study of cosmetics including their preparation, uses and effects. This course is designed to impart knowledge and skills necessary for the fundamental need for cosmetic and cosmeceutical products.
	BP810 ET. PHARMACOLOGICAL SCREENING METHODS	CO47: This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results.
	BP 811 ET. ADVANCED INSTRUMENTATION TECHNIQUES	CO48: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.
	BP 812 ET. DIETARY SUPPLEMENTS AND NUTRACEUTICALS	CO49: This subject covers foundational topics that are important for understanding the need and requirements of dietary supplements among different groups in the population.

M. Pharm. (Pharmaceutics)

PO1: Imparting theoretical knowledge and practical skills with the use of various advanced analytical instruments including NMR, Mass spectrometer, IR, HPLC, GC etc. It shall be applicable for identification, characterization, qualitative and quantitative analysis of various drugs in single and combination dosage forms.

PO2: In depth knowledge in the area of advances in novel drug delivery systems. This shall enable students to know the approaches for development of novel drug delivery systems, criteria for selection of drugs and polymers for the development of delivering system and about the formulation and evaluation of Novel drug delivery systems.

PO3: Imparting knowledge on various aspects viz. manufacturing of bulk, formulations in pharmaceutical industries. To understand the system as whole component wise studies is dispensed i.e., about preformulation studies, Active Pharmaceutical Ingredients, Generic drug Product development, Industrial Management, GMP Considerations, Optimization Techniques, Pilot Plant Scale Up Techniques, Stability Testing, sterilization process and packaging of dosage forms.

PO4: The information on regulatory affairs serves to gain advanced knowledge and skills required to learn the concept of generic drug and their development, various regulatory filings in

different countries, different phases of clinical trials and submitting regulatory documents : filing process of IND, NDA and ANDA.

PO5: The knowledge of Biopharmaceutics & Pharmacokinetics is for development of skills necessary for dose calculations, dose adjustments and to apply biopharmaceutics theories in practical problem solving. Basic theoretical discussions of the principles of biopharmaceutics and pharmacokinetics are provided to help the students' to clarify the concepts.

PO6: Necessary training is imparted on computer applications in pharmaceutical research and development, it helps to understand the application of computers across the entire drug research and development process. Basic theoretical discussions of the principles of more integrated and coherent use of computerized information (informatics) in the drug development process are provided to help the students to clarify the concepts.

PO7: Appreciable knowledge and exercise is imparted on Biostatistics And Research Methodology to make the students understand the applications like descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA of Biostatistics in Pharmacy.

Program Specific Outcomes (PSOs)

PSO1: To develop new/ groundbreaking medications / bulk drug/pharmaceutical formulation require latest methods, technologies and processes. In this, phase/topic wise is covered in the syllabus e.g., selection of drugs, dose calculations, dose adjustments by applying biopharmaceutics theories, pharmacokinetic and bioequivalence models, *in-vitro* and *in-vivo* studies using computer simulations, population modeling's, potential clinical pharmacokinetic and problem analysis, selection of polymers and various preformulation elements, pilot plant scale up techniques, industrial management, GMP considerations, stability testing, sterilization, formulation, evaluation and packaging of dosage forms.

PSO2: Professional Training to the students to work on drug compounds and develop new medications based on research. In this students learn test medications for efficiency and safety, oversee the production process to ensure medication are produced accurately, conducting clinical drug trials and evaluating the results of these trials to gauge a drugs's effectiveness and to determine potential risks or side effects.

PSO3: Students are trained to collaborate with various pharmaceutical companies and variety of health care professionals to ensure clinical drug trials are conducted safely as per regulatory guidelines for the testing of drugs.

PSO4: To develop a scientific innovation thought /innovation by assigning independent research projects to each students under specialized subjects supervisors. The findings/outcome of the research are promoted to be published in reputed national/international journals.

Course outcomes (COs):

YEAR/ Sem.	SUBJECT & SUBJECT CODE	OUTCOME
I sem.	MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPH 101T)	CO1: This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.
	DRUG DELIVERY SYSTEMS (MPH 102T)	CO2: This course is designed to impart knowledge on the area of advances in novel drug delivery systems.
	MODERN PHARMACEUTICS (MPH 103T)	CO3: Course designed to impart advanced knowledge and skills required to learn various aspects and concepts at pharmaceutical industries.
	REGULATORY AFFAIRS (MPH 104T)	CO4: Course designed to impart advanced knowledge and skills required to learn the concept of generic drug and their development, various regulatory filings in different countries, different phases of clinical trials and submitting regulatory documents : filing process of IND, NDA and ANDA
II sem.	MOLECULAR PHARMACEUTICS (NANO TECHNOLOGY & TARGETED DDS) (NTDS) (MPH 201T)	CO5: This course is designed to impart knowledge on the area of advances in novel drug delivery systems.
	ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS (MPH 202T)	CO6: This course is designed to impart knowledge and skills necessary for dose calculations, dose adjustments and to apply biopharmaceutics theories in practical problem solving. Basic theoretical discussions of the principles of biopharmaceutics and pharmacokinetics are provided to help the students' to clarify the concepts.
	COMPUTER AIDED DRUG DEVELOPMENT (MPH 203T)	CO7: This course is designed to impart knowledge and skills necessary for computer Applications in pharmaceutical research and development who want to understand the application of computers across the entire drug research and development process. Basic theoretical discussions of the principles of more integrated and coherent use of computerized information (informatics) in the drug development process are provided to help the students to clarify the concepts.
	COSMETICS AND COSMECEUTICALS (MPH 204T)	CO8: This course is designed to impart knowledge and skills necessary forth fundamental need for cosmetic and cosmeceutical products.
III sem.	RESEARCH METHODOLOGY & BIOSTATISTICS (MRM 301T)	CO9: The student will be known the Biostatistics arrangement, presentation and formation of tables and charts. They also know the correlation and regression & application of different methods, analysis of data and also learn how to write dissertation, thesis and Research paper.