Programme Outcomes, Programme Specific Outcomes and Course Outcomes
For PG Programmes

Programme Name: **The Master of Pharmacy**

*Number of Semesters: **4***

Name of the Department
University of North Bengal
West Bengal, INDIA

Programme Outcomes

- Pharmaceutical Technology where two specialization will be conducted i.e. M.Pharm in Pharmaceutics and M.Pharm in Pharmacognosy" focused on research and coursework relating to the development, production and characterization of dosage forms, as well as the disposition and action of drugs in the body.

- The department works towards promoting a multidisciplinary, team-based approach to drug delivery, embracing a variety of activities in the broad area of drug formulation and delivery.

- Major areas of emphasis include physical and applied pharmaceutics, drug disposition and dynamics, and drug delivery.

- The department works towards research in the following areas: Formulation optimization &characterization of solid, liquid and semi-solid dosage forms.

- It also deals with Novel Drug Delivery Systems including Buccal, Osmotic, Gastro Retentive, Vaginal, Colon Targeted, Microsphere, Immediate Release Formulations, Nanotechnology, Medicated Chewing Gum, Multi-Unit Pellet Systems, Ocular Delivery, Novel formulations for surgical site, Transdermal Delivery etc.

Programme Specific Outcomes

- M. Pharm or Master of Pharmacy is a postgraduate Academic Degree which is granted for a course or program in the field of Pharmaceutical Technology.
- Pharmaceutics is the discipline of pharmacy that deals with all facets of the process of turning a new chemical entity (NCE) into a medication able to be safely and effectively used by patients in the community.
- Pharmaceutics is the science of dosage form design. There are many chemicals with known pharmacological properties but a raw chemical is of no use to a patient.
- Pharmaceutics deals with the formulation of a pure drug substance into a dosage form. Branches of pharmaceutics include: Pharmacokinetics, Pharmacodynamics, Pharmaco-epidemiology, Pharmacogenomics, Pharmacovigilance, Pharmaceutical formulation etc.
- Pharmacognosy is an important discipline in the Pharmacy curriculum and deals with the study of crude drugs from natural sources.
- The subject has played a diverse role in the discovery, characterization, production and standardization of crude drugs.
- In the recent past, the world has witnessed a tremendous renewal of interest in natural products in the area of drug discovery, cosmeceuticals and neutraceuticals. Pharmacognosy now encompasses many fields like botany, ethanobotany, marine biology, microbiology, alternative medicines, chemistry, pharmacology, phytochemistry, pharmaceutics, clinical pharmacy and molecular biology and has a multidisciplinary approach.

Course Outcomes

SEMESTER—I		
Pharmaceutics		
Course Code	**Course Name**	**Course Outcomes**
MPH101T	Modern Pharmaceutical Analytical Techniques	Knowledge gained: • About the instruments like NMR, Mass spectrometer, IR, HPLC, GC etc. • Understand the basic concepts and advances in analytical techniques and theoretical skills of the analytical instruments. Skills gained: • Advanced analytical instrumental techniques for identification, characterization and quantification of drugs. • The analysis of various drugs in single and combination dosage forms. • Skills in selecting the suitable techniques for analysis of drugs and pharmaceuticals. Competency developed: • Knowledge for characterization of a drug. • Skills in selecting the suitable techniques for analysis of drugs and pharmaceuticals. • To apply the knowledge learnt in developing new procedures of their own design • .
MPH102T	Drug Delivery System	Knowledge gained: • The various approaches for development of novel drug delivery systems. • The criteria for selection of drugs and polymers for the development of delivering system • The formulation and evaluation of Novel drug delivery systems Skills gained: • Fundamentals of drug delivery system (s) development • Step by step Pre-formulation study design • Studying of different evaluation parameters based on delivery system • Advanced analytical instrumental techniques for identification, characterization and quantification of drugs • The analysis of various drugs in single and combination dosage forms • Skills in selecting the suitable techniques for analysis of drugs and pharmaceuticals. Competency developed: • Impart knowledge on the area of advances in novel drug delivery systems

		• Knowledge in characterization of a drug and other excipients used in the development of delivery system • Skills in selecting the suitable techniques for analysis of drugs and pharmaceuticals
MPH103T	Modern Pharmaceutics	Knowledge gained: • The elements of pre-formulation studies • The Active Pharmaceutical Ingredients and Generic drug Product development • Industrial Management and GMP Considerations • Optimization Techniques & Pilot Plant Scale Up Techniques • Stability Testing, sterilization process & packaging of dosage forms Skills gained: • Pre-formulation study design • Generic drug product and API development • Process of validation, cGMP and Industrial management • Compression and compaction of tablet formulation • Consolidation parameters • Optimization techniques in Pharmaceutical Formulation Competency developed: • Different methods to identify Drug Excipient interactions • Statistical design, Response surface method, Contour designs, Factorial designs and application in formulation • ICH & WHO guidelines for calibration and validation of Master plan • Policies of current good manufacturing practices • Physics of tablet compression and compaction profiles • Diffusion parameters, Dissolution parameters and Pharmacokinetic parameters
MPH104T	Regulatory Affair	Knowledge gained: • Generic drug development strategies • Regulatory norms for different countries • Phases involved in clinical trials • Submitting regulatory documents Skills gained: • Innovation and generic drug development process • Filing and approval process guidelines/ protocols • Dossier submission for regulatory agencies • Post approval regulatory requirements for actives and drug products. • Submission of Global documents in CTD and eCTD documents • Clinical trial requirements for conducting Clinical trials • Process of monitoring clinical trials through Pharmacovigilence Competency developed: • Drug development Strategies • Ideas on regulatory norms for different countries

		• Knowledge on different phases of Clinical trials • Submission process on regulatory documents submission
MPH105P	Pharmaceutics Practical I	Knowledge gained • Analysis of Pharmacopoeial compounds/ formulations by spectrophotometry • Experiments based on HPLC, GC, HPLC, Flurimetry, Flame Photometry • In vitro dissolution profiles of different formulation, SR matrix tablets, osmotically controlled DDS, • Formulation and evaluation of mucoadhesive patches and transdermal patches • Preformulaton studies • Effects of compressional force on tablets disintegration time. • Micromeritic properties of powders and granulation. • Effect of particle size on dissolution of a tablet. • Effect of binders on dissolution of a tablet. • Heckal plot, Higuchi and peppas plot and determine similarity factors. Skills Gained: • Operational procedures of spectrophotometry, HPLC, GC, Flurimetry, Flame Photometry • Preparation of dissolution profiles of different formulation, SR matrix tablets, osmotically controlled DDS, • Optimization, formulation, development and evaluation of mucoadhesive tablets and transdermal patches • Concepts of preformulaton studies • Intense idea on tablets disintegration time. • Flow patterns and properties of powders and granulation. • Idea on particle size and binders on dissolution of a tablet. • Procedures for preparing Heckal plot, Higuchi and Peppas plot and determine similarity factors. Competancy developed: • Accurate analysis of formulations by instruments like HPLC, GC, Flurimetry, Flame Photometry • SR matrix tablets, osmotically controlled DDS its dissolution procedures • Powder and granule flow patterns • Design and development of an optimized Transdermal formulation and mucoadhesive tablets • Method on preparing Heckal plot, Higuchi and Peppas plot and determine similarity factors. • Effects of particle size on dissolution
MPH106P	Seminar/ Assignment	Knowledge gained: • Assigning different topics from the course study matters Skills gained: • Capability development of the students to deliver seminars and

		typographic assignment for their skill enhancement Competancy developed: • Speech development for seminars and conferences, deep learning and development of knowledge through assingments
Pharmacognosy		
MPG101T	Modern Pharmaceutical Analytical Techniques	Knowledge gained: • About the instruments like NMR, Mass spectrometer, IR, HPLC, GC etc. • Understand the basic concepts and advances in analytical techniques and theoretical skills of the analytical instruments. Skills gained: • .Advanced analytical instrumental techniques for identification, characterization and quantification of drugs. • The analysis of various drugs in single and combination dosage forms. • Skills in selecting the suitable techniques for analysis of drugs and pharmaceuticals. Competency developed: • Knowledge for characterization of a drug. • Skills in selecting the suitable techniques for analysis of drugs and pharmaceuticals. • To apply the knowledge learnt in developing new procedures of their own design
MPG102T	Advanced Pharmacognosy-1	Knowledge gained: • About the Cultivation and production of crude drugs. • Isolation of drugs from natural origin. • Medicinal use and health benefits of Nutraceuticals. Skills gained: • About different phyto-pharmaceuticals and their source, its utilization and medicinal value. • Pharmacovigilance of drugs of natural origin. • Drugs of marine origin. Competency developed: • Knowledge about recent trends and advances in cultivation, novel products of natural origin, Phytochemistry and Pharmacovigilance. • Evaluate the medicinal importance of nutraceuticals and marine drugs. • Perform the experiments on analytical chemistry, isolations and standardization of drugs from Natural origin.
MPG103T	Phytochemistry	Knowledge gained: • About the different type of extraction of natural products. • Phytochemical aspects and biogenesis of various secondary

		metabolites. • Application of HPTLC and LCMS/GCMS in characterization of herbal extracts. Skills gained: • Biosynthetic pathways of secondary metabolites. • Extraction and general process of natural product drug discovery. • Phytochemical fingerprinting and structure elucidation of phytoconstituents. Competency developed: • Gain the knowledge of drug discovery, extraction and isolation techniques. • Learn the fundamentals of cultivation, isolation of Phytoconstituents and health benefits of nutraceuticals. • Knowledge about recent trends and advances in the field of Phytochemistry. • About the method for structure elucidation of phytochemicals
MPG104T	Industrial Pharmacognostical Technology	Knowledge gained: • Starting up of new herbal drug industry. • Regulatory requirements/ documentation for starting a new natural drug industry. • Export and import policies in herbal industry sector. Skills gained • ISO documentation. • GMP / GLP in Herbal drug sector. • WHO guidelines in safety assessment of herbal drugs. • Monograph preparation Competency developed • Develop Competency in testing of herbal drugs and Knowledge about IPR and Patenting • Monorgraph preparation and documentation of herbal drugs and extracts. WHO guidelines in safety assessment of herbal drugs.
MPG105P	Pharmacognosy Practical I	Knowledge gained: • Explain correct use of various equipments in Pharmacognosy laboratory. • Handle simple/compound/digital microscope in technically correct way. Skills gained • Demonstrate skill of plant material sectioning, staining, mounting & focusing. • Decide on staining reagents required for specific part of plant. Competency developed

		• Identify the parts of plants from its morphological & microscopically features by applying experimental & theoretical knowledge of morphology & anatomy obtained in theory classes.
MPG106P	Seminar/Assignment	Knowledge gained: • Assigning different topics from the course study matters Skills gained • Capability development of the students to deliver seminars and typographic assignment for their skill enhancement Competency developed • Speech development for seminars and conferences, deep learning and development of knowledge through assignments.

SEMESTER—II		
Pharmaceutics		
Course Code	**Course Name**	**Course Outcomes**
MPH201T	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	Knowledge gained: • About various approaches for development of different novel drug delivery systems. • Formulation and evaluation of various novel drug delivery systems. • About drugs and polymers for the development of Nano Tech and Targeted DDS. Skills gained: • The formulation and evaluation of targeted drug delivery systems for tumor targeting or brain targeting. • Learn to prepare nanoparticles and liposomes and evaluate them • Prepare and evaluate microsphere and microcapsules • Learn the approach of pulmonary drug delivery • Learn the nucleic acid- based drug delivery based on knowledge of therapeutic antisense molecules and aptamers Competency developed: • Learn to select criteria for selection of drugs for the development of NTDS • Learn to select criteria for selection of polymers for the development of NTDS • Learn the method for developing a drug delivery system and evaluate them •
MPH202T	Advanced Biopharmaceutics & Pharmacokinetics	Knowledge gained: • The basic concepts in biopharmaceutics and pharmacokinetics. • About the design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters. • The potential clinical pharmacokinetic problems and application of basics of pharmacokinetic.

		Skills gained: • The use raw data and derive the pharmacokinetic models and parameters the best describe the process of drug absorption, distribution, metabolism and elimination. • Applications of pharmacokinetics • Knowledge of drug absorption phenomenon from GI tract Competency developed: • The design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters •
MPH203T	Computer Aided Drug Delivery System	Knowledge gained: • Computer applications in pharmaceutical research and development. • Computers in Preclinical Development • Computers in Clinical Development • Artificial Intelligence (AI) and Robotics Skills gained: • Application of computers across the entire drug research and development process. Competency developed: • Optimization Techniques in Pharmaceutical Formulation • Computer-aided formulation development • Computer-aided biopharmaceutical characterization • Computer Simulations in Pharmacokinetics and Pharmacodynamics
MPH204T	Cosmetic and Cosmeceuticals	Knowledge gained: • Fundamental knowledge on cosmetic and cosmeceuticals. • Key ingredients used in cosmetics and cosmeceuticals. • Key building blocks for various formulations. • Current technologies in the market • Various key ingredients and basic science to develop cosmetics and Cosmeceuticals • Scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability and efficacy. Skills gained: • Learn about Indian regulatory requirements for license, loan license and standard for cosmetic manufacturing along with its labeling, import, etc. • Learn various skin problems and how to overcome through skin preparations • Learn about the formulation design, formulation and evaluations of cosmetics. • Learn formulation of herbal cosmetics.

		Competency developed: • Learn formulation, manufacturing and quality assessment of cosmetics. • Learn role of key ingredients in formulation of cosmetics.
MPH205P	Pharmaceutics Practical II	Knowledge gained: • Effect of various process variables on microencapsulation. • Preparation method and evaluation of multiple unit beads. • Formulation and evaluation of gelatin /albumin microspheres, and liposomes/niosomes, spherules. • Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique. • Protein binding study of a highly protein bound drug & poorly protein bound drug • How to compare two different brands • Pharmacokinetic and IVIVC data analysis by WinnolineR software • In vitro cell studies for permeability and metabolism • DoE Using Design Expert® Software • Formulation data analysis Using Design Expert® Software • Quality-by-Design in Pharmaceutical Development • Computer Simulations in Pharmacokinetics and Pharmacodynamics • To develop Clinical Data Collection manual • To carry out Sensitivity Analysis, and Population Modeling. • Development and evaluation of Creams, Shampoo and Toothpaste base Skills gained: • Preparation of microcapsules and microspheres and their evaluation Preparation and evaluation of multiple unit beads. • Formulation and evaluation of protein loaded microspheres, and preparation of liposomes/niosomes, spherules. • Improvement of dissolution profile of slightly soluble drug by Solid dispersion technique. • Protein binding study of a highly protein bound drug & poorly protein bound drug • Bioequivalence study • Pharmacokinetic study alongwith in vitro in vivo correlation study and data analysis by WinnolineR software • Permeability study using cell line in in vitro condition. • Use of Design Expert Software • Formulation data analysis Using Design Expert® Software • Quality-by-Design in Pharmaceutical Product Development • Computer Simulations in Pharmacokinetics and Pharmacodynamics • Clinical Data Collection • Sensitivity Analysis and Population Modeling. • Development and evaluation of Creams, Shampoo and

		Toothpaste base Competency developed: • Preparation of various novel drug delivery systems such as microspheres, liposomes, niosomes, their evaluations, use of software for quality-by-design approach for product development, Pharmacokinetic study and analysis of data by software, Bioequivalence study.
MPH206P	Seminar/ Assignment	Knowledge gained: • Learn how to prepare Power Point Slide for presentation • Learn how to collect information on a particular topic, organize them in slide • Learn how to present a seminar with Power Point slide and Projector Skills gained: • Preparation of attractive power Point Slide • Seminar presentation Competency developed: • Collection of information and materials on a particular topic, organization of them, presentation in slide and presentation before people.
PHARMACOGNOSY		
MPG201T	Medicinal Plant biotechnology	Knowledge gained: • Study of DNA, RNA and protein replication, genetic code, regulation of gene expression, structure and complicity of genome, cell signaling, DNA recombinant technology. • Different plant tissue culture techniques and their applications. • Gene transfer in plants and their applications. • Immobilization techniques of plant cell and its application on secondary metabolite Production. • Different methods of cloning and its applications. Advantages and disadvantages of plant cell cloning. • Secondary metabolism in tissue cultures with emphasis on production of medicinal agents. Precursors and elicitors on production of secondary metabolites. • Biotransformation, bioreactors for pilot and large scale cultures of plant cells and retention of biosynthetic potential in cell culture. • Transgenic plants, identification, localization and sequencing of genes. Application of PCR in plant genome analysis. • Application of Fermentation technology in the production of ergot alkaloids, single cell proteins, enzymes of pharmaceutical interest. Skills gained: • Developing plant biotechnology as a source of medicinal agents. • Different techniques of cell imprisonment and Culture of different types of tissues to obtain secondary metabolites. • Identification, localization and sequencing of genes

		• Production of natural compounds using fermentation technology. Competency developed: • Application of the process like genetic engineering in medicinal plants for higher yield of Phytopharmaceuticals • Using of the biotechnological techniques for obtaining and improving the quality of natural products/medicinal plants
MPG202T	Advanced Pharmacognosy-II	Knowledge gained: • Herbal remedies – toxicity and regulations, efficacy of herbal medicine products, validation of herbal therapies, pharmacodynamic and pharmacokinetic issues • Types of adulteration/ substitution of herbal drugs, causes and measures of adulteration, sampling procedures, determination of foreign matter, DNA finger printing techniques in identification of drugs of natural origin, detection of heavy metals, pesticide residues, phytotoxin, microbial contamination in herbs and their formulations. • Ethnobotany in herbal drug evaluation, Impact of Ethnobotany in traditional medicine, New development in herbals, Bio-prospecting tools for drug discovery, Role of Ethnopharmacology in drug evaluation, Reverse Pharmacology. • Analytical profiles of different herbal drugs • Phyto-pharmacological screening, new strategies for evaluating natural products. In vitro and In vivo evaluation techniques for different bioactive drugs. Toxicity studies as per OECD guidelines Skills gained: • Determining the efficacy of herbal medicine. • Identifying and determining the type of adulterant • Verifying the role of ethnobotany and ethnopharmacology in herbal drug evaluation. • Screening of natural product by using different in vitro and in vivo techniques. • Determining toxicity of crude drug. Competency developed: • Validation of herbal remedies. • Detection of adulteration and evaluation techniques. • Screening of herbals for various biological properties
MPG203T	Indian system of medicine	Knowledge gained: • Fundamental concepts and different dosage forms of the ISM. Study of Ayurvedic Pharmacopoeia, Analysis of formulations and bio crude drugs with references to: Identity, purity and quality.Study of Siddha: Gunapadam (Siddha Pharmacology), raw drugs/Dhatu/Jeevam in Siddha system of medicine, Purification process (Suddhi). • Study of the basic principles and treatment modalities. Study of Yoga and its different streams . Asanas, Pranayama, Meditations and Relaxation techniques. Study of Aromatherapy , aroma oils for common problems, carrier. • Salient features of the techniques of preparation of some of the important class of Formulations as per Ayurveda, Siddha,

		Homeopathy and Unani Pharmacopoeia and texts. Standardization, Shelf life and Stability studies of ISM formulations. • Good Manufacturing Practice of Indian systems of medicine, Components of GMP (Schedule – T) and its objectives, Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records. Quality assurance in ISM formulation industry - GAP, GMP and GLP. Preparation of documents for new drug application and export registration. Regulation, quality assurance and control, National/Regional Pharmacopoeias. • TKDL, Geographical indication Bill, Government bills in AYUSH, ISM, CCRAS, CCRS, CCRH, CCRU Skills gained: • Comparing various Indian systems of medicine and analyzing of herbal formulations. • Practice of naturopathy, yoga and aroma therapy for the prevention of diseases. • Preparation and standardization of herbal formulation according to the different Indian systems of medicine. • Manufacturing of herbal formulation and its regulation, quality assurance and control. • Preparation of different types of bill. Competency developed: • Current Good Manufacturing Practice of Indian systems of medicine and their formulations.
MPG204T	Herbal cosmetics	Knowledge gained: • Basic knowledge regarding herbal drugs. • Guidelines for herbal cosmetics. • Raw material and finished products of herbal cosmetics. Skills gained: • understand the basic principles of various herbal/natural cosmetic preparations. • Current Good Manufacturing Practices of herbal cosmetics. • Natural cosmetics preparation as per the regulatory authorities. Competency developed: • Ability to think about various herbal cosmetics. • Basic preparation various research areas in Phytochemistry.
MPG205P	Pharmacognosy Practical II	Knowledge gained: • Various herbs and their health benefits. • Qualitative and quantitative experiment. • Phytochemical Screening. Skills gained: • understand the basic knowledge of natural products.

		• Current Good Manufacturing Practices of herbal cosmetics. • Formulation of different dosage form. Competency developed: • Basic knowledge about pharmaceutical research.
MPG206P	Seminar/ Assignment	Knowledge gained: • Self presentation ability improve • Talking power • Various research knowledge gained from seminar Skills gained: • Review writing • Writing skill development. • Formulation of different dosage form. Competency developed: • Basic knowledge regarding pharmacy field.

SEMESTER—III		
Pharmaceutics & Pharmacognosy		
Course Code	**Course Name**	**Course Outcomes**
MRM 301T	Research Methodology and Biostatistics	Knowledge gained: • Designing research work. • Basic concepts of randomization, crossover design, placebo, blinding techniques, null hypothesis, P values, ethics committees, record keeping. • Concept of biostatistics and its importance in research work. • Concept of CPCSEA guidelines. Skills gained: • Efficiency in solving practical difficulties. • Efficiency in veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease of laboratory animals. Competency developed: • Using modern techniques in research work. • Using statistical methods to calculate various parameters. • Ability to handle laboratory animals with proper care. • Ability to write research report.
MRM 302JC	Journal club	Knowledge gained: • Concepts of recently published articles. • Advanced techniques. • Clinical demonstration of new medicines and therapy. • Detailed knowledge of a specific area of research including the

		literature published in that area, its underlying concepts, theories and assumptions. Skills gained: • Critical thinking skills in appraisal of the scientific literature. • Efficiency about progress of work in particular area. • Understanding and debating current topics of active interest in their field. Competency developed: • Ability to write various types of manuscripts. • Ability to apply newer technologies in research.
MRM 303PP	Presentation (Proposal Presentation)	Knowledge gained: • Communication skills. • Confidence development. • Scientific presentation. Skills gained: • Efficiency to prepare power point presentation. • Ability to prepare more focused and professional slides which will enhance the credibility. Competency developed: • Presenting information clearly and effectively. • Ability to develop confidence to present the right thing, in the right way, to the right people.
MRM 304RW	Research Work	Knowledge gained: • Planning of research and its budget. • Concept of research methodologies, methods and analytical techniques. • Gathering knowledge about various software and instruments used in research work. Skills gained: • Efficiency to do research work independently. • Efficiency to solve research problems. Competency developed: • Ability to search for, find, collect, analyze, interpret and evaluate the information that is related to the specific area of research. • Ability to develop new product. • Ability to write research report.
SEMESTER—IV		
MRM 401JC	Journal club	Knowledge gained: • Select scientific articles from reputed journals

		• Use search engines to select scientific articles • Clinical demonstration of new medicines and therapy. • Detailed knowledge of a specific area of research including the literature published in that area, its underlying concepts, theories and assumptions. Skills gained: • Critical thinking skills in appraisal of the scientific literature. • Efficiency about progress of work in particular area. • Understanding and debating current topics of active interest in their field. Competency developed: • Ability to write various types of manuscripts. • Ability to apply newer technologies in research. •
MRM 402RW	Research Work	Knowledge gained: • Review scholarly literature collected from various sources critically for the project and formulate a research problem. • Prepare and present a research proposal. Skills gained: • Conduct research to achieve research objectives. • Propose new ideas/ methodologies or procedures for further improvement of the research problem Competency developed: • Create research document of the findings. • Defend the research findings in front of scholarly audience.
MRM 403FP	Final Presentation	Knowledge gained: • Delivering an effective presentation can be the differentiator that provides the competitive edge. • Build presentations that create maximum impact Skills gained: • Figure out how to engage your audience. • Deal with nerves and think more positively about public speaking. • Use body language and tone of voice to enhance their presentations • Use slides and visual aids effectively Competency developed: • Deliver an enthusiastic and well-practiced presentation. • Present any topic in front of audience positively.