



**ROYAL SCHOOL OF PHARMACY
(RSP)
Master of Pharmacy (M.Pharm)**

**SYLLABUS
&
COURSE STRUCTURE**

**M.Pharm. (Pharmaceutics)
PCI Syllabus 2016**

M.PHARM. (PHARMACEUTICS)**Programme Structure**

Semester-I							
Sl.No.	Subject Code	Names of subjects	L	T	P	C	TCP
Core Subjects							
1	MPH101T	Modern Pharmaceutical Analytical Techniques	3	1	0	4	4
2	MPH102T	Drug Delivery System	3	1	0	4	4
3	MPH103T	Modern Pharmaceutics	3	1	0	4	4
4	MPH104T	Regulatory Affair	3	1	0	4	4
5	MPH105P	Pharmaceutics Practical I	0	0	12	6	12
6	MPH106S	Seminar /Assignment	0	0	7	4	7
		TOTAL	12	4	19	26	35

Semester-II							
Sl. No.	Subject Code	Names of subjects	L	T	P	C	TCP
Core Subjects							
1	MPH201T	Molecular Pharmaceutics (NanoTech and Targeted DDS)	3	1	0	4	4
2	MPH202T	Advanced Biopharmaceutics & Pharmacokinetics	3	1	0	4	4
3	MPH203T	Computer Aided Drug Delivery System	3	1	0	4	4
4	MPH204T	Cosmetic and Cosmeceuticals	3	1	0	4	4
5	MPH205P	Pharmaceutics Practical II	0	0	12	6	12
6	MPH206S	Seminar/Assignment	0	0	7	4	7
		TOTAL	12	4	19	26	35

3rdSemester							
Sl.No.	Subject Code	Names of subjects	L	T	P	C	TCP
Core Subjects							
1	MRM301T	Research Methodology and Biostatistics	3	1	0	4	4
2	MPH302S	Journal Club	0	0	1	1	1
3	MPH303P	Discussion/ Presentation (Proposal Presentation)	0	0	2	2	2
4	MPH304P	Research work	3	0	28	14	28
		TOTAL	3	1	31	21	35

4thSemester							
Sl.No.	Subject Code	Names of subjects	L	T	P	C	TCP
Core Subjects							
1	MPH401S	Journal Club	0	0	1	1	1
2	MPH402P	Research work	0	0	31	16	31
3	MPH 403P	Discussion / Final Presentation	0	0	3	3	3
4	MPH 404S	Co-Curricular activities					
TOTAL			0	0	35	20	35

Table-1: Semester wise credits distribution

Semester	Credit Points
I	26
II	26
III	21
IV	20
Co-curricular Activities (a) Participation in National Level Seminar/Conference/Workshop/Symposium/ Training Programs(related to the specialisation of the student-01) (b) Research/Review Publication in National Journals (Indexed in Scopus/Web of Science-01)	Min-02/Max-07
Total Credit Points	Min-95 & Max. 100

Scheme of Evaluation

Theory Papers (T):

- Internal assessment: 25%
- End Term Examination: 75%

Practical Papers (P):

- Internal assessment: 30%
- End Term examination: 70%

Internal assessment: Continuous mode

The marks allocated for Continuous mode of Internal Assessment shall be awarded as per the scheme given below.

Table–2: Scheme for awarding internal assessment: Continuous mode

Theory	
Criteria	Maximum Marks
Attendance (Refer Table–3)	8
Student–Teacher interaction	2
Total	10
Practical	
Attendance (Refer Table–3)	10
Based on Practical Records, Regular viva-voce, etc.	10
Total	20

Table–3: Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95–100	8	10
90–94	6	7.5
85–89	4	5
80–84	2	2.5
Less than 80	0	0

SEMESTER-I SYLLABUS

Paper I / Subject Name: MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPH 101T)

L-T-P-C – 4-0-0-4

Credit Units:4

Scheme of Evaluation:(T)

Objective: 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.

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

CO1: Understand the operation and applications of modern analytical instruments used in drug analysis, including UV-Visible, IR, Spectrofluorimetry, flame emission, and atomic absorption spectroscopy.

CO2: Understand the principles of NMR and mass spectroscopy and learn to interpret data for identifying organic compounds.

CO3: Understand chromatographic separation processes and apply them to the analysis of pharmaceutical compounds, gaining practical skills in chromatography and electrophoresis techniques.

CO4: Explore X-ray crystallography and immunological assays (RIA, ELISA) for characterizing and quantifying biological compounds. Develop skills in drug analysis using advanced techniques, and learn to interpret NMR, Mass, and IR spectra for identifying and characterizing organic compounds.

Detailed Syllabus:

Module	Topics (if applicable)/Course Content	Hours
I.	UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier-Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation. Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by fluorimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer. Flame emission spectroscopy and atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.	15 hrs
II.	NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin	15 hrs

	coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³ C NMR. Applications of NMR spectroscopy. Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	
III.	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: a. Thin Layer chromatography b. High Performance Thin Layer Chromatography c. Ion exchange chromatography d. Column chromatography e. Gas chromatography f. High Performance Liquid chromatography g. Ultra High Performance Liquid chromatography h. Affinity chromatography i. Gel Chromatography	15 hrs
IV.	Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction. Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry. Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation and advantages and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.	15 hrs
TOTAL		60 hrs

Text Books:

1. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
2. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
3. Pharmaceutical Analysis - Modern Methods – Part B - J W Munson, Vol 11, Marcel. Dekker Series.
4. Spectroscopy of Organic Compounds, 2nd edn., P.S/Kalsi, Wiley estern Ltd., Delhi.
5. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.

Reference Books:

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
4. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.

Teaching Learning Process and Assessment Methods:

Unit No.	Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
I.	CO1: Students will understand and apply principles of UV-Visible, IR, and Spectrofluorimetry, as well as flame emission and atomic absorption spectroscopy in drug analysis.	Traditional teaching, PPT	Class tests, assignments, MCQs
II.	CO2: Students will understand the principles of ionization and mass fragmentation and learn to interpret Mass and NMR spectroscopy data.	Traditional teaching, PPT	Class tests, assignments, MCQs
III.	CO3: Students will gain practical skills in chromatography and electrophoresis techniques for the separation and analysis of compounds.	Traditional teaching, PPT	Class tests, assignments, MCQs
IV.	CO4: Students will explore X-ray crystallography methods and immunological assays (RIA, ELISA) for the characterization and quantification of biological compounds.	Traditional teaching, PPT	Class tests, assignments, MCQs

Objective: This course is designed to impart knowledge in the area of advances in novel drug delivery systems.

Course Outcome: Upon completion of the course the student will be able to

CO1: Compare the various approaches for development of novel drug delivery systems.

CO2: Identify the criteria for selection of drugs and polymers for the development of drug delivery system

CO3: Formulate and evaluate various types of Novel drug delivery systems.

Detailed Syllabus

Modules	Topics (if applicable) & Course Contents	Period
I.	Sustained Release (SR) and Controlled Release(CR) formulations: Introduction & basic concepts, advantages/ disadvantages, factors influencing, Physicochemical & biological approaches for SR/CR formulation, Mechanism of Drug Delivery from SR/CR formulation. Polymers: introduction, definition, classification, properties and application. Dosage Forms for Personalized Medicine: Introduction, Definition, Pharmacogenetics, Categories of Patients for Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines, 3D printing of pharmaceuticals, Telepharmacy.	15 hr
II.	Rate Controlled Drug Delivery Systems: Principles & Fundamentals, Types, Activation; Modulated Drug Delivery Systems; Mechanically activated, pH activated, Enzyme activated, and Osmotic activated Drug Delivery Systems Feed back regulated Drug Delivery Systems; Principles & Fundamentals.	15 hr
III.	Gastro-Retentive Drug Delivery Systems: Principle, concepts advantages and disadvantages, Modulation of GI transit time approaches to extend GI transit. Buccal Drug Delivery Systems: Principle of mucoadhesion, advantages and disadvantages, Mechanism of drug permeation, Methods of formulation and its evaluations. Ocular Drug Delivery Systems: Barriers of drug permeation, Methods to overcome barriers.	15 Hr
IV	Transdermal Drug Delivery Systems: Structure of skin and barriers, Penetration enhancers, Transdermal Drug Delivery Systems, Formulation and evaluation. Protein and Peptide Delivery: Barriers for protein delivery. Formulation and Evaluation of delivery systems of proteins and other macromolecules. Vaccine delivery systems: Vaccines, uptake of antigens, single shot vaccines, mucosal and transdermal delivery of vaccines	15 hr
TOTAL		60 hours

TEXTBOOKS:

1. Controlled and Novel Drug Delivery, N.K. Jain, Second Edition, 2023, CBS Publishers and Distributors Pvt. Ltd.
2. Controlled Drug Delivery - concepts and advances, S.P. Vyas and R.K. Khar, First edition, 2012, Vallabh Prakashan.

REFERENCE BOOKS:

1. Novel Drug Delivery Systems, Yie Chien, 2nd edition, Volume 50, 1991, Marcel Dekker Inc., CRC Press Inc.
2. Controlled Drug Delivery Systems, Joseph Robinson, Vincent H.L. Lee, Second Edition, 1987, CRC Press.
3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Volume 3, 1999, Published by Wiley Interscience Publication.

JOURNALS

1. Indian Journal of Pharmaceutical Sciences (IPA)
2. Indian drugs (IDMA)
3. Journal of controlled release (Elsevier Sciences) desirable
4. Drug Development and Industrial Pharmacy (Marcel & Decker) desirable

Teaching Learning Process and Assessment Methods

Unit No.	Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
I, II,	CO1: Compare the various approaches for development of novel drug delivery systems.	Class room lectures through online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
I, II, III, IV	CO2: Identify the criteria for selection of drugs and polymers for the development of drug delivery system	Class room lectures through online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
III & IV	CO3: Formulate and evaluate various types of Novel drug delivery systems.	Class room lectures through online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,

Objective: This course is designed to impart advanced knowledge and skills required to learn various aspects and concepts at pharmaceutical industries

Course Outcome: Upon completion of the course the student will be able to:

CO1: Identify the elements of preformulation studies and experiment on formulation development.

CO2: Select drug candidate for development of various types of drug product.

CO3: Inspect and apply the principle of GMP in Industrial Management.

CO4: Apply optimization techniques during pilot Plant ScaleUp Techniques

CO5: Design and conduct StabilityTesting, sterilization process & packaging of dosage forms.

DetailedSyllabus

Modules	Topics(ifapplicable)&Course Contents	Periods
I.	<p>(a) Preformation Concepts–Drug Excipient interactions- different methods, kinetics ofstability, Stabilitytesting. Theoriesof dispersion and pharmaceutical Dispersion (Emulsion and Suspension, SMEDDS) preparation andstability Large and small volume parental – physiological and formulation consideration, Manufacturing and evaluation.</p> <p>(b) Optimization techniques in Pharmaceutical Formulation: Concept and parameters of optimization, Optimization techniques in pharmaceutical formulation and processing. Statistical design, Response surface method,Contour designs, Factorial designs and application in formulation</p>	17 hours
II.	Validation: Introduction to Pharmaceutical Validation, Scope & merits ofValidation, Validation and calibrationof Master plan, ICH & WHO guidelinesfor calibrationand validation of equipments, Validation of specificdosage form, Types of validation. Government regulation, Manufacturing Process Model, URS, DQ, IQ, OQ & P.Q. of facilities.	13 hours
III.	cGMP & Industrial Management: Objectives and policies of current good manufacturing practices, layout of buildings, services, equipments and their maintenance Production management: Production organization, , materials management, handling and transportation, inventory management and control, production and planning control, Sales forecasting, budget and cost control,industrialand personal relationship. Concept of Total Quality Management.	12 hours
IV.	<p>Compression and compaction: Physics of tablet compression, compression, consolidation,effect of friction, distribution of forces, compaction profiles. Solubility.</p> <p>Study of consolidation parameters; Diffusionparameters, Dissolution parameters andPharmacokinetic parameters, Heckel plots, Similarity factors – f2 and f1, Higuchiand Peppas plot, Linearity Concept of significance,Standard deviation , Chi square test, students T-test , ANOVA test.</p>	18 hours
TOTAL		60 hours

TextBook:

1. Theory and Practice of Industrial Pharmacy By Lachmann and Liberman, Fourth Edition, 2020, CBS Publisher.
2. ModernPharmaceutics; By Gillbert S. Banker and Christopher Rhodes, Fourth Edition, 2002, Informa Healthcare.

Reference Books

1. Pharmaceutical dosage forms:Tablets Vol.1-3, Herbert A. Lieberman, Leon Lachman and Joseph B. Schwartz, Second Edition, CRC Press.
2. Pharmaceutical Dosage forms: Disperse systems, Vol,1-2; Gilbert S. Banker, A. Liberman and Martin M. Rieger, Second Edition, 2008, Informa Healthcare.
3. Pharmaceutical Dosage forms: Parenteral medications Vol.1-2; Kenneth E. Avis, Herbert Lieberman and Leon Lachman, Second Edition, 1993, CRC Press.
4. Remington The Science and Practice of Pharmacy, Adrejare A., 23rd Edition, 2021, Elsevier.
5. Advances inPharmaceuticalSciencesVol.1-5; H.S.Bean & A.H. Beckett, First Edition, 2009, Elsevier.
6. Martin's Physical Pharmacy and Pharmaceutical Sciences; Patrick J. Sinko, Sixth Edition, 2010, Lippincott Williams & Wilkins.
7. Bentley'sTextbook of Pharmaceutics, E.A Rawlins, Eight Edition, 2010, Elsevier.
8. Good manufacturing practices for Pharmaceuticals: A planfor total quality control, Graham P. Bunn, Seventh Edition, 2019, CRC Press.
9. Quality Assurance Guide; By Organization of Pharmaceutical producers of India
10. Drugformulationmanual; D.P.S.Kohli and D.H.Shah, First Edition, 2003, Eastern publishers.
11. How to practice GMPs; P.P.Sharma, Seventh Edition, 2015, Vandhana Publications.
12. PharmaceuticalProcessValidation; Ira.R.Berry andRobertA.Nash, Second Edition, 57 Volume, 1993, CRC Press.
13. PharmaceuticalPreformulations and Formulation, Mark Gibson, Second Edition, Volume 199, 2009, CRC Press Inc..

Teaching learning process and assessment

Unit No.	CourseLearning Outcomes	TeachingandLearning Activity	AssessmentTasks
I.	CO1: Identify the elements of preformulation studies and experiment on formulation development.	Class room lectures though online resources, Educational Softwares, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
I	CO2: Select drug candidate for development of various types of drug product.	Class room lectures though online resources, Educational Softwares, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
II, III	CO3: Inspect and apply the principle of GMP in Industrial Management.	Class room lectures though online resources, concept videos, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, report writing, Internal assessments

			(Sessional exams), continuous evaluation) and End Sem Examinations,
I, IV,	CO4: Apply optimization techniques during pilot Plant ScaleUp Techniques	Class room lectures though online resources, Educational Softwares, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
I, II, IV	CO5: Design and conduct Stability Testing, sterilization process & packaging of dosage forms.	Class room lectures though online resources, Educational Softwares, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations.

Objective: This course is 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 drug application procedures.

Course Outcome: Upon completion of this course the student will be able to:

CO1: Evaluate the concept of innovator and generic drugs during drug development process.

CO2: Interpret the Regulatory guidance and guidelines for filing and approval process

CO3: Prepare Dossiers and their submission to regulatory agencies in different countries.

CO4: Understand the Post approval regulatory requirements for API and drug products

CO5: Evaluate the submission of global documents in CTD/eCTD formats including approval documents for conducting clinical trials.

Detailed Syllabus

Modules	Topics (if applicable) & Course Contents	Periods
I.	(a) Documentation in Pharmaceutical industry: Master formula record, DMF (Drug Master File), distribution records. Generic drug product development Introduction, Hatch-Waxman act and amendments, CFR (CODE OF FEDERAL REGULATION), drug product performance, in-vitro, ANDA regulatory approval process, NDA approval process, BE and drug product assessment, in-vivo, scale up process approval changes, post marketing surveillance, outsourcing BA and BE to CRO. (b) Regulatory requirement for product approval: API biologics, novel therapies obtaining NDA, ANDA for generic drugs ways and means of US registration for foreign drugs	15 hours
II.	CMC, post approval regulatory affairs. Regulation for combination products and medical devices. CTD and eCTD format, industry and FDA liaison. ICH - Guidelines of ICH-Q, S E, M. Regulatory requirements of EU, MHRA, TGA and ROW countries.	15 hours
III.	Nonclinical drug development: Global submission of IND, NDA, ANDA. Investigation of medicinal products dossier, dossier (IMPD) and investigator brochure (IB).	15 hours
IV.	Clinical trials: Developing clinical trial protocols. Institutional review board/ independent ethics committee Formulation and working procedures informed Consent process and procedures. HIPAA- new, requirement to clinical study process, pharmacovigilance safety monitoring in clinical trials.	15 hours
Total		60 hours

Text Book:

1. Good manufacturing practices for pharmaceuticals-a plan for total quality control. Sidney H. Willig, Murray M, Marcel Dekker, Seventh Edition, 2019, CRC Press.
2. Pharmaceutical Regulatory Affairs, Jigar Vyas, Nensi Raythatha and Isha Shah, First Edition, 2023, CBS Publishers.

Reference Books

1. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Second Edition, Vol.212, 2013, Taylor and Francis Inc. The Pharmaceutical Regulatory Process, Ira R. Berry and Robert P.Martin, Drugs and thePharmaceuticalSciences, Second Edition, Vol.185, CRC Press Inc..
2. New Drug Approval Process: Accelerating Global Registrations By RichardA Guarino, MD, 5th edition, Volume 190, Drugs and the Pharmaceutical Sciences, CRC Press Inc.
3. Guide book for drug regulatory submissions; SandyWeinberg. First Edition, 2009, JohnWiley & Sons.Inc.
4. FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics; Douglas J. Pisano, David S. Mantus, Second Edition, 2008, CRC Press.
5. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A.Rozovsky and Rodney K. Adams
 - www.ich.org/
 - www.fda.gov/
 - europa.eu/index_en.htm
 - <https://www.tga.gov.au/tga-basics>

Teaching learning process and assessment

Unit No.	Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
I.	CO1: Evaluate the concept of of innovator and generic drugs during drug development process.	Class room lectures though online resources, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
I, II	CO2: Interpret the Regulatory guidance and guidelines for filing and approval process	Class room lectures though online resources, practical demonstrations, case based presentations, scientific report discussions.	Seminar, quiz, assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,

II, III	CO3: Prepare Dossiers and their submission to regulatory agencies in different countries.	Class room lectures though online resources, concept videos, scientific report discussions.	Seminar, quiz, assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
I, II	CO4: Understand the Post approval regulatory requirements for API and drug products	Class room lectures though online resources, concept videos, practical demonstrations, case based presentations, scientific review paper discussions.	Seminar, quiz, assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
II, IV	CO5: Evaluate the submission of global documents in CTD/eCTD formats including approval documents for conducting clinical trials.	Class room lectures though online resources, concept videos, practical demonstrations, case based presentations.	Seminar, quiz, assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations.

PHARMACEUTICS PRACTICAL - I (MPH 105 P)

Detailed Syllabus

Modules	Topics (if applicable) & Course Contents	Periods
I.	1. Analysis of pharmacopoeial compounds and their formulations by UV-Vis spectrophotometer 2. Simultaneous estimation of multi-component containing formulations by UV spectrophotometry. 3. Experiments based on HPLC 4. Experiments based on Gas Chromatography	12 hr/wk
II.	5. Estimation of riboflavin/quinine sulphate by fluorimetry 6. Estimation of sodium/potassium by flame photometry 7. To perform In-vitro dissolution profile of CR/SR marketed formulation 8. Formulation and evaluation of sustained release matrix tablets 9. Formulation and evaluation osmotically controlled DDS	12 hr/wk
III.	10. Preparation and evaluation of Floating DDS-hydrodynamically balanced DDS 11. Formulation and evaluation of Mucoadhesive tablets. 12. Formulation and evaluation of transdermal patches. 13. To carry out preformulation studies of tablets. 14. To study the effect of compressional force on tablets disintegration time.	12 hr/wk
IV	15. To study Micromeritic properties of powders and granulation. 16. To study the effect of particle size on dissolution of a tablet. 17. To study the effect of binders on dissolution of a tablet. 18. To plot Heckal plot, Higuchi and peppas plot and determine similarity factors.	12 hr/wk
TOTAL		180 hr

SEMESTER-II SYLLABUS

Paper I/Subject Name:	MOLECULAR PHARMACEUTICS (NANO TECHNOLOGY AND TARGETED DDS (NTDS))	CODE: MPH201
L-T-P-C: 3-1-0-4	Credit Units: 4	Scheme of evaluation: (T)

Objective: This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

Course Outcome: Upon completion of the course the student will be able to

CO1: Categorize and evaluate the various approaches for development of novel drug delivery systems.

CO2: Select drugs and polymers for the design and development of NTDS

CO3: Evaluate and design various types of novel drug delivery systems.

Detailed Syllabus

Modules	Topics (if applicable) & Course Contents	Period
I.	1. Targeted Drug Delivery Systems: Concepts, Events and biological process involved in drug targeting. Tumor targeting and Brain specific delivery. 2. Targeting Methods: introduction preparation and evaluation. Nano Particles & Liposomes: Types, preparation and evaluation.	15 hr
II.	Micro Capsules / MicroSpheres: Types, preparation and evaluation, Monoclonal Antibodies; preparation and application, preparation and application of Niosomes, Aquasomes, Phytosomes, Electrosomes.	15 hr
III.	Pulmonary Drug Delivery Systems: Aerosols, propellents, Containers Types, preparation and evaluation, Intra Nasal Route Delivery systems; Types, preparation and evaluation.	15 Hr
IV	Nucleic acid based therapeutic delivery system: Gene therapy, introduction (ex-vivo & in-vivo gene therapy). Potential target diseases for genetherapy (inherited disorder and cancer). Gene expression systems (viral and nonviral gene transfer). Liposomal gene delivery systems. Biodistribution and Pharmacokinetics. Knowledge of therapeutic antisense molecules and aptamers as drugs of future.	15 hr
TOTAL		60 hours

TEXTBOOKS:

1. Molecular Pharmaceutics (Nanotechnology and Targeted Drug Delivery System), N.G Raghavendra Rao, M.A Sheela, Aarati Maurya and Irfan Ali, First Edition, 2024, JEC Publication.
2. Molecular Pharmaceutics: Nanotechnology and Targeted Drug Delivery System, Suryakanta Swain, Sarwar Beg and Rabinarayan Parhi, First Edition, 2019, Woodhead Publishing India in Medicine.

REFERENCE BOOKS:

1. Novel Drug Delivery Systems, YW.Chien, 2nd edition, 1992, Marcel Dekker Inc.
2. Controlled Drug Delivery-concepts and advances, S.P.Vyas and R.K. Khar, First edition 2002, VallabhPrakashan.

3. Controlled and Novel Drug Delivery, N.K.Jain, First edition 1997 (reprint in 2001), CBS Publishers & Distributors.

Teaching Learning Process and Assessment Methods

Unit No.	Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
I, II,	CO1: Categorize and evaluate the various approaches for development of novel drug delivery systems.	Class room lectures through online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
I, II, III, IV	CO2: Select drugs and polymers for the design and development of NTDS	Class room lectures through online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
III & IV	CO3: Evaluate and design various types of novel drug delivery systems.	Class room lectures through online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,

Paper II/Subject Name: ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS
COURSE CODE: MPH202T

L-T-P-C: 3-1-0-4

Credit Units: 4

Scheme of evaluation: (T)

Objective: 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.

Course Outcome: Upon completion of the course the student will be able to

CO1: Apply pharmacokinetic models and parameters to best describe the process of drug absorption, distribution, metabolism and elimination.

CO2: Evaluate and estimate the results of biopharmaceutic studies involving drug product equivalency.

CO3: Evaluate and design dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.

CO4: Apply, analyze and interpret the potential clinical pharmacokinetic problems associated with drug products.

Detailed Syllabus

Modules	Topics (if applicable) & Course Contents	Period
I.	Drug Absorption from the Gastrointestinal Tract: Gastro intestinal tract, Mechanism of drug absorption, Factors affecting drug absorption, pH-partition theory of drug absorption. Formulation and physicochemical factors: Dissolution rate, Dissolution process, Noyes-Whitney equation and drug dissolution, Factors affecting the dissolution rate. Gastrointestinal absorption: role of the dosage form: Solution (elixir, syrup and solution) as a dosage form, Suspension as a dosage form, Capsule as a dosage form, Tablet as a dosage form, Dissolution methods, Formulation and processing factors, Correlation of in vivo data with in vitro dissolution data. Transport model: Permeability-Solubility-Charge State and the pH Partition Hypothesis, Properties of the Gastrointestinal Tract (GIT), pH Microclimate Intracellular pH Environment, Tight-Junction Complex.	15 hr
II.	Biopharmaceutic considerations in drug product design and In-Vitro Drug Product Performance: Introduction, biopharmaceutic factors affecting drug bioavailability, rate-limiting steps in drug absorption, physicochemical nature of the drug formulation factors affecting drug product performance, in vitro: dissolution and drug release testing, compendial methods of dissolution, alternative methods of dissolution testing, meeting dissolution requirements, problems of variable control in dissolution testing performance of drug products. In vitro-in vivo correlation, dissolution profile comparisons, drug product stability, considerations in the design of a drug product.	15 hr
III.	Pharmacokinetics: Basic considerations, pharmacokinetic models, compartment modeling: one compartment model- IV bolus, IV infusion, extra-vascular. Multi compartment model: two compartment - model in brief, non-linear pharmacokinetics: cause of non-linearity, Michaelis -	15 Hr

	Menten equation, estimation of k_{max} and v_{max} . Drug interactions: introduction, the effect of protein-binding interactions, the effect of tissue-binding interactions, cytochrome p450-based drug interactions, drug interactions linked to transporters.	
IV	<p>Drug Product Performance, In-Vivo: Bioavailability and Bioequivalence: drug product performance, purpose of bioavailability studies, relative and absolute availability. methods for assessing bioavailability, bioequivalence studies, design and evaluation of bioequivalence studies, study designs, cross over study designs, evaluation of the data, bioequivalence example, study submission and drug review process. biopharmaceutics classification system, methods. Permeability: In-vitro, in-situ and In-vivo methods. generic biologics (biosimilar drug products), clinical significance of bioequivalence studies, special concerns in bioavailability and bioequivalence studies, generic substitution.</p> <p>Application of Pharmacokinetics: Modified-Release Drug Products, Targeted Drug Delivery Systems and Biotechnological Products. Introduction to Pharmacokinetics and pharmacodynamic, drug interactions. Pharmacokinetics and pharmacodynamics of biotechnology drugs. Introduction, Proteins and peptides, Monoclonal antibodies, Oligonucleotides, Vaccines (immunotherapy), Gene therapies.</p>	15 hr
TOTAL		60 hours

TEXTBOOKS:

1. Biopharmaceutics and Pharmacokinetics, A. Treatise, D .M. Brahmanekar and Sunil B. Jaiswal., First Edition, 2015, Vallab Prakashan.
2. Textbook of Biopharmaceutics and Pharmacokinetics, Dr. Shobha Rani R. Hiremath, Second Edition, 2021, Prism Publications.
3. Advanced Biopharmaceutics and Pharmacokinetics, Md. Rageeb Md. Usman, Atish A. Salunkhe, Pralhad K. Kanke and Kiran D. Baviskar, First Edition, 2020, S Vikas and Company.

REFERENCE BOOKS:

1. Biopharmaceutics and Clinical Pharmacokinetics; Milo Gibaldi, Fourth edition, 2005, Pharma Book Syndicate.
2. Applied Biopharmaceutics and Pharmacokinetics; Leon Shargel and Andrew B.C.Yu, Seventh Edition, 2016, McGraw-Hill Education (Asia).
3. Pharmacokinetics; Milo Gibaldi and D. Perrier, Second Edition, 1982, Marcel Dekker Inc.
4. Current Concepts in Pharmaceutical Sciences: Biopharmaceutics, James Swarbrick, 1971, Lea and Febiger.
5. Clinical Pharmacokinetics, Concepts and Applications; Malcolm Rowland and Thom~N. Tozer, Third Edition, 1995, Lea and Febiger.
6. Dissolution, Bioavailability and Bioequivalence, Abdou. H.M, 1989, Mack Publishing Company.
7. Biopharmaceutics and Clinical Pharmacokinetics, An Introduction, Robert. E. Notari, 4th edition, 1987, Marcel Dekker Inc.
8. Biopharmaceutics and Relevant Pharmacokinetics; John.G Wagner and M.Pemarowski, First edition, 1971, Drug Intelligence Publications.
9. Encyclopedia of Pharmaceutical Technology, James Swarbrick, James. G. Boylan, Volume 13, 1996, Marcel Dekker Inc.
10. Basic Pharmacokinetics, Sunil S Jambhekar and Philip J Breen, First Edition, 2009, Pharmaceutical press, RPS Publishing.
11. Absorption and Drug Development- Solubility, Permeability and Charge State, Alex Avdeef, 2003, John Wiley & Sons, Inc.

Teaching Learning Process and Assessment Methods

Unit No.	Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
I, II,	CO1: Apply pharmacokinetic models and parameters to best describe the process of drug absorption, distribution, metabolism and elimination.	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
I, II, III, IV	CO2: Evaluate and estimate the results of biopharmaceutical studies involving drug product equivalency.	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
II, III & IV	CO3: Evaluate and design dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
III&I V	CO4: Apply, analyze and interpret the potential clinical pharmacokinetic problems associated with drug products.	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,

Paper III/Subject Name: COMPUTER AIDED DRUG DEVELOPMENT
COURSE CODE: MPH203T

L-T-P-C: 3-1-0-4

Credit Units: 4

Scheme of evaluation: (T)

Objective: 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.

Course Outcome: Upon completion of the course the student will be able to

CO1: Understand the history of Computers in Pharmaceutical Research and Development.

CO2: Identify and apply the tools of Computational Modeling in preclinical and drug disposition studies.

CO3: Apply Optimization Techniques in Pharmaceutical Formulation

CO4: Experiment and analyze market analysis data using Computer.

CO5: Utilize, analyze and create study design using clinical data in Computers.

CO6: Learn and solve problems using Artificial Intelligence (AI), Robotics and computational fluid dynamics.

Detailed Syllabus

Modules	Topics (if applicable) & Course Contents	Period
I.	a. Computers in Pharmaceutical Research and Development: A General Overview: History of Computers in Pharmaceutical Research and Development. Statistical modeling in Pharmaceutical research and development: Descriptive versus Mechanistic Modeling, Statistical Parameters, Estimation, Confidence Regions, Nonlinearity at the Optimum, Sensitivity Analysis, Optimal Design, Population Modeling b. Quality-by-Design In Pharmaceutical Development: Introduction, ICH Q8 guideline, Regulatory and industry views on QbD, Scientifically based QbD - examples of application.	15 hr
II.	Computational Modeling Of Drug Disposition: Introduction , Modeling Techniques: Drug Absorption, Solubility, Intestinal Permeation, Drug Distribution , Drug Excretion, Active Transport; P-gp, BCRP, Nucleoside Transporters, hPEPT1, ASBT, OCT, OATP, BBB-Choline Transporter	15 hr
III.	Computer-aided formulation development: Concept of optimization, Optimization parameters, Factorial design, Optimization technology & Screening design. Computers in Pharmaceutical Formulation: Development of pharmaceutical emulsions, microemulsion drug carriers Legal Protection of Innovative Uses of Computers in R&D, The Ethics of Computing in Pharmaceutical Research, Computers in Market analysis	15 Hr

IV	<p>a. Computer-aided biopharmaceutical characterization: Gastrointestinal absorption simulation. Introduction, Theoretical background, Model construction, Parameter sensitivity analysis, Virtual trial, Fed vs. fasted state, In vitro dissolution and in vitro- in vivo correlation, Biowaiver considerations</p> <p>b. Computer Simulations in Pharmacokinetics and Pharmacodynamics: Introduction, Computer Simulation: Whole Organism, Isolated Tissues, Organs, Cell, Proteins and Genes.</p> <p>c. Computers in Clinical Development: Clinical Data Collection and Management, Regulation of Computer Systems</p> <p>Artificial Intelligence (AI), Robotics and Computational fluid dynamics: General overview, Pharmaceutical Automation, Pharmaceutical applications, Advantages and Disadvantages. Current Challenges and Future Directions.</p>	15 hr
TOTAL		60 hours

TEXTBOOKS:

1. Computer Aided Drug Development, Rabinarayan Parhi, Suryakanta Swain and Sandip Prasad Tiwari, First Edition, 2022, Woodhead Publishing India Pvt. Ltd.
2. Computer Aided Drug Development, Karri VVS Narayana Reddy, K. Gowthamarajan and Arun Radhakrishnan, First Edition, 2020, Pee Vee Publication.

REFERENCE BOOKS:

1. Computer Applications in Pharmaceutical Research and Development, Sean Ekins, 2006, John Wiley & Sons.
2. Computer-Aided Applications in Pharmaceutical Technology, Jelena Djuris, First Edition, Woodhead Publishing.
3. Encyclopedia of Pharmaceutical Technology, James Swarbrick, James G. Boylan, Volume 13, 1996, Marcel Dekker Inc.

Teaching Learning Process and Assessment Methods

Unit No.	Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
I, II,	CO1: Understand the history of Computers in Pharmaceutical Research and Development.	Class room lectures through online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
I, II, III, IV	CO2: Identify and apply the tools of Computational Modeling in preclinical and drug disposition studies.	Class room lectures through online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,

		presentations, scientific report discussions (Research articles, research reports etc.)	
II, III & IV	CO3: Apply Optimization Techniques in Pharmaceutical Formulation	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
III & I V	CO4: Experiment and analyze market analysis data using Computer.	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
I, II, IV	CO5: CO5: Utilize, analyze and create study design using clinical data in Computers.	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
IV	CO6: Learn and solve problems using Artificial Intelligence (AI), Robotics and computational fluid dynamics.	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,

Paper IV/Subject Name: COSMETICS AND COSMECEUTICALS
COURSE CODE: MPH204T

L-T-P-C: 3-1-0-4

Credit Units: 4

Scheme of evaluation: (T)

Objective: This course is designed to impart knowledge and skills necessary for the fundamental need for cosmetic and cosmeceutical products.

Course Outcome: Upon completion of the course the student will be able to

CO1: Identify and evaluate the key ingredients used in cosmetics and cosmeceuticals.

CO2: Choose and combine Key building blocks for various cosmetic formulations.

CO3: Understand, apply and evaluate the current technologies in the market

CO4: Select and design cosmetics and cosmeceuticals using key ingredients.

CO5: Design studies to evaluate safety, stability and efficacy of cosmetics and cosmeceuticals.

Detailed Syllabus

Modules	Topics (if applicable) & Course Contents	Period
I.	Cosmetics –Regulatory: Definition of cosmetic products as per Indian regulation. Indian regulatory requirements for labeling of cosmetics. Regulatory provisions relating to import of cosmetics., Misbranded and spurious cosmetics. Regulatory provisions relating to manufacture of cosmetics – Conditions for obtaining license, prohibition of manufacture and sale of certain cosmetics, loan license, offences and penalties.	15 hr
II.	Cosmetics-Biological aspects: Structure of skin relating to problems like dry skin, acne, pigmentation, prickly heat, wrinkles and body odor. Structure of hair and hair growth cycle. Common problems associated with oral cavity. Cleansing and care needs for face, eyelids, lips, hands, feet, nail, scalp, neck, body and under-arm.	15 hr
III.	Formulation Building blocks: Building blocks for different product formulations of cosmetics/cosmeceuticals. Surfactants– Classification and application. Emollients, rheological additives: classification and application. Antimicrobial used as preservatives, their merits and demerits. Factors affecting microbial preservative efficacy. Building blocks for formulation of a moisturizing cream, vanishing cream, cold cream, shampoo and toothpaste. Soaps and syndet bars. Perfumes; Classification of perfumes. Perfume ingredients listed As allergens in EU regulation. Controversial ingredients: Parabens, formaldehyde liberators, dioxane	15 Hr
IV	Design of cosmeceutical products: Sun protection, sunscreens classification and regulatory aspects. Addressing dry skin, acne, sun-protection, pigmentation, prickly heat, wrinkles, body odor., dandruff, dental cavities, bleeding gums, mouth odor and sensitive teeth through cosmeceutical formulations. Herbal Cosmetics: Herbal ingredients used in Haircare, skin care and oral care. Review of guidelines for herbal cosmetics by private bodies like cosmos with respect to preservatives, emollients, foaming agents, emulsifiers and rheology modifiers.	15 hr
TOTAL		60 hours

TEXTBOOKS:

1. Cosmetics and Cosmeceuticals, Shailesh Sharma, Neelam Sharma and Punam Gaba, First Edition, 2022, Nirali Prakashan.
2. Text book of Cosmetics and Cosmeceuticals, Shikha Baghel Chauhan, First Edition, 2022, Walnut Publication.

REFERENCE BOOKS:

1. Harry's Cosmeticology, Martin M. Rieger, Eight Edition, 2009, Chemical Publishing Co. Inc.
2. Poucher's perfumecosmeticsandSoaps, H. Butler, Tenth Edition, 2000, Chapman and Hall.
3. Cosmetics - Formulation, Manufacture and quality control, PP.Sharma, Fourth Edition, Vandana Publications Pvt. Ltd.
4. Handbook of cosmetic science and Technology, Andre.O.Barel, Marc.Paye and Howard.I.Maibach, Third Edition, 2009, Taylor & Francis.
5. Cosmetic and Toiletries recent suppliers catalogue.
6. CTFAdirectory.

Teaching Learning Process and Assessment Methods

Unit No.	Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
II,III, IV	CO1: Identify and evaluate the key ingredients used in cosmetics and cosmeceuticals.	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
III, IV	CO2: Choose and combine Key building blocks for various cosmetic formulations.	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
I, II, III & IV	CO3: Understand, apply and evaluate the current technologies in the market	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,

II, III & IV	CO4: Select and design cosmetics and cosmeceuticals using key ingredients.	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,
IV	CO5: Design studies to evaluate safety, stability and efficacy of cosmetics and cosmeceuticals.	Class room lectures though online resources, Educational Softwares, digital simulations, concept videos, practical demonstrations, case based presentations, scientific report discussions (Research articles, research reports etc.)	Seminar, quiz, assignments, journal club, problem based assignments, report writing, Internal assessments (Sessional exams), continuous evaluation) and End Sem Examinations,

PHARMACEUTICS PRACTICAL - II (MPH 205 P)**Detailed Syllabus**

Modules	Topics (if applicable) & Course Contents	Periods
I.	1. To study the effect of temperature change, non solvent addition, incompatible polymer addition in microcapsules preparation 2. Preparation and evaluation of Alginate beads 3. Formulation and evaluation of gelatin/album in microspheres 4. Formulation and evaluation of liposomes/niosomes 5. Formulation and evaluation of spherules 6. Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique.	12 hr/wk
II.	7. Comparison of dissolution of two different marketed products/brands 8. Protein binding studies of a highly protein bound drug & poorly protein bound drug 9. Bioavailability studies of Paracetamol in animals. 10. Pharmacokinetic and IVIVC data analysis by Winnoline R software 11. Invitro cell studies for permeability and metabolism	12 hr/wk
III.	12. DoE Using Design Expert® Software 13. Formulation data analysis Using DesignExpert®Software 14. Quality-by-Design in Pharmaceutical Development 15. Computer Simulations in Pharmacokinetics and Pharmacodynamics 16. Computational Modeling Of Drug Disposition	12 hr/wk
IV	17. To develop Clinical Data Collection manual 18. To carryout Sensitivity Analysis, and Population Modeling. 19. Development and evaluation of Creams 20. Development and evaluation of Shampoo and Toothpaste base 21. To incorporate herbal and chemical actives to develop products 22. To address Dryskin, acne, blemish, Wrinkles, bleeding gums and dandruff	12 hr/wk
TOTAL		180 hr