



ANAND PHARMACY COLLEGE, ANAND
(An Autonomous College under UGC Regulations 2023)
Managed by Shri Ramkrishna Seva Mandal
(Approved by PCI, NAAC Accredited – A+ Grade, 3.38 CGPA)
Awarding University: Gujarat Technological University, Ahmedabad



Name of Program: **M. Pharm**

Branch: **Pharmaceutics/ Pharmaceutical Technology/ Pharmaceutical Quality Assurance/ Pharmacology/ Regulatory Affairs**

Semester: **III**

Course Code: M000301TT

Course Name: Research Methodology and Biostatistics

Course Type: **Core**

Year of Implementation: **2024 – 25**

Teaching and Examination Scheme:

Number of hours/Week			Number of credits			Total credits	Evaluation Scheme (Marks)								Total Marks
							Sessional Exams						End Semester Assessment		
							Theory			Practical					
L	Tu	P	L	Tu	P		CIE	E	T	CIE	E	T	T	P	
4	0	0	4	0	0	4	10	15	25	0	0	0	75	0	100

Scope:

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

Course Outcomes (CO):

Upon completion of the course student shall be able to

CO1	Understand basic research methodology, including problem selection, proposal writing, and applying Design Thinking for innovative solutions.
CO2	Learn the fundamentals of biostatistics and hypothesis testing for pharmaceutical data analysis.
CO3	Apply advanced experimental design techniques and data analytics to optimize pharmaceutical processes and minimize variability.
CO4	Analyze regulatory guidelines and intellectual property rights to navigate patenting and legal considerations in pharmaceutical research.

Course Content

Total Teaching hours: **60 hours**

Unit 1	Research Overview: Definition, objectives, requirements Review of Literature: Importance of literature review and use of libraries, journals, Medline, Internet, and reprints for literature survey. Design Thinking: Role in proposal selection by fostering innovation and user-centered solutions, ensuring problem relevance and feasibility Problem Selection and Proposal Preparation: Identifying research problems, formulating research questions, and preparing research proposals. Questionnaire Design: Designing effective questionnaires for data collection. Research Grants: Sources for research funding, including national/international agencies and government/private bodies.	12 hours
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	Presentation Skills: Importance and types of oral/poster presentations, skills required (gestures, eye contact, facial expressions, volume, pitch), and proper use of visual aids. Research Report, paper and thesis writing: Structure of research reports, difference between research and review papers, and thesis writing; essential components of research documents. Plagiarism and research ethics: Importance of originality in research; preventing plagiarism by promoting independent thought and proper citation. Promoting Ethical Research Practices and data integrity	
Unit 2	Terminology and Definitions Related to Experimental Design Key concepts: Variables, factors, interactions, and outcomes in experimental setups, sampling types and plan, Definitions of control, treatment groups, and dependent/independent variables. Basic Steps in Experimental Design - Defining the research question, hypotheses, and variables. - Experimental planning: Selection of tools, methods, and analysis techniques. - Data collection and analysis strategies. Screening Designs Fractional Factorial Design (FFD): - Purpose, advantages, and disadvantages of fractional factorial designs, Concept of Aliased Effects and Design Aliasing, - Case study analysis of Fractional factorial design. Plackett-Burman Designs - Purpose and application of Plackett-Burman designs. - Advantages, disadvantages, and comparison with fractional factorial designs. Constructing matrices for Plackett-Burman design and case study. Optimization Techniques - Overview of optimization methods: Response surface methodology, optimization of process parameters, Evolution of Full and Reduced Mathematical Models in Experimental Designs Contour plots: Introduction and application for optimization. Full Factorial Design - Advantages and limitations of full factorial design. - Case study: Application and analysis of full factorial design in pharmaceutical experiments. Response Surface Design: - Central composite designs: Overview, types, and application in optimization. - Taguchi and mixture designs: Concepts, advantages, and applications in experimental studies. Application of Experimental Design in Pharmacology for Reduction of Animal Studies - Statistical optimization methods to minimize the use of animals in pharmacological testing	15 hours
Unit 3	Biostatistics Definition and Application	08 hours

	- Statistical Tests of Significance - Parametric Tests: t-test, ANOVA, Correlation Coefficient, Regression - Non-Parametric Tests: Wilcoxon Rank Test, Chi-Square Test, Kruskal-Wallis Test, Mann-Whitney U Test - Hypothesis Testing - Null Hypothesis, P-values, Degree of Freedom - Post-hoc Tests - Dunnett's Test, Tukey's Test, Dunn's Test Perform biostatistical calculations like T-test, ANOVA, regression, chi-square, basics of Confidence interval and Data Analysis Toolpak. - Bioequivalence Data Testing and Statistical Analysis	
Unit 4	Regulatory perspectives of Medical research History of medical research (Nuremberg code, The declaration of Helsinki), initiation of ICH-GCP guidelines, advantages of ICH-GCP, core principles of ICH -GCP guidelines , Ethical Committee: Institutional Review Board, Ethical Guidelines by ICMR for Biomedical Research and Human Participants(ethical issues- informed consent process, confidentiality, payments, conflict of interest, vulnerable participants), Schedule Y, Preparation of clinical protocol, Investigator Brochure, Case Report Forms	10 hours
Unit 5	CPCSEA guidelines for laboratory animal facility Objective and functions of IAEC, background and process of evolution of guidelines, statutory provisions regarding scientific experiments of animals, CPCSEA guidelines for animal experimentation and laboratory animal facility 2015, care and handling of animals, concept of 4 R, protocol preparation for Preclinical studies (Form B)	05 hours
Unit 6	Introduction to Patents: - Definition of Patents, Importance for patenting Types of Patents: Utility patents, Design patents, Plant patents - Conditions for patentability: Novelty, inventive step (non-obviousness), industrial applicability Types of patent applications: Provisional, complete specification, and PCT applications The essential elements of patents: Title, Abstract, Background, Detailed Description, Drafting of patent claims - Guidelines and best practice for maintaining a laboratory notebook Non-obviousness in Patents: Legal and technical considerations - Introduction to patent search: Methods, tools, and important websites for patent searches (e.g., WIPO, USPTO, and EPO) Copyrights and Trademarks: - Brief introduction to trademark protection: Importance of trademarks in branding and identity Overview of copyrights: Protection of original works of authorship The Patents Act 1970 and The Patents Rule 2003 and its Patents (Amendment) Rules, 2024 - Key provisions of The Patents Act 1970 - Special emphasis on patent application procedure in India - Forms to be submitted along with a patent application: - Filing process: Submission, fees, and timelines	15 hours

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| | <ul style="list-style-type: none">• Practical considerations in filing and prosecuting patents | |
|--|--|--|

Recommended Books^: (Latest Editions)

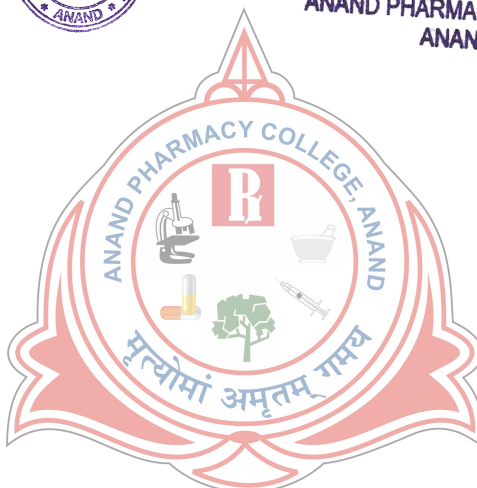
1. Research Methodology by C.R. Kothari
2. Compendium of CPCSEA 2018
3. Presentation skills - Michael Hallon- Indian Society for Institute education
4. Pharmaceutics Statistics by Sanford Bolton, Charles Bon
5. Patent laws, By P. Narayan. Eastern law house publications
6. Pharmaceutical Experimental Design by Gareth Lewis and Didier Mathieu
7. www.ipindia.nic.in , www.uspto.gov
8. www.cpcsea.nic.in
9. www.icmr.nic.in

L= Lecture, Tu= Tutorial, P= Practical, T = Theory

^ This is not an exhaustive list




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Name of Program: **M. PHARM**

Semester: **III**

Course Code: **M000305EP**

Course Name: **Essential Skills for Quality Assurance**

Course Type: **Elective (SEC - Skill Enhancement Courses)**

Year of Implementation: **2024-25**

Teaching and Examination Scheme:

Number of hours/Week			Number of credits			Total credits	Evaluation Scheme (Marks)								Total Marks
							Sessional Exams						End Semester Assessment		
							Theory			Practical					
L	Tu	P	L	Tu	P		CIE	E	T	CIE	E	T	T	P	
-	-	2	-	-	1	1	-	-	-	5	10	15	-	35	50

Scope:

This course equips scholars with essential research skills, covering topic selection, ethics, data analysis, manuscript drafting, and IP management. It blends theory with practical applications to enhance research proficiency.

Course Outcomes (CO):

Upon completion of the course student shall be able to

CO1	Develop essential research skills, including literature review, data integrity, analysis tools, manuscript drafting principles and intellectual property management.
CO2	Apply basic techniques for method development and understand basic concepts of quality assurance.

Course Content

Total Teaching hours: **30 hours**

PART	Topic and Subtopics	Hours
A	Research Fundamentals: Identifying research gaps and defining objectives Framing a strong research question Conducting literature reviews using databases (PubMed, Scopus, Google Scholar) Utilizing AI tools for literature search and analysis Understanding research ethics and avoiding plagiarism Exercise Case study on topic selection Hands-on AI tool exploration for literature review Plagiarism check using software tools Research Documentation & Thesis Writing Reference management using EndNote and Mendeley Importing, organizing, and citing references Structuring a thesis and manuscript Writing a strong abstract, introduction, and conclusion	12 Hours



	Essential tools for thesis formatting (MS Word, LaTeX) Effective research presentation techniques Exercise: Practical usage of EndNote & Mendeley Drafting a thesis chapter Formatting a thesis section and presenting key findings Data Integrity & Statistical Analysis Proper data collection, storage, and integrity practices Best practices for laboratory notebooks and research records Basics of quantitative analysis using Excel Introduction to GraphPad Prism for data visualization Interpretation of FTIR, DSC, and XRD results Principal Component Analysis (PCA) & Partial Least Squares (PLS) Intellectual Property & Research Compliance Importance of intellectual property in research Conducting patent searches using online databases Compiling and writing PSAR (Prior Art Search Report) Writing patent publications and claims Experimental Research & Compliance Ethical considerations for animal research Preparing and submitting Institutional Animal Ethics Committee (IAEC) proposals Standard procedures for animal care and handling and Demonstration of proper animal handling techniques Compliance with CPCSEA guidelines	
B	Experiments on: To perform calibration /validation / qualification. To perform physico-chemical characterization of drug substance. To perform analytical method development and validation. To perform bio-analytical method development. Concept of related substances and impurities as per pharmacopoeial requirements. Case study related to CAPA, deviation, OOS, OOT.	18 Hours

Recommended Books: (Latest Editions)

1. Kothari, C. R., & Garg, G. (2019). Research Methodology: Methods and Techniques. New Age International Publishers.
2. Bolton, S. (1990). Pharmaceutical Statistics: Practical and Clinical Applications. Marcel Dekker Inc.
3. Day, R. A., & Gastel, B. (2011). How to Write and Publish a Scientific Paper. Cambridge University Press.
4. Department of Science & Technology (DST). (n.d.). Intellectual Property - A Primer for Academia. Government of India.



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Name of Program: **M. PHARM**

Semester: **III**

Course Code: **M000306EP**

Course Name: **Fundamental Techniques for the manufacturing of Oral Solid dosage forms**

Course Type: **Elective (SEC - Skill Enhancement Courses)**

Year of Implementation: **2024-25**

Teaching and Examination Scheme:

Number of hours/Week			Number of credits			Total credits	Evaluation Scheme (Marks)								Total Marks
							Sessional Exams						End Semester Assessment		
							Theory			Practical					
L	Tu	P	L	Tu	P		CIE	E	T	CIE	E	T	T	P	
-	-	2	-	-	1	1	-	-	-	5	10	15	-	35	50

Scope:

This course equips scholars with essential research skills, covering topic selection, ethics, data analysis, manuscript drafting, and IP management. It blends theory with practical applications to enhance research proficiency.

Course Outcomes (CO):

Upon completion of the course student shall be able to

CO1	Acquire essential research skills, including literature review, data integrity, analysis tools, manuscript drafting principles and intellectual property management.
CO2	Analyze and apply advanced techniques for manufacturing tablets, capsules, and pellets, including granulation, compression, and coating, for interdisciplinary research applications.

Course Content

Total Teaching hours: **30 hours**

PART	Topic and Subtopics	Hours
A	Research Fundamentals: Identifying research gaps and defining objectives Framing a strong research question Conducting literature reviews using databases (PubMed, Scopus, Google Scholar) Utilizing AI tools for literature search and analysis Understanding research ethics and avoiding plagiarism Exercise Case study on topic selection Hands-on AI tool exploration for literature review Plagiarism check using software tools Research Documentation & Thesis Writing Reference management using EndNote and Mendeley Importing, organizing, and citing references Structuring a thesis and manuscript	12 Hours

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	Writing a strong abstract, introduction, and conclusion Essential tools for thesis formatting (MS Word, LaTeX) Effective research presentation techniques Exercise: Practical usage of EndNote & Mendeley Drafting a thesis chapter Formatting a thesis section and presenting key findings Data Integrity & Statistical Analysis Proper data collection, storage, and integrity practices Best practices for laboratory notebooks and research records Basics of quantitative analysis using Excel Introduction to GraphPad Prism for data visualization Interpretation of FTIR, DSC, and XRD results Principal Component Analysis (PCA) & Partial Least Squares (PLS) Intellectual Property & Research Compliance Importance of intellectual property in research Conducting patent searches using online databases Compiling and writing PSAR (Prior Art Search Report) Writing patent publications and claims Experimental Research & Compliance Ethical considerations for animal research Preparing and submitting Institutional Animal Ethics Committee (IAEC) proposals Standard procedures for animal care and handling and Demonstration of proper animal handling techniques Compliance with CPCSEA guidelines	
B	Perform solubility enhancement of poorly water soluble drug by physical mixing, and kneading method. Formulation and evaluation of sustained release tablet by wet granulation method. Formulation and evaluation of immediate release tablet prepared by direct compression method. Formulation of tablet by dry compression method and comparison with marketed tablet using f_1 and f_2 analysis. Formulation and evaluation of capsule filled with granules or powders. Formulation and characterization of pellets by Extrusion-Spheronization technique.	18 Hours

Recommended Books: (Latest Editions)

1. Kothari, C. R., & Garg, G. (2019). Research Methodology: Methods and Techniques. New Age International Publishers.
2. Bolton, S. (1990). Pharmaceutical Statistics: Practical and Clinical Applications. Marcel Dekker Inc.
3. Day, R. A., & Gastel, B. (2011). How to Write and Publish a Scientific Paper. Cambridge University Press.
4. Department of Science & Technology (DST). (n.d.). Intellectual Property - A Primer for Academia. Government of India.



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Name of Program: **M. PHARM**

Semester: **III**

Course Code: **M000307EP**

Course Name: **Fundamental Techniques for Preclinical Research**

Course Type: **Elective (SEC - Skill Enhancement Courses)**

Year of Implementation: **2024-25**

Teaching and Examination Scheme:

Number of hours/Week			Number of credits			Total credits	Evaluation Scheme (Marks)								Total Marks
							Sessional Exams						End Semester Assessment		
							Theory			Practical					
L	Tu	P	L	Tu	P		CIE	E	T	CIE	E	T	T	P	
-	-	2	-	-	1	1	-	-	-	5	10	15	-	35	50

Scope:

This course equips scholars with essential research skills, covering topic selection, ethics, data analysis, manuscript drafting, and IP management. It blends theory with practical applications to enhance research proficiency.

Course Outcomes (CO):

Upon completion of the course student shall be able to

CO1	Develop essential research skills, including literature review, data integrity, analysis tools, manuscript drafting principles and intellectual property management.
CO2	Apply basic techniques for preclinical research and understand basic concepts of cell line in pharmacological research.

Course Content

Total Teaching hours: **30 hours**

PART	Topic and Subtopics	Hours
A	Research Fundamentals: Identifying research gaps and defining objectives Framing a strong research question Conducting literature reviews using databases (PubMed, Scopus, Google Scholar) Utilizing AI tools for literature search and analysis Understanding research ethics and avoiding plagiarism Exercise Case study on topic selection Hands-on AI tool exploration for literature review Plagiarism check using software tools Research Documentation & Thesis Writing Reference management using EndNote and Mendeley Importing, organizing, and citing references Structuring a thesis and manuscript	12 Hours



	Writing a strong abstract, introduction, and conclusion Essential tools for thesis formatting (MS Word, LaTeX) Effective research presentation techniques Exercise: Practical usage of EndNote & Mendeley Drafting a thesis chapter Formatting a thesis section and presenting key findings Data Integrity & Statistical Analysis Proper data collection, storage, and integrity practices Best practices for laboratory notebooks and research records Basics of quantitative analysis using Excel Introduction to GraphPad Prism for data visualization Interpretation of FTIR, DSC, and XRD results Principal Component Analysis (PCA) & Partial Least Squares (PLS) Intellectual Property & Research Compliance Importance of intellectual property in research Conducting patent searches using online databases Compiling and writing PSAR (Prior Art Search Report) Writing patent publications and claims Experimental Research & Compliance Ethical considerations for animal research Preparing and submitting Institutional Animal Ethics Committee (IAEC) proposals Standard procedures for animal care and handling and Demonstration of proper animal handling techniques Compliance with CPCSEA guidelines	
B	Experiments on: Commonly used instruments in experimental pharmacology and Handling of common laboratory animals Common laboratory techniques of blood withdrawal, urine collection, anaesthesia and euthanasia Study of different routes of drugs administration in mice/rats. Calculation of pharmacokinetic parameters using biological sample Study of taste masking of a given drug Handling, Passaging, Cell counting and MTT assay using cell line	18 Hours

Recommended Books: (Latest Editions)

1. Kothari, C. R., & Garg, G. (2019). Research Methodology: Methods and Techniques. New Age International Publishers.
2. Bolton, S. (1990). Pharmaceutical Statistics: Practical and Clinical Applications. Marcel Dekker Inc.
3. Day, R. A., & Gastel, B. (2011). How to Write and Publish a Scientific Paper. Cambridge University Press.
4. Department of Science & Technology (DST). (n.d.). Intellectual Property - A Primer for Academia. Government of India.
5. Ghosh, M. N. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
6. Kulkarni, S. K. Handbook of Experimental Pharmacology. Vallabh Prakashan.
7. Basic Cell Culture Protocols by Cheril D. Helgason and Cindy L. Miller.



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Name of Program: **M. PHARM**

Semester: **III**

Course Code: **M000308EP**

Course Name: **Essential Skills for Regulatory Affairs**

Course Type: **Elective (SEC - Skill Enhancement Courses)**

Year of Implementation: **2024-25**

Teaching and Examination Scheme:

Number of hours/Week			Number of credits			Total credits	Evaluation Scheme (Marks)								Total Marks
							Sessional Exams						End Semester Assessment		
							Theory			Practical					
L	Tu	P	L	Tu	P		CIE	E	T	CIE	E	T	T	P	
-	-	2	-	-	1	1	-	-	-	5	10	15	-	35	50

Scope:

This course equips scholars with essential research skills, covering topic selection, ethics, data analysis, manuscript drafting, and IP management. It blends theory with practical applications to enhance research proficiency.

Course Outcomes (CO):

Upon completion of the course student shall be able to

CO1	Develop essential research skills, including literature review, data integrity, analysis tools, manuscript drafting principles and intellectual property management.
CO2	Apply fundamentals for dossier compilation, submission and understand basic concepts of Regulatory Affairs.

Course Content

Total Teaching hours: **30 hours**

PART	Topic and Subtopics	Hours
A	Research Fundamentals: Identifying research gaps and defining objectives Framing a strong research question Conducting literature reviews using databases (PubMed, Scopus, Google Scholar) Utilizing AI tools for literature search and analysis Understanding research ethics and avoiding plagiarism Exercise Case study on topic selection Hands-on AI tool exploration for literature review Plagiarism check using software tools Research Documentation & Thesis Writing Reference management using EndNote and Mendeley Importing, organizing, and citing references Structuring a thesis and manuscript	12 Hours



	Writing a strong abstract, introduction, and conclusion Essential tools for thesis formatting (MS Word, LaTeX) Effective research presentation techniques Exercise: Practical usage of EndNote & Mendeley Drafting a thesis chapter Formatting a thesis section and presenting key findings Data Integrity & Statistical Analysis Proper data collection, storage, and integrity practices Best practices for laboratory notebooks and research records Basics of quantitative analysis using Excel Introduction to GraphPad Prism for data visualization Interpretation of FTIR, DSC, and XRD results Principal Component Analysis (PCA) & Partial Least Squares (PLS) Intellectual Property & Research Compliance Importance of intellectual property in research Conducting patent searches using online databases Compiling and writing PSAR (Prior Art Search Report) Writing patent publications and claims Experimental Research & Compliance Ethical considerations for animal research Preparing and submitting Institutional Animal Ethics Committee (IAEC) proposals Standard procedures for animal care and handling and Demonstration of proper animal handling techniques Compliance with CPCSEA guidelines	
B	Experiments on: Preparation and Submission of Module 3 of the dossier using eCTD Software. Preparation and Submission of Module 5 of the dossier using eCTD Software. Comparison of Module 3 as per eCTD, ACTD and Sugam portal. Determination of Shelf Life through Stability Testing in Various Climatic Zones. Case study related to Warning Letters, GMP Compliance, and Submission Queries. Case study related to labelling requirements and Package insert.	18 Hours

Recommended Books: (Latest Editions)

1. Kothari, C. R., & Garg, G. (2019). Research Methodology: Methods and Techniques. New Age International Publishers.
2. Bolton, S. (1990). Pharmaceutical Statistics: Practical and Clinical Applications. Marcel Dekker Inc.
3. Day, R. A., & Gastel, B. (2011). How to Write and Publish a Scientific Paper. Cambridge University Press.
4. Department of Science & Technology (DST). (n.d.). Intellectual Property - A Primer for Academia. Government of India.



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COURSE OUTCOMES (COS) FOR M. PHARM SEMESTER III

1. PHARMACEUTICAL QUALITY ASSURANCE (A03)

SR. NO.	SUBJECT CODE	SUBJECT NAME	COS	Course Outcome Statement
1	M000301TT	Research Methodology and Biostatistics	CO1	Understand basic research methodology, including problem selection, proposal writing, and applying Design Thinking for innovative solutions.
			CO2	Learn the fundamentals of biostatistics and hypothesis testing for pharmaceutical data analysis.
			CO3	Apply advanced experimental design techniques and data analytics to optimize pharmaceutical processes and minimize variability.
			CO4	Analyze regulatory guidelines and intellectual property rights to navigate patenting and legal considerations in pharmaceutical research.
2	M030302PP	Journal Club I	CO1	Understand and apply the critical thinking skills to use search engines for selection and appraisal of scientific literature.
			CO2	Learn skill to write and create various types of manuscripts and scientific report article
3	M030303PP	Discussion / Presentation (Proposal Presentation)	CO1	Apply ability to understand, prepare and present scientific evidences by effective presentations with clarity
			CO2	Acquire skills like self-confidence to discuss, evaluate research problem and scientific report with team and peers
4	M030304PP	Research Work - Dissertation Phase I	CO1	Understand research concept, research methodologies, softwares, instrumentation and apply basic fundamentals of pharmaceutical sciences for implementing the project.
			CO2	Analyze the effectiveness to plan research proposal, research budget, solve research problem and develop effective research writing skills for report.

2. PHARMACEUTICAL TECHNOLOGY (A04)

SR. NO.	SUBJECT CODE	SUBJECT NAME	COS	Course Outcome Statement
1	M000301TT	Research Methodology and Biostatistics	CO1	Understand basic research methodology, including problem selection, proposal writing, and applying Design Thinking for innovative solutions.





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			CO2	Learn the fundamentals of biostatistics and hypothesis testing for pharmaceutical data analysis.
			CO3	Apply advanced experimental design techniques and data analytics to optimize pharmaceutical processes and minimize variability.
			CO4	Analyze regulatory guidelines and intellectual property rights to navigate patenting and legal considerations in pharmaceutical research.
2	M040302PP	Journal Club I	CO1	Understand and apply the critical thinking skills to use search engines for selection and appraisal of scientific literature.
			CO2	Learn skill to write and create various types of manuscripts and scientific report article
3	M040303PP	Discussion / Presentation (Proposal Presentation)	CO1	Apply ability to understand, prepare and present scientific evidences by effective presentations with clarity
			CO2	Acquire skills like self-confidence to discuss, evaluate research problem and scientific report with team and peers
4	M040304PP	Research Work - Dissertation Phase I	CO1	Understand research concept, research methodologies, softwares, instrumentation and apply basic fundamentals of pharmaceutical sciences for implementing the project.
			CO2	Analyze the effectiveness to plan research proposal, research budget, solve research problem and develop effective research writing skills for report.

3. PHARMACEUTICS (A05)

SR. NO.	SUBJECT CODE	SUBJECT NAME	COS	Course Outcome Statement
1	M000301TT	Research Methodology and Biostatistics	CO1	Understand basic research methodology, including problem selection, proposal writing, and applying Design Thinking for innovative solutions.
			CO2	Learn the fundamentals of biostatistics and hypothesis testing for pharmaceutical data analysis.
			CO3	Apply advanced experimental design techniques and data analytics to optimize pharmaceutical processes and minimize variability.
			CO4	Analyze regulatory guidelines and intellectual property rights to navigate patenting and legal considerations in pharmaceutical research.

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2	M040302PP	Journal Club I	CO1	Understand and apply the critical thinking skills to use search engines for selection and appraisal of scientific literature.
			CO2	Learn skill to write and create various types of manuscripts and scientific report article
3	M040303PP	Discussion / Presentation (Proposal Presentation)	CO1	Apply ability to understand, prepare and present scientific evidences by effective presentations with clarity
			CO2	Acquire skills like self-confidence to discuss, evaluate research problem and scientific report with team and peers
4	M040304PP	Research Work - Dissertation Phase I	CO1	Understand research concept, research methodologies, softwares, instrumentation and apply basic fundamentals of pharmaceutical sciences for implementing the project.
			CO2	Analyze the effectiveness to plan research proposal, research budget, solve research problem and develop effective research writing skills for report.

4. PHARMACOLOGY (A06)

SR. NO.	SUBJECT CODE	SUBJECT NAME	COS	Course Outcome Statement
1	M000301TT	Research Methodology and Biostatistics	CO1	Understand basic research methodology, including problem selection, proposal writing, and applying Design Thinking for innovative solutions.
			CO2	Learn the fundamentals of biostatistics and hypothesis testing for pharmaceutical data analysis.
			CO3	Apply advanced experimental design techniques and data analytics to optimize pharmaceutical processes and minimize variability.
			CO4	Analyze regulatory guidelines and intellectual property rights to navigate patenting and legal considerations in pharmaceutical research.
2	M060302PP	Journal Club I	CO1	Understand and apply the critical thinking skills to use search engines for selection and appraisal of scientific literature.
			CO2	Learn skill to write and create various types of manuscripts and scientific report article
3	M060303PP	Discussion / Presentation	CO1	Apply ability to understand, prepare and present scientific evidences by effective presentations with clarity

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		(Proposal Presentation)	CO2	Acquire skills like self-confidence to discuss, evaluate research problem and scientific report with team and peers
4	M060304PP	Research Work - Dissertation Phase I	CO1	Understand research concept, research methodologies, softwares, instrumentation and apply basic fundamentals of pharmaceutical sciences for implementing the project.
			CO2	Analyze the effectiveness to plan research proposal, research budget, solve research problem and develop effective research writing skills for report.

5. REGULATORY AFFAIRS (A07)

SR. NO.	SUBJECT CODE	SUBJECT NAME	COS	Course Outcome Statement
1	M000301TT	Research Methodology and Biostatistics	CO1	Understand basic research methodology, including problem selection, proposal writing, and applying Design Thinking for innovative solutions.
			CO2	Learn the fundamentals of biostatistics and hypothesis testing for pharmaceutical data analysis.
			CO3	Apply advanced experimental design techniques and data analytics to optimize pharmaceutical processes and minimize variability.
			CO4	Analyze regulatory guidelines and intellectual property rights to navigate patenting and legal considerations in pharmaceutical research.
2	M070302PP	Journal Club I	CO1	Understand and apply the critical thinking skills to use search engines for selection and appraisal of scientific literature.
			CO2	Learn skill to write and create various types of manuscripts and scientific report article
3	M070303PP	Discussion / Presentation (Proposal Presentation)	CO1	Apply ability to understand, prepare and present scientific evidences by effective presentations with clarity
			CO2	Acquire skills like self-confidence to discuss, evaluate research problem and scientific report with team and peers
4	M070304PP	Research Work - Dissertation Phase I	CO1	Understand research concept, research methodologies, softwares, instrumentation and apply basic fundamentals of pharmaceutical sciences for implementing the project





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			CO2	Analyze the effectiveness to plan research proposal, research budget, solve research problem and develop effective research writing skills for report.
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COURSE OUTCOMES (COS) FOR M. PHARM SEMESTER IV

1. PHARMACEUTICAL QUALITY ASSURANCE (A03)

SR. NO.	SUBJECT CODE	SUBJECT NAME	COS	Course Outcome Statement
1	M030401PP	Journal Club II	CO1	Apply and analyze the critical thinking skills to use search engines and for selection and appraisal of scientific literature
			CO2	Apply skill to write and create various types of manuscripts and scientific report article
2	M030402PP	Discussion / Presentation	CO1	Apply ability to understand, prepare and present scientific evidences by effective presentations with clarity
			CO2	Acquire skills like self-confidence to discuss, evaluate research problem and scientific report with team and peers
3	M030403PP	Research Work - Dissertation Phase II	CO1	Investigate and propose new ideas/ methodologies or procedures for preparation, conduction of research to achieve research objectives.
			CO2	Create research thesis, manuscript of the findings along with presentations and viva for research outcome

2. PHARMACEUTICAL TECHNOLOGY (A04)

SR. NO.	SUBJECT CODE	SUBJECT NAME	COS	Course Outcome Statement
1	M040401PP	Journal Club II	CO1	Apply and analyze the critical thinking skills to use search engines and for selection and appraisal of scientific literature
			CO2	Apply skill to write and create various types of manuscripts and scientific report article
2	M040402PP	Discussion / Presentation	CO1	Apply ability to understand, prepare and present scientific evidences by effective presentations with clarity
			CO2	Acquire skills like self-confidence to discuss, evaluate research problem and scientific report with team and peers
3	M040403PP	Research Work - Dissertation Phase II	CO1	Investigate and propose new ideas/ methodologies or procedures for preparation, conduction of research to achieve research objectives.



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			CO2	Create research thesis, manuscript of the findings along with presentations and viva for research outcome
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3. PHARMACEUTICS (A05)

SR. NO.	SUBJECT CODE	SUBJECT NAME	COS	Course Outcome Statement
1	M040401PP	Journal Club II	CO1	Apply and analyze the critical thinking skills to use search engines and for selection and appraisal of scientific literature
			CO2	Apply skill to write and create various types of manuscripts and scientific report article
2	M040402PP	Discussion / Presentation	CO1	Apply ability to understand, prepare and present scientific evidences by effective presentations with clarity
			CO2	Acquire skills like self-confidence to discuss, evaluate research problem and scientific report with team and peers
3	M040403PP	Research Work - Dissertation Phase II	CO1	Investigate and propose new ideas/ methodologies or procedures for preparation, conduction of research to achieve research objectives.
			CO2	Create research thesis, manuscript of the findings along with presentations and viva for research outcome

4. PHARMACOLOGY (A06)

SR. NO.	SUBJECT CODE	SUBJECT NAME	COS	Course Outcome Statement
1	M060401PP	Journal Club II	CO1	Apply and analyze the critical thinking skills to use search engines and for selection and appraisal of scientific literature
			CO2	Apply skill to write and create various types of manuscripts and scientific report article
2	M060402PP	Discussion / Presentation	CO1	Apply ability to understand, prepare and present scientific evidences by effective presentations with clarity
			CO2	Acquire skills like self-confidence to discuss, evaluate research problem and scientific report with team and peers





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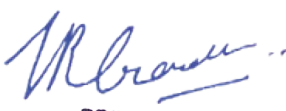


3	M060403PP	Research Work - Dissertation Phase II	CO1	Investigate and propose new ideas/ methodologies or procedures for preparation, conduction of research to achieve research objectives.
			CO2	Create research thesis, manuscript of the findings along with presentations and viva for research outcome

5. REGULATORY AFFAIRS (A07)

SR. NO.	SUBJECT CODE	SUBJECT NAME	COS	Course Outcome Statement
1	M070401PP	Journal Club II	CO1	Apply and analyze the critical thinking skills to use search engines and for selection and appraisal of scientific literature
			CO2	Apply skill to write and create various types of manuscripts and scientific report article
2	M070402PP	Discussion / Presentation	CO1	Apply ability to understand, prepare and present scientific evidences by effective presentations with clarity
			CO2	Acquire skills like self-confidence to discuss, evaluate research problem and scientific report with team and peers
3	M070403PP	Research Work - Dissertation Phase II	CO1	Investigate and propose new ideas/ methodologies or procedures for preparation, conduction of research to achieve research objectives.
			CO2	Create research thesis, manuscript of the findings along with presentations and viva for research outcome




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