

PHARMACEUTICAL ANALYSIS

Program Educational Objectives (PEOs)

- The course is designed to impart the knowledge in the field of Pharmaceutical Analysis. The various modern analytical techniques like UV-Visible, IR, NMR, Mass, GC, HPLC, different chromatographic methods are taught to enable the students to understand and apply the principle involved in the determination and of different bulk drugs and their formulations, analysis of food constituents and finished food products.
- In addition to the theoretical aspects, the basic practical knowledge relevant to the analysis is also imparted.
- The topics which are present in the Drug regulatory affairs are very much useful which increases the knowledge regarding the regulatory aspects in the pharmaceutical industries.
- The course deals with various hyphenated analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are LC-MS, GC-MS, and hyphenated techniques in analytical and biological samples.
- This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications, GLP and regulatory affairs.

Program Outcomes (POs)

- Gain appreciable knowledge about the theoretical and practical aspects of modern analytical techniques and their application in analysis of drug substances, formulations, excipients and food products and about different validation procedures according to guidelines.
- Understand the advancements in major instrumental analytical techniques used in bio-analysis, herbal and cosmetic analysis and also about QA practices
- Attain knowledge in research methodologies, biostatistical tools and article writing in Journals.
- Able to develop new analytical methods by using various instrumental techniques for application in different fields of science

Program Specific Outcomes (PSOs)

- ❖ PSO1: Understand and apply principles of various analytical techniques.
- ❖ PSO2: Understand and apply various methods of analysis of pharmaceutical food sources and probiotics.
- ❖ PSO3: Provide exposure in various techniques in equipment and premises validation and validation of analytical methods

- ❖ PSO4: Understand and apply principles of various Bio-analytical techniques and provide exposure to advanced experimental/theoretical methods of analysis biological.
- ❖ PSO5: understand the application biostatistics in project works.

Course Outcomes:

M.Pharm Sem – I (Pharmaceutical Analysis)

(Program Core - I)

Modern Pharmaceutical Analytical Techniques

Outcomes:

1. To know about basic principles and techniques of chromatography.
2. To know about detection and quantification of analytes by instrumental chromatographic techniques.
3. To determine and illustrate the samples by spectroscopic methods.
4. To know the molecular weight of the compounds and application of hyphenated techniques.
5. For structure elucidation with the help of protons and carbons present.

(Program Core – II)

Pharmaceutical Food Analysis

Outcomes:

At completion of this course student shall be able to understand various analytical techniques in the determination of

1. Food constituents
2. Food additives
3. Finished food products
4. Pesticides in food
5. And also, student shall have the knowledge on food regulations and legislations

(Program Elective - I)

1. Advanced Pharmaceutical Analysis

Outcomes:

1. Quantitative determination of compounds by titration methods.
2. Quantitative determination of functional groups by titration methods.
3. Applications of various reagents
4. Analysis of various excipients
5. To know various microbial and biological assays in determination of compounds.

2. Drug Regulatory Affairs

Outcomes:

1. Students will come to know the different competent regulatory authorities globally.
2. Students be aware of technical aspects pertaining to the marketing authorization application (MAA)
3. The regulatory guidelines and directions framed by the regulatory authorities will be helpful to place the drug products in market for marketing approvals.

3. Phytochemistry

Outcomes:

1. Students will study the biogenetic investigation techniques, understands the basic metabolic pathways in plants
2. Brief outline towards various approaches, strategies of the natural product drug discovery.
3. Students will acquire knowledge on the basis of chemistry data of phytoconstituents in the plants.
4. An exposure to both simple and sophisticated extraction techniques.
5. Students will gain knowledge on colouring principles and flavouring principles of plants used in pharmaceutical preparations.

(Program Elective - II)

1. Pharmaceutical Validation

Outcomes:

Upon completion of the subject student shall be able to

1. Explain the aspect of validation
2. Carryout validation of manufacturing processes
3. Apply the knowledge of validation to instruments and equipments
4. Validate the manufacturing facilities

2. Cosmetics And Cosmeceuticals

Outcomes:

Upon completion of the course, the students shall be able to understand

1. Key ingredients used in cosmetics and cosmeceuticals.
2. Key building blocks for various formulations.
3. Current technologies in the market
4. Various key ingredients and basic science to develop cosmetics and cosmeceuticals
5. Scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

3. INDUSTRIAL PHARMACOGNOSTICAL TECHNOLOGY

Outcomes:

By the end of the course the student shall be able to know:

1. The requirements for setting up the herbal/natural drug industry.
2. The guidelines for quality of herbal/ natural medicines and regulatory issues.
3. The patenting /IPR of herbals/natural drugs and trade of raw and finished materials.

Audit Course

RESEARCH METHODOLOGY AND IPR

Outcomes:

At the end of this course, students will be able to

1. Understand research problem formulation.
2. Analyse research related information and Follow research ethics,
3. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

M.Pharm Sem – II (Pharmaceutical Analysis)

(Program Core - III)

Advanced Instrumental Analysis - I

Outcomes:

By the completion of the topic, the students will come out with the thorough knowledge

1. On crystal structure elucidation by XRD
2. Separation of components by new chromatographic techniques.
3. Separation of components (RNA & DNA) by electrophoresis.
4. Physical nature of compounds by thermal methods.

(Program Core - IV)

Modern Bio-Analytical Techniques

Outcomes:

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

1. Extraction of drugs from biological samples

2. Separation of drugs from biological samples using different techniques
3. Guidelines for BA/BE studies

(Program Elective - III)

1. Pharmaceutical Quality Control and Quality Assurance

Outcome:

1. The study of this subject builds the confidence in the minds on the students to develop and formulate high quality pharmaceutical products.
2. The students will know about the organization and personnel of an industry.
3. To know about packaging and labelling in industry.
4. To know about SOPs followed as per regulations.

2. HERBAL COSMETICS

Outcomes:

Students will learn about

1. Regulatory Provisions relation to manufacture of cosmetics
2. The raw materials used in herbal cosmetics and get exposed to various preparations of herbal cosmetics.
3. Various herbal skin care products and some formulations.
4. Herbal hair care products and some hair care preparations.
5. Importance of some herbal plants that we use in day-to-day life.

3. Pharmacoepidemiology & Pharmacoeconomics

Outcomes:

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

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

(Program Elective - IV)

1. ADVANCED INSTRUMENTAL ANALYSIS - II

Outcomes: By the completion of topics the students will come out with the thorough knowledge

1. On various electrochemical methods,

2. On elemental analysis by fluorimetry, AAS
3. Determination of macro molecules by RIA & ELISA

2. NUTRACEUTICALS

Outcomes: Helps the student

1. To understand the importance of Nutraceuticals in various common problems with the concept of free radicals.
2. Importance of phytochemicals as nutraceuticals
3. Concepts of antioxidants
4. The students acquire knowledge about various food laws and regulations

3. CLINICAL RESEARCH AND PHARMACOVIGILANCE

Outcome:

1. Upon completion of the course, the student shall be able to,
2. Explain the regulatory requirements for conducting clinical trial
3. Demonstrate the types of clinical trial designs
4. Explain the responsibilities of key players involved in clinical trials
5. Execute safety monitoring, reporting and close-out activities
6. Explain the principles of Pharmacovigilance
7. Detect new adverse drug reactions and their assessment
8. Perform the adverse drug reaction reporting systems and communication in pharmacovigilance

M.Pharm Sem – III (Pharmaceutical Analysis)

(Program Elective - V)

1. BIOSTATISTICS

Outcomes:

1. The student will know the Biostatistical data arrangement, presentation and formation of tables and charts.
2. They also know the correlation and regression of data & application of different statistical methods in analysis of data.

2. SCALE UP AND TECHNOLOGY TRANSFER

Outcomes:

On completion of this course, it is expected that students will be able to understand,

1. Manage the scale up process in pharmaceutical industry.
2. Assist in technology transfer.

3. To establish safety guidelines, which prevent industrial hazards

3. PRODUCTION AREA DESIGN & PACKAGING DEVELOPMENT

Outcomes:

1. At the end of the semester student will get an idea about Industrial area design and packaging of different formulations and its stability conditions.

(Open Elective)

1. SCREENING METHODS IN PHARMACOLOGY

Outcomes:

1. The expected outcomes are students will know how to handle animals and CPCSEA guidelines.
2. Basic principles of biological standardization with some examples of bioassays.
3. They will know about OECD guidelines and different toxicity tests.
4. Know about various techniques for screening of drugs for different pharmacological activities, guidelines and regulations for screening new drug molecules on animals.
5. Pharmacological activity of new substances with emphasis on the evaluation of some drug agents.

2. ENTREPRENEURSHIP MANAGEMENT

Outcomes: On completion of this course, it is expected that students will be able to understand,

1. The Role of enterprise in national and global economy
2. Dynamics of motivation and concepts of entrepreneurship
3. Demands and challenges of Growth Strategies and Networking

3. STABILITY OF DRUGS AND DOSAGE FORMS

Outcomes:

1. The students should describe the evaluation of stability of solutions, solids and formulations against adverse conditions.
2. The students should be able to suggest the measures to retain stability and storage conditions for retaining the efficacy of the products.

4. COSMETIC SCIENCE

Outcomes:

At completion of this course, it is expected that students will be able to

1. Gain knowledge on the regulatory requirements for manufacture, sale and import of cosmetics.

2. Impart knowledge on various building blocks used in cosmetics and the safety parameters of various excipients.
3. Impart a specialized knowledge to know various cosmetics, their preparation, properties, MOA, uses etc.
4. Understanding of properties and evaluation of these cosmetics by analytical methods.
5. The students should be able to suggest the proper usage of cosmetics.

5. HAZARDS AND SAFETY MANAGEMENT

Outcomes

At completion of this course, it is expected that students will be able to

1. Understand about environmental problems among learners.
2. Impart basic knowledge about the environment and its allied problems.
3. Develop an attitude of concern for the industry environment.
4. Ensure safety standards in pharmaceutical industry
5. Provide comprehensive knowledge on the safety management
6. Empower an idea to clear mechanism and management in different kinds of hazard management system
7. Teach the method of Hazard assessment, procedure, methodology for provide safe industrial atmosphere.

6. AUDITS AND REGULATORY COMPLIANCE

Outcomes:

Upon completion of this course the student should be able to

1. To understand the importance of auditing
2. To understand the methodology of auditing
3. To carry out the audit process
4. To prepare the auditing report
5. To prepare the check list for auditing

PHARMACEUTICS

Program Educational Objectives (PEOs)

- The course is designed to impart specialized knowledge on the properties of drugs and dosage forms during manufacture storage and shelf life and to train the students on scale up, technology transfer process and industrial safety issues.
- In addition to the theoretical aspects, the basic practical knowledge relevant to the pharmaceuticals is added.
- The course deals bioavailability, bioequivalence and factor affecting bioavailability. They also learn the pharmacokinetic parameter like drug disposition, absorption, non-linear and time dependant pharmacokinetics. They also understand about the drug interactions & problems, practice associated in pharmacokinetic parameters calculations.
- The topics which are present in the Drug regulatory affairs are very much useful which increases the knowledge regarding the regulatory aspects in the pharmaceutical industries.
- The students shall apply the pharmacokinetic and pharmacodynamic principles in the design of CDDS. They also apply the design, evaluation and applications related to oral, parenteral, transdermal, implants, bioadhesives and targeted drug delivery systems.

Program Outcomes (POs)

- Gain appreciable knowledge about the theoretical and practical aspects of conventional and novel drug delivery systems and their application in analysis of drug substances, formulations, excipients and food products and about different validation procedures according to guidelines.
- Understand the advancements in major dosage forms in designing the safe and effective formulations.
- Attain knowledge in research methodologies, biostatistical tools and article writing in Journals.

Program Specific Outcomes: (PSO's):

- ❖ PSO1: Exposure to the basic concepts of various dosage forms
- ❖ PSO2: Understand various biopharmaceutical and pharmacokinetic approaches
- ❖ PSO3: Exposure to Industrial applications of various unit operations

- ❖ PSO4: Formulation of Novel drug delivery systems for various active pharmaceutical agents
- ❖ PSO5: Understand the application biostatistics in project works

Course Outcomes:

M.Pharm Sem – I (Pharmaceutics)

(Program Core-I)

MODERN PHARMACEUTICS -I

Outcomes:

1. Students shall explain the pre-formulation parameters.
2. Students will gain a good knowledge on various excipients used in tablet formulation.
3. Students also explain about formulation and development, use of excipients in tablets, powders, capsules, micro-encapsules and coating techniques.
4. A good knowledge on stability on various solid dosage forms.
5. They also learn and apply the statistical design in different formulations.

(Program Core-II)

APPLIED BIOPHARMACEUTICS AND PHARMACOKINETICS

Outcomes:

1. Students will be able to express factors affecting the bioavailability.
2. Students gains knowledge on bioequivalence protocols for bioequivalent studies.
3. They also evaluate the parameters for the various drug disposition process and compartment modelling.
4. Michaelis-Menton constants for non-linear kinetics.
5. They will learn about Chrono-pharmacokinetics principles and drug interactions.

(Program Elective-I)

1. ADVANCED PHYSICAL PHARMACEUTICS

Outcomes:

1. The students will gain knowledge on polymers and its properties. The use of polymers in various drug delivery systems.
2. They will learn about mechanism of tablet compression and its tooling.
3. Student will also practice the stability calculations, shelf-life calculations and accelerated stability studies.
4. They also understand the rheology, related to liquids and semi-solid dosage forms with advances.
5. They also know the factors affecting the dissolution and solubility in related to invitro/in vivo correlations.

2. DRUG REGULATORY AFFAIRS

Outcomes:

1. Students will come to know the manufacturing and distribution process in India.
2. Students will come to know the different competent regulatory authorities globally.
3. Students be aware of technical aspects pertaining to the marketing authorization application (MAA).
4. The regulatory guidelines and directions framed by the regulatory authorities will be helpful to place the drug products in market for marketing approvals.
5. Preparation, review and submission of Drug Master Files to Regulatory Authorities as per their specific requirements.

3. PHARMACEUTICAL FOOD ANALYSIS

Outcomes:

1. Student shall be able to understand various analytical techniques in the determination of Food constituents
2. Student shall be able to understand various analytical techniques in the determination of Food additives
3. Student shall be able to understand various analytical techniques in the determination of Finished food products
4. Student shall be able to understand various analytical techniques in the determination of Pesticides in food
5. Student will have the knowledge on food regulations and legislations

(Program Elective-II)

1. COSMETICS AND COSMECEUTICALS

Outcomes:

1. Students will learn about the regulatory requirements of cosmetic products.
2. To know the various building blocks used in cosmetics products.
3. To know the manufacturing of cosmetics and its application.
4. To learn about the regulatory requirements of cosmetic products.
5. To get good knowledge on Herbal ingredients used in hair, skin and oral care.

2. PHARMACEUTICAL VALIDATION

Outcomes:

1. Student shall be able to explain the aspect of validation
2. To carryout validation of manufacturing processes
3. To apply the knowledge of validation to instruments and equipment's
4. Student will have good knowledge on validation of the manufacturing facilities

5. They gain knowledge on Validations of various analytical methods as per ICH guidelines and USP.

3. INDUSTRIAL PHARMACOGNOSTICAL TECHNOLOGY

Outcomes:

1. By the end of the unit I the student shall be able to know the requirements for setting up the herbal/natural drug industry.
2. Students gain knowledge on regulatory and quality policy for the trade of drugs of natural origin.
3. Students will be aware of herbal companies and their formulations and also learn about how to document the herbal medicine for future reference
4. Student will know about the guidelines, quality testing of herbal/natural medicines
5. The patenting/IPR of herbals/natural drugs and trade of raw and finished materials.

Audit Course

RESEARCH METHODOLOGY AND IPR

Outcomes:

1. Understand research problem formulation.
2. Analyse research related information and Follow research ethics
3. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

M.Pharm Sem – II (Pharmaceutics)

(Program Core III)

MODERN PHARMACEUTICS-II

Outcomes:

1. Students will understand the planning of pilot plant and scale up techniques used for all pharmaceutical dosage forms such as tablets, capsules, parenteral
2. They will learn various novel techniques in manufacturing of parenteral
3. To manufacture and evaluate pharmaceutical aerosol systems

4. They will gain knowledge on Cosmetics and nutraceuticals
5. They will know various air handling systems and aseptic operations.

(Program Core IV)

ADVANCED DRUG DELIVERY SYSTEMS

Outcomes:

1. Students will be able to formulate various controlled release drug delivery systems
2. They will learn about design, fabrication and evaluation transdermal, implantable, ocular and intrauterine drug delivery systems
3. They will have knowledge on the Bio-adhesive, nasal and colon drug delivery systems
4. They will gain knowledge on novel drug delivery vehicles
5. They will know about delivery of drug to lungs, brain and neoplasms

(Program Elective III)

1. INDUSTRIAL PHARMACY

Outcomes:

1. The students will explain the machinery involved in milling, mixing, filtration and drying
2. The students will know the packing material constructions used in the production of pharmaceutical materials
3. They also learn salient features of GMP, TQM applicable in industry
4. They also understand the effluent treatments and prevention of the pollution
5. They also should evaluate the validation of analytical methods and processes

2. HERBAL COSMETICS

Outcomes:

Students will learn about

1. Regulatory Provisions relation to manufacture of cosmetics
2. The raw materials used in herbal cosmetics and get exposed to various preparations of herbal cosmetics.
3. Various herbal skin care products and some formulations.
4. Herbal hair care products and some hair care preparations.
5. Importance of some herbal plants that we use in day-to-day life.

3. PHARMACOEPIDEMIOLOGY & PHARMACOECONOMICS

Outcomes:

1. Students shall be able to understand the various epidemiological methods and their applications
2. Students shall be able to understand the fundamental principles of Pharmacoeconomics.
3. Students shall be able to identify and determine relevant cost and consequences associated with pharmacy products and services.
4. Students shall be able to perform the key Pharmacoeconomics analysis methods
5. Students shall be able to understand the Pharmacoeconomic decision analysis methods and its applications.
6. Students shall be able to describe current Pharmacoeconomic methods and issues.
7. Students shall be able to understand the applications of Pharmacoeconomics to various pharmacy settings.

(Program Elective IV)

1. NANO BASED DRUG DELIVERY SYSTEMS

Outcomes:

1. The students will be able to select the right kind of nano-materials for nano drug delivery systems.
2. They will be able to develop nano formulations with appropriate technologies
3. The students will gain knowledge in designing various drug delivery systems for cancer, pulmonary and localized systems.
4. They will learn the applications of nanomaterials in invitro diagnostics and therapeutics
5. The students will learn the evaluation of the various nanodrug delivery systems

2. NUTRACEUTICALS

Outcomes:

1. Helps the student to understand the importance of Nutraceuticals in various common problems with the concept of free radicals
2. The students will know the various phytochemicals used as nutraceuticals and their medicinal values
3. They will learn about free radicles, its production and measurement
4. They will gain knowledge on antioxidants and its role in prevention of diseases

5. The students will know the various food laws and regulations

3. CLINICAL RESEARCH AND PHARMACOVIGILANCE

Outcomes:

1. The student shall be able to explain the regulatory requirements for conducting clinical trial
2. The student shall be able to demonstrate the types of clinical trial designs
3. The student shall be able to explain the responsibilities of key players involved in clinical trials
4. The student shall be able to execute safety monitoring, reporting and close-out activities
5. The student shall be able to explain the principles of Pharmacovigilance
6. The student shall be able to detect new adverse drug reactions and their assessment
7. The student shall be able to perform the adverse drug reaction reporting systems and communication in pharmacovigilance

M.Pharm Sem – III (Pharmaceutics)

(Program Elective - V)

1. BIostatISTICS

Outcomes:

3. The student will know the Biostatistical data arrangement, presentation and formation of tables and charts.
4. They also know the correlation and regression of data & application of different statistical methods in analysis of data.

2. SCALE UP AND TECHNOLOGY TRANSFER

Outcomes:

On completion of this course, it is expected that students will be able to understand,

1. Manage the scale up process in pharmaceutical industry.
2. Assist in technology transfer.
3. To establish safety guidelines, which prevent industrial hazards

3. PRODUCTION AREA DESIGN & PACKAGING DEVELOPMENT

Outcomes:

1. At the end of the semester student will get an idea about Industrial area design and packaging of different formulations and its stability conditions.

(Open Elective)

1. SCREENING METHODS IN PHARMACOLOGY

Outcomes:

1. The expected outcomes are students will know how to handle animals and CPCSEA guidelines.

2. Basic principles of biological standardization with some examples of bioassays.
3. They will know about OECD guidelines and different toxicity tests.
4. Know about various techniques for screening of drugs for different pharmacological activities, guidelines and regulations for screening new drug molecules on animals.
5. Pharmacological activity of new substances with emphasis on the evaluation of some drug agents.

2. ENTREPRENEURSHIP MANAGEMENT

Outcomes: On completion of this course, it is expected that students will be able to understand,

1. The Role of enterprise in national and global economy
2. Dynamics of motivation and concepts of entrepreneurship
3. Demands and challenges of Growth Strategies and Networking

3. STABILITY OF DRUGS AND DOSAGE FORMS

Outcomes:

1. The students should describe the evaluation of stability of solutions, solids and formulations against adverse conditions.
2. The students should be able to suggest the measures to retain stability and storage conditions for retaining the efficacy of the products.

4. COSMETIC SCIENCE

Outcomes:

At completion of this course, it is expected that students will be able to

1. Gain knowledge on the regulatory requirements for manufacture, sale and import of cosmetics.
2. Impart knowledge on various building blocks used in cosmetics and the safety parameters of various excipients.
3. Impart a specialized knowledge to know various cosmetics, their preparation, properties, MOA, uses etc.
4. Understanding of properties and evaluation of these cosmetics by analytical methods.
5. The students should be able to suggest the proper usage of cosmetics.

5. HAZARDS AND SAFETY MANAGEMENT

Outcomes

At completion of this course, it is expected that students will be able to

1. Understand about environmental problems among learners.
2. Impart basic knowledge about the environment and its allied problems.
6. Develop an attitude of concern for the industry environment.
7. Ensure safety standards in pharmaceutical industry

8. Provide comprehensive knowledge on the safety management
9. Empower an idea to clear mechanism and management in different kinds of hazard management system
10. Teach the method of Hazard assessment, procedure, methodology for provide safe industrial atmosphere.

6. AUDITS AND REGULATORY COMPLIANCE

Outcomes:

Upon completion of this course the student should be able to

1. To understand the importance of auditing
2. To understand the methodology of auditing
3. To carry out the audit process
4. To prepare the auditing report
5. To prepare the check list for auditing

PHARMACOGNOSY

Program Educational Objectives (PEOs)

1. The subjects of the course is framed to help the students to get exposed to natural product drug discovery and to perform quantitative and qualitative evaluation of herbal extracts and to understand the chemistry of important phytoconstituents of different categories.
2. To provide an opportunity for the students to understand the cultivation and utilization aspects of drugs falling under this chapter. Helps the students to get exposed to various techniques of plant tissue culture and explore marine origin natural products.
3. To understand the Industrial and commercial potential of drugs of natural origin, integrate traditional Indian systems of medicine with modern medicine and also to know regulatory and quality policy for the trade of herbals and drugs of natural origin.
4. The students get exposure to principles and concepts of alternative systems of medicine like Ayurveda, Siddha, Homeopathy and Unani medicine and they acquire knowledge on the methods of preparation and use of formulations of various systems of medicines.
5. Some of the topics are designed to help the students to get exposed to various techniques of plant tissue culture. Use the biotechnological techniques for obtaining and improving the quality of natural products/medicinal plants

Program Outcomes (POs)

1. The students will gain applicable knowledge about various types of phytoconstituents present in the plants and the traditional plants and marine source which helps them to work upon them for proving their use scientifically.
2. The student shall be able to know the, standardization and evaluation techniques for the herbal drugs and to understand the organization and research of natural products in herbal drugs industries.
3. The course helps the students in understanding the influence of various alternative systems of medicine in the development of herbal drugs.
4. Students will learn about the raw materials used in herbal cosmetics and get exposed to various preparations of herbal cosmetics.
5. Students will gain the knowledge about various strategies of plant tissue culture and students will gain knowledge about various secondary metabolites produced by plant tissue culture and also the students will know how to handle animals and know about various techniques for screening of drugs for different pharmacological activities, guidelines and regulations for screening new drug molecules on animals.

Program Specific Outcomes: (PSO's):

- ❖ PSO1: Applies various approaches of Natural Product drug discovery.
- ❖ PSO2: Understands the chemistry of important Phytoconstituents.
- ❖ PSO3: Provides exposure to trade and regulatory aspects of herbals
- ❖ PSO4: Understand and apply principles of various analytical techniques and provide exposure to advanced experimental/theoretical methods of analysis.
- ❖ PSO5: Exposure to concepts of alternative systems of medicines

M.Pharm Sem – I (PHARMACOGNOSY)

(Program Core –I)

PHYTOCHEMISTRY

Outcomes:

1. Students will study the biogenetic investigation techniques, understands the basic metabolic pathways in plants
2. Brief outline towards various approaches, strategies of the natural product drug discovery.
3. Students will acquire knowledge on the basis of chemistry data of phytoconstituents in the plants.
4. An exposure to both simple and sophisticated extraction techniques.
5. Students will gain knowledge on colouring principles and flavouring principles of plants used in pharmaceutical preparations.

(Program Core –II)

ADVANCED PHARMACOGNOSY- I

Outcomes:

1. Gains knowledge on the cultivation and utilization aspects of medicinal and aromatic plants.
2. Acquires contemporary information on Phytochemical and Pharmacological aspects and uses of medicinal plants.
3. An exposure to marine source which helps them to work upon them for proving their use scientifically.
4. Students acquire knowledge about the importance of nutraceuticals for various ailments
5. Students will gain knowledge about the phytopharmaceuticals chemistry and health benefits.

(Program Elective - I)

1. MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES

Outcomes:

1. The appreciable knowledge will be gained by the students in various separation techniques helpful during isolation of compounds.
2. The students will also be in a position to apply their knowledge about HPLC, HPTLC, GC in developing the new methods for the determination and validate the procedures.
3. The Modern spectroscopic theories can be applied in the Analysis of various bulk drugs and their formulations
4. Students can apply for identification and structure determination
5. Concepts of NMR can be useful in characterization of various novel compounds.

2. DRUG REGULATORY AFFAIRS

Outcomes:

1. Students will come to know the different competent regulatory authorities globally.
2. Students be aware of technical aspects pertaining to the marketing authorization application.
3. The regulatory guidelines and directions framed by the regulatory authorities will be helpful to place the drug products in market for marketing approvals.
4. Knowledge on Manufacturing and quality aspects of cosmetic products and herbal products
5. Student will now about how to prepare drug master filing to submit to regulatory authorities

3. PHARMACEUTICAL FOOD ANALYSIS

Outcomes:

At completion of this course student shall be able to understand various analytical techniques in the determination of

1. Food constituents
2. Food additives and probiotic applications
3. Lipids in food
4. vitamins in food
5. And also, student shall have the knowledge on food regulations and legislations

(Program Elective-II)

1. INDUSTRIAL PHARMACOGNOSTICAL TECHNOLOGY

Outcomes:

1. By the end of the unit I the student shall be able to know the requirements for setting up the herbal/natural drug industry.

2. students gains knowledge on regulatory and quality policy for the trade of drugs of natural origin.
3. Students will be aware of herbal companies and their formulations and also learn about how to document the herbal medicine for future reference
4. student will know about the guidelines, quality testing of herbal/natural medicines
5. The patenting/IPR of herbals/natural drugs and trade of raw and finished materials.

2. PHARMACEUTICAL VALIDATION

Outcomes:

Upon completion of the subject student shall be able to

1. Explain the aspect of validation
2. Carryout validation of manufacturing processes
3. Apply the knowledge of validation to instruments and equipment's
4. Will understand the cleaning validation procedures
5. Validate the manufacturing facilities

3. COSMETICS AND COSMECEUTICALS

Outcomes:

1. Upon completion of the course, the students shall be able to understand Regulatory provisions relating to manufacture of cosmetics
2. Learns about the basic aspects of skin and hair to develop cosmetics and cosmeceuticals
3. Key ingredients used in cosmetics and cosmeceuticals
4. Helps in designing of cosmeceuticals
5. An exposure on importance of herbal ingredients in cosmetics

Audit course

RESEARCH METHODOLOGY AND IPR

Outcomes:

At the end of this course, students will be able to

1. Understand research problem formulation.
2. Analyze research related information and Follow research ethics,
3. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

M.Pharm Semester-II (PHARMACOGNOSY)

(Program Core –III)

ADVANCED PHARMACOGNOSY-II

Outcomes:

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

1. Adulteration techniques and identification of adulterants.
2. Standardization and evaluation techniques for the herbal drugs.
3. Some important vegetable bitters and vegetable Laxatives.
4. Role and importance of Ethnobotany and Ethnopharmacology.
5. Performing of Phyto Pharmacological screening

(Program Core –IV)

INDIAN SYSTEM OF MEDICINE

Outcomes: Helps the students in understanding the influence of various alternative systems of medicine in the development of herbal drugs.

1. Evolution of Ayurveda and its importance.
2. Students study about various Ayurvedic formulations.
3. Students come to know about Naturopathy and Yoga practices.
4. Learn about Homeopathic and Siddha medicines.
5. Preparation of different dosage forms of Unani medicine and Aromapathy.

(Program Elective –III)

1. HERBAL COSMETICS

Outcomes:

Students will learn about

1. Regulatory Provisions relation to manufacture of cosmetics
2. The raw materials used in herbal cosmetics and get exposed to various preparations of herbal cosmetics.
3. Various herbal skin care products and some formulations.
4. Herbal hair care products and some hair care preparations.
5. Importance of some herbal plants that we use in day-to-day life.

2. PHARMACEUTICAL QUALITY CONTROL AND QUALITY ASSURANCE

Outcomes: The study of this subject builds the confidence in the minds on the students to develop and formulate high quality pharmaceutical products.

1. The study of this subject builds the confidence in the minds on the students to develop and formulate high quality pharmaceutical products.
2. The students will know about the organization and personnel of an industry.
3. To know about packaging and labelling in industry.
4. To know about SOPs followed as per regulations.

3. PHARMACOEPIDEMIOLOGY & PHARMACOECONOMICS

Outcomes:

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

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

(Program Elective –IV)

1. MEDICINAL PLANT BIOTECHNOLOGY

Outcomes: Students will gain the knowledge about

1. Conditions to maintain aspect cultures and its requirements.
2. Various strategies of plant tissue culture.
3. Students will gain knowledge about various secondary metabolites produced by plant tissue culture.
4. Concepts of Biotransformation and Transgenesis.
5. Production of Secondary metabolites from callus culture and suspension culture with some examples.

2. NUTRACEUTICALS

Outcomes: Helps the student

1. To understand the importance of Nutraceuticals in various common problems with the concept of free radicals.
2. Importance of phytochemicals as nutraceuticals
3. Concepts of antioxidants
4. The students acquire knowledge about various food laws and regulations

3. CLINICAL RESEARCH AND PHARMACOVIGILANCE

Outcomes:

1. Upon completion of the course, the student shall be able to,
2. Explain the regulatory requirements for conducting clinical trial
3. Demonstrate the types of clinical trial designs
4. Explain the responsibilities of key players involved in clinical trials
5. Execute safety monitoring, reporting and close-out activities
6. Explain the principles of Pharmacovigilance
7. Detect new adverse drug reactions and their assessment
8. Perform the adverse drug reaction reporting systems and communication in pharmacovigilance

M.Pharm Semester - III (PHARMACOGNOSY)

(Program Elective - V)

1. BIostatISTICS

Outcomes:

1. The student will know the Biostatistical data arrangement, presentation and formation of tables and charts.
2. They also know the correlation and regression of data & application of different statistical methods in analysis of data.

2. SCALE UP AND TECHNOLOGY TRANSFER

Outcomes: On completion of this course, it is expected that students will be able to understand,

1. Manage the scale up process in pharmaceutical industry.
2. Assist in technology transfer.
3. To establish safety guidelines, which prevent industrial hazards

3. PRODUCTION AREA DESIGN & PACKAGING DEVELOPMENT

Outcomes:

1. At the end of the semester student will get an idea about Industrial area design and packaging of different formulations and its stability conditions.

(Open Elective)

1. SCREENING METHODS IN PHARMACOLOGY

Outcomes:

1. The expected outcomes are students will know how to handle animals and CPCSEA guidelines.
2. Basic principles of biological standardization with some examples of bioassays.

3. They will know about OECD guidelines and different toxicity tests.
4. Know about various techniques for screening of drugs for different pharmacological activities, guidelines and regulations for screening new drug molecules on animals.
5. Pharmacological activity of new substances with emphasis on the evaluation of some drug agents.

2. ENTREPRENEURSHIP MANAGEMENT

Outcomes: On completion of this course, it is expected that students will be able to understand,

1. The Role of enterprise in national and global economy
2. Dynamics of motivation and concepts of entrepreneurship
3. Demands and challenges of Growth Strategies and Networking

3. STABILITY OF DRUGS AND DOSAGE FORMS

Outcomes:

4. The students should describe the evaluation of stability of solutions, solids and formulations against adverse conditions.
5. The students should be able to suggest the measures to retain stability and storage conditions for retaining the efficacy of the products.

4. COSMETIC SCIENCE

Outcomes:

At completion of this course, it is expected that students will be able to

6. Gain knowledge on the regulatory requirements for manufacture, sale and import of cosmetics.
7. Impart knowledge on various building blocks used in cosmetics and the safety parameters of various excipients.
8. Impart a specialized knowledge to know various cosmetics, their preparation, properties, MOA, uses etc.
9. Understanding of properties and evaluation of these cosmetics by analytical methods.
10. The students should be able to suggest the proper usage of cosmetics.

5. HAZARDS AND SAFETY MANAGEMENT

Outcomes

At completion of this course, it is expected that students will be able to

1. Understand about environmental problems among learners.
2. Impart basic knowledge about the environment and its allied problems.
11. Develop an attitude of concern for the industry environment.
12. Ensure safety standards in pharmaceutical industry
13. Provide comprehensive knowledge on the safety management

14. Empower an idea to clear mechanism and management in different kinds of hazard management system
15. Teach the method of Hazard assessment, procedure, methodology for provide safe industrial atmosphere.

6. AUDITS AND REGULATORY COMPLIANCE

Outcomes:

Upon completion of this course the student should be able to

1. To understand the importance of auditing
2. To understand the methodology of auditing
3. To carry out the audit process
4. To prepare the auditing report
5. To prepare the check list for auditing

M. Pharm (Pharmaceutical Chemistry) 2021-23

Program Educational Objectives (PEO's)

- ❖ PEO1: The course structure is designed to give the knowledge of organic chemistry at an advanced level and mainly aimed at the stereochemistry and different organic named reactions including preparations of reactive intermediates.
- ❖ PEO2: The course contents are mainly aimed to have advanced knowledge of rational drug design including QSAR and molecular modeling and also aimed at the identification of lead molecule from natural sources for the development of new drugs.
- ❖ PEO3: The various modern analytical techniques like UV-Visible, IR, NMR, Mass, GC, HPLC, different chromatographic methods and other important topics are taught to enable the students to understand and apply the principles involved in the determination of different bulk drugs and their formulation.
- ❖ PEO4: The topics are framed to enhance the student's knowledge in the various areas of molecular modeling, molecular docking, pharmacophore concepts, drug design techniques with detail concepts of all the mentioned areas.
- ❖ PEO5: The students will acquire the knowledge about the various aspects of X-Ray diffraction methods, all types of IR methods, particle sizing methods, also DSC, DTA, TGA etc
- ❖ PEO6: The contents are mainly aimed at utilization of different synthetic reagents used in the preparation of intermediates and final compounds and also aimed at the principles of green chemistry. At scale of processes for the preparation of new pharmaceutical agents and also to design different synthetic strategies.

Program Outcomes (PO's)

- ❖ PO1: The goal of a process chemist is to develop synthetic routes that are safe, cost-effective, environmentally friendly, and efficient. The subject is designed to impart knowledge on the development and optimization of a synthetic procedure for the manufacture of Active Pharmaceutical Ingredients (APIs) and new chemical entities (NCEs) for the drug development phase.
- ❖ PO2: The student would get detailed knowledge of rationale for structure-based drug design which is useful to involve in new drug discovery Program by the utilization of natural leads and also computer aided drug design and molecular modeling.
- ❖ PO3: Students can apply for identification and structure determination using various analytical techniques.
- ❖ PO4: The students learn how to perform molecular docking which is the most important part of drug's research and also new innovations.

Program Specific Outcomes: (PSO's):

- ❖ PSO1: Understand and apply principles of new drug discovery.
- ❖ PSO2: Understand the concepts of green chemistry.
- ❖ PSO3: Provide exposure to processes for the preparation of new pharmaceutical agents.
- ❖ PSO4: Understand and apply principles of various analytical techniques and provide exposure to advanced experimental/theoretical methods of analysis.
- ❖ PSO5: Engage in research and life-long learning to adapt to changing environment.

M.Pharm Sem – I (PHARMACEUTICAL CHEMISTRY)

(Programme Core - I) ADVANCED ORGANIC CHEMISTRY

Course Outcomes:

1. The student would be in position to design a stereoselective synthesis of new chemical entities (NCE) for the treatment of different diseases in new drug discovery Program.
2. Chirality and Racemic modifications.
3. The students learn the concepts of aromaticity and antiaromaticity.
4. Various mechanisms of organic reactions help the student in research.
5. Elimination, Electrocyclic, pericyclic and sigmatropic Reactions help out in designing new drug molecules.

(Programme Core - II)

ADVANCED MEDICINAL CHEMISTRY – I

Course Outcomes:

1. The student would get detailed knowledge of rationale for drug design which is useful to involve in new drug discovery Program by the utilization of natural leads.
2. The students learn computer aided drug design and molecular modeling.
3. They learn the concepts of drug discovery with the help of structure-based drug design.
4. The receptors concepts and their inhibitors give the student an idea of drug designing.

(Programme Elective - I)

1. CHEMISTRY OF NATURAL PRODUCTS

Course Outcomes:

1. The student would like to explore the natural lead compounds for the treatment of different diseases like cancer, malaria, diabetes etc.
2. They study structure elucidation of some important examples of Alkaloids.
3. The students learn stereochemistry and structure elucidation of steroids.
4. The students learn Polypeptides and proteins.
5. By the end of the chapters the students learn the structural modifications concepts and their therapeutic uses.

(Programme Elective - I)

2. MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES

Course Outcomes:

1. The appreciable knowledge will be gained by the students in various separation techniques helpful during isolation of compounds.
2. The students will also be in a position to apply their knowledge about HPLC, HPTLC, GC in developing the new methods for the determination and validate the procedures.

3. The Modern spectroscopic theories can be applied in the Analysis of various bulk drugs and their formulations
4. Students can apply for identification and structure determination
5. Concepts of NMR can be useful in characterization of various novel compounds.

(Programme Elective - I)

3. DRUG REGULATORY AFFAIRS

Course Outcomes:

1. Students will come to know the different competent regulatory authorities globally.
2. Students are aware of technical aspects pertaining to the marketing authorization application.
3. The regulatory guidelines and directions framed by the regulatory authorities will be helpful to place the drug products in market for marketing approvals.
4. Knowledge on Manufacturing and quality aspects of cosmetic products and herbal products
5. Student will now about how to prepare drug master filing to submit to regulatory authorities

(Programme Elective - II)

1. DRUG DISCOVERY AND DESIGN

Course Outcomes:

1. This enables the students to get a broad idea on the drug discovery mechanisms, its related terms
2. They learn concepts of designing of drugs.
3. The students learn how to perform molecular docking which is the most important of drug research.
4. They also learn the concepts of Informatics methods in drug design.

(Programme Elective - II)

2. PHARMACEUTICAL FOOD ANALYSIS

Course Outcomes:

At completion of this course student shall be able to understand various analytical techniques in the determination of

1. Food constituents
2. Food additives and probiotic applications
3. Lipids in food
4. vitamins in food
5. And also student shall have the knowledge on food regulations and legislations

(Programme Elective - II)

3. SPECTRAL ANALYSIS

Course Outcomes:

1. By the completion of topics the students will come out with the thorough knowledge of various spectral aspects of X-Ray, IR, SEM, ORD etc
2. The students learn about various analytical equipments and their working which help them in further projects works and also industrial opportunities.

RESEARCH METHODOLOGY AND IPR

Course Outcomes: At the end of this course, students will be able to

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

M.Pharm Sem – II (PHARMACEUTICAL CHEMISTRY)

(Programme Core - III)

ADVANCED ORGANIC CHEMISTRY - II

Course Outcomes:

1. The student would be in a position to have advanced knowledge of different synthetic reagents and reaction processes,
2. They learn the synthetic routes by involving green chemistry principles.
3. The student would also have techniques to utilize the chemical library of combinatorial chemistry.

(Programme Core - IV)

ADVANCED MEDICINAL CHEMISTRY – II

Course Outcomes:

1. The student would be in a position to involve in the development of different enzyme inhibitors, prodrugs.
2. They learn about antipsychotic agents and the NTs involved in that.
3. Students learn Prodrug concepts equipped with different biotechnological techniques of recombinant DNA products.

(Programme Elective - III)

PHARMACEUTICAL PROCESS CHEMISTRY

Course Outcomes: At completion of this course it is expected that students will be able to understand

1. The strategies of scale up process of APIs and intermediates.
2. The various unit operations and various reactions in process chemistry.
3. The manufacture of Active Pharmaceutical Ingredients (APIs) and new chemical entities (NCEs) for the drug development phase.
4. Industrial Safety concepts.

Programme Elective - III)
Pharmaceutical Quality Control and Quality Assurance

Course Outcomes:

1. The study of this subject builds the confidence in the minds on the students to develop and formulate high quality pharmaceutical products.
2. The students will know about the organization and personnel of an industry.
3. To know about packaging and labeling in industry.
4. To know about SOPs followed as per regulations.

(Programme Elective - III)

3. Pharmacoepidemiology & Pharmacoeconomics

Course Outcomes:

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

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

(Programme Elective - IV)

1. Advanced Instrumental Analysis - II

Course Outcomes: By the completion of topics the students will come out with the thorough knowledge of following

4. On various electrochemical methods,
5. On elemental analysis by fluorimetry, AAS
6. Determination of macro molecules by RIA & ELISA

(Programme Elective - IV)

2. NUTRACEUTICALS

Course Outcomes: Helps the student

1. To understand the importance of Nutraceuticals in various common problems with the concept of free radicals.
2. Importance of phytochemicals as nutraceuticals
3. Concepts of antioxidants
4. The students acquire knowledge about various food laws and regulations

(Programme Elective - IV)

3. Clinical Research and Pharmacovigilance

Course Outcomes:

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

1. Explain the regulatory requirements for conducting clinical trial
2. Demonstrate the types of clinical trial designs
3. Explain the responsibilities of key players involved in clinical trials
4. Execute safety monitoring, reporting and close-out activities
5. Explain the principles of Pharmacovigilance
6. Detect new adverse drug reactions and their assessment

7. Perform the adverse drug reaction reporting systems and communication in pharmacovigilance

**M.Pharm Sem – III (PHARMACEUTICAL CHEMISTRY)
(Programme Elective - V)**

1. Biostatistics

Outcomes:

1. The student will know the Biostatistical data arrangement, presentation and formation of tables and charts.
2. They also know the correlation and regression of data & application of different statistical methods in analysis of data.

(Programme Elective - V)

2. Scale Up And Technology Transfer

Outcomes:

On completion of this course it is expected that students will be able to understand,

1. Manage the scale up process in pharmaceutical industry.
2. Assist in technology transfer.
3. To establish safety guidelines, which prevent industrial hazards

(Programme Elective - V)

3. Production Area Design & Packaging Development

Outcome:

At the end of the semester student will get an idea about

1. Industrial area design and packaging of different formulations and its stability conditions.

(Open Elective)

1. Screening Methods in Pharmacology

Outcomes:

1. The expected outcomes are students will know how to handle animals and CPCSEA guidelines.
2. Basic principles of Biological standardization with some examples of bioassays.
3. They will know about OECD guidelines and different toxicity tests.
4. Know about various techniques for screening of drugs for different pharmacological activities, guidelines and regulations for screening new drug molecules on animals.
5. Pharmacological activity of new substances with emphasis on the evaluation of some drug agents.

2. Entrepreneurship Management

Outcomes: On completion of this course it is expected that students will be able to understand,

1. The Role of enterprise in national and global economy
2. Dynamics of motivation and concepts of entrepreneurship
3. Demands and challenges of Growth Strategies And Networking

3. Stability of Drugs and Dosage Forms

Outcomes: The students should describe the evaluation of stability of solutions, solids and formulations against adverse conditions. The students should be able to suggest the measures to retain stability and storage conditions for retaining the efficacy of the products.

4. Cosmetic Science

Outcomes:

1. The students should describe the properties and uses of various cosmetics on various parts of the body.
2. The students should be able to suggest the proper usage of cosmetics.

5. Hazards and Safety Management

Outcomes

At completion of this course it is expected that students will be able to

1. Understand about environmental problems among learners.
2. Impart basic knowledge about the environment and its allied problems.
3. Develop an attitude of concern for the industry environment.
4. Ensure safety standards in pharmaceutical industry
5. Provide comprehensive knowledge on the safety management
6. Empower an ideas to clear mechanism and management in different kinds of hazard management system
7. Teach the method of Hazard assessment, procedure, methodology for provide safe industrial atmosphere.

6. Audits and Regulatory Compliance

Outcomes:

Upon completion of this course the student should be able to

1. To understand the importance of auditing
2. To understand the methodology of auditing
3. To carry out the audit process
4. To prepare the auditing report
5. To prepare the check list for auditing