

**MAR IVANIOS COLLEGE (AUTONOMOUS), THIRUVANANATHAPURAM  
PG & RESEARCH DEPARTMENT OF CHEMISTRY**

**DIPLOMA IN PHARMACEUTICAL CHEMISTRY (DPCh)**

**Aim of the Course:**

Diploma in Pharmaceutical Chemistry (DPCh) offered by the College is designed as an add on course to equip the degree students with the fundamental knowledge and skills to enhance career opportunities within pharmaceutical industries or pharmaceutical regulatory organizations.

**Course objectives:**

The field of pharmaceutical chemistry arises from the combination of synthetic organic chemistry with pharmacology and medicinal sciences. It encompasses the design, chemical synthesis and development of active pharmaceutical ingredients (APIs), or bio-active molecules. It enables a student to have a detailed knowledge of the chemical aspects of identification, followed by systematic, thorough synthetic alteration of new chemical entities to make them suitable for therapeutic use. It includes synthetic and computational aspects of the study of existing drugs and agents in development in relation to their bioactivities (biological activities and properties), i.e., understanding their structure-activity relationships (SAR). Pharmaceutical chemistry is focused on quality aspects of medicines and aims to assure fitness for purpose of medicinal products.

Pharmaceutical chemists apply their chemistry training to the process of synthesizing new pharmaceuticals. They also improve the processes by which existing pharmaceuticals are made. Pharmaceutical chemists are focused on drug discovery and development and are concerned with the isolation of medicinal agents found in plants, as well as the creation of new synthetic drug compounds. Thus Pharmaceutical chemistry is a versatile and stimulating field as it links many scientific disciplines and allows for collaboration with other scientists in researching and developing new drugs.

The Diploma in Pharmaceutical Chemistry has been structured by experts from the industry themselves and thus comprehensive coverage and understanding of the industry and its functional areas is promised. Regulatory aspects and details about the market share of various pharmaceuticals will be covered in the course. The goal of the Diploma Programme is to familiarize the student with the updated theoretical and practical aspects of the Pharmaceutical Chemistry to gain access to this challenging and interesting field.

## **Eligibility for Admission**

- Students pursuing their degree course or completed their degree programme (any subject) having studied Chemistry as one of the subjects at the +2 level.

**Total number of seats:** 50 (with 20 % of the seats reserved for SC/ST categories)

**Mode of selection:** Based on an aptitude test with questions at the +2 level.

**Course Duration:** 1 Year (**non semester**) with **50 hours of class room/online sessions.**

**Class timing:** Classes will be held on Saturdays or after 3:30 pm without affecting the regular College hours.

## **Course Modules:**

**Module 1:** Drug discovery and development

**Module 2:** Modern Analytical Techniques

**Module 3:** Industrial Process and Bulk scale manufacturing of Pharmaceuticals at the plant

**Module 4:** Laboratory demonstration of Pharmaceutical Chemistry practicals.

## **Examination & Certification:**

**Descriptive examination and viva voce examination will be held at the end of the year**

i) Descriptive examination (Theory): Max. 100 marks; Time: 3 hours (Pass mark: 40)

ii) Practical examination: Max. 80 marks; Time: 3 hours (Pass mark: 30)

iii) Viva voce: 10 marks

iv) Industrial visit report: 10 marks

**Total: 200 marks**

**Minimum 80 marks should be scored overall to qualify for the diploma with individual pass mark for both theory and practical examinations.**

**Minimum 70 % attendance is required in the classes to write the examination.**



**Module: II****Modern Analytical Techniques****20 hours**

UNIT – I : Introduction to chromatography and classification of chromatographic methods based on the mechanism of separation

1. Column Chromatography: Adsorption and partition, theory, preparation, procedure and methods of detection
2. Thin Layer Chromatography: Theory, preparation, procedures, detection of compounds
3. Paper Chromatography: Theory, different techniques employed, filter papers used, qualitative and quantitative detection

UNIT – II

1. Gas chromatography: Introduction, fundamentals and instrumentation,
2. HPLC: Principles and instrumentation, solvents and columns used, detection and applications

UNIT – III

1. UV-Visible spectroscopy: Introduction, electromagnetic spectrum, absorbance laws and limitations and applications of UV-Visible spectroscopy
2. IR spectroscopy: Basic principles-Molecular vibrations, vibrational frequency, sampling techniques, interpretation of spectra, FT-IR, theory and applications

UNIT – IV : Mass spectroscopy: Theory, ionization techniques: electron impact ionization, chemical ionization, field ionization, fast atom bombardment resolution, interpretation of spectra and applications for identification and structure determination

UNIT–V: NMR: Theory, instrumentation, chemical shift, shielding and deshielding effects, splitting of signals, spin-spin coupling, proton exchange reactions, coupling constant(J) and its applications and applications in pharmacy

References:

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Strategies for Organic Drug Synthesis and Design by Daniel Lednice
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel

**Module: III Industrial Process and Bulk scale manufacturing of Pharmaceuticals at the plant**  
**10 hours**

UNIT-1: Status of pharmaceutical industry: Status of bulk drugs, natural products and formulations in India vis-a-vis industrialized nations.

Scale-up Techniques: Scale-up techniques for process optimization, maximization of productivity, in-process control techniques.

Chemical technology of selected drugs: Case studies with emphasis on rationale for selection

of routes, raw materials, process control methods, pollution control procedures etc.

UNIT-II: Data collection during pilot plant trails, preparations of flow diagrams, material balance sheets and technical data sheets.

Process technologies for some selected natural products of commercial interest, e.g. 4-hydroxyisoleucine.

UNIT-III: Scale-up techniques for industrial pharmacy, typical standard operating procedures for different dosage forms; In-process control procedures. Pharmaceutical manufacturing equipment: Equipment used to manufacture bulk drugs

References:

1. Process Chemistry in Pharmaceutical Industry by Kumar Gadamasetti, Vol I & II
2. Advanced Organic Chemistry by Jerry March
3. Pharmaceutical Process Chemistry for Synthesis: Rethinking the Routes to Scale-Up by Peter J. Harrington , Wiley
4. Practical Process Research and Development by Neal G. Anderson, Academic Press
5. Strategies for Organic Drug Synthesis and Design by Daniel Lednice

**Module 4: Laboratory demonstration of Pharmaceutical Chemistry practicals**

**10 hours**

1. Synthesis of Methyl salicylate.
2. To establish pharmacopoeial standards of Methyl salicylate.
3. Synthesis of Paracetamol.
4. To establish pharmacopoeial standards of Paracetamol.
5. To study the TLC profile of turmeric powder.
6. Isolation of caffeine from tea powder.
7. Determination of unknown concentration of copper sulphate solution by colorimetry.
9. To determine the pH of various substances.
10. Acid-base titrations

References:

1. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/ Longman, London.
2. Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.
3. Pharmacopoeia of India, Ministry of Health, Govt. of India.