**Chitkara College of Pharmacy**
**Chitkara University, Rajpura, Punjab**
**Chandigarh–Patiala National Highway, Punjab – 140 401, India**

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| **Institute/School Name** | Chitkara College of Pharmacy | | |
| **Department Name** | Pharmacy | | |
| **Programme Name** | B.Pharmacy | | |
| **Course Name** | Instrumental Methods of Analysis | **Session** | Jul-Dec 25 |
| **Course Code** | BP701T | **Semester/Batch** | VII/ 2022 |
| **L-T (Per Week)** | 3-1 | **Course Credits** | 4 |
| **Pre-requisite** | Students must have basic knowledge of electromagnetic radiataions and various chromatographic techniques. | **NHEQF Level** | 6 |
| **Course Coordinator** | Dr. Rohit Bhatia | | |
| **SDG** | 2, 4 | | |

**Objectives of the Course:**

Upon completion of the course, the student shall be able to Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis, Understand the chromatographic separation and analysis of drugs and to Perform quantitative & qualitative analysis of drugs using various analytical instruments.

**Course Outcomes (COs)**

Student should be able to:

| | **COs** | **Program Outcomes (PO)** | **NHEQF Level Descriptor** | **No. of Lectures** |
|---|---|---|---|---|
| CO01 | Acquire basic theoretical knowledge of the instrumentation techniques available and to correlate it's relevant applications. | PO1 | Q1, Q2 | 10 |
| CO02 | Understand the chromatographic separation and analysis of drugs and perform quantitative & qualitative analysis of drugs using various analytical instruments. | PO4 | Q2 | 10 |
| CO03 | Make accurate analysis and report the results in defined formats. | PO6 | Q1, Q5 | 10 |
| CO04 | Know the professional and safety responsibilities for working in the analysis laboratory. | PO8 | Q4 | 5 |
| CO05 | Gain basic knowledge for structural interpretation of organic and natural compounds by UV and IR Spectroscopical Methods. | PO3 | Q4 | 5 |
| CO06 | To understand basic principles of Woodward-Fieser Rule | PO1, PO2 | Q2 | 10 |
| Total Contact Hours | | | | 50 |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | Type of Assessment's |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | | 3 | | | 2 | | | | | | | Formative/Summative |
| CO02 | | | 3 | | 2 | | | 1 | | | | Formative/Summative |
| CO03 | | | 3 | | 1 | | | 2 | | | | Formative/Summative |
| CO04 | | | 3 | | | | | 2 | | | | Formative/Summative |
| CO05 | | | 3 | | | | | | | | | Formative/Summative |
| CO06 | | | 3 | | | | | 2 | | | | Formative/Summative |

3=High, 2=Medium,1=Low

**Recommended Books:**

**B01:** Organic spectroscopy by Y.R Sharma.
**B02:** Instrumental Methods of Chemical Analysis by B.K Sharma
**B03:** Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel.
**B04:** Instrumental Methods of Chemical Analysis by G.R. Chatwal.
**B05:** Spectrophotometric identification of Organic Compounds by Silverstein.

**Other readings and relevant websites:**

| Serial No | Link of Journals, Magazines, websites and Research Papers |
|---|---|
| 1. | https://pubs.acs.org/doi/10.1021/ed066p927.1 |
| 2. | https://onlinelibrary.wiley.com/journal/9169 |
| 3. | https://link.springer.com/book/10.1007/978-1-4020-2575-4 |
| 4. | https://www.sciencedirect.com/journal/vibrational-spectroscopy |
| 5. | https://www.mdpi.com/journal/spectroscj/special_issues/10E1CD24Q0 |

**Resources Theory Plan:**

| Lect. No. | Topics | Book No, CH No, Page No | TLM | ALM | Web References | Audio-Video |
|---|---|---|---|---|---|---|
| 1 | UV Visible Spectroscopy: Electronic transitions, chromophores, auxochromes | B04, CH 6.4, Page no. 2.151-2.155 | Lecture, Discussion | Just in Time Teaching | https://www.technologynetworks.com/analysis/articles/uv-vis-spectroscopy-principle-strengths-and-limitations-and-applications-349865 | |
| 2 | Spectral shifts, solvent effect | B04, CH 6.10, Page no. 2.160 | Lecture, Discussion | Just in Time Teaching | https://mas-iiith.vlabs.ac.in/exp/uv-visible-spectra/theory.html# | |
| 3 | Beer and Lambert's law, Derivation and deviations | B04, CH 5.3, Page no. 2.112-2.116 | Lecture, Discussion | Just in Time Teaching | https://www.vedantu.com/physics/derivation-of-beer-lambert-law | |
| 4-6 | Instrumentation - Sources of radiation wavelength selectors, sample | B04, CH 6.12, Page no. 2.167-2.172 | Lecture, Discussion | Just in Time Teaching | https://www.technologynetworks.com/analysis/articles/uv-vis-spectroscopy-principle-strengths-and-limitations-and-applications-349865 | |

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| | cells<br>Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode. | | | | | |
| 7 | Applications - Spectrophoto metric titrations, Single component and multi component analysis | B04, CH 6.13-14, Page no. 2.172-2.177 | Lecture, Discussion | Summary | https://link.springer.com/chapter/10.1007/978-3-031-38355-7_19 | |
| 8-10 | Fluorimetry • Theory, Concepts of singlet, doublet and triplet electronic states<br>internal and external conversions, factors affecting fluorescence<br>Quenching, instrumentation and applications. | B04, CH 16.1-16.5, Page no. 2.399-2.411 | Lecture, Discussion | Summary | https://microbenotes.com/fluorimetry/ | |
| 11-12 | IR spectroscopy • Introduction<br>Fundamental modes of vibrations in poly atomic molecules, sample handling | B04, CH 3.3-3.4, Page no. 2.30-2.32 | Lecture, Discussion | Summary | https://byjus.com/chemistry/infrared-spectroscopy/ | |
| 13-15 | Factors affecting vibrations<br>Instrumentation - Sources of radiation<br>Wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications | B04, CH 3.9-3.12, Page no. 2.40-2.62 | Lecture, Discussion | Summary | https://byjus.com/chemistry/infrared-spectroscopy/ | |
| 16-17 | Flame Photometry • Principle, interferences<br>instrumentation | B04, CH 14.1-14.7, Page no. 2.368-2.372 | Lecture, Discussion | Student Created ppt | https://www.sciencedirect.com/topics/medicine-and-dentistry/flame-photometry | |

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| | and applications | | | | | |
| 18-19 | Atomic Absorption Spectroscopy • Principle<br>Interferences, instrumentation and applications | B04, CH 13.1-13.8, Page no. 2.340-2.355 | Lecture, Discussion | Student Created ppt | https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/atomic-absorption | |
| 20-21 | Nepheloturbidometry<br>Principle, instrumentation and applications | B04, CH 15.1-15.4, Page no. 2.389-2.392 | Lecture, Discussion | Student Created ppt | https://www.firsthope.co.in/principle-of-nepheloturbidometry | |
| 23-26 | Introduction to chromatography, Adsorption and partition column chromatography<br>Thin layer chromatography • Introduction, Principle<br>Methodology, Rf values<br>Advantages, disadvantages and applications. | B04, CH 33.1-33.4, Page no. 2.599-2.606 | Lecture, Discussion | Student Created ppt | https://byjus.com/chemistry/thin-layer-chromatography/ | |
| 27-28 | Paper Chromatography • Introduction, methodology<br>Development techniques, advantages, disadvantages and applications | B04, CH 32.1-32.4, Page no. 2.588-2.592 | Lecture, Discussion | Group Discussion | https://www.sciencedirect.com/science/article/abs/pii/B9780443191749000337 | |
| 29-32 | Electrophoresis • Introduction, factors affecting electrophoretic mobility<br>Paper Electrophoresis<br>Gel Electrophoresis<br>Capillary Electrophoresis | | Lecture, Discussion | Group Discussion | https://www.ncbi.nlm.nih.gov/books/NBK585057/ | |
| 33-36 | Gas Chromatograph | B04, CH 40.1-40.9, Page no. | Lecture, Discussion | Group Discus | https://www.sciencedirect.com/science/article/abs/pii/B97801 | |

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| | y • Introduction, theory<br>Instrumentation, derivatization<br>Instrumentation, derivatization<br>Temperature programming, advantages, disadvantages and applications | 2.673-2.687 | | sion | 28113301000119 | |
| 37-39 | High Performance Liquid Chromatography (HPLC) | B04, CH 35.1-35.7, Page no. 2.624-2.635 | Lecture, Discussion | Summary | https://microbenotes.com/high-performance-liquid-chromatography-hplc/ | |
| 40-41 | Ion exchange chromatography • Introduction, classification<br>Ion exchange resins, properties, factors affecting ion exchange | B04, CH 39.1-39.6, Page no. 2.662-2.670 | Lecture, Discussion | Summary | https://microbenotes.com/ion-exchange-chromatography/ | |
| 42-43 | Gel chromatography • Introduction, theory<br>Instrumentation and applications. | B04, CH 38.1-38.5, Page no. 2.656-2.661 | Lecture, Discussion | Summary | https://www.britannica.com/science/gel-chromatography | |
| 44-45 | Affinity chromatography • Introduction, theory<br>Instrumentation and applications. | | Lecture, Discussion | Summary | https://microbenotes.com/affinity-chromatography/ | |
| 46-50 | Revision | | Questioning | Debate | | |

Teacher in-charge Assistant Dean Dean