

**Rajiv Gandhi University of Health Sciences, Karnataka**

**4th T Block Jayanagar, Bengaluru**

Curriculum delivery design of B. Pharm. course of Semester VII System

w.e.f Academic year 2020-21

**SEMESTER-VII**

**BP701T: INSTRUMENTAL METHODS OF ANALYSIS (Theory)**

**Scope:** This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.**.**

1. Departmental objectives (what the learners will be able to perform after completing the subject):
2. Learning Objectives:

 **Upon completion of this course the student should be able to**

1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
2. Understand the chromatographic separation and analysis of drugs.
3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.
4. Annual objectives (for each year, if the subject is spread over different years):**NA**
5. Content distribution as per the list of topics, time allotted for each topic, distribution for ‘Must know’, ‘Desirable to know’ and ‘Nice to know’ and the probable weightage.

The following table can also be a reference frame for continuous and formative assessment of learning. If the curriculum management is scheduled as per the tabulation, there can be clarity for both learners and teachers to take stock of the mastery achieved in each objective. This will also help for professional excellence that goes beyond the examination process.

|  |  |  |
| --- | --- | --- |
| **UNIT-I** | **Hours: 10** | **Weightage: 24 Marks** |
| **Learning content distribution** | **Topics** |
| **UV Visible spectroscopy and Fluorimetry** |
| **Must to know** | **UV Visible spectroscopy:** Introduction, Nature of EMR, Energies associated with the organic molecules, Electronic transitions, Chromophores, Auxochromes, Beer and Lambert’s law, Derivation and Deviations. Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Barrier layer cell, Photomultiplier tube, Photo voltaic cell, Spectrophotometric titrations.**Fluorimetry:** Introduction, Theory, Jablonski process, concepts of singlet, doublet and triplet electronic states, internal and inter system crossing, inner filter effect, factors affecting fluorescence, quenching, instrumentation and applications. |
| **Desirable to know** | Energy of EMR, wavelength, frequency, wave number, absorbance, Transmittance, absorptivity, molar extinction co-efficient, Color wheel, Solvent effect on absorption spectra, spectral shifts, Photo tube, Silicon Photodiode, Single component and multi component analysis. Equilibrium constant and rate constant. |
| **Nice to know** | K bands and R bands, E band and B band, forbidden and allowed transitions, Woodward Fieser rule. |

|  |  |  |
| --- | --- | --- |
| **UNIT-II** | **Hours: 10** | **Weightage: 21 Marks** |
| **Learning content distribution** | **Topics** |
| **IR spectroscopy, Flame Photometry, Atomic absorption spectroscopy, Nephloturbidometry** |
| **Must to know** | **IR Spectroscopy:** Introduction, criteria of a molecule to absorb IR, modes of vibrations in molecules, sample handling, Instrumentation- Sources of radiation, wavelength selectors, detectors –Bolometer, Golay cell, Thermocouple Thermistor, Pyroelectric detector and applications of IR.**Atomic Spectroscopy:****Flame Photometry:** Introduction, Principle, Events occurring in the flame, structure of flame, instrumentation and applications of flame photometry.**Atomic Absorption spectroscopy:** Principle, thermal atomizers and applications.Interferences in Atomic spectroscopy.**Nepheloturbidometry** Principle, instrumentation and applications |
| **Desirable to know** | Vibrational frequency of alcholol, aldehyde, ketone, carboxyl, amine, amide. |
| **Nice to know** | Hooke’s law in IR spectroscopy, FTIR, NIR, fuel and oxidants used in flame emission spectroscopy, differentiates fluorimeter and Nephelometer, Colorimeter and turbidimeter. |

|  |  |  |
| --- | --- | --- |
| **UNIT-III** | **Hours: 10** | **Weightage: 19 Marks** |
| **Learning content distribution** | **Topics** |
| **Introduction to chromatography, Column chromatography, TLC, PC and Electrophoresis** |
| **Must to know** | Chromatographic principle and its classifications.Column chromatography: Introduction, Methodology, advantages, disadvantages and applications.Thin layer chromatography: Introduction, preparation, activation and visualization, advantages, disadvantages and applications,Paper chromatography: Introduction, development techniques, visualization, advantages, disadvantages and applications.Electrophoresis– Introduction, factors affecting electrophoresis mobility, Techniques of paper, gel and applications. |
| **Desirable to know** | Isocratic and gradient, Normal Phase and Reverse Phase Chromatography, analytical and preparative, Frontal, displacement and elution analysis, Rf, Rx and Rm values, Classification and ideal properties of adsorbents, detecting reagents, Silica Gel GF254, edge effect, two-dimensional chromatography, capillary electrophoresis. |
| **Nice to know** | Eluotropic series of solvents, Difference between TLC and HPTLC, Stahl’s triangle in TLC, Moving boundary electrophoresis, isoelectric focusing electrophoresis. |

|  |  |  |
| --- | --- | --- |
| **UNIT-IV** | **Hours: 08** | **Weightage: 17 Marks** |
| **Learning content distribution** | **Topics** |
| **Gas Chromatography and High-Performance Liquid Chromatography** |
| **Must to know** | Theories of Chromatography: Plate theory and Rate theory **Gas Chromatography:** Introduction, types, instrumentation, advantages, disadvantages and applications.**High-Performance Liquid Chromatography:** Introduction, types, instrumentation, advantages and applications.Stationary phases of GC & HPLC. |
| **Desirable to know** | Temperature programming in GC, derivatization in GC, Guard column, system suitability factors. |
| **Nice to know** | LC-MS and GC-MS. |
| **UNIT-V** | **Hours: 07** | **Weightage: 14 Marks** |
| **Learning content distribution** | **Topics** |
| **Ion exchange chromatography, Gel chromatography and Affinity chromatography** |
| **Must to know** | **Ion exchange chromatography:** Introduction, mechanism, classification of ion exchange resins, factors affecting ion exchange and applications.**Gel chromatography:** Introduction, principle, various gels used, instrumentation and applications.**Affinity chromatography:** Introduction, principle, various ligands used and applications. |
| **Desirable to know** | Properties of ion exchange resins, regeneration of cation and anion exchange resin, theory of gel chromatography, theory of affinity chromatography. |
| **Nice to know** | Ion exchange capacity, Size exclusion chromatography, Chiral chromatography, Ion Chromatography. |

1. Blueprint of question paper, for each QP. This shows the weightage given to each chapter in the summative assessment. This improves the content validity by distributing the assessment of learners in the competencies that are represented by learning objectives under each chapter.

State the number of QPs for the subject.

The following template demonstrates how each QP Blueprint would look like:

|  |
| --- |
| BLUE PRINT OF MODEL QUESTION PAPER**BP701T: Instrumental Methods of Analysis (Theory)**TIME: 3 HOURS MAX. MARKS: 75 |
| **Unit No** | **Hours** | **Must know** | **Desirable to know** | **Weightage of marks** |
| **LE****(10X3)** | **SE****(5X8)** | **SA****(2X5)** | **LE****(10X0)** | **SE****(5X1)** | **SA****(2X5)** |
| Unit-I | 10 | 1 | 1 | 1 | - | 1 | 1 | 24 |
| Unit-II | 10 | 1 | 1 | 2 | - | - | 1 | 21 |
| Unit-III | 10 | - | 3 | - | - | - | 2 | 19 |
| Unit-IV | 08 | 1 | 1 | - | - | - | 1 | 17 |
| Unit-V | 07 | - | 2 | 2 | - | - | - | 14 |
| **Total** | **45** | **30** | **40** | **10** | **-** | **5** | **10** | **95** |
|  |  | **80** | **15** | **95** |

\* 80 % of the questions shall be from the Must Know area and 20 % shall be from the Desirable to Know area of the Curriculum.