ADVANCED PHARMACEUTICAL ANALYSIS

UNIT-I

UV-VISIBLE & DERIVATIVE SPECTROSCOPY

Brief review of electromagnetic spectrum, UV-Visible range, Energy wavelength colour relationships. Interaction of electromagnetic radiation (UV-Vis) and matter and its effects, Chromophores and their interaction with EMR, Woodward-Fischer rule, Absorption spectra of organic compounds and complexes illustrating the phenomenon and its utilization in qualitative and quantitative studies of drugs, Beer-Lambert's law, Shifts and their interpretation (including solvent effects). Principles, Instrumentation-including sources, monochromators, detectors, preparation of calibration curves and pharmaceutical applications including assay of official compounds and formulations used in the structure determination, Multicomponent analysis, Derivative spectroscopy. Source of errors and their corrections and validation of spectrophotometric methods.Pharmaceutical Applications

INFRARED SPECTROSCOPY

Nature of Infra-red radiation, Molecular or infra-red spectra, origin of infra red spectra, vibrational energies of diatomic molecules, Interaction of IR radiation with organic molecules and effects on bonds, Brief outline of classical IR instrumentation and interpretation of spectra. including sample preparation for spectroscopy, qualitative interpretation of IR Spectra, influence of substituent's, ring size, hydrogen bonding, vibrational coupling and field effect on frequency, quantitative methods, FT-IR and applications. Recent advances in IR Spectroscopy (FT-NIR), Interpretation of IR spectra- Characteristic molecules Pharmaceutical Applications.

UNIT-II

H^1 NMR AND C 13 NMR SPECTROSCOPY

Nuclear spin and magnetic moment, nuclear magnetic resonance-origin of NMR spectra, theory of NMR spectroscopy, Nuclear resonance: saturation-relaxation process in NMR, Flipping ongin of signal, factors effecting -chemical shift and spin spin splitting. Double resonance spin spin decoupling and nuclear overhauser effect (NOE). One dimensional and two dimensional NMR spectroscopy- comparisons between one dimensional and two dimensional NMR, C13 NMR-natural abundance of C13, resolution and multiplicity FT mode, RF mode, uses of proton coupled, decoupled and off resonance decoupling techniques, deuterium substitution, chemical

equivalence in peak assignment, chemical shift. Effect of 4 substitution on chemical shifts, position of alkanes, alkenes, alkynes and benzene spin coupling and c13 -H 1 coupling - other techniques and pharmaceutical Applications.

UNIT III

MASS SPECTROSCOPY

Basic principles and instrumentation (components and their significance). Ionization techniques (FAB, MALDI, SELDI, APCI, APPI, ESI and DART).Mass analyzers [Quadrupole, Ion Trap, FT-ICR, TOF and tandem mass (MS-MS)].High resolution mass spectroscopy. Concepts of interpretation of mass spectra: Mass spectrum, molecular ion, metastable ions, fragmentation patterns a fission, ß fission. Mac Lafferty rearrangement, Retro Diels Alder rearrangement. Pharmaceutical applications.

Hyphenated techniques of Mass Spectroscopy Hyphenated techniques-GC-MS/MS, LC- MS/MS- including recent advances in MS, fast atom bombardment mass spectroscopy; Pharmaceutical Applications.

UNIT IV

HIGH PERFORMANCE LIQUID CHROMATOGRAPHY AND DERIVATIVE METHODS

Theoretical principles involved in HPLC, discussion of typical equipment including pumps, columns, injection systems, detectors, packing materials and solvent systems, pharmaceutical applications, advantages and disadvantages. Precolumn and post column derivatization, detection methods, reagents for coloured and UV absorbing derivatives, reagents for UV/Visible detection, fluorimetric detection, fluorescent derivatives, electrochemical 5 derivatives, chiral derivatization reagents. Introduction to UPLC and pharmaceutical applications.

UNIT V

GAS CHROMATOGRAPHY

Basic principles, instrumentation, columns, detectors, Van Deemter equation, Kovats retention index and HETP and temperature programming, qualitative and quantitative applications in Pharmacy, Introduction to head space GC and pharmaceutical applications. combination of GLC with other methods, advantages and disadvantages. Derivatization techniques acylation, silylation, alkylation and esterification introduced to head space GC and pharamaceutical applications

Super critical fluid chromatography Introduction, theory, important properties of supercritical fluids, fluid extraction solvents, Categorization of SFC, instrumentation and pharmaceutical applications.

UNIT VI

ANALYTICAL METHOD VALIDATION

a. Recommendation of ICH guideline- Definition of accuracy, precision, linearity, LOD,

LOQ, range, robustness, ruggedness, specificity, system suitability test. b. USP requirement of analytical validation- different category of assays.

c. Stability indicating methods.

d. Bio analytical method validation.

UNIT VII

INSTRUMENTS CALIBRATION

a. Analytical balance calibration.

b. Calibration of weight box.

c. Calibration of UV-spectrophotometer.

d. Calibration of IR spectrophotometer. e. Calibration of HPLC system.

f. Calibration of Gas Chromatography instrument.

g. Performance check of HPLC/GC column.

h. Out of Calibration.

UNIT VIII

ANALYSIS OF DRUGS IN DOSAGE FORMS

A detailed study of principles and procedure involved in various physicochemical methods of analysis including instrumental methods, (biological and microbiological methods to be completely excluded) of pharmaceutical preparations and dosage forms include in the Indian pharmacopoeia containing the following class of drugs.

a) Anti Malarial drugs b) Anti Neoplastic Drugs

c) Antibiotics d) Anti viral drugs

UNIT-IX

ANALYSIS OF DRUGS IN DOSAGE FORMS

A detailed study of principles and procedure involved in various physicochemical methods of analysis including instrumental methods, (biological and microbiological methods to be completely excluded) of pharmaceutical preparations and dosage forms include in the Indian pharmacopoeia containing the following class of drugs.

a) Steroidal Harmones b) Vitamins

c) Anti tubercular drugs d) Sulfonamides

UNIT X

ANALYSIS OF DRUGS IN DOSAGE FORMS

A detailed study of principles and procedure involved in various physicochemical methods of analysis including instrumental methods, (biological and microbiological methods to be completely excluded) of pharmaceutical preparations and dosage forms include in the Indian pharmacopoeia containing the following class of drugs.

a) Adrenergic drugs b) Diuretics.

c) Anti hypertensive drugs

UNIT -XI

ANALYSIS OF DRUGS IN DOSAGE FORMS

A detailed study of principles and procedure involved in various physicochemical methods of analysis including instrumental methods, (biological and microbiological methods to be completely excluded) of pharmaceutical preparations and dosage forms include in the Indian pharmacopoeia containing the following class of drugs.

a) Drugs acting on CNS (Local anesthetics, Sedatives and hypnotics, Anti depressants, Anti psychotics)

b) Analgesics and Anti Pyretics.

UNIT XII

REAGENTS AND FUNCTIONAL GROUP BASED ANALYSIS OF ACTIVE PHARMACEUTICAL INGREDIENTS (API)

Principles and procedures involved in quantitative determination of the following functional groups

a) Hydroxy b) Aldehyde c) Ketone d) Amine

e) Methoxyl f) Ester g) Carboxyl

Analytical principles, procedures and applications involved in the use of the following reagents.

a) MBTH (3-methyl-2-benzothiazoline hydrazone).

b) Folin-Ciocalteu (FC) reagent.

c) 2,6-Dichloroquinone chlorimide.

d) 2,3,5- Triphenyl tetrazolium salt.

e) 1,2-naptho quininoxe -4- sulfonate.

f) Bratton-Marshall reagent.

g) p-Dimethyl amino cinnamaldehyde (PDAC) reagent

UNIT XIII

Stability Testing

Solidstatedrugstability, acceleratedstabilitystudies,physicaldegradationofpharmaceuticalproducts, prolongingtheshelflife, effectofpackagingmaterialsondosage formonstability,ICHguidelines-ICHbasicprinciples,stabilitytestingofnewdrugsubstanceandformulations, photostabilitytesting,Containers. WHOstabilityguidelines. Forced Degradation.

ImpurityProfiling

Sourcesofimpuritiesandtheireffectondrugstabilityandtherapeuticaction.Determinationofimpurities inbulkdrugs: Isolation, characterization,andanalytical methods Formulationrelatedimpurities:Isolation,characterization, andanalyticalmethods.ICHandWHOguidelinesforimpurityandrelatedsubstances in the drugs.

ANDHRA UNIVERSITY
TRANS-DISCIPLINARY RESEARCH HUB

MODEL QUESTION PAPER

Time: 3 hours Max marks: 100

Answer any Five Questions

1. Write principle, instrumentation and applications of UV Visible spectroscopy and IR spectroscopy.

2. What is the principle involved in NMR spectroscopy. How can you Interpret the NMR spectra explain with example.

3. Explain in detail

   a. Various Ionization techniques involved in Mass Spectroscopy

   b. LC-MS

4. Write principle, instrumentation and applications of HPLC add a note on various detection techniques.

5. Give a detailed explanation on

   a. Super critical fluid chromatography

   b. Various derivatization techniques available in Gas chromatography.

6. Write about

   a. Analytical method validation

   b. Stability indicating methods

   c. Calibration of HPLC

7. Write the principle and procedure for the determination of

   a. Antiviral drugs

   b. Sulfonamides

8. Write the principle and procedure for the determination of

a. Drugs containing Hydroxy group

b. Principle involved in usage of Folin - Ciocalteu(FC)reagent.