M. Pharm

Pharmaceutical Analysis

A. Goals:

The goals of postgraduate training course in pharmaceutical analysis would be train a B. Pharm pharmacist who will:

A. Control the quality of basic drugs, formulations, packing materials and additives in pharmaceutical formulations efficiently and effectively, backed by scientist knowledge and skill base

B. Be careful in maintaining the official standards of pharmaceuticals and follow the directions given by various bodies like WHO in maintaining the standards of pharmaceuticals.

C. Continue to evince keen interest in continuing education in pharmaceutical analysis irrespective of whether he is in a teaching institution or pharmaceutical industry.

D. Be a motivated "teacher"- keen to share his knowledge and skills with a colleague or a junior or any learner.

B. Objectives

The following objectives are laid out to achieve the goals of the course. These objectives are to be achieved by the time candidate completes the course. The objectives may be considered under the subheadings

a. Knowledge

b. Skills

c. Attitudes and communication abilities

2.1. Knowledge

A list of objectives related to knowledge and higher cognitive abilities that are expected to be achieved during the course is given

- Knowledge of basic chemical principles, theories and laboratory techniques as would be acquires through the successful completion of M. Pharm course in pharmaceutical analysis.
- Knowledge of use of common and more advanced instruments such as balances, pH meter, melting apparatus, refractometer, colourimeter, polarimeter, moisture balance required to be used in compendia methods in conformance with SOP, HPLC, GC, HPTLC, IR, FTIR, NMR and Mass spectrophotometer.

- Application of required quality assurance procedures.
- Adherence to established laboratory safety procedures.
- Knowledge of GMP/GLP.
- Knowledge of analysis of samples of pharmaceuticals (bulk and finished products) using established and validated analytical procedures.
- Development of new methods of revision of existing methods and validation of the methods so developed.
- Participation in collaborative studies at inter or intra-laboratory level.
- Planning of work for most efficient use of the resources.
- Knowledge of statistical methods for data evaluation.
- Supervision of the proficiency testing of the analysis.

2.2. Skills

- Knowledge of basic chemical principles, theories and laboratory techniques.
- Use of common and most modern instruments.
- Adequate knowledge of GMP/GLP.
- Establishing laboratory safety procedures.
- Communication of laboratory results in written reports.
- Development of analytical procedures is an important function of the laboratory in which all analysis should be involved to some extent.

2.3. Attitudes and Communications

- Possesses aptitude and attitude of mind to become competent analyst.
- Enjoys his assignment with pride.
- Punctual and disciplined
- Has pleasant personality, in humane and modest.
- Well organized and methodological

- Has initiative, drive, creative urge and ability to interact.
- Flexible and appreciates others view point.
- Imbibes confidence in his colleagues.
- Able to work independently and as member of a team.
- Plans his work for efficient use of time and resources.
- Can complete his assignment in a given time frame.
- Pays full attention to details.
- Can identify the cause and solve the problem.
- Able to think and evaluate scientifically and critically.
- Good presentations and communication skills.

M. Pharm. I	TITLES OF PAPERS	Total Hours	Hours per week	
			Theory	Practical
PAPER-I	Modern Pharmaceutical Analysis	**75**	**3**	**6**
PAPER-II	Pharmaceutical & Cosmetic AnalysisChemistry	**50**	**2**	**6**
PAPER-III	Instrumental Method of Analysis	**50**	**2**	**6**
PAPER-IV	Chemical& Biological Evaluaiton	**50**	**2**	**6**
M. Pharm. II	Dissertation Work	**One Year**		

Paper II: Pharmaceutical And Cosmetic Analysis

THEORY

Goals:

To keep abreast with the developments in pharmaceutical and cosmetical analysis, to apply and adopt both conventional and non-conventional methods to own special needs.

Objectives:

On completion of the course in Pharmaceutical and Cosmetical Analysis, the candidates must be able to-

- Exten and improvise systems for quality control.

- Understand the latest internationally recognized standards, innovations and developments in the field of pharmaceutical and cosmetical analysis.
- Develop newer analytical methods for pharmaceutical and cosmetics.

Course Content
THEORY: 50 hr (2hr/week)

1. Titrimetric analysis:

b) Classification of reactions in titrimetric analysis, standard solutions, preparation of standard solutions, primary and secondary standard substances. Theory of acids-base titration. Neutralisation indicators, mixed and universal indicators, neutralization curves and displacement titrations. **4 hours (10-14 Marks)**

c) Non-aqueous titrations involving the following :

1. Primary, secondary and tertiary amines
2. Halogenated salts of bases
3. Acidic substances
4. Assay of official drugs in IP by non- aqueous titrimetry. **2 hours (05-07 Marks)**

d) Aquametry: Determination of water by titration with Karl Fischer Reagent (KFR) and other methods. **2 hours (05-07 Marks)**

2. Principles and pharmaceutical application of redox titrations involving:

a) Potassium Iodate/bromate titrations
b) Ceric ammonium sulphate titrations
c) Examples of assay of official drugs in IP. **2 hours (05-07 Marks)**

3. Principles and pharmaceutical applications of complexometric titrations involving:

a) Direct titration of polymetalic system with sodium editate
b) Residual titrations with sodium editate
c) Titaration involving the displacement of one complex by another.
d) pM indicators
e) Examples of assays of official drugs in IP. **3 hours (08-10 Marks)**

4. a) Principles and procedures involved in gravimetric and argentimetric analysis with examples
   b) Diazotization titrations with at least 4 examples and applications. **3 hours (08-10 Marks)**

5. Thermo analytical methods of analysis: Application in cosmetics. **2 hours (05-07 Marks)**

6. Quality control of crude drugs- ash values, fiber content, powder analysis quantitative microscopy and microchemical tests, extractive values, arsenic and heavy metal analysis in crude drugs **4 hours (10-14 Marks)**

7. Principles and pharmaceutical applications of electroanalytical methods.

a) Potentiometry
b) pH measurements
c) Polarography and it types
d) Amperometry
e) High frequency titarations
f) Conductometric titrations
g) Advanced electro analytical methods **8 hours (20-24 Marks)**

8. Identification and quantitative determination of preservatives, antioxidants, colouring materials, emulsifiers and stabilizers in pharmaceutical formulations and cosmetics. **4 hours (10-14 Marks)**
9. Pharmaceutical methods for evaluation of tablets, capsules, liquid dosage forms, parentral preaparations, ointments and creams, suppositories and controlled release products as per IP. **5 hours (13-15 Marks)**
10. Official evaluation methods of primary and secondary packing pharmaceuticals. **3 hours (08-10 Marks)**
11. a) Quality control of any four cosmetic products under each of the following categories - hair care products, skin care products, colour cosmetics, baby care products, colour makeup preparations, lipsticks, and eye shadows. **6 hours (16-20 Marks)**

    b) Safety and legislation for cosmetic products. **2 hours (05-07 Marks)**

Practicals: **150 hr (6hr/week)**

The following experiments or similar to be carried out and relevant documentation made.

1. Assay of Ibuprofen tablets, IP 1996
2. Assay of bisacodyl suppositories IP 1996
3. Assay of sodium diatrizoate injection IP 1996
4. Assay of ferrous sulphate tablets, IP 1996
5. Determination of moistuer content in following drugs using Karl Fischer Reagent
   a) Ampicillin Trihydrate

b) Fructose
c) Gentamycin sulphate
d) Calcium lactate or gluconate/emitin dihydrochloride

6. Assay of cephalexin caplsules, IP 1996
7. Assay of calcium gluconate injection, IP 1996
8. Asay of sodium aurothiomalate injection, IP 1996
9. Quality control tests for tablets
10. Quality control tests for capsules
11. Quality control tests for paranteral preparations
12. Quality control tests for ointments and creams
13. Quality control tests for pessaries, suppositories and controlled release products.
14. Detection and quantitative determination of preservatives
15. Detection and quantitative determination of antioxidants
16. Detection and quantitative determination of colouring materials.
17. Quality control tests for some cosmetic preparations
18. Quality control tests for pharmaceutical containers
19. Evaluation of packing material by ATR data
20. Determination of extractive values of crude drugs
21. Quality control of secondary packaging materials.

Text Books

Practical Pharmaceutical Chemistry, by A. H. Beckett and J. B. Stenlake. 3rd Ed., Part I & II, 1997, CBS Publishers and Distributors, New Delhi.

G.H. Jeffery, J. Bassett, J. Mendham Vogel's Textbook of Quantitative Chemical Analysis 5th Edition and 6ht Edition, 1989, ELBS

The Controller of Publications; *New Delhi, Govt. of India, Indian Pharmacopoeia Vol I & II 1996*

The Theory and Practice of *Industrial Pharmacy* by Leon *Lachman*

W.A. Poucher: Poucher's Perfumes, Cosmetics and Soaps: Vol 3, 9th Edition, Chapman and Hill, Landon.

R. J. Moore, J. B. Wilkinson: Harry's Cosmeticology 7th Edition: Lonagman Scientific & Technical Publishers, Singapore.

Reference Books

Text Books

P.D. Sethi; *Quantitative* Analysis of Drugs in Pharmaceutical Formulations, 3rd Edition – 1997

Chatwal and Anand .Instrumental Methods of Chemical analysis 7th edition 1992 Publisher: Himalaya Publishing House. New Delhi

Alfonso R. *Gennaro:* Remington: the science and practice of pharmacy, Volume 1. By Joseph Price Remington, *Lippincott* Williams & Wilkins profile of *Wolters Kluwer company Philaldelphia*

Gilbert S. Banker, Christopher T. Rhodes Modern pharmaceutics 2nd Edition, Marcel Dekker Inc, New York

E G Thomson Modern Pharmaceutics *1985 Publisher*: Universal Publishing Corporation, U.K

INSTRUMENTAL METHODS OF ANALYSIS

Theory:

Goals:
To keep abreast with instrumental analytical techniques.

Objectives:
At the end of the course, the candidate must be able to-

- Exten and improvise instrumental systems for quality control.

- Become skilled in application of instrumental methods in the development and use of medicines.
- Invent new analytical methods for quality control of pharmaceuticals.

Course Content

THEORY: 50 hr (2hr/week)

a) Analysis of drugs and excipients in the solid state: Introduction, importance of particle size in various dosage forms, methods of particle size analysis, x-ray powder diffraction. Application of SEM & TEM in particle size analysis. **4 hours (10-14 Marks)**

22. Light scattering methods in quantitative analysis a) Turbidimetry b) Nephelometry

2 hours (05-07 Marks)

b) Light emission methods in quantitative analysis: a) Fluorimetry b) Flame photometry c)Raman spectroscopy. Theory & Applications of Inductively Coupled Plasma – Optical Emmission Spectrometers (ICP – OES) and Mass spectrometers (ICP – MS)
Atomic Absorption Spectrometry: Introduction, theory, instrumentation and applications.

6 hours (16-20 Marks)

c) A detailed study of principles and procedures involved in various physico-chemical methods of analysis including instrumental methods of analysis of pharmaceutical dosage of any five official drugs from the following classes of drugs:
   a) Sulphonamides
   b) Barbiturates
   c) Adrenergic drugs
   d) Anti-tubercular drugs
   e) Diuretics
   f) Anti-malarials
   g) Local anaesthetics
   h) General anaesthetics
   i) Analgesics and anti-pyretics
   j) Anthelmintics
   k) Fluroquinolones **12 hours (32-38 Marks)**

d) Principles and procedures involved in the analysis of pharmaceutical drugs and dosage forms containing the following groups of substances official in Pharmacopoea:
   A) Alkaloids
   B) Glycosides
   C) Vitamins
   D) Antibiotics
   E) Steroid hormones **6 hours (16-20 Marks)**

e) Principles and procedures involved in the quantitative determination of the following groups:
   a. Hydroxyl
   b. Carboxylic acid

c. Carbonyl groups
d. Methoxyl
e. Ester
f. Amine
g. Nitrates **6 hours (16-20 Marks)**

f) Principles and procedures involved in the use of the following reagents in pharmaceutical analysis:
   a) MBTH (3-methyl-2-benzothiazolone hydrazone) reagent
   b) FC (Folin ciocalteu) reagent
   c) 1,2-naptha quinone-4-sulfonate reagent
   d) 2,3,5-triphenyltetrazolium salt
   e) PDAB (Paradimethyl amino benzaldehyde)
   f) PDAC (Paradimethyl amino cinamaldehyde)
   g) Ninhydrine reagent
   h) Carr-price reagent
   i) Bratton-marshal reagent
   j) 2,6-dichloroquinone chlorimide **5 hours (13-16 Marks)**

g) Study of General Notices of IP 2007 **3 hours (08-10 Marks)**

23. Analytical method validation as per ICH guidelines **2 hours (05-07 Marks)**

h) Application of instrumental methods in product characterization for drug development, product development, production and pharmacopoeial controls, concept of analytical method development. **2 hours (05-07 Marks)**

i) Analysis of radiopharmaceuticals **2 hours (05-07 Marks)**

Practicals: **150 hrs (6hrs/week)**

1. Determination of chloride and sulphate in calcium gluconate by Nephloturbidimetric analysis.
2. Estimation of any two drugs by fluorimetry a) doxazosin mesylate b) riboflavin c) thiamine d) terazocin
3. Study of quenching effect in fluorimetry-eg. Quenching of quinine fluorescence by iodide ions.
4. Determination of sodium/potassium by flame photometry.
5. Colourimetric estimation of sulphadiazine/ sulphacetamide using N-(1-napthyl) ethylene diamine di hydrochloride.
6. Quantitative analysis of drugs in multicomponent dosage forms

a) Diclofenac, Paracetamol & Chlorzoxazone
b) Mefenamic acid Paracetamol
c) Paracetamol & Diclofenac
d) Sulphamethoxazole & Trimethoprim
e) Nimesulide & Paracetamol

7. Quantitative determination of functional groups A) Hydroxyl B) Amine C) Aldehydes D) Esters E) Carbonyl and F) Methoxyl

9. Quantitative colorimetric determination of any drug by using para dimethylamino cinnamaldehyde reagent.
10. Quantitative colorimetric determination of any drug by MBTH reagent.
11. Colorimetric estimation of ferrous ions using 1, 10-phenanthroline
12. Assay of Adrenaline by metal-ligand complexation colourimetry.
13. Assay of Paracetamol tablets IP.
14. Assay of drugs by HPLC (5 Experiments)
19. Assay of Alprazolam tablets IP.
20. Assay of Atropine sulphate tablets IP.
21. Assay of Benzhexol Hydrochloride tablets.
22. Identification and verification of standards for a sample of castor oil IP.
23. Identification and verification of standards for a sample of cetyl alcohol IP.
24. Identification of drugs using IR spectra

Text books:

1. A.I Vogel:Text Book Of Inorganic Chemistry 4th edition, ELBS Publications,London
2. Beckett and Stenlake: Practical Pharmaceutical Chemistry, 3rd Edn. Vol. II and CBS Publishers, New Delhi.
3. K. A .Connors: A Textbook of Pharmaceutical Analysis, 3rd Edn. Wiley-inter Science Publication, New York.
4. Sydney, Siggia; Quantitative Organic Analysis,4thedition ,Wiley Interscience Publications,John Wiley and Sons Newyork, Toronto.

Reference books:

1. P.D Sethi: Quantitative Analysis of Drugs in Pharmaceutical Formulations,2nd Edition ,CBS Publisher
2. S. C Gupta, V.K Kapoor: Fundamentals of Applied Statistics
3. John H. Kennedy: Principles of Analytical Chemistry, 2nd Edition, Saunders College Publishing, New York.
4. Jorg Augstin,Barbara: Methods of Vitamin Assay, 4th Edition, Wiley Interscience Publications, John Wiley & Sons, New York.
5. David. G. Watson: Pharmaceutical Analysis, Churchill Livingston, Edinburg.
6. Indian Pharmacopeia 1996.
7. Controller of Publications, Govt of India: Indian Pharmacopoeia, vol. I & II,III 2007.

8. Higuchi, Bechmman And Hassan: Pharmaceutical Analysis,2nd Edition .John Wiley And Sons, New York.
9. British Pharmacopeia 2005.
10. United States Pharmacopeia.

Journals:

Indian Journal of Chemical Society.

Indian Drugs

CHEMICAL AND BIOLOGICAL EVALUATION

THEORY

GOALS

Achieve global standards in manufacture of drugs & pharmaceuticals and skills in biological evaluation.

Objectives

At the end of course in chemical and biological evaluation, the candidate must be able to –

- ❖ Answer various managerial problems and provide strategies needed to attain and hold quality leadership in an environment of continuous improvement.
- ❖ Identity and execute acquisition of control characteristics, process, inspection equipments, fixtures, total production resources and skills which may be needed to achieve required quality.
- ❖ Comprehend and document-design, production process, inspection and test procedures.
- ❖ Identify and prepare quality records.
- ❖ Evaluate biological preparations.

Course Content

THEORY: 50 hr (2hr/week)

1. Quality control, its procedure, responsibilities, good laboratory practices, Training, qualification of analytical instruments, Sampling techniques, specification, SOPs, Documentation review and batch release, Vendor and warehouse audit, Working references and Pharmacopoeial standards, Retention of active pharmaceutical ingredients and finished formulations and quality review, Schedule M of drug rules and WHO certification for export of pharmaceuticals, Salvaging of returned goods and reprocessing. **10 hours (26-32 Marks)**

2. Application of computers in quality control laboratory, Introduction to validation of computer systems and concepts of limbs. **2 hours (05-07 Marks)**

3. a) Validation: Cleaning validation, Personnel validation.
b) Calibration of following instruments 1) Analytical balance 2) UV-Visible spectrophotometer 3) FT-IR and 4) HPLC
c) Technology Transfer and method verification. **7 hours (18-22 Marks)**

4. Development of drug information profiles. **2 hours (05-07 Marks)**

5. Enzyme immune assay. Concepts and methodology. **3 hours (08-10 Marks)**

6. Microbiological validation, BET (Bacterial enumeration test) and sterility testing - methodology and interpretation **4 hours (10-14 Marks)**

7. Tests for effectiveness of antimicrobial preservatives. **2 hours (05-07 Marks)**

8. Detailed study of principles and procedures involved in the biological assays of the following:
a) Oxytocin
b) Streptokinase
c) Tetanus antitoxin
d) Tuberculin purified protein derivative **5 hours (13-16 Marks)**

9. Pyrogens- sources, chemistry and properties of bacterial pyrogens and endotoxins. Pyrogens testing: Official methods. Interpretation of data. **3 hours (08-10 Marks)**

10. Microbial assays of antibiotics zone of inhibition and vitamins zone of exhibition **3 hours (08-10 Marks)**

11. Chemical and bacteriological analysis of potable water, purified water and water for injection. **2 hours (05-07 Marks)**

12. Stability studies and impurity profiling as per ICH Guidelines Q2, Q3 A, Q3B, and Q3C **3 hours (08-10 Marks)**

13. Biological sample preparation (protein precipitation, Liquid-Liquid extraction (LLE), Solid phase extraction (SPE), Solid phase micro extraction (SPME)) and Biological method validation as per ICH Guidelines. **4 hours (10-14 Marks)**

Practical: **150 hrs (6hrs/week)**

1. General requirement and URS for manufacturing area as per GMP.
2. General requirement and URS for QC Lab as per GMP.
3. Qualification of analytical instruments- UV,IR,HPLC
4. Qualification of pharmaceutical manufacturing machinery
5. a) Design of analytical method validation protocol
   b) Execution of method validation using UV - Visible spectrophotometer.
6. Design of In-process testing parameters for different dosage form.
7. Calibration of volumetric glassware
8. Development of summary report for analytical method development.
9. Documentation for specification finalization
10. Quality control records
11. Standard operating procedures- for analytical instrumentation-UV-Visible Spectrophotometer
12. Standard operating procedures- for operating Dissolution test apparatus
13. Standard operating procedures- cleaning process of Tablet coating pan
14. Standard operating procedures- for Disintegration apparatus
15. Assay of amikacin sulphate injection, IP 1996
16. Assay of bacitracin zinc, IP 1996
17. Evaluation of preservatives in parenteral preparations
18. Development of analytical profiles for any two drugs
19. Estimation of paracetamol in Biological fluids
20. Test for pyrogens and abnormal toxicity

References:

Text Books

1. Kaushik Maitra and Sadhan K.Ghosh: A guide to total quality management, Oxford Publishing House, Calcutta.
2. M.L.Mehra: GMP, I Edition, University book agency, Allahabad.
3. P.P.Sharma: How to practice GMPs, Vandana Publications, Agra.
4. Sadhan K.Ghosh: Introduction to ISO 9000 and Total quality management, Oxford Publishing House, Calcutta.
5. Dr.A.Patani: The drug and cosmetics act 1940, Eastern book company, Lucknow.
6. Vijay Malik: The drug and cosmetics act 1940, Eastern book company, Lucknow.
7. D.H.Shah: SOP guidelines, 1st Edition, Business horizons, New Delhi.
8. R.S.Iyer: Schedule M and beyond good manufacturing practices, Indian Drug Manufacturers Association, Mumbai.

9. D.H.Shah: QA Manual, 1st Edition, 2000, Business horizons, New Delhi.
10. Controller of Publications, Govt of India: Indian Pharmacopoeia, vol.I & II, 1996.
11. Burn, Fininey and Godwin: Biological standardization, 2nd Edition, Oxford University Press, London.
12. British Pharmacopeia 2012

Reference Books:

1. Guidelines for developing national drug policies by WHO publications(1998)
2. Regulation of Pharmaceuticals in developing countries legal issues and approaches by D.C.Jeering WHO publications(1985)
3. The international pharmacopoeia Vol. 1, 2, 3 ,4; 3rd Edition, General methods of analysis and quality specifications for pharmaceutical substances, excipients, dosage forms.
4. Quality assurance of pharmaceuticals- A compendium of guidelines and related materials Vol.-1 (WHO publications)
5. Basic tests for pharmaceutical substances- WHO (1988)
6. Basic tests for pharmaceutical Dosage forms- WHO (1991)
7. WHO expert committee on 'Specifications for pharmaceutical preparations' 13th, 22nd, 23rd, 24th and 34th reports.
8. WHO expert committee on 'Biological standardizations'-37,38,39,40,41,42,43,44 and 45th report
9. Wilmer A, Jenkins & Kenton R Osborn: Packaging of drugs and Pharmaceuticals Technomic Publishing Company Inc.,Pennsylvania.
10. H.Lookhart and F.A. Paine: Packaging of Pharmaceuticals and Health care products.
11. M.Purkany: Quality assurance and TQM for analytical laboratories, the royal society of chemistry, Cambridge, London.
12. Donald C. Singer and Ronald P.Upton: Guide lines for laboratory quality auditing (Quality and Reliability Series No.39),1st Edition (1993), Marcel Dekker, New York.
13. Broton.J.Wright: Microbiological assays.

Journals

1. Indian Journals of Pharmaceutical Education.
2. Bulletin- Association Pharmaceutical Analysis
3. Pharma Times.