JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTAPUR

Course Structure and Syllabi for Pre Ph.D
PHARMACY (2009-10)

PART-I

Choose any **one** subject of the following

S.NO	PAPER	PAPER CODE
1	**Instrumental Methods of Pharmaceutical Analysis**	09PH00101
2	**Biological Screening Methods**	09PH00102

PART-II

Choose any **one** subject of the following

S.NO	PAPER	PAPER CODE
1	**Advanced Pharmaceutics**	09PH00201
2	**Advanced Pharmaceutical and Medicinal Chemistry**	09PH00202
3	**Advanced Pharmacology and Toxicology**	09PH00203
4	**Advanced Pharmaceutical Analysis**	09PH00204
5	**Advanced Pharmaceutical Biotechnology**	09PH00205
6	**Advanced Pharmacognosy**	09PH00206

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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Pre-Ph.D - PHARMACY

(09PH00101) Instrumental Methods of Pharmaceutical Analysis

Unit I

UV-VISIBLE SPECTROSCOPY: Brief review of electromagnetic spectrum. Interaction of electromagnetic radiation (UV-visible) with matter and its effects. Chromophores and their interactions with E.M.R. Absorption spectra of organic compounds and complexes illustrating the phenomenon and its utilization in qualitative and quantitative studies of drugs. Shifts and their interpretation (including solvent effects). Empirical correlation of structure with absorption phenomena (Woodward's rules etc) Quantitative estimations. Instrumentation and applications of single and double beam spectroscopy.

Unit II

INFRARED SPECTROSCOPY: Basic principles, molecular vibrations, vibration frequency and its influencing factors, sampling techniques, instrumentation and applications. Interpretation of IR spectra

Unit III

NMR SPECTROSCOPY: Fundamental principles of NMR (Magnetic properties of nuclei, applied field and precession; absorption and transition; frequency). Chemical shifts, shielding and deshielding effect, anisotropic, splitting of signals (multiplicity), instrumentations and applications of ^{1}HNMR, ^{13}CNMR.

Unit IV

MASS SPECTROSCOPY: Basic principles and brief outline of instrumentation and applications. Ion formation and types; molecular ion, Meta stable ions, fragmentation processes. Fragmentation patterns and fragmentation characteristics in relation to parent structure and functional groups.

Unit V

Polarimetry, fluorimetry and refractometry: Principle, instrumentation and applications with examples.

Unit VI

CHROMATOGRAPHIC TECHNIQUES: Classification of chromatographic methods based on mechanism of separation. Paper and classical column (Preparative and analytical) chromatography; techniques and applications. Thin Layer Chromatography, comparison to paper chromatography and HPLC, adsorbents for TLC. Preparation techniques, mobile phase selection, reversed phase TLC.

Unit VII

LIQUID CHROMATOGRAPHY: Instrumentation in HPLC, analytical, preparative and microbore columns, normal and reversed phase packing materials, reverse phase HPLC, Column selection, Mobile phase selection, efficiency parameters, resolution, detectors in HPLC. Comparison of sensitivity, selectivity and field of applications of detectors. HPTLC-instrumentation and applications.

Unit VIII

GAS CHROMATOGRAPHY: Principle, instrumentation, column efficiency parameters, the Vandeemeter equation, resolution, liquid stationary phase, derivitazation methods of GC including acylation, perfloro-acylation, alkylation and esterification. Comparison of sensitivity, selectivity and field of applications of different detectors. Examples of GC applications in pharmaceutical analysis. A brief note on LC-MS and GC-MS

References:

1. **Instrumental methods of chemical analysis** by Chatwal. K, anand, 5th edition.
2. **Vogel's text book of quantitative chemical analysis** by G.H.Jeffery, J.Bassett, J.Mendhan, R.C.Denny.
3. **Instrumental methods of analysis** by Willard, Merit, Dean, Settle.
4. **Organnic spectroscopy** by Y.R.Sharma.
5. **Spectrometric identification of organic compounds** by Silverstein, Webster.
6. **Spectroscopy** by B.K.Sharma
7. **Fundamentals of analytical chemistry** by Skoog
8. **Instrumental methods of analysis** by Skoog.
9. **Organic spectroscopy** by William Kemp

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Pre-Ph.D - PHARMACY

(09PH00102) Biological Screening Methods

Unit I

Drug discovery process: Principles, techniques and strategies used in new drug discovery. High throughput screening, human genomics, robotics and economics of drug discovery, Regulations.

Unit II

Bioassays: Basic principles of bioassays, official bioassays, experimental models and statistical designs employed in biological standardization.

Unit III

Alternatives to animal screening procedures, cell-line, patch –clamp technique, In-vitro models, molecular biology techniques.

Unit IV

Principles of toxicity evaluations, ED50, LD50 and TD values, International guidelines (ICH recommendations).

Unit V

Preclinical studies: General principles and procedures involved in acute, sub-acute, chronic, teratogenicity, mutagenicity and carcinogenicity.

Unit VI

Screening of differePnt classes of drugs using micro-organisms. Vitamin and antibiotic assays.

Unit VII

Enzymatic screening methods: α-glucosidase, α- amylase, DNA polymerase, nucleases, L-asparginase, lipases and peptidases.

Unit VIII

Screening methods involved in toxins and pathogens.

References:

1. **Basic and clinical pharmacology** by Bertram G. Katzung (International edition) lange medical book / Mc Graw Hill, USA 2001 8th edition
2. **Pharmacology** by Rang H.P, Dale MM and Ritter JM., Churchill Livingston, London, 4/e
3. **Goodman and Gilman's The pharmacological basis of therapeutics** (International edition) Mc Graw Hill, USA 2001 10th edition.
4. **General and applid toxicology** by B.Ballantyne, T.Marrs, P.Turner (Eds) The Mc Millan press Ltd, London.
5. **Drug Discovery** by Vogel's
6. **Drug Discovery and evaluation – Pharmacological assays** by H.Gerhard.Vogel, 2nd edition, Springer verlag, Berlin, Heidelberg.
7. **Tutorial Pharmacy (Vol I and II)** by Cooper and Gunns.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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Pre-Ph.D - PHARMACY

(09PH00201) Advanced Pharmaceutics

Unit I

Preformulation Studies: Goals of preformulation, preformulation parameters, methodology, Solid state properties, solubility and partition coefficient, drug excipient compatability. Excipients used in pharmaceutical dosage forms: properties and selection criteria for various excipients like surfactant, viscosity promoters, diluents, coating materials, plasticizers, preservatives, flavours and colours.

Unit II

Basic concepts of pharmacokinetics: compartment models: One, two and non- compartmental approaches to pharmacokinetics. Recent trends, merits and limitations of these approaches. Application of these models to determine the various pharmacokinetic parameters of ADME.

Unit III

Bioavailability: Rate and extent of bioavailability, assessing bioavailability, multiple dosing bioavailabilities, in-vitro bioavailability studies, bioequivalence – general principles, criteria for establishment of bioequivalence requirements.

Unit VI

Multiple dosage regimens: Drug accumulation, i.v and oral regiment, loading dosing, scheduling. Disease dose adjustment: hepatic disease, renal disease. Therapeutic drug monitoring.

Unit V

Novel drug delivery system: Review of fundamentals of controlled drug delivery system: Fundamentals, rationale of sustained / controlled drug delivery, factors influencing the design and performance of sustained / controlled release products, pharmacokinetic / pharmacodynamic basis of controlled drug delivery. Use of synthetic polymers and biocompatible polymers in controlled release dosage forms. Evaluation of controlled release drug delivery system.

Unit VI

Transmucosal drug delivery systems: Buccal, nasal, vaginal, ocular drug delivery systems. Transdermal drug delivery systems: Permeation across skin, matrix and reservoir systems, Enhancement of drug permeation through skin by permeation enhancers, iontophoresis, electrophoresis, ultra-sound and micro-needles.

Unit VII

Target oriented drug delivery systems: Rationale for targeted drug delivery, biological processes and events involved in drug targeting, pharmacokinetics and pharmacodynamic considerations, targeting in the gastrointestinal tracts and colon specific systems.

Unit VIII

Stability protocols of pharmaceutical dosage forms as per ICH guidelines

References:

1. **Pharmacokinetics by** Gibaldi M., Marcel Decker Inc, New York.
2. **Bioavailability and bioequivalence**, Abtou, H.M., Dissolution, Mack publishing Co, Easton, PA.
3. **Bioequivalence, Marcel & Decker Inc**, Welling, P.G., Tse, FIS & Dighe, S.V. (eds), New York.

4. **Applied Biopharmaceutics & Pharmacokinetics**, Shargel, L & Yu, ABC, Appleton and Lange, Connecticut, USA.
5. **Pharmaceutical dosage forms**: Liberman, HA & Lachman L Tablets vol I, II & III.
6. **Pharmaceutical dosage forms**: Avis, Lachman I & liberman HA; Pareneteral medication Vol I & II.
7. **Turco S and King RF Sterile dosage forms**, Lea & Febiger, Philadelphia.
8. **Pharmaceutical Sciences** Remintons

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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Pre-Ph.D - PHARMACY
(09PH00202) Advanced Pharmaceutical and Medicinal Chemistry

Unit I

Reactions mechanisms: Generation, stability, structure and reactivity of free radicals, carboanions, carbocations and carbenes. Mechanism of free radical, electophilic, nucleophilic (addition and substitution reactions, elimination reactions including stereochemistry concepts). Electocyclic, pericyclic and sigmatropic reactions.

Unit II

Structural elucidation: Applications of UV, IR, H^1NMR, C^{13} NMR, mass spectroscopic data in structural elucidation of natural, synthetic and semi-synthetic drugs.

Unit III

Synthetic strategies: Introduction, target selection, disconnection approach, functional group inter conversions, synthoms, reagents, retro synthesis, region selectivity, linear and convergent synthesis.

Unit IV

Drug Receptors: Receptor types and isolation, drug receptor Interaction, theories of drug action, mechanism of drug action.

Unit V

Enzyme Inhibitors: A detailed study of the following types of enzyme inhibitors, related drugs and their pharmaceutical significance:

a. PG Synthetase (Cycloxygenase)
b. Angiotensin converting enzyme (ACE) Inhibitors
c. Acetyl Cholinesterase (Ach E) Inhibitors.
d. Phosphodiesterase (PDE) inhibitors.

Unit VI

Rational Drug Design: QSAR; parameters involved in QSAR, lipophilicity (polarisability, electronic and stearic parameters). Quantitative models – Hansch analysis, free Wilson analysis and their relationships, linear relationships and applications of Hansch and free Wilson analysis.

Unit VII

Chemistry and pharmacology of drugs used in CVS, CNS with emphasis on recent drugs.

Unit VIII

Moleucal modeling drug design.

References:

1. **Org. Chemistry of Drug Design and drug Action**. Richard B. Silvermann
2. **Berger's Medicinal Chemistry and Drug Design**. 6th Edition.
3. **Identification of organic compounds** by Silverstain.
4. **Comprehensive Medicinal Chemistry** Corwin Hansch
5. **Medicinal Chemistry by** William O Foye.
6. **Introduction to Medicinal Chemistry** by G. Patrick.
7. **Advanced organic chemistry by** Jerry March.
8. **Introduction to principles of drug design by** Smith and Williams, Harwood Academy press.
9. **Organic Medicinal and Pharmaceutical Chemistry** by Wilson and Gisvold.
10. **Advanced organic chemistry**. Part A and B. Francis A, Carey and Richard J. Sunberg
11. **Some modern methods of organic synthesis**. W. Carruthers Cambridge University Press. Cambridge.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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Pre-Ph.D - PHARMACY

(09PH00203) Advanced Pharmacology and Toxicology

Unit I

Receptor Pharmacology: - Drug receptor interaction theory, occupation theory and rate theory. Receptor occupation and response relationship, spare receptors, silent receptors, orphan receptors, presynaptic and postsynaptic receptors. Receptor characterization method: Pharmacological characterization methods, radio ligand methods, monoclonal antibodies, receptor subtypes.

Unit II

Recent development in chemotherapeutic agents, multi-drug resistance, antiviral, antibacterial, anti-protozoal and cancer chemotherapy.

Unit III

Drug development process, clinical trials, safety evaluation, bioequivalence studies, statistical design in clinical trials, data analysis technique.

Unit IV

Biotransformation of drugs: Phase I and II. Excretion of drugs: Renal and non-renal (mechanisms and factors affecting). Clearance: Renal and hepatic clearance. Kinetic of drug absorption: compartment models evaluation of pharmacokinetic parameters.

Unit V

Preclinical models employed in the screening of new drugs belonging to following categories: Antipsychotic, analgesic and anti-inflammatory, anti-hypertensive, anti-diabetic, anti-ulcer agents.

Unit VI

Drug therapy in pediatrics and geriatrics.

Unit VII

Drugs acting on central nervous system: General Anaesthetics, sedative and hypnotics, anti-psychotics, anti-depressants, anti-epileptics, analgesics, anti-migraine agents and anti-parkinsonism agents.

Unit VII

Drugs acting on autonomic nervous system: Sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics and neuromuscular junction and ganglionic blockers.

References:

4. **Basic and Clinical pharmacology** by Bertram G. Katzung (International edition) lange medical book / Mc Graw Hill, USA 2001 8th edition
5. **Pharmacology** by Rang H.P, Dale MM and Ritter JM., Churchill Livingston, London, 4/e
6. **Goodman and Gilman's The pharmacological basis of therapeutics** (International edition) Mc Graw Hill, USA 2001 10th edition.
7. **Harrison's principles of internal medicine two Vols, 2001** by Braunwald, Fauci, Kasper, Hauser, Longo Jameson, Mc Graw Hill, Newyork 15th edition
5. **Pharmacology** by K.D.Tripati.
6. **Drug Discovery and evaluation – Pharmacological assays** by H.Gerhard.Vogel, 2nd edition, Springer verlag, Berlin, Heidelberg.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

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Pre-Ph.D - PHARMACY

(09PH00204) Advanced Pharmaceutical Analysis

Unit I

Validation and calibration of various instruments used for drug analysis such as UV-visible spectrophotometer, IR spectrophotometer, HPLC, GC and HPTLC.

Unit II

Quality control and in process quality control of tablets, capsules, liquid dosage forms, parentral and sterile preparations.

Unit III

Interpretation spectral data of IR, HNMR, ^{13}CNMR, mass spectroscopy in the characterization of organic medicinal compounds.

Unit IV

Analysis of drugs and excipients in solid state- particle size analysis, DTA, SCS, DGA, X-ray diffraction – principle, instrumentation and applications.

Unit V

A detailed study of principles and procedures involved in various physico- chemical methods of analysis including instrumental methods of analysis of pharmaceutical dosage forms containing the following classes of drugs. (Official in IP).

a. Sulphonamides, b. Barbiturates.
c. Adrenergic drugs. d. Anti tubercular drugs.
e. Diuretics.

Unit VI

New drug development and approval process: Investigational new drug (IND), new drug applications (NDA), supplemental new drug application (SNDA)

Unit VII

Radiometric analysis: Radio activity, radioisotopes and pharmaceutical applications of radiopharmaceuticals. Radio immune assay: Principle, procedures and applications. ELISA test.

Unit VIII

Principles and procedures involved in the use of the following reagents in pharmaceutical analysis.

a. MBTH (3-methyl-2-benzothiazolone hydrazone) reagent.
b. FC reagent
c. 2, 6 - dichloroquinine monoamine reagent.
d. 2, 3, 5-tri phenyl tetrazonium salt.
e. PDAB (paramethyle aminobenzaldehyde) reagent
f. PDACA (paradimethyleamino cinnamaldehyde) reagent.
g. 2,4 dinitrophenyl hydrazine
i. DPPH

References:

1. **A.I. Vogel text book of inorganic chemistry** , 4th edition, ELBS publication, London
2. **Pharmaceutical drug analysis** by P.D.Seth
3. **K.A.Connors text book of pharmaceutical analysis**, 3rd edition, Willey Interscience publication New York.
4. **Instrumental methods of analysis** by Willard, Merit, Dean, Settle.
5. **Instrumental methods of analysis** by Skoog.
6. IP, BP, USP, RPS.
7. **Analysis** by BK Sharma.
8. **Spectrometric identification of organic compounds** by Silverstein, Webster.
9. **Quality Assurance of Pharmaceuticals** (A compendium of guidelines and selected materials) Vol I and II (Pharma Book Syndicate).
10. **Pharmaceutical analysis of modern methods**. Part A and B. Dekker Series.
11. **Pharmaceutical Process Validation** by Ira R. Berry and Robert A, Nash.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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Pre-Ph.D - PHARMACY

(09PH00205) Advanced Pharmaceutical Biotechnology

Unit I

Introduction to Proteins and Nucleic acids and their structure and features

Unit II

Introduction to Genetic Engineering, enzymes and vectors in genetic engineering, concepts of cloning, cDNA and genomic libraries, Cloning for production of biopharmaceuticals, Screening and detection methods for clones.

Unit III

Recombinant DNA products and their applications

Unit IV

Immune System – Innate and acquired immunity, Monoclonal antibodies and immunological techniques.

Unit V

Basic techniques of mammalian cell culture in vitro; disaggregation of tissue and primary culture, maintenance of cell culture; cell separation, and applications of mammalian cell culture.

Unit VI

Different areas and applications of plant tissue culture. Nutritional components of tissue culture media. Totipotency

Unit VII

Transgenic plants and animals and their applications.

Unit VIII

Introduction to bioinformatics overview and its applications.

References:

1. **Bio-Chemistry** by Stryer
3. **Molecular cell Biology** by Baltimore
4. **Med. Plant Biotechnology** by siddi Veereshan.
5. **Med. Plant Biotechnology** by dixit and vyas
5. **Plant biotechnology** by Purohit, Mathur
6. **Bio process engineering** by Shular
7. **Principles of fermentation technology** by starbury

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Pre-Ph.D - PHARMACY

(09PH00206) Advanced Pharmacognosy

Unit I

Plant drug cultivation: General aspects invo0lved in the cultivation of medicinal plants. Conservation of medicinal plants: *ex-situ* and *in-situ* cultivation; Biodiversity loss; WTO and TRIPS agreement.

Unit II

Current trends in tissue culture and its applications in pharmaceutical and allied fields. Immobilized cell systems and techniques of immobilization, biotransformation resulting into pharmaceutically important secondary metabolites, using tissue cultures. Micro-propagation, hair root cultures and their applications in pharmacy.

Unit III

Quality control methods for medicinal plant materials: Development of standardization parameters according to WHO guidelines for assessment of crude drugs:

Unit IV

Detailed Phytochemical study of following classes of phytoconstituents including important drugs .

a) alkaloids
b) glycosides
c) steroids
d) flavanoids

Unit V

Applications of UV, IR, NMR and Mass spectrometry in the structural elucidation of phytoconstituents.

Unit VI

General methods and principles of extraction methods, types of extraction and their merits and demerits for crude drugs, slection and purification of solvents for extraction. General methods of isolation of different class of phytochemical.

Unit VII

Screening of plant extract/fractions on anti-diabetic, hepatoprotective, antiepileptic, diuretic and CVS.

Unit VIII

Herbal Cosmetics:

a. Raw materials of herbal origin used in cosmetics ; Oils, waxes, gums, hydrophilic colloids, colors, perfumes, protective agents, bleaching agents, preservatives, anti-oxidants and other ancillary agents.
b. Formulation aspects of incorporating herbal extracts in various preparations like skin care creams, deodorants, anti-perspriants, and hair care preparations.

References:

1. **Text book of Pharmacognosy** by Trease and Evans.
2. **Phytochemical methods** by JB Heraborne.
3. **Instrumental methods of analysis** by BK Sharma.
4. **Pharmacognsoy and Phytochemistry** by Vinod Rangari.
5. **Plant Tissue culture** by Razdawn.
6. **Text book of Pharmacognosy** by Brady and Tyler.
7. **Quality control of herbal drugs and approach to evaluation of botanicals** by Dr. Puloak Mukherjee.