SYLLABUS
(2007-2008)

MASTER OF PHARMACY
(Pharmaceutical Chemistry)

Rajiv Gandhi Proudyogiki Vishwavidyalaya
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First Year 1st Semester
MODERN ANALYTICAL TECHNIQUES (MPY 101)

Theory

1. Theory, Instrumentation, Methods and Applications of VU Spectrophotometer.
2. Theory and Instrumentation of IR and FT-IR, its advantage and applications in Structural elucidation.
3. NMR, C¹³ NMR, Origin of spectra, Chemical shifts, Spin-spin coupling, Coupling constant, Instrumentation and application for Structural elucidation.
5. Theory, Instrumentation and application for the following:
   i) Fluorescence
   ii) X – Ray crystallography
   iii) Atomic spectroscopy
   iv) Ultra centrifugation
   v) ESR
   vi) Liquid Scintillation spectrometry
   vii) Auto radio graphy
6. Separation Techniques; Fundamental principles, Basic instrumentation, Qualitative and Quantitative Pharmaceutical applications of Gas-liquid Chromatography, HPLC, HPTLC, Gel Chromatography, Electrophoresis and Ion-pair Chromatography.
7. General Principle, instrumentation and application of optical rotatory dispersion (ORD) and Circular dichroism (CD).
8. Immunoassay Techniques: Enzyme and Radioimmunoassay techniques. Theory, Methods and applications.
Books and References Recommended:

10. Willard, Merrit and Dean, *Instrumental Methods of Analysis*.
15. Block and Durrum, *Paper Chromatography and Electrophoresis*.
16. Remington's *Pharmaceutical Sciences*.
17. Sirmer, *Spectroscopic Analysis*. 
BIOTECHNOLOGY & BIOINFORMATICS (MPY 102)


2. **Recombinant DNA Technology**: Constructing Recombinant DNA molecules, Restriction enzymes, Vectors, Gene Cloning, Genomic libraries, Polymerase Chain reaction – based DNA cloning, Restriction mapping, Blotting techniques, DNA sequencing, Pharmaceutical applications of recombinant DNA.


4. **Basics of Immunology, Monoclonal antibodies & Hybridoma technology & its Applications.**
   - **Vaccines** – Conventional vaccines, Modern Vaccine technologies, Genetically improved live vaccines, Genetically improved subunit vaccines, Pharmaceutical considerations.

5. **Fundamentals of Cell biology:**
   - **Cell organization and plasma membrane**: Transport of substances across the membrane.
   - **Cellular reproduction**: The Cell cycle, Mitosis & Meiosis, Apoptosis.
   - **Cell Signaling**: Communication between cells and their environment


7. **Molecular, Structural and Chemical Biology in pharmaceutical research**: Molecular biology of disease and invivo transgenic models, Genomic protein targets and recombinant therapeutics, Structural biology and rational drug design, Chemical biology and Molecular diversity, Gene therapy & DNA/ RNA targeted therapeutics. Future of pharmaceutical research.

8. **Introduction to Bioinformatics**: Biological databases, Sequence analysis, Protein structure, Genetic and physical mapping, Application of bioinformatics in pharmaceutical industries.

Recommended Readings

1. Lehninger, *Principles of Biochemistry*
6. Watson and Trooze, *Recombinant DNA Techniques*
7. Lesk., *Introduction to Bioinformatics*.
10. Watson, J.D., Gilman, M., *Recombinant DNA Technology*
13. Paul, W.E, *Fundamentals of Immunology*
DRA, INTELLECTUAL PROPERTY RIGHTS AND QUALITY ASSURANCE (MPY -103)

Theory

1. Requirements of GMP, CGMP, GLP, USFDA, WHO guidelines and ISO 9000 Series.
6. Sewage disposal and Pollution control.
8. Basic concept of Quality Control and Quality Assurance systems, Source and Control of Quality variation of Raw materials, Containers, Closures, Personnel, Environmental, etc.
9. In process quality control tests, IPQC problems in Pharmaceutical industries. ICH Guidelines
10. Sampling plans, Sampling and Characteristic curves.
11. Master formula generation and Maintenance, Standard Operating Procedure (SOP) for different dosage forms.

Books and References Recommended:

3. Bharathi, Drugs and Pharmacy Laws in India.
4. Patel, Industrial Microbiology.
8. OPPI, Quality Assurance.
11. Indian Pharmacopoeia.
PRODUCT DEVELOPMENT AND FORMULATION (MPY-104)

Theory

1. **Preformulation studies:** Study of physical, chemical and pharmaceutical factors influencing formulation of drugs.

2. **Formulation additives:** Study of formulation additives, Drug – Excipient, Excipient - Excipient interactions and Incompatibilities.

3. **Solubilization:** Theory of solubilization, methods of solubility enhancement and factor influencing solubility. Solids dispersion.

4. **Dissolution Technology:** Design of dissolution apparatus, dissolution media, dissolution testing of different types of dosage formulations, data interpretation, *in-vitro* and *in-vivo* correlation.

5. **Tablets:** Recent advances in tablet technology and automation in manufacturing process, formulation and evaluation of dispersible, effervescent, floating and multilayers tablets.

6. **Formulation consideration and evaluation:** Parenterals and Ophthalmics.


8. **Nutraceuticals:** Introduction, formulations, uses, recent developments and law governing nutraceuticals.

9. **Pharmaceutical packaging:** Packaging materials, type and tests of containers and closures, Pilot plant scale up technique.

10. **Drug stability:** Stability study programmes for formulations. Determination of Expiry date (shelf life) and Overage calculations. Stability indicating assays and ICH guidelines for stability.

11. **Optimization Techniques:** Computers in pharmacy, Optimization techniques, Computer aided drug formulations.
Books and References Recommended:

First Year 2\textsuperscript{nd} Semester

ADVANCED MEDICINAL CHEMISTRY (MPY-201 Pch)

Theory

1. Theoretical basis of newer drug delivery systems; Prodrug, Dendrimer and Polymers as carrier.
4. Classification, biomacromolecular study, mode of action, SAR, side effects, biological evaluation & recent advances in research of the following category of drugs.
   a) Antineoplastics
   b) Immunosuppressants
   c) Antiviral and Anti HIV
   d) Antiprotozoal
   e) NSAIDS
   f) Antihyperlipidemic Drugs
   g) Antihypertensive
   h) Antiparkinsonism
   i) Antialzheimer Drugs

Books and References Recommended:

1. Patrick. G.L, \textit{An Introduction to Medicinal Chemistry}.
2. Burger, A., \textit{Medicinal Chemistry}.
5. Schueler, \textit{Chemobiodynamic and drug design}.
ADVANCED ORGANIC CHEMISTRY (MPY-202 Pch)

Theory

1. Stereo Chemistry:
   b) Asymmetric carbon atom: Newer methods of asymmetric synthesis (including enzymatic and catalytic synthesis), Enentio selective and Stereo selective synthesis.
   c) Stereochemistry of ring system. Stereoisomerism, Stability and ease of ring formation.
   d) Effects of conformation on reactivity in acyclic and cyclohexanes.

2. Formation and stability of Carboanion, Carbocation, Free radical, Carbenes and Nitrenes.

3. Mechanism of Oxidation, Reduction and Hydrolysis.

4. Uses of the following reagents and catalysts in organic synthesis.
   i) Ruthenium tetroxide, Nickel peroxide, Caro’s reagent, Lemieuxvon-Rudloft reagent, Jones reagent, Corey’s reagent and Collins reagent.
   ii) Borane in THF, AlCl₃ in THF, NaAlEt₂H₂, Pd, LiAlH₄
   iii) Ziegler – Natta catalyst, Wilkinson catalyst, Glimann reagent, Dicyclohexyl Carbodimide and phase transfer catalyst.

5. Reaction Mechanism and method of determining them, Aliphatic nucleophilic (SN1, SN2, SN’1, SN’2) and Aromatic nucleophilic substitution (SNAr and benzynme mechanism) reactions.


7. E1 and E2 mechanism, Hoffmann and Saytzeff like elimination reactions.

8. Effects of structure on reactivity.


10. Dakin reaction, Reformatskey, Chichibabin reaction, Birch reduction, Wittig reaction, Oppensuer oxidation, Ozonolysis and Jourdan Ullmann reaction, Stork enamine reaction, Ene reaction, Barton reaction, Shapiro reaction.

Books and References Recommended:

Advanced Pharmaceutical Chemistry (MPY-203 Pch)

1) Techniques involved in Extraction isolation & Standardization with Specific reference to herbal products
   - Supercritical fluid extraction
   - Solid phase micro extraction
   - H P TL C
   - Electro chromatography
   - Mass spectrometry

2) Basic Metabolic pathways for production of secondary metabolites-
   - Acetate pathway
   - Shikimate pathway
   - Mevalonate pathway

3) Biosynthesis-
   - Tropane alkaloids
   - Adrenocorticosides
   - Sex hormones
   - Peptides and their derivatives viz. Thyroid hormones, Oxytocin, Insulin, Penicillin, cephalosporin and clavulanic acid.

4) Isolation and Phytochemical studies of some important constituents in -
   - Digitalis glycosides
   - Senna glycosides
   - Cinchona alkaloids
   - Rawolfia alkaloids
   - Ergot alkaloids
   - Taxal

5) Principles and application of Tracer techniques in biology.
6) Constitution and applications of Thyroid hormones, Oxytocin and Insulin.
7) Isolation from microorganisms and Chemistry of Antibiotic special references to Macrolide, Beta lactum and amino glycoside antibiotics.

Books and References Recommended:
8. Schueler, *Chemobiodynamic and drug design*.
DRUG DESIGN (MPY-204 Pch)

1. **Introduction to Drug Design & Discovery** – Historical perspective, Generation of leads & lead optimization, Cell Biology & Genomics as a source of Drugs, future developments in the drug design.

2. **Molecular Recognition in Drug Design** – Introduction, Thermodynamic considerations of Drug design, Physical basis of intermolecular interactions, total energy intermolecular interaction, estimating individual group components in ligand receptor interactions and co-operativity and thumb rules.

3. **Stereochemistry and drug design** – Stereospecificity in molecular recognition, Significance of stereochemistry in drug design, Methods of obtaining pure stereoisomers, Analytical methods of determining purity of stereoisomers.

4. **Bioisosterism in drug design**.

5. **Three dimensional aided drug design** – structure aided drug design process, methods to derive 3D structures, Design process, software aided drug design, optimization of identified compounds, example of structure aided drug design.

6. **Computer Aided Drug Design – Pharmacophoric approach**: Pharmacophore based ligand design, pharmacophore concept, Pharmacophore elements and representation, active conformation, molecular superimposition, receptor excluded and receptor essential volumes, solvation effects, examples of 3D pharmacophore models and their use.

7. **Quantitative Structural Activity Relationships (QSAR)**: Fundamentals of QSAR, Biological data, the additivity of group contribution Hansch analysis and related approaches, physicochemical properties, Statistical methods in QSAR, application of Hansch and related approaches, 3D QSAR approach.

8. **Molecular modeling** – Generation of 3D coordinates, Sketch approach, conversion of 2D structure in 3D form, force field, geometry optimization, energy minimizing procedures, Quantum mechanical methods, conformational analysis, pharmacophore identification, molecular modeling in 3D QSAR – CoMFA and related methods.

9. **Nucleic Acid Based Drug Design**: Structure, Protein-nucleic acid interaction, Drug-nucleic acid interaction.
Books and References Recommended:

4. Schueler, *Chemobiodynamic and drug design*.
5. Foye, *Principles of Medicinal Chemistry*.