Syllabus M.Pharm (Pharmaceutical Chemistry)
## STUDY AND EVALUATION SCHEME

Course: M. Pharm. (Pharmaceutical Chemistry) Effective From Session 2008 – 09

### Semester-I

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
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#### Practical

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T-Theory, P-Practical, IA-Internal Assessment, ESE-End Semester Examination

Note: Duration of ESE –Theory exam is of 3 hours and Practical exam is of 6 Hours.
**STUDY AND EVALUATION SCHEME**

Course: M. Pharm. (Pharmaceutical Chemistry) Effective From Session 2008 – 09
Semester-II

<table>
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**Practical**

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**Day to Day Evaluation**

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**Total** 600

T- Theory, P- Practical, IA- Internal Assessment, ESE- End Semester Examination
Note: Duration of ESE- Theory exam is 3 hours and Practical exam is 6 hours.
## STUDY AND EVALUATION SCHEME

**Course: M.Pharm (Pharmaceutical Chemistry)**  
**Semester-III& IV**

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M. Pharm (Pharmaceutical Chemistry)  
(First Semester)

PHAR-511  Modern Analytical Techniques

Unit - 1  

Unit - 2  
Infrared Spectroscopy: Infrared radiation and its interaction with organic molecules, vibrational mode of bonds, instrumentation and applications, effect of hydrogen bonding and conjugation on absorption bands, interpretation of IR spectra. FTIR and ATR, X-ray diffraction methods.

Unit - 3  
Nuclear magnetic resonance spectroscopy: Magnetic properties of nuclei, field and precession, chemical shift concept, isotopic nuclei, reference standards and solvents. $^1$H NMR spectra, chemical shifts, multiplicity, coupling constants, integration of signals, interpretation of spectra, decoupling-double resonance and shift reagent methods. Principles of FT-NMR with reference to $^{13}$C NMR, free induction decay, average time domain and frequency domain signals. Spin-spin and spin-lattice relaxation phenomenon. Protein noise decoupled spectra. Nuclear overhauser enhanced $^{13}$C NMR spectra, their interpretation and application. APT and DEPT techniques. Introduction of 2D NMR techniques, COSY, with application.

Unit - 4  
Mass spectrometry: Basic principles and brief outline of instrumentation. Ion formation, molecular ion, metastable ion, fragmentation process in relation to molecular structure and functional groups. Relative abundance of isotopes, chemical ionization, FAB, ESI, Maldy, GC-MS and other recent advances in mass spectrometry.

Unit - 5  
Chromatographic techniques: Principles of separation and application of Column, Paper, Thin layer and Gas chromatography, HPLC, HPTLC, Size exclusion chromatography, Affinity chromatography, Electrophoresis. Instrumentation of HPLC, Preparative and micropore columns, Reverse phase columns, Mobile phase selection and detectors in HPLC. Instrumentation and application of DCCC. Biological standardization: Bioassay & Radioimmunoassay: ELISA, Radioimmunoassay of drugs like Digitalis & Insulin
PHAR-511 P  Modern Analytical Techniques

Practicals based on theory syllabus.

Books Recommended:

10. Gordy, W., Theory & Applications of Electron Spin Resonance, Willy.
14. Beckett and Stenlake, Practical Pharmaceutical Chemistry, CBS.
16. Giddings, J.C., Principles and Theory- Dynamics of Chromatography, Marcel Dekker.
20. Gross - Mass Spectrometry
24. Haffmann, Chromatography.
25. Sethi and Charcgankar, Identification of Drugs in Pharmaceutical Formulations by TLC.
29. George, S., Steroid Analysis in Pharmaceutical Industry.
30. Higuchi, Pharmaceutical Analysis.
31. Bidingmeyer, Practical HPLC Methodology and Applications.
33. Scott, Techniques and Practice of Chromatography.
34. Wilkins, Identification of Microorganism by Mass Spectrometry.

PHAR-512 Pharmaceutical Biostatistics and Computer Applications

Unit - 1
Methods of collection of data, classifications and graphical representation of data. Binomial and normal probability distribution. Polygon, histogram, measure of central tendency. Significance of statistical methods, probability, degree of freedom, measures of variation - Standard deviation, Standard error.

Unit - 2
Sampling, sample size and power. Statistical inference and hypothesis. Tests for statistical significance: student t-test, Chi-square test, confidence level, Null hypothesis.

Unit - 3
Linear regression and correlation. Analysis of Variance (one way and two way). Factorial designs (including fraction factorial design). Theory of probability, Permutation and Combination, Ratios, Percentage and Proportion. Two way ANOVA and Multiple comparison procedures.

Unit - 4
Non-parametric tests, Experimental design in clinical trials, Statistical quality control, Validation, Optimization techniques and Screening design. Correlation and regression, least square method, significance of coefficient of correlation, nonlinear regression.

Unit - 5

Book Recommended:

9. Gauthaman, Biostatistics for Pharmacy students.
11. Liwan Po, Statistics for Pharmacist.

**PHAR-514 Drug Regulatory Affairs and Intellectual Property Rights**

**Unit - 1**
Drug & Cosmetics Act with special reference to schedule Y and M, schedule of medical devices.

**Unit - 2**
Concept of total quality management, requirements of GMP, GLP, GCP, Regulatory requirements of drugs and Pharmaceutical (USFD-NDA/ ANDA)

**Unit - 3**
Documentation and Maintenance of records.

**Unit - 4**
Intellectual property rights patents, Trademarks, Copyrights, Patents Act.

**Unit - 5**
Environment protection Act, Pollution Control, Factories Act.

**Books Recommended:**
8. Bansol, IPR Guidelines for Pharm students and Researchers.
PHAR-516  Advanced Organic Chemistry

Unit-I
a. Aliphatic electrophilic substitution.
b. Aromatic electrophilic substitution.
c. Aliphatic nucleophilic substitution.
d. Aromatic nucleophilic substitution.

Unit-II
a. Free radical reactions.
b. Elimination reactions.
c. Addition to carbon-carbon multiple bonds.

Unit-III
Study of reactions of Synthetic importance:
a. Birch reduction.
b. Mannich reaction.
c. Diel’s alder reaction.
d. Meerwin Pondroff-Verley reduction.
e. Oppeneaur oxidation.
f. Beckmann rearrangement.
g. Grignard reaction.
h. Hoffmann rearrangement.
i. Catalytic hydrogenation reactions.
j. Ozonolysis.
k. Reformatsky reaction.
l. Micheal reaction.

Unit-IV
a. Geometrical isomerism & Stereochemistry of Allenes.
b. Optical rotation and Optical rotatory dispersion.
c. Uses of achiral and chiral heterogenous and homogenous catalysts.
Unit-V
a. Stereochemistry of five & six membered rings fused & bridged rings.
b. Stereoselective synthesis and stereoregulated polymerization.

PHAR- 516 P Advanced organic chemistry
Practical based on theory syllabus

Books Recommended

   New York.
Unit-I

Introduction to Drug Design Concept, Lead Discovery Interactions (Forces) Involved in Drug-Receptor Complex, Physicochemical Properties in Relation to Biological Action, Stereochemical Aspects in Drug Design.

Unit-II

Drug metabolism- Phase-I & Phase-II Metabolic Reactions, Introduction to Drug Designing on the Basis of Metabolic Pathways.
Prodrugs- Bioprecursor & Carrier Linked Prodrugs, Hard and Soft Drugs.

Unit-III

Analog Based Drug Design-Introduction, Designing of Analogs.
Structure Based Drug Design- Introduction, Drug Design on Structure Based.

Unit-IV


Unit-V

Molecular Modeling- Introduction to Molecular Mechanics, Quantum Mechanics, Molecular Dynamics, Molecular Graphics and Molecular Docking.

QSAR- Introduction, Tools & Techniques, Physicochemical Parameters, Quantitative Models, Introduction to 2D and 3D QSAR.
Books Recommended
(Second Semester)

PHAR- 526 Advanced Medicinal Chemistry

Unit-I
Classification, mechanism of action, SAR, synthetic approach and recent advances of fourth generation cephalosporins and fluoroquinolone antibacterials.

Unit-II
Classification, mechanism of action, SAR, synthetic approach and recent advances of CNS depressant agents.

Unit-III
Classification, mechanism of action, SAR, synthetic approach and recent advances of:
  a. Sex Hormones and corticosteroids.
  b. Adrenergic agents.

Unit-IV
Classification, mechanism of action, synthetic approach & recent advances of:
  a. Anti-HIV agents.
  b. ACE inhibitors and statins

Unit-V
Classification, mechanism of action and recent advances of:
  a. Drugs used in peptic ulcer.
  b. COX-2 inhibitors
  c. Artemisin derivatives
  d. Macrolide and anti-cancer antibiotic.
Books Recommended
3. Monographs and relevant review articles appearing in various periodicals and journals.

PHAR-526 P Advanced Medicinal Chemistry
Practical Based on Theory syllabus
Unit-I
Role of Natural Products in new Drug Development, plant derived drugs, novel drug templates.

Unit-II
Bioactive compounds from micro-organism with reference to antibiotics, anti-protozoals and marine natural products.

Unit-III
Structural elucidation insights for natural products by combination of classical, synthetic, degradative and spectral methods with reference to quercetin, tropanes and morphinan type alkaloids, quinine, digitoxigenin, camphor and caffeine.

Unit-IV
Pharmacological Screening of Herbal Drugs- Introduction and evaluation of herbal drugs for antidiabetic, hepatoprotective, diuretic, anti-diarrhocal, antiulcer, wound healing, cardiovascular, anti-inflammatory, analgesic, antipyretic, antifertility, anti-oxidant, anti-viral & cyto-toxic properties.

Unit-V
Biomedicinals from plant tissue culture- Introduction, profile of plant tissue culture, bioproduction of commandable secondary metabolites, Hi-Tech products from plant sources with reference to Genistein, Comptophein, Rhein & Taxanes, Recombinant DNA technology.

Book Recommended

5. Drug Discovery and Evaluation, Pharmacological assays, H. Gerhard Vogel, 2nd edition, Springer publications,
10. Chemistry of Natural Products, by O.P. Agarwal, Vol-I & II.
PHAR-528  Polymer and Bio-Organic Chemistry

Unit-I
Polymers- Classification, Synthesis, reactions, crystallinity, polymer degradation mechanism, copolymerization and their applications in Pharmacy.

Unit-II
Classification, Chemistry and biological activity of vitamins.

Unit-III
Classification, structural determination, linkages, stereochemistry and biological activity of carbohydrates.

Unit-IV
Classification, structural determination, linkages, stereochemistry, biological activity of steroids with reference to cholesterol, bile acids, sex hormones, corticoids (gluco & mineralo- corticoids) cardiac glycosides and saponins.

Unit-V
1. Introduction to glycoproteins, lipoproteins and glycopeptidolipids.
2. Fullerenes- Introduction, chemical reactions and applications.

Book Recommended

(16)

**PHAR-528 P Polymers and Bio-organic Chemistry**
Practical Based on Theory syllabus

**Third and Fourth Semester**

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