M.PHARM (PHARMACEUTICAL CHEMISTRY)

Course Structure, Scheme of Instruction and Evaluation

AIMS:

A post-graduate in Pharmaceutical Chemistry while undergoing the course should acquire adequate knowledge and necessary practical skills and attitude required for understanding reaction mechanisms, identification of lead molecules and their eventual refinement for development as drugs, knowledge of natural and synthetic molecules used as therapeutic agents.

OBJECTIVES:

The objectives are dealt under two headings namely
(a) knowledge and understanding
(b) attitudes

a) Knowledge and understanding:

A postgraduate student should acquire detailed theoretical knowledge and practical techniques of the following during the period of his course. He/she should acquire thorough theoretical knowledge and practical skills in Pharmaceutical analysis with special emphasis on all modern analytical instruments and techniques. He/she should acquire adequate theoretical knowledge and practical skills in QSAR, Computer Aided Drug Design and design of drugs targeted to act at specific sites.

He/she should acquire adequate theoretical and practical knowledge about structure elucidation of natural products of medicinal interest, reaction mechanism elucidation and also mechanism of different reactions involved in the synthesis of various classes of drugs used in therapy.

b) Attitude:

A postgraduate student must inculcate attitude for applying his acquired knowledge of reaction mechanisms and drug design in the synthesis of new molecules to provide a cure for diseases of mankind. He/she should continuously upgrade the acquired knowledge by keeping in touch with contemporary research through national and international journals and should be willing to participate in continuing education programs.

SEMESTER I
(Minimum of 20 weeks)

COURSE NO.	SUBJECTS/ PAPER	TH /PR	INSTRUCTIONS HRS/WEEK		EVALUATION		DURATION OF UNI.EXAM (HOURS)
			Theory	Practical	Int.	Ext	
41T1	Modern Pharmaceutical Analysis	Th	3	-	30	70	3
41T2	Advanced Organic Chemistry	Th	3	-	30	70	3
41T3	Pharmaceutical Statistics & Computer Application	Th *Pr	3 -	- 2	30 15	70 35	3 3 (Class Exam)
41T4	Drug Regulatory Affairs & Intellectual Property Rights	Th	3	-	30	70	3
41P1	Modern Pharmaceutical Analysis	Pr	-	6	30	70	6
41P2	Advanced Organic Chemistry	Pr	-	6	30	70	6
	*Evaluation Seminars (1)	-	-		50	-	
	Total -700				**245**	**455**	

*** only Internal Assessment**

SEMESTER II
(Minimum of 20 weeks)

COURSE NO.	SUBJECTS/ PAPER	TH /PR	INSTRUCTIONS HRS/WEEK		EVALUATION		DURATION OF UNI.EXAM (HOURS)
			Theory	Practical	Int.	Ext	
41T5	Advanced Medicinal Chemistry	Th	3	-	30	70	3
41T6	Chemistry of Natural Products.	Th	3	-	30	70	3
41T7	Drug Design	Th	3	-	30	70	3
41T8	Research Methodology	Th	3	-	30	70	3
41P3	Advanced Medicinal Chemistry	Pr	-	6	30	70	6
41P4	Chemistry of Natural Products..	Pr	-	6	30	70	6
41T9	*Entrepreneurship Management	Th	1	-	50	-	-
	*Evaluation Seminar	-	-		50	-	-
	Total -700				**280**	**420**	

*** only Internal Assessment**

SEMESTER III AND IV (Combined)
(Minimum of 40 weeks)

COURSE NO.	SUBJECTS/ PAPER	**TH /PR**	EVALUATION
			Marks
41P5	Dissertation and Viva-Voce	Pr	300

Dissertation. Original research work carried out by the candidate under the guidance of regular teaching faculty of the department should be submitted in the bound Form.

* Beginning of the 3rd semester, preparation and approval of the protocol for research projects and submission of the progress report after 3 months (1st report) and 6 months (2nd report) of the 3rd semester.

Note : Distribution of marks for dissertation and viva-voce shall be as under

Dissertation Work	**Marks**
a) Reference Work	20
b) Experimental work	100
c) Scientific Contents	20
d) Presentation/ Communication	30
e) Results/ Conclusion	30

Total Marks	200

Viva-Voce	**Marks**
a) Scientific Contents	20
b) Presentation/ Communication	30
c) Discussion	50

Total Marks	100

Modern Pharmaceutical Analysis
(Minimum of 60 Hrs)

Semester - I

Subject Code: 41T1	Sessional exam: 30
Period/Week : 3 hr	Uni. Examination: 70
Examination : Theory	Exam Duration : 3 hr

1. UV-Viscible Spectroscopy: Brief review of Electro Magnetic Radiation, laws governing spectrophotometry. Interaction of EMR with matter and effects. Spectra of isolated Chromophores. absorption spectrum in qualitative and quantitative studies of drugs, shifts and their interpretation including solvent effects. Multicomponent analysis, derivative spectroscopy. 6 hr
2. Spectrofluorimetry: Fluorescence, Phosphorescence, Chemiluminescence- Theory, instrumentation and applications. 2 hr
3. Infra-Red spectroscopy: Basic principles, effects of substituents, ring size, H-bonding. Coupling and field effects on frequency. Sample preparation, qualitative methods, and their interpretation. FT-IR, applications with recent advances. 8 hr
4. Optical Rotatory Dispersion: Principle, plain curves, Cotton effect, Circular dichroism and. Measurement of rotation angle in ORD and applications 2 hr
5. Nuclear Magnetic Resonance spectroscopy: Fundamental principles, Proton magnetic spectrum characteristics and presentations, terms used, Brief outline of principles of ^{13}C NMR. Introduction to 2-D-NMR technique in pharmacy and biotechnology. 12 hr
6. Mass spectroscopy: Principles, instrumentation, methods, interpretations and applications. 8 hr
7. X- ray Crystallography: Production of X rays, Different X ray methods, Braggs law, Rotating crystal technique, X ray powder technique, Types of crystals, Interpretation of diffraction patterns and applications of X-ray diffraction 4 hr
8. Chromatographic methods, Introduction, classifications,
    a) Liquid chromatography, instrumentation, materials, column selection, resolution optimization and efficiency parameters. HPLC detectors, modes of HPLC, Ion –

pair, Ion exchange, Size exclusion, Supercritical, gel-permeation, flash chromatography, applications.

b) High performance thin layer chromatography: Detection methods qualitative and quantitative HPTLC

c) Gas Chromatography: Instrumentation, Column parameters, Resolution, Liquid Phases Derivatisation and detectors, Applications

d) Capillary electrophoresis.: Introduction, methods and applications 15 hr

9. Radio Immuno Assay and ELISA for some drugs. 3 hr

References:

1. Willard, H.H., Merrit, L.L., Dean, J.A., Settle P.A., Instrumental Methods of Analysis, Van Nostrand.
2. Skoog, D.A., Heller, F.J., Nieman, T.A., Principles of Instrumental Analysis, WB Saunders.
3. Hunson, J.W., ed. Pharmaceutical Analysis, Modern Methods, part A & B, Marcel Dekker.
4. Schirmer, R.E., ed. Modern Methods of Pharmaceutical Analysis, Vols 1, 2. Boca Raton F.L., CRC Press.
5. Ewing's Analytical Instrumentation HandBook. Third Edn.CRC Press,
6. Mann, C.K., et al., Instrumental Analysis Harper & Row.
7. A.Braithwaite and F.J.Smith. Chromatographic Methods, Springer
8. 6. Jaffe, H.H., Orchin M., Theory & Applications of Ultraviolet Spectroscopy, Willy.
9. Silverstein, Spectrometric identification of Organic Compounds, Willy.
10. Bovey, F., Jelinski, L., Miran, P., Nuclear Magnetic Resonance Spectroscopy, Sau: Diego Academic.
11. Stothers, J.B., Carbon-13 NMR.Spectroscopy, Academic.
12. Ardrey, R.E., Pharmaceutical Mass Spectra, Pharmaceutical Press, London.
13. Budzikiewicz, et al., Interpretation of Mass Spectra of Organic Compounds, Holden-Day San Francisco.
14. Beckett and Stenlake, Practical Pharmaceutical Chemistry, CBS.
15. Stahl, E., Thin Layer Chromatography- A laboratory Handbook, Springer-Verlag
16. Giddings, J.C., Principles and Theory- Dynamics of Chromatography, Marcel Dekker.
17. Sethi, P.D., Quantitative Analysis of Pharmaceutical formulations, CBS Publishers, New Delhi.
18. Kemp William, Organic spectroscopy, Pal grave, New York.
19. Kalsi, P.S., Spectroscopy of organic compounds, New age publishers, New Delhi.
20. Gross - Mass Spectrometry
21. WHO - Quality Assurance of Pharmaceuticals, Vol. I, II.

22. Sethi, P.D., HPLC, Quantitative Analysis of Pharmaceutical Formulations, CBS Publishers, Delhi.
23. Sethi, P.D., HPTLC, Quantitative Analysis of Pharmaceutical Formulations, CBS Publishers, Delhi.
24. Haffmann, Chromatography.
25. Sethi and Charcgankar, Identification of Drugs in Pharmaceutical Formulations by TLC.
26. Robert D. Braun, Introduction to Instrumental Analysis.
27. Wilfried, M.A. Niessen- Liquid Chromatography-Mass Spectrometry.
28. Harry G. Brittain, Spectroscopy of Pharmaceutical Solids.
29. George, S., Steroid Analysis in Pharmaceutical Industry.
30. Hoffmann, Mass Spectrometry: Principle and Application.
31. Scott, Techniques and Practice of Chromatography.
32. Wilkins, Identification of Microorganism by Mass Spectrometry.
33. Wu, Handbook for Size Exclusion Chromatography and related Techniques.
34. Van Emon, Jeanette M. Immunoassay and other bioanalytical techniques. CRC Press
35. E.Charel An introduction to Radioimmunoassay and related techniques. Elsevier press.

Modern Pharmaceutical Analysis
(Minimum of 120 Hrs)

Semester - I
Subject Code:-41P1 Sessionals:-30
Periods/Week:- 6 hr Uni. Examination:-70
Examination:-Practical Examination Duration:-6 hr

List of Experiments

1. UV/Visible spectrum scanning of a few organic compounds for UV- absorption and correlations of structures (2 compounds) and isobestic point in case of mixtures.
2. Effect of solvents and pH on UV spectrum of drugs.
3. Estimation of multicomponent formulation by UV- Spectrophotometer in formulations. (2 experiments)
4. Experiments based on the derivatisation spectroscopy.
5. Experiments based on TLC and HPLC (Isocratic and Gradient elution) techniques.
6. Workshop of spectroscopy: (UV, IR, NMR, MASS) structural elucidation of at least 5 compounds. (4 experiments)
7. ELISA Test/ LAL Test based experiments
8. Any other relevant experiments based on theory.

ADVANCED ORGANIC CHEMISTRY
THEORY
(Minimum of 60 Hr)

Semester – I
Subject Code: 41T2 Sessional Exam: 30
Period/Week : 3 hr Uni. Examination: 70
Examination : Theory Exam Duration : 3 hr

I. Stereochemistry of Carbon & Nitrogen Compounds:
(i) Optical Isomerism (due to Asymmetric carbon atoms)
Compounds with one asymmetric carbon atoms, compounds with two or more unequal asymmetric carbon atoms, compounds containing like asymmetric carbon atoms, compounds with asymmetric carbon atoms in branched chains. 2 hr
(ii) Stereo-chemistry of Biphenyls. 2 hr
(iii)Racemic modification: Nature of modifications, formation of racemic modifications, (a) by mixing (b) by synthesis, (c) by racemization and by chemical transformation. 2 hr
(iv)Configuration: Definition, rotation, absolute configuration and relative configuration. 2 hr
(v) Synthesis of optically active compounds : Stereo selective synthesis. 2 hr
(vi) Stereochemistry of Nitrogen compounds 2 hr

II. Study of Reaction mechanisms with at least one application: 10 hr
• Free Radical Reaction: Kinetic characteristics of chain reaction, Structure reactivity relationship. Free radical substitution reaction, free radical addition reaction, Intramolecular free radical reaction, and Rearrangement and fragmentation reactions of free radical.
• Nucleophillic addition to carbonyl group
• Nucleophillic substitution at carbonyl group
• Nucleophillic substitution at carbonyl group with loss of C=O
• Nucleophillic substitution at saturated carbon
• Elimination reactions
• Electrophillic addition to Alkenes.
• Electrophillic Aromatic Substitution

Concerted Pericyclic Reaction**:** Electrocyclic reaction, Sigmatropic reaction, Cycloaddition reaction 4 hr

III. Oxidation & Reduction Reactions: Alcohol to carbonyl using chromium (VI) Oxidants, modified chromium (VI) Oxidants, dimethyl sulfoxide oxidation, Oxidation with other metal derivatives like TPAP, MnO_2 , Oppenauer oxidation, oxidation with silver. 4 hr

• Formation of Phenols & Quinone, Conversion of Alkenes to Epoxide, Conversion of Alkenes to Diols, Bayer-villeger Oxidation, Oxidative bind cleavage using $KMnO_4$, Osmium reagents, Ruthenium reagents and chromium reagents, LTA, Sodium per-iodoate, Oxidation of alkyl or alkenyl fragments, Oxidation of sulphur , Selenium and nitrogen 5 hr

• Reduction with complex metal hydrides, Alkoxy Aluminate reducing agents, Reduction with Boro hydradies, Alkoxy and alkyl Boro hydradies, Borane, aluminum hydride & derivatives, Catalytic hydrogenation, Dissolving metal reductions, Reduction with non-metallic reducing agents. 5 hr

IV. Named Reactions : Acyloin condensation, Allylic rearrangement, Arndt-Eistert reaction, Bayer-villeger rearrangement, Beckmann rearrangement, Bischler Napieralski synthesis, Claisen condensation , Claisen-Schmidt reaction, Dakin reaction, Curtius reaction, Dieck-Mann reaction, Diels–Alder reaction, Fittig reaction, Fries rearrangement, Gabriel synthesis, Hell-Volhard Zelinsky reaction, Knoevenagel reaction, Leuckart reaction , Mannich reaction, Perkin reaction , Pechmann reaction, Pinacol-pinacolone Rearrangement, Reformatsky reaction, Schmidt reaction, Stobbe condensation, Wagner-Meerwein rearrangement. Willgerodt reaction, Wittig reaction, Wolff rearrangement, Suzuki coupling. 20 hr

REFERENCES:

1. Organic Chemistry, Robert Thornton Morrison, Robert Neilson Boyd, Pearson Education, 6th Ed. – 2005.
2. Vogel's Text Book of Practical Organic Chemistry, Pearson Education, 5th Ed. – 2005.
3. Reaction & Reagents, O.P.Agarwal, Goel Pulication, Meerut, 38th Ed.-2004.
4. Stereochemistry of Organic Chemistry, E.L.ELIEL & S.H.WILEN, John Wiley & Sons – 1st Ed. – 2008.
5. Advanced Organic Chemistry, Michael B.Smith & Jerry March, Wiley Inter-Science A John Wiley & Sons, Inc., Publication, 6th Ed. – 2007.
6. Structure & mechanism in Organic Chemistry, C.K.Ingold, CBS Publishers, 2nd Ed. -1994.
7. The Organic Chemistry of Drug Synthesis Vol-I to Vol-6, Lednicer & Mitscher, John Wiley & Sons, 1st ed. – 2005.
8. The Chemistry of Heterocyclic compounds – 3rd Edn., R. Morrin Acheson (2009), Wiley Publications.

ADVANCED ORGANIC CHEMISTRY
PRACTICALS
(Minimum of 120 Hr)

Semester – I

Subject Code: 41P2	Sessional exam: 30
Period/Week : 6 hr	Uni. Examination: 70
Examination : Practicals	Exam Duration : 6 hr

(A minimum of 20 experiments shall be conducted)

1. At least ten named reactions including reactions involving Grignard reagent and Reformatsky
2. At least five oxidation reactions involving different reagents
3. At least five reduction reactions involving different reagents

PHARMACEUTICAL STATISTICS AND COMPUTER APPLICATION
THEORY
(Minimum of 60 Hr)

Semester – I
Subject Code: 41T3 Sessional Exam: 30
Period/Week : 3 hr Uni. Examination: 70
Examination : Theory Exam Duration : 3 hr

Computer Application:

1. Data processing- System analysis and design, Development of Databases useful in Pharmacy Practice. (5hrs)

2. Applications of Computers in Pharmaceutical Sciences, SAP, Drug Information systems , Hospital Information Systems (4hrs)

3. Introduction to Computer programming**:** C language: Constant and string variables, expressions, functions, structures, repetition statements (loops), nested loop, definite and indefinite loop and arrays. Concepts of files. sequential files and random access files, simple program writing for bio-statistical methods. (6hrs)

4. Basics of Bioinformatics, Data mining, Nanotechnology: Software's used Introduction to Neural Networks and its applications. (6hrs)

5. Introduction to Expert Systems, advantages and Components , Pharmaceutical Expert Systems . (5hrs)

6. Computer Modeling and simulation-Applications in Computer aided Drug Design(CADD) (4hrs)

Biostatistics:

7. Hypothesis testing : Types of errors, tests for significance: one-tailed and two tailed tests, t test,, Chi square test- Testing of goodness of fit, testing of independence, Test of homogeneity (5hrs)

8. Probability, Correlation and regression Using Computers (5hrs)

9. Analysis of variance: one way & ,two way classification, F-analysis by coding method, Test statistics (5hrs)

10. Non-parametric tests: The sign test, The Mann-Whitney U test. (4hrs)

11. Statistics in Computing: Statistical data analysis, Quality Control Charts using Computers, Applications of software for Statistical Calculations. (6hrs)

12. Experimental designs: Basic Concepts, Principles Types-CRD,RCD,LSD (Advantages & Disadvantages) (5hrs)

M Pharm Syllabus (Common Paper)
Computer Application and Biostatistics (Practical)

Semester I — Sessional Exam: 30
Subject Code: 41T3 — **Internal Exam: 70**
Examination: Practical — Exam Duration 3hrs
Period/week:2hrs.

1. Designing and development of databases ,information storage and retrieval, report Generation.

2. Statistical data Analysis using statistical software /Data Analysis Tool pack-MS Excel Descriptive statistics, Hypothesis Testing Regression and Correlation Formation of linear regression equation.

3. Sample programs in C**:** Program to calculate simple and complex arithmetic expressions, program using structures, program using loops and nested loops, program using functions and simple programs using arrays.

Reference Books (Theory and Practical)

1. Fundamentals of BIOSTATISTICS: Khan and Khanum, Ukaaz publications.
2. Computer aided Drug design: Thomas Perun,C.L.Propst
3. Biostatistics and computer Applications:Nageshwara Rao and Tiwari
4. Mathematics and Statistics for use in Pharmacy,Biology and Chemistry:Saunders & Flemming
5. Let us "C" by Kanetkar, BPB publications
6. Pharmaceutical Statistics: S. Bolton
7. Computer Applications in Pharmaceutical Research and Development by Sean Ekins
8. Essential Statistics for the Pharmaceutical Sciences by Philip Rowe
9. Computer Applications in Pharmaceutical Sciences by Syed Mohiuddin, A. Venkateshwar Reddy and Azra Sultana. Edited by Irfan Ali Khan and Atiya Khanum, Ukaaz Publications
10. Computer Applications and Practical's: Introduction of software – SPSS/SAS and Practical exercises.
11. Computer Fundamentals, Sinha, R.K. BPB Publications.
12. Computer fundamentals with Pharmacy Applications by N.K.Tiwari
13. Microsoft Office Access – Cary N.Prague, Michael R.Irwin

DRUG REGULATORY AFFAIRS & INTELLECTUAL PROPERTY RIGHTS

THEORY

(Minimum of 60 Hr)

Semester – I

Subject Code: 41T4 — Sessional Exam: 30

Period/Week : 3 hr — Uni. Examination: 70

Examination : Theory — Exam Duration : 3 hr

1. Quality management in the drug industry: philosophy and essential elements, Concept of Total Quality Management, GMP, GLP and GCP — 8 hr
2. W.H.O. certification scheme on the quality of pharmaceutical products. — 3 hr
3. Guidelines on the inspection of pharmaceutical manufacture and drug distribution channels. — 3 hr
4. Drugs Prices Control Order — 3 hr
5. New Drug Policy — 2 hr
6. ISO 9000 and 9002 documentation: Introduction and Support package: Guidance on the terminology used in ISO 9001:2000 and ISO 9004:2000. — 5 hr
7. General Principles of Intellectual Property: Copyright, Trademark Patents: need of patents, major types of patents, patent offices in India, US and Europe, International registration of patents, how patents are obtained for drugs and their impact on industry and patients, patent term and extension The Patents Act, 1970 – Salient features. — 8 hr
8. New Drug Application (NDA): Steps involved in the development of new drug. New Drug applications as per WHO guidelines and abbreviated NDA. Requirement and guidelines on clinical trials. — 5 hr
9. Industrial safety: Industrial hazards due to fire, chemicals, pharmaceuticals, radiation and accidents - mechanical and electrical equipments. Monitoring and prevention systems, Industrial effluent testing, Environment Protection act, Pollution Control — 5 hr
10. Factory act, Consumer Protection Act — 4 hr
11. Stability Studies of Drug substances and Products & Impurity Profiling: ICH guidelines — 8 hr
12. GATT and WTO. GATT –Historical prospectives, fundamental principle, impact on developing countries. WTO – Objectives, Scopes, functions, structure, status, membership And withdrawal, dispute settlement, impact on globulisation, India- task and challenges. — 6 hr

REFERENCES:

1. How to Practice GMPs, P.P.Sharma, Vandana Publication, New Delhi, 5th Ed. –2008.
2. Law Relating to Drugs & Cosmetics, V.Mallick, Eastern Book Company, Lucknow, 19th Ed. – 2007.
3. Quality Assurance – Manual, D.H.Shah, Business Horizon, New Delhi, 1st Ed. – 2007.
4. Willing, S.W., & Stoker, Good Manufacturing Practices for Pharmaceuticals, Marcel Dekker, New York.
5. Guarino, R.A., New Drug Approval Process, Marcel Dekker, New York.
6. Drug & Cosmetic Act.
7. Patents Act.
8. Consumer Protection Act.
9. Environmental Protection Act.
10. Federal Food, Drug & Cosmetic Act.
11. Bansol, IPR Guidelines for Pharm students and Researchers.
12. Pisano-FDA Regulatory Affairs.
13. Phillip W. Grubb, Patents for Chemicals, Pharmaceuticals and Biotechnology.
14. Web-site of ICH

ADVANCED MEDICINAL CHEMISTRY
THEORY
(Minimum of 60 Hr)

Semester – I
Subject Code: 41T5 Sessional Exam: 30
Period/Week : 3 hr Uni. Examination: 70
Examination : Theory Exam Duration : 3 hr

1. Physico-chemical properties in relation to Biological action: 15 hr

Complex events between drug administration and drug action, route of administration, absorption, site of loss (storage site, protein binding, neutral fat), metabolism and excretion, biological activities of Homologous series, drug receptor interactions, isosterism, steric features of drugs, concept of drug receptor, forces involved theories on interaction, selected physico-chemical properties influencing biological action like ionization, hydrogen bonding chelation, oxidation-reduction potential, surface activity, solubility and partition coefficient.
Receptors, their types, location, isolation, Transduction mechanism

2. Metabolism of drugs: 15 hr

Role of cytochrome P-450 monooxygenase in oxidative biotransformation, oxidation of aromatic moieties, olefins, benzylic carbon all cyclic carbon, carbon nitrogen systems, carbon oxygen systems, carbon sulphur systems with examples of drugs, reductive reactions involving aldehydes, ketones, nitro and azo compounds, hydrolytic reactions with examples conjugation pathway with glucoronic acid, glycine, glutamine with specific example, acetylation and methylation of drugs.
Stereo chemical aspects of drug metabolism, production of pharmacologically active metabolites. Relationship of drug metabolism and drug design.

3. Combinatorial chemistry: 15 hr

High through put organic synthesis : Solid phase organic synthesis : Solution phase synthesis ; Library construction strategy: Parallel synthesis, pooled synthesis, Compound design within combinatorial library: Library diversity, controlling Molecular properties.
Looking for leads, Discovery Library : Synthesis of oligomers, efficient constructions, branching strategy, leveraging knowledge, targeted libraries.
The fundamentals of Pharmacophore under lying in combinatorial chemistry.

4. Strategies for synthesis of Candidate Drug: 15 hr

• Target selection
• Retro- synthesis (The disconnection approach, Consecutive versus convergent synthesis)
• Various strategic approaches including **LHASA**
• Strategic bond approach
• Strategic bond in ring approach
• Degradation techniques as a tool for Retro-synthesis.

REFERENCES:

1. Essentials Pharmaceutical Chemistry, Donald Cairns (PhP) Pharmaceutical Press, 3rd Ed. =-2007.
2. Text Book of Medicinal & Pharmaceutical Chemistry, Wilson & Gisvold, Lippincott Williams & Wilkins,10th Ed.
3. Principles of Medicinal Chemistry, William Foye, Lippincott Williams & Wilkins, 5th Ed.
4. Computer Aided Drug Design, T.J.Perun & C.L.Propst, Marcel Dekker, Publisher, 1st Ed.-2007.
5. Medicinal Chemistry & Drug Discovery, Alfred Burger, A.John Wiley & Sons, Inc. Publication, 6th Ed. – 2007.
6. An Introduction to Medicinal Chemistry, Graham L.Patrick Oxford University Press, 3rd Ed. – Reprint 2006.
7. Medicinal Chemistry, V.K.Ahluwalia, Madhu Chopra, "Ane Books India" 1st Ed. – 2008.
8. Fundamentals of Medical Chemistry – G.Thomas, Wiley Publication, 1stEd.–2006.

ADVANCED MEDICINAL CHEMISTRY
PRACTICALS
(Minimum of 120 Hr)

Semester – II
Subject Code: 41P3 — Sessional Exam: 30
Period/Week : 6 hr — Uni. Examination: 70
Examination : Practicals — Exam Duration : 6 hr

(A minimum of 20 experiments shall be conducted)

1. Synthesis of various Barbiturates and determination of pKa value of Barbiturates in relation to their biological activity.
2. Synthesis of local anesthetics and evaluation of their biological activity.
3. Synthesis of some Anticonvulsants (other than Barbiturates) and their evaluation.
4. Synthesis and evaluation of non-narcotic analgesics.
5. Suitable synthesis and the evaluation of drugs based on theory topics.

CHEMISTRY OF NATURAL PRODUCTS

THEORY

(Minimum of 60 Hr)

Semester – II

Subject Code: 41T6 Sessional Exam: 30

Period/Week : 3 hr Uni. Examination: 70

Examination : Theory Exam Duration : 3 hr

1. General methods of isolation and separation of plant constituents. Qualitative reactions employed for the detection of plant constituents. .Application of G.L.C., HPLC and counter current distribution to separation and analysis of plant constituents Determination of Organic structures through Interpretation of - **Infrared spectroscopy**, **H1 N.M.R & C13 N.M.R**, **MASS spectroscopy**. 10 hr

2. Study of biogenesis: The acetate hypothesis, Isoprene rule Biogenetic hypotheses relation to alkaloids. 7 hr

3. Alkaloids: Isolation and study of the constitution of ergot alkaloids, opium alkaloids, atropine and reserpine. 8 hr

4. Steroids: Chemistry and stereo-chemistry of cholesterol. Preparation and chemistry of corticosteroids. 6 hr

5. Glycosides: A general study of glycosides with detailed treatment of cardiac glycosides, Digoxin, Scilarin-A and ovabain. 6 hr

6. Antibiotics: A general study of the chemistry of antibacterial antibiotics, antifungal antibiotics and anti viral antibiotics with detailed treatment of newer semi synthetic penicillins and cephalosporins. 15 hr

7. Vitamins: Detailed study including commercial preparations of vitamin-A, vitamin - C, cyanacobalamin, Nicotinamide, folic acid, thiamine, riboflavine and pyridoxine. 8 hr

REFERENCES:

1. Organic Chemistry Vol.-II – Stereochemistry & the Chemistry of Natural Products, I.L.Finar, Person Education, 5th Ed.-2003.
2. Pharmacognosy Trease & Evans, Elsevier Publication, 15th Ed.-2008.
3. Organic Chemistry of Natural Products Vol.-I, Gurudeep & Chatwal, Himalaya Publishing House, 7th Ed. -2008.
4. Organic Chemistry Natural Product Vol.-I, O.P.Agarwal, Goel Publication Meerut, 36th Ed.-2008.
5. Recent Progress in Medicinal Plants Vol.-I, Singh, Govil, Singh, Sci. Tech., Publication LLC, USA, 1st Ed.-2002.

CHEMISTRY OF NATURAL PRODUCTS
PRACTICALS
(Minimum of 120 Hr)

Semester – II

Subject Code: 41P4	Sessional exam: 30
Period/Week : 6 hr	Uni. Examination: 70
Examination : Practicals	Exam Duration : 6 hr

(A minimum of 20 experiments shall be conducted)

1. Exercise involving the extraction, isolation and separation characterization by modern methods and quantitative estimation of therapeutically important phytoconstituents.
2. Screening of natural products for biological activities mentioned as below:

a) Anti-inflammatory activity
b) Hypoglycemic activity
c) Diuretic activity
d) Cardiac activity
e) Antimicrobial activity
f) Anti-neoplastic activity
g) Psychopharmacological activity
h) Anti-fertility activity.

DRUG DESIGN
THEORY
(Minimum of 60 Hr)

Semester – II
Subject Code: 41T7 Sessional Exam: 30
Period/Week : 3 hr Uni. Examination: 70
Examination : Theory Exam Duration : 3 hr

1) A Revisit to 2-D QSAR: Free- Wilson Model, Fugita- Ban Model, Hansch analysis, Electronic factors, steric factors, & hydrophobic factors. Comparison between Free- Wilson model and Hansch analysis. Molecular Connectivity Index (MCI). 5 hr
2) Recent techniques and applications in Pharmacophore Mapping. 5 hr
3) 3-D QSAR Analysis: Receptor independent 3-D QSAR Analysis, Receptor dependent 3-D QSAR Analysis. 5 hr
4) Receptor pre-organization for activity and its role in identifying Ligand binding sites on Docking molecules into protein binding sites, *de-novo* Ligand design 5 hr
5) Enzyme Inhibitors: A detailed study of the following types of enzyme inhibitors, related drugs and their pharmaceutical significance;
a) P.G.Synthetase (cycloxygenese and lipoxygenase inhibitors)
b) Phosphodiesterase (PDE) inhibitors.
c) Carbonic anhydrase inhibitors.
d) Angiotensin converting enzyme (ACE) Inhibitors
e) Acetyl choline Esterase (AchE) inhibitors. 20 hr
6) Miscellaneous classes of drugs: Recent advances in the following classes of drugs:
a) Proton-pump Inhibitors as antiulcer agents.
b) Immunosuppressive and immunostimulant agents.
c) Antiviral agents
d) Beta – Adrenergic blockers (Beta 1 and Beta 2) 20 hr

REFERENCES:

1. Donald Cairns, Essentials Pharmaceutical Chemistry, (PhP) Pharmaceutical Press, 3rd Ed. (2007)
2. Foye WO " Principles of Medicinal chemistry ' Lea & Febiger.
3. Delgado JN, Remers WA eds " Wilson & Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York.
4. T.J.Perun & C.L.Propst, Computer Aided Drug Design, Marcel Dekker, Publisher, 1st Ed.(2007)
5. Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" John Wiley & Sons, New York.
6. Graham L. Patrick, An Introduction to Medicinal Chemistry, Oxford University Press, 3rd Ed. – Reprint (2006)
7. Ahluwalia VK, Madhu Chopra, Medicinal Chemistry, "Ane Books India" 1st Ed. (2008)
8. Thomas G, Fundamentals of Medical Chemistry –Wiley Publication, 1stEd (2006)
9. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston.
10. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York.
11. Robert GCK,, "Drug Action at the Molecular Level" University Prak Press Baltimore.
12. Martin YC. "Quantitative Drug Design" Dekker, New York.
13. Lien EJ. SAR "Side effects and Drug Design" Dekker, New York.
14. William H, Malick JB " Drug Discovery and Dovelopment" Humana Press Clifton.
15. Korolkovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley Interscience.
16. Ariens EJ " Drug Design" Academic Press New York.
17. Olson EC "Computer Assisted Drug Design" American Chemical Society ACS Symposium Series 112.
18. Roberts SM, Price B.J.Eds. " Medicinal Chemistry. The Role of Organic Chemistry in Drug Research " Academic Press New York.
19. Pope & Perruuns " Computer Aided Drug Design " Academic Press New York.
20. Fischer Janos, Ganellin C. Robin "Analogue-based drug Discovery, Wiley-VCH Verlag Gmb H & Co. KG &A.
21. Pandi, Veerapandian "Structure based drug design New York Marcel Dekker, Inc., 1997.
22. Wermuth GC, "The Practice of Medicinal Chemistry" Second edition, Academic Press, Elsevier

RESEARCH METHODOLOGY
THEORY
(Minimum of 60 Hr)

Semester – II
Subject Code: 41T8 — Sessional Exam: 30
Period/Week : 3 hr — Uni. Examination: 70
Examination : Theory — Exam Duration : 3 hr

1. Research- Meaning of research, purpose of research and types of research (clinical experimental, basic, applied and patent and oriented research) objects of research 5 hr

2. Literature survey: Using library, book and journals, MEDLINE- internet getting patents and reprints of articles as sources for literature survey. 4 hr

3. Selecting a problem and preparing a research proposal for different types of research sources of procurements of grants from ICMR, AICTE, CSIR and such other agencies. 3 hr

4. Documentation:
Importance of documentation in case of research record 3 hr

5. Research report/paper writing/thesis writing / poster presentation:
Different parts of research report or paper
- Title-title of project with authors name
- Abstract-statement of the problem, background in brief, purpose and scope
- Key words
- Methodology-subject, apparatus/instrumentation and procedure
- Results-tables, graphs, figures and statistical presentation
- Discussion-support or non-support to hypothesis. Practical and theoretical implications
- Acknowledgements
- References
- Errata
- Importance of spell check
- Use of foot notes 8 hr

6. Methods and tools used in research: Research design (features of good design, types of research designs, basic principles of experimental design), Qualitative studies, quantitative studies.
6 hr

7. Simple data organization, descriptive data organization.
- Limitations and sources of errors.
- Enquiries in forms of questionnaire, opinionnaire and interviews 9 hr

8. Presentation:

- Importance, types, different skills
- Content of presentation format of model, introduction and endings.
- Posture, gesture, eye contact, facial expression, stage fright.
- Volume, pitch, speed, pauses and languages
- Visual aids and seating arrangements
- Question and answer session 12 hr

9. Protection of patents & trade marks designs & copyrights

The patents system in India, present status of intellectual property rights. Advantages, The Science in law, Qurimetrics (Introduction), What may be patented, who may apply for patents, Preparation of patent proposal registration of patents in foreign countries & vice versa

6 hr

10. Cost analysis of the project – cost incurred on raw materials, Procedure, instrumentations

2 hr

11. Industrial-institution interaction- Industrial projects, their, feasibility reports 2 hr

REFERENCES

1. Research in education – John W. Best Jems V. Kahn
2. Research methodology – C. R. Kothari
3. Methodology and techniques of social research – Willkinson and Bhandarkar
4. Presentation skills – Michel Halton – Indian society for institute education
5. Practical introduction to copyrights – Gavin Mofariane
6. Thesis projects in sciences and engineering – Richard M. Devis
7. Scientist in legal system – Ann Labor Science
8. Thesis and assessment writing – Janolthon Anderson
9. Writing a technical paper – Donald Manzel
10. Effective business report writing – Lel and Brown
11. Protection of industrial property rights – Purshottam Das and Gokul Das
12. Spelling for millions – Edna Furmess
13. Preparation for publications – King Edwards hospital foundation for London
14. Information technology – The hindu speeks
15. Documentation – genesis and development – 3792.
16. Ayurveda and modern medicine – R. D. Lele
17. How to write and publish a scientific paper – Robert A. Day Cambridge
18. University Press 4th edition 1994
19. Lecture notes on patent TIFAC: DOC: 022, TIFAC July 2002.
20. Introduction to Statistical Methods- C. B. Gupta
21. A first course in Mathematical Statistics- C. E. Weatherborn
22. Introduction to Biostatistics-Mahajan

ENTREPRENEURSHIP MANAGEMENT
(Minimum of 20 Hrs)

Semester - II
Subject Code : 41T9 Sessional : --
Periods/week : 1 hr Examination : 50
Nature of Exam: Int Assesment Exam Duration: --

Course Objectives:

- To provide conceptual inputs regarding entrepreneurship management.
- To sensitise and motivate the students towards entrepreneurship management.
- To orient and impart knowledge towards identifying and implementing entrepreneurship opportunities.
- To develop management skills for entrepreneurship management.

Chapter – I:- CONCEPTUAL FRAME WORK 5 hr

- Concept need and process in entrepreneurship development.
- Role of enterprise in national and global economy
- Types of enterprise – Merits and Demerits
- Government policies and schemes for enterprise development
- Institutional support in enterprise development and management

Chapter – II:- THE ENTREPRENEUR 4 hr

- - Entrepreneurial motivation – dynamics of motivation.
- - Entrepreneurial competency – Concepts.
- - Developing Entrepreneurial competencies - requirements and understanding the process of entrepreneurship development, self awareness, interpersonal skills, creativity, assertiveness, achievement, factors affecting entrepreneur'' role.

Chapter – III:- LAUNCHING AND ORGANISING AN ENTERPRISE 5 hr

- - Environment scanning – Information, sources, schemes of assistance, problems.
- - Enterprise selection, market assessment, enterprise feasibility study, SWOT Analysis.
- - Resource mobilisation - finance, technology, raw material, site and manpower.
- - Costing and marketing management and quality control.
- - Feedback, monitoring and evaluation.

Chapter – IV:- GROWTH STRATEGIES AND NETWORKING 4 hr

- - Performance appraisal and assessment
- - Profitability and control measures, demands and challenges
- - Need for diversification
- - Future Growth – Techniques of expansion and diversification, vision strategies
- - Concept and dynamics
- - Methods, Joint venture, co-ordination and feasibility study

Chapter – V:- PREPARING PROJECT PROPOSAL TO START ON NEW ENTERPRISE 2 hr

- Project work – Feasibility report; Planning, resource mobilisation and implementation.

References

1. Akhauri, M.M.P.(1990): Entrepreneurship for Women in India, NIESBUD, New Delhi.
2. Hisrich, R.D & Brush, C.G.(1996) The Women Entrepreneurs, D.C. Health & Co., Toranto.
3. Hisrich, R.D. and Peters, M.P. (1995): Entrepreneurship – Starting, Developing and Managing a New Enterprise, Richard D., Inwin, INC, USA.
4. Meredith, G.G. etal (1982): Practice of Entrepreneurship, ILO, Geneva.
5. Patel, V.C.(1987): Women Entrepreneurship – Developing New Entrepreneurs, Ahmedabad EDII.