

SCHEME OF INSTRUCTION, EXAMINATION AND EVALUATION

Program Code: 884

M. Pharm. (Pharmaceutical Chemistry)

2015 – 16

SEMESTER - I

Course Code	Course Title	Hours /Week			Credits	Marks		Duration of Exam
		L	T	P		Internal	End Exam	
PY.09.884.11.T	Pharmaceutical Analytical Techniques	3	0	-	3	25	75	3
PY.09.888.12.T	Adv. Chemistry of Natural Products	4	0	-	4	25	75	3
PY.09.884.13.T	Adv. Pharm. Organic Chemistry – I	4	0	0	4	25	75	3
PY.09.884.14.T	Advanced Medicinal Chemistry – I	4	0	0	4	25	75	3
PY.09.884.15.T	Drug Design and Development	3	0	0	3	25	75	3
PY.09.884.11.P	Pharmaceutical Analytical Techniques	-	0	4	2	25	75	6
PY.09.888.12.P	Adv. Chemistry of Natural Products	-	0	4	2	25	75	6
					22	175	525	
PY.09.884.10.S	SAIL	1	2	0	2	Grade		
PY.09.884.11.S	Seminar	1	0	2	2	Grade		

SEMESTER - II

Course Code	Course Title	Hours /Week			Credit	Marks		Duration of Exam
		L	T	P		Internal	End Exam	
PY.09.885.21.T	Int. Property Rights & Reg. Affairs	3	0	-	3	25	75	3
PY.09.884.22.T	Adv. Pharm. Organic Chemistry – II	4	0	-	4	25	75	3
PY.09.884.23.T	Advanced Medicinal Chemistry – II	4	0	0	4	25	75	3
PY.09.884.24.T	Drug Screening Methods	4	0	0	4	25	75	3
PY.09.88X.25.T	Elective *	3	0	0	3	25	75	3
PY.09.884.22.P	Adv. Pharm. Organic Chemistry – II	-	0	4	2	25	75	6
PY.09.884.23.P	Advanced Medicinal Chemistry –II	-	0	4	2	25	75	6
					22	175	525	
PY.09.884.20.S	SAIL	1	2	0	2	Grade		
PY.09.884.21.S	Seminar	1	0	2	2	Grade		
* Discipline Centric – Herbal Drug Standardization / Bulk Drug Technology; Open – Research Methodology & Biostatistics								

SEMESTER – III

Course Code	Course Title	Hours /Week	Credits	Marks		Duration in Weeks
				Internal	External	
PY.10.884.31.P	Design Seminar	30	6	50	-	6
PY.10.884.32.P	Progressive Seminar	30	10	50	-	10
		480	16	100		

SEMESTER – IV

Course Code	Course Title	Hours /Week	Credits	Marks		Duration in Weeks
				Internal	External	
PY.10.884.41.P	Pre-Submission Seminar	30	10		50	10
PY.10.884.42.P	Submission and Adjudication	30	12		200	6
PY.10.884.43.P	Final Viva-voce	30	2		50	1
		510	24		300	17

PHARMACEUTICAL ANALYTICAL TECHNIQUES**Scheme of Instruction**

Total Duration	: 60 Hrs.
Hours/Week	: 3 Hrs.
Credits	: 3
Instruction Mode	: Lecture
Course Code	: PY.09.884.11.T

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 3 Hrs.

Course Objectives:

To familiarize students in conventional and modern techniques of analysis used in different areas of pharmacy.

To understand the experimental concepts, the procedures and safety considerations in a quality control lab.

To give training in use of the technique and its applications in day to day practice.

To build on the basics learned at UG level and give latest advances in the area.

Course Outcomes:

By pursuing this course students are prepared for:

- Research and Development
- Food, Bio and Pharma Industries
- Clinical Research and Quality Control Administration

Unit - I :

UV-Visible Spectroscopy: Basic principles, interaction of electromagnetic radiation with matter and its effects (electronic transitions). Concept of chromophore and Auxo-chrome, effect of conjugation, solvent and pH. Instrumentation (components and their significance). Absorption spectra of organic compounds and complexes illustrating the phenomenon and its utilization in qualitative and quantitative studies of drugs including multicomponent analysis. Woodward-Fieser rules for calculating absorption maximum for unsaturated hydrocarbons. Difference and derivative spectra.

Infra-Red Spectroscopy: Interaction of infrared radiation with organic molecules and its effects on bonds. Instrumentation- Dispersive IR spectrophotometers and Fourier transform spectrophotometers. Sample handling for IR spectroscopy. Interpretation of IR spectra. Brief note on ATR. (Attenuated Total Reflectance).

Unit - II :

Nuclear Magnetic Resonance Spectroscopy: Fundamental Principles of NMR, Chemical shifts concept, spin-spin coupling, spin-spin decoupling, shielding, de-shielding, shift reagents and solvents. Signal multiplicity phenomena in high resolution PMR. Interpretation of PMR spectra. Brief introduction about Carbon-13 NMR Spectroscopy.

Mass Spectrometry: Basic principles Mass Spectrometry. Ionization techniques (EI and CI), Mass spectrum and its characteristics, molecular ion, metastable ions, fragmentations; fragmentation processes, Nitrogen Rules, Relative abundances of isotopes and their contribution to characteristic peaks and molecular formula determination.

Unit - III :

Chromatographic Techniques: General Principles, Classification of Chromatographic Methods Thin Layer Chromatography, Paper Chromatography and Column Chromatography and Methods based on Mechanism.

Gas Chromatography: Instrumentation, Column efficiency parameters, derivatization methods, applications in pharmaceutical analysis.

Liquid Chromatography: Principles of HPLC, Instrumentation, Normal and Reversed Phase Packing Materials, Column Selection, Mobile Phase Selection, Efficiency Parameters, Applications in Pharmaceutical Analysis. Chiral Chromatography, Flash Chromatography, and Supercritical Fluid Chromatography (SFC).

Unit - IV :

Electrophoresis: Principles, Instrumentation and Applications of Moving Boundary Electrophoresis Zone Electrophoresis (ZE), Isoelectric Focusing (IEF), Continuous Electrophoresis (Preparative) and Capillary Electrophoresis. SDS Gel Electrophoresis and Blotting Techniques.

Radio immunoassay and ELISA: Principle, instrumentation, applications and limitations.

Unit - V :

X-Ray Spectroscopy: Origin of X-rays, basic aspects of crystals, X-ray crystallography, miller indices, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.

Thermal Analytical Techniques: Principles, Theory and Application of Thermal Analysis (DSC, DTA and TGA)

Books and References:

1. Skoog, DA, Holler, FJ, Crouch, SR. Principles of Instrumental Analysis. 6th ed., Baba Barkha Nath Printers, Haryana, 2007.
2. Silverstein, RM, Webster, FX. Spectrometric identification of organic compounds. 6th ed., John Wiley & Sons (Asia) Pvt. Ltd., Singapore, 2005.
3. William Kemp. Organic spectroscopy, 3rd ed., Palgrave, New York, 2006.
4. Jag Mohan, Organic spectroscopy: Principles and Applications, 2nd ed., Narosa Publishing House Pvt Ltd., New Delhi, 2005.
5. Connors KA. A Text book of pharmaceutical analysis, 3rd ed., John Wiley & Sons, Singapore, 2004.
6. Willard HH, Merritt LL, Dean JA, Settle FA. Instrumental methods of analysis, 7th ed., CBS Publishers & Distributors, New Delhi, 1986.
7. Pavia DL, Lampman GM, Kriz GS, Vyvyan JA. Introduction to spectroscopy. 4th ed., Brookscole publishers, California, 2008.
8. Sharma BK. Instrumental methods of chemical analysis, 25th Ed., Goel Publishing house, Meerut, 2006.
9. Beckett, AH, Stenlake, JB. Practical pharmaceutical chemistry, Part I & II, 4th ed., CBS Publishers & distributors, New Delhi, 2004.
10. Ewing, GW. Instrumental methods of chemical analysis, 5th ed., McGraw Hill Book Company, New York, 1985.
11. Schirmer, RE. Modern methods of pharmaceutical analysis, Vol. I & II, 2nd ed., CRC Press, Florida, 2000.

ADVANCED CHEMISTRY OF NATURAL PRODUCTS**Scheme of Instruction**

Total Duration	: 60 Hrs.
Hours/Week	: 4 Hrs.
Credits	: 4
Instruction Mode	: Lecture
Course Code	: PY.09.888.12.T

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 3 Hrs.

Course Objectives:

To inculcate knowledge of natural products and their medicinal applications.

Course Outcomes:

To develop the ability to effectively apply knowledge of natural products chemistry in development of newer drugs, excipients, their safety and efficacy, in the management of diseases.

Unit - I :

Natural Products as leads for New Drugs: Approaches to discovery and development of natural products; New drugs selection and optimization of lead compounds; Development of antibiotics, CNS, and cardiovascular agents; Extraction of Plant constituents

Unit - II :

Alkaloids: Isolation, classification and General methods of structure elucidation; Opium alkaloids: Morphine-structural elucidation, development of morphine analogues and morphine antagonists; Rauwolfia alkaloids: Reserpine-structural elucidation, structural modifications and therapeutic uses;

Unit - III :

Steroids: Nomenclature and stereochemistry of steroids; Structural elucidation of cholesterol and chemistry of diosgenin; Structural modifications and therapeutic uses of steroidal anti-inflammatory and anti-fertility agents; Chemistry of Cardiac Steroids;

Unit - IV :

Polypeptides and Proteins: General methods of separation of degradation and end group analysis; General methods of synthesis of peptides; Primary, secondary, tertiary and quaternary structure of proteins; Chemistry of insulin; Structural elucidation of thyroxine;

Unit - V :

β -Lactam Antibiotics: Historical account of discovery of Penicillin Formulations and SAR of Cephalosporins.

Anticancer agents of Plant Origin: Instead: Sources, structures, mechanism of action, synthetic analogues and therapeutic uses of Taxol, Camptothecin and Vinca alkaloids

Books and References:

1. Finar IL. Organic Chemistry-stereochemistry and the chemistry of natural products. 5th ed. vol 2. Dorling Kindersley (India) Pvt. Ltd., New Delhi; 2006.
2. Abraham DJ, editor. Burger's medicinal chemistry and drug discovery. 6th ed. vol 1-6, John Wiley & Sons, 2007.
3. Morrison RT, Boyd RN. Organic Chemistry. 6th ed. Delhi: Pearson education Pvt. Ltd., New Delhi; 2003.
4. Pelletier SW. Alkaloids-chemical & biological perspectives. vol 1-15. Pergamon; London: 2001.
5. Alagarsamy V, Pharmaceutical Chemistry of Natural Products, Elsevier: New Delhi: 2012.
6. Steroids by Fischer & Fischer.

7. Evans WC. Treatise and Evans Pharmacognosy. 15th ed. Edinburgh: Saunders. 2004.
8. Ataur Rahman. Chemistry of Natural Products
9. Bhat SV, Nagasampagi BA, Sivakumar M. Chemistry of natural products. Narosa Publishing House; New Delhi: 2005.
10. Agrawal OP. Organic chemistry-natural products. 30th ed. vol 1-2. Meerut: Goel Publishing House; 2006.
11. Wallis TE. Textbook of pharmacognosy. 5th ed. CBS Publishers & Distributors; New Delhi: 2002.
12. Lemke TL, Williams DA, Roche VF, Zito SW. Foye's principles of medicinal chemistry. 6 ed. Wolters Kluwer/ Lippincott Williams & Wilkins. New Delhi: 2008.
13. Block JH, Beale JM, editor. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry. 11th ed. Lippincott Williams & Wilkins; Baltimore: 2004.
14. Murray RK, Granner DK, Mayes PA, Rodwell VW. Harper's Illustrated biochemistry. 26th ed. Mc Graw Hill, New Delhi: 2003.
15. Remington: The Science and Practice of Pharmacy. 21st ed., Vol. I & II, Lippincott Williams & Wilkins, New Delhi, 2005.

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ADVANCED PHARMCEUTICAL ORGANIC CHEMISTRY - I**Scheme of Instruction**

Total Duration	: 60 Hrs.
Hours/Week	: 4 Hrs.
Credits	: 4
Instruction Mode	: Lecture
Course Code	: PY.09.884.13.T

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 3 Hrs.

Course Objectives:

To inculcate knowledge of basics of organic chemistry, reaction mechanisms, techniques of organic synthesis, and their application in drug development.

Course Outcomes:

To develop the ability to effectively apply knowledge of organic chemistry and reaction mechanisms in the synthesis of medicinal products.

Unit - I :

Stereochemistry: Stereoisomerism; Elements of symmetry (Plane of symmetry, Centre of Symmetry, Axis of Symmetry and Alternating Axis of Symmetry); D, L and R, S – Nomenclature and sequence rules; Kinds of molecules displaying optical activity; Cis/Trans, E-Z isomerism in alkenes, monocyclic and fused ring systems; Stereochemistry of biphenyls, allenes and spiranes; Racemic modifications and methods of resolution of racemic mixtures;

Unit - II :

Reactive Intermediates: Structure, generation, stability and reactivity of Free radicals, Carbo-cations, Carbanions, Carbenes, Nitrenes and Nitrenium ions;

Unit - III :

Mechanisms of Organic Reactions: Addition and Substitution Reactions for Electrophilic; Nucleophilic and Free Radical Reagents; Elimination Reactions (E^1 , E^2 and E^{1cb} Mechanisms);

Unit - IV :

Synthetic Reagents and their Applications: Lead Tetra Acetate (LTA) and Osmonium Tetraoxide; N-Bromo Succinamide (NBS); Lithium Aluminum Hydride and Sodium Boro-Hydride; Di-Cyclohexyl Carbodimide (DCC), and 2,3-Dichloro-5,6-Dicyano-1,4-Benzo-Quinone (DDQ)

Unit - V :

Rearrangement Reactions: Carbon to Carbon Migration: Wagner-Meerwin, Pinacol-Pinacolone and Benzil-Benzilic Acid Rearrangements; Carbon to Nitrogen Migration: Hoffmann, Curtius, and Beckmann and Lossen Rearrangement; Carbon to Oxygen Migration: Bayer-Villiger Rearrangement and Rearrangement of Hydroperoxides; Aromatic Rearrangements - Fries Rearrangement;

Books and References:

1. Carey FA, Sundberg RJ. Advanced organic chemistry. Part- B: Reactions and synthesis. 5th ed. New York: Springer; 2007.
2. Eliel EL, Wilen SH. Stereochemistry of organic compounds. Delhi: John Wiley & Sons; 2008
3. March J. Advanced organic chemistry: reactions, mechanisms and structures. 4th ed. Singapore: John Wiley & Sons; 2003.
4. Finar IL. Organic Chemistry. 5th ed. vol 1. Delhi: Dorling Kindersley (India) Pvt. Ltd; 2006.

5. Finar IL. Organic Chemistry-stereochemistry and the chemistry of natural products. 5th ed. vol 2. Delhi: Dorling Kindersley (India) Pvt. Ltd; 2006.
6. Clayden J, Greeves N, Warren S, Wothers P. Organic chemistry. Delhi: Oxford University Press; 2001.
7. Carruthers W. Modern methods of organic synthesis. 4th ed. Delhi: Cambridge University Press; 2007.
8. Ege S. Organic chemistry. 3rd ed. Delhi: A.I.T.B.S. Publishers & Distributors; 1999.
9. Morrison RT, Boyd RN. Organic chemistry. 6th ed. New Delhi: Pearson Education; 2007.
10. Skyes P. A guided book to mechanism in organic chemistry. 6th ed. Delhi: Pearson Education; 2006.
11. Loudon GM. Organic chemistry, 4th ed. India: Delhi: Oxford University Press; 2006.
12. Mc Murry J. Organic chemistry, 5 ed. Singapore: Thomson Asia Pte Ltd; 2001.
13. Gallego MG, Sierra M.A. Organic reaction mechanisms. Delhi: Rajkamal Electric Press; 2007.
14. Fergusson LN. Textbook of organic chemistry. 2nd ed. New Delhi: East-West Press Private Limited; 2008.
15. Patrick G. Organic chemistry. New Delhi: Viva Books Private Limited; 2000.
16. Macomber R. Organic chemistry, 1st ed. Vol I. New Delhi: Viva Books private Limited; 2002.
17. Roland EL, Alan PM. Orbital symmetry: a problem solving approach, New York: Academic Press.
18. Ahluwalia VK. Organic reaction mechanisms, 3rd ed. Kolkata: Narosa Publishing house; 2007.
19. Nasipuri. Stereochemistry. New Delhi: New Age International (P) Ltd Publishers.

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ADVANCED MEDICINAL CHEMISTRY - I**Scheme of Instruction**

Total Duration	: 60 Hrs.
Hours/Week	: 4 Hrs.
Credits	: 4
Instruction Mode	: Lecture
Course Code	: PY.09.884.14.T

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 3 Hrs.

Course Objectives:

To inculcate knowledge of synthetic medicinal compounds, their mechanisms of action and safety.

Course Outcomes:

To develop the ability to effectively apply knowledge of synthetic medicinal products in development of newer drugs, their safety and efficacy.

Unit - I :

Chiral Drugs: Chirality and the importance of chiral drugs; Techniques for preparing chiral drugs (Chirality pool, enzymatic transformation and asymmetric synthesis); Role of Chirality in selective and specific therapeutic agents; Enantio selectivity in drug absorption, metabolism, distribution and elimination;

Unit - II :

Principles of Drug Metabolism: Enzymes responsible for biotransformation; Microsomal and non-microsomal mechanisms; Phase-I and phase-II bio-transformations; Factors influencing bio-transformations;

Unit - III :

Anti - Viral Agents: Structure and life cycle of virus and viral diseases; Antiviral agents used against DNA virus - herpes, chicken pox; Antiviral agents used against RNA virus - HIV, influenza;

Unit - IV :

Chemotherapy of Cancer: Molecular biology of cancer and types of cancer; SAR and mechanism of action of alkylating agents and antimetabolites; Antitumor antibiotics; Drug resistance in cancer chemotherapy; Novel targets and recent developments in cancer therapy;

Unit - V :

Therapeutic Agents: Targets, Therapeutic approaches, Mechanism of Action of Synthetic Analogues and their SAR of the following Therapeutics - Anti-ulcer drugs; Lipid lowering Agents; Anti-angiogenesis Agents; Antihypertensive drugs;

Books and References:

1. Abraham DJ, editor. Burger's Medicinal Chemistry and Drug Discovery, 6th Ed. Vol 1-6. John Wiley & Sons; New Jersey: 2007.
2. Hansch C, editor. Hansch's Comprehensive Medicinal Chemistry, Raj kamal Electronic Press; Delhi: 2005.
3. Silvermann RB. The Organic Chemistry of Drug Design and Drug Action. 2nd ed. Academic press (Elsevier); London: 2004.
4. Ariens EJ, editor. Drug Design vol. I-X.: Academic Press; Noida 2009.
5. Lednicher D, Mitscher LA, The Organic Chemistry of Drug Synthesis, Volume-1-6.: A Wiley-Interscience Publication; New York; 2005.
6. Alagarsamy V, Text Book of Medicinal Chemistry, Elsevier; New Delhi; 2010.
7. Roth HJ, Kleemann A. Pharmaceutical Chemistry. Vol-I. Drug synthesis. Ellis Harwood Ltd; New York; 1988.

8. Lemke TL, Williams DA, Editor. Foye's Principles of Medicinal Chemistry. 6th Ed. Wolters Kluwer and Lippincott Williams & Wilkins; New Delhi: 2008.
9. Gyorgy K, Istvan T. Molecular Path Mechanisms and New Trends in Drug Research. Taylor & Francis; NY; 2003.
10. Andrejus K. Essentials of Medicinal Chemistry. 2nd ed. John Wiley & Sons; New Delhi: 1988.
11. Testa B, Jenner P. Drug Metabolism: Chemical and Biochemical Aspects, Marcel Dekker; New York: 1976.
12. William AP. Strategies of Drug Design: A Guide to Biological Activity, John Wiley & Sons, NY; 1973.
13. Block JH, Beale JM, editor. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry. 11th ed. Lippincott Williams & Wilkins; Baltimore: 2004.
14. Remington: The Science and Practice of Pharmacy. 21st ed., Vol. I & II, Lippincott Williams & Wilkins, 2005.
15. Purcell, Strategies of Drug Design.

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DRUG DESIGN AND DEVELOPMENT**Scheme of Instruction**

Total Duration	: 60 Hrs.
Hours/Week	: 3 Hrs.
Credits	: 3
Instruction Mode	: Lecture
Course Code	: PY.09.884.14.T

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 3 Hrs.

Course Objectives:

To inculcate knowledge of various software used for synthetic medicinal products

Course Outcomes:

To develop the ability to effectively apply knowledge of synthetic medicinal products in development of newer drugs, their safety and efficacy.

Unit - I :

Introduction to Drug Design: Concept, Lead Discovery Physicochemical Properties in Relation to Biological Action;

Receptors and Genesis of New Drugs: Types of receptors; Forces involved in drug-receptor interactions; Theories of drug-receptor interactions; Topographical and stereo chemical considerations; Discovery of drugs from natural origin; Serendipity, random and non-random screening of drugs; Bio-isosterism concept and molecular modification approaches in genesis of drugs;

Unit - II :

Rational Drug Design: Types of Rational drug design, Rational drug design techniques; QSAR descriptors: hydrophobicity, electronic effects, steric factors, molar refractivity, verloop steric parameter; Hansch analysis, Free-Wilson approach and Topliss scheme; 2D and 3D QSAR and molecular graphics in drug design; Drug development-cimetidine;

Unit - III :

Molecular Modeling and Docking: Molecular mechanics: Energy minimization, force field calculations and molecular dynamic simulations; Quantum mechanics: Quantum chemical calculations and applications; Modeling ligands for known and unknown receptors; Molecular docking approaches and scoring techniques; Molecular docking applications;

Unit - IV :

Combinatorial Chemistry- Introduction, Solid Phase Synthesis, Liquid Phase Synthesis, Methods of Parallel and Mixed Combinatorial Synthesis, Deconvolution and High Throughput Screening; De-convolution techniques, tagging and photolithography; Planning, designing and limitations of combinatorial synthesis; Dynamic combinatorial chemistry; Applications of combinatorial chemistry

Unit - V :

Homology Modeling: Biological databases; Sequence alignment methods (pair wise and multiple sequence); Phylogenetic analysis; Homologymodeling algorithms, scoring systems; 3D structure prediction and evaluation;

Text Books and References:

1. Abraham DJ, editor. Burger's Medicinal Chemistry and Drug Discovery, 6th ed. Vol 1-6. New Jersey: John Wiley & Sons; 2007.
2. Lemke TL, Williams DA, editor. Foye's principles of medicinal chemistry. 6th ed. New Delhi: Wolters

- Kluwer and Lippincott Williams & Wilkins; 2008.
3. Ariens EJ, editor. Drug design vol. I-X. Noida: Academic Press; 2009.
 4. Hansch C, editor. Hansch's comprehensive medicinal chemistry, Delhi: Rajkamal Electronic Press; 2005.
 5. Silvermann RB. The organic chemistry of drug design and drug action. 2nd ed. London: Academic press (Elsevier); 2004.
 6. Gyorgy K, Istvan T. Molecular pathomechanisms and new trends in drug research. New York: Taylor & Francis; 2003.
 7. Thomas Nogard. Medicinal chemistry. A biochemical approach. Oxford University Press.
 8. Patrick GL. An introduction to medicinal chemistry. 3rd ed. New Delhi: Oxford University Press; 2006.
 9. Block JH, Beale JM, editor. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry. 11th ed. Baltimore: Lippincott Williams & Wilkins; 2004.
 10. Hilisch A, Hilgenfeld R, editors. Modern methods of drug discovery, Basel-Boston-Berlin: Birkhauser verlag; 2003.
 11. Jhoti H, Leash AR, editors. Structure based drug discovery, Dordrecht, The Netherlands: Springer; 2007.
 12. Perun TJ, Propst CL, editors. Computer-Aided drug discovery, New York: Marcel Dekker INC; 1989.
 13. Butinck P, De Winter H, Langenaekar W, Tollenaere JP, Computational Medicinal chemistry for drug discovery, New York: Marcel Dekker INC; 2009.
 14. Buchler L, Rastidi HH, Bioinformatics basics, Boca Raton: Taylor & Francis, CRC press; 2009.
 15. Mount DW, Bioinformatics, sequence and genome analysis, 2nd ed. New Delhi: CBS publishers and distributors; 2005.
 16. Rastogi SC, Mendiratta N, Rastogi P, Bioinformatics, concepts, skills & applications, New Delhi: CBS publishers and distributors; 2004.

PHARMACEUTICAL ANALYTICAL TECHNIQUES**Scheme of Instruction**

Total Duration	: 60 Hrs.
Hours/Week	: 4 Hrs.
Credits	: 2
Instruction Mode	: Practical
Course Code	: PY.09.884.11.P

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 6 Hrs.

Course Objectives:

To make students familiar with the principles of modern analytical techniques and application of analytical instruments in pharmacy.

Course Outcomes:

At the end of the course, the student will be able to understand the fundamental concept of modern analytical techniques, which is important for qualitative as well as quantitative analysis of drug substances and drug product.

List of Experiments :

1. UV/Visible spectrum scanning of a few organic compounds for UV- absorption and correlations of structures (5 compounds) and isosbestic point in case of mixtures.
2. Effect of solvents and pH on UV spectrum of drugs (2 experiments).
3. Estimation of multicomponent formulation by UV- Spectrophotometer in formulations. (2 experiments).
4. Experiments based on the application of derivative spectroscopy. (2 experiments).
5. Experiments based on HPLC (Isocratic and Gradient elution) techniques. (2 experiments).
6. Interpretation of drugs by IR spectra.
7. Workshop of spectroscopy: (UV, IR, NMR, MASS) structural elucidation of at least 5 compounds (4 experiments).
8. Separation of protein drug substances by electrophoresis.
9. Any other relevant experiments based on theory.

Books and References:

ADVANCED CHEMISTRY OF NATURAL PRODUCTS

Scheme of Instruction

Total Duration	: 60 Hrs.
Hours/Week	: 4 Hrs.
Credits	: 2
Instruction Mode	: Practical
Course Code	: PY.09.884.12.P

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 6 Hrs.

Course Objectives:

To explore the knowledge of natural product chemistry including the extraction techniques, identification tests and separation techniques of various phytoconstituents

Course Outcomes:

Upon completion of the course, the student shall be able to

- Know the techniques of extraction, identification, separation and structural elucidation of compounds.
- Apply the knowledge of natural products chemistry in the synthetic derivatives of the same

List of Experiments:

1. Isolation and Characterization of the following Natural Products
 - a. Piperine from Black Pepper
 - b. Hesperidine from Orange Peel
 - c. Strychnine from Nux Vomica Seeds
 - d. Curcumin from Turmeric Powder
 - e. Lycopene from Tomatoes
 - f. Myristicin and Trimyristicin from Nutmeg
 - g. Tannic Acid from Myrobalan
 - h. Isolation of Casein from Milk
 - i. Lysozyme from Albumen
2. Extraction and Estimation of Carvone from Caraway Seeds
3. Separation of Natural Products through Column Chromatography
4. Degradation and Characterization of Degradation Products
 - a) Piperine
 - b) Atropine
 - c) Caffeine
5. Any other Relevant Experiments based on Theory

Books and References:

1. Raphael I, Natural Products: A Laboratory Guide, 2nd Ed. Elsevier; New Delhi, 2005
2. Kokate C.K., Practical Pharmacognosy, Vallabh Prakashan; New Delhi
3. Khadelwal K.R., Practical Pharmacognosy, Nirali Prakashan; Pune
4. Rangari V.D., Pharmacognosy and Phytochemistry Part-II, Career Publications; New Delhi, 2004
5. Qadry J.S Shah, Qadry's Pharmacognosy, 12th Ed. B.S. Shash Prakashan; Ahmedabad, 2005

INTELLECTUAL PROPERTY RIGHTS & REGULATORY AFFAIRS**Scheme of Instruction**

Total Duration	: 60 Hrs.
Hours/Week	: 3 Hrs.
Credits	: 3
Instruction Mode	: Lecture
Course Code	: PY.09.885.21.P

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 3 Hrs.

Course Objectives:

To make students familiar with the fundamental principles of IPR and Drug Regulatory Affairs

Course Outcomes:

On completion of the course the student would understand the principle and importance of IPR and Drug Regulatory Affairs in the Competitive World.

Further to familiarize with Safety and Pollution Control Regulations in addition to Other Product Regulations and Sustainable Development Principles.

Unit - I :

Intellectual Property Rights (IPR): Objectives, types of IPR, Patents-advantages, types, criteria, inventions – patentable, Impact on Pharmaceutical Industry, copyrights-types rights, trademarks-functions, types, geographical indications-significance, types, industrial designs, and trade secrets.

India Patents Act, 1970, Amendments, 1999, 2002, 2005, stages of patenting, patent opposition (Post Grant), maintaining the patent rights – Conditions, patent information – search and sources

Unit - II :

International Patent Filing Procedures – Requirements for patenting, utility, novelty non-obviousness, patent specification & claims, patent infringement and doctrine of equivalents, federal circuit and patent system.

International Organizations and Agreements – IPR: General Agreement on Tariffs and Trade (GATT)- Historical perspectives, objectives and impact, World Trade Organization (WTO)- scope, functions, structure, withdrawal of membership, dispute settlement, World Intellectual Property Organization (WIPO) - objectives and programs, Paris Convention – background, scope, impact, Berne Convention, TRIPS Agreement-scope general features, specific features, The Doha Declaration, Patent Cooperation Treaty (PCT), Madrid Protocol.

Unit - III :

ICH – Guidelines: Harmonization Efforts, Basic Principles (Quality, Safety and Efficacy), ICH Q11 (Quality Management Systems); Common Technical Document (CTD) and Generic Drug Products.

WHO – Guidelines: Sampling Operations

PICS Guidelines: Basic Requirements of Medicinal Products and API's

OECD Guidelines: Clinical Studies

US-FDA: Orange Book, FDA Guidelines on Investigational New Drugs (IND), New Drug Applications (NDA).

Unit - IV :

Regulatory Affairs: Indian Context - Drugs and Cosmetics Act 1940 and Rules 1945 with reference to Schedule M, U and Y. Drug Regulatory Controls and Authorities;

Important Regulations: Import and Export of Drugs; Preparation and Submission of Marketing Application of India, US and Europe; Approval and Appeals Present and Issues of Confidentiality.

Unit - V

Industrial Safety Regulations: Industrial Development & Regulation Act 1951, Industrial Hazards – Mechanical, Electrical, Chemical and Pharmaceutical (MSDS Preparation), Industrial Safety - Plant, Gas, Dust, Fire and Explosion, Safety Management. Monitoring & Prevention Systems,

Pollution Control Regulations: Pollution Control Act; Industrial Effluent Testing & Treatment. Control of Environmental Pollution, Water and Solid Waste in Formulation, Synthetic and Fermentation Plants.

Other Product Regulations: Prevention of Food Adulteration Act 1954; Consumer Protection Act

Sustainable Development: 10 Principles Bench Marked against leading International Standards;

Books and References:

1. Guarino RA. New Drug Approval Processes, 4th ed., Vol 139, Marcel Dekker Inc., New York, 2004.
2. Willing SH. Good Manufacturing Practices for Pharmaceuticals. 5th ed., vol 109, Marcel Dekker Inc., New York, 2001.
3. Das P, Das G. Protection of Industrial Property Rights.
4. Treece DJ. Managing Intellectual Capital: Organizational, Strategic and Policy Dimension. Oxford University Press, England. Latest Edition.
5. Wadedhra BL. Law Relating to Patents, Trademarks, Copyright Design and Geographical Indications. Universal Law Publishing, New Delhi. Latest Edition.
6. Bansal P. IPR Handbook for Pharma Students and Researchers, Pharma Book Syndicate, Hyderabad. Latest Edition.
7. Katju SN. Laws and Drugs. Law Publishers.
8. Original Laws Published by Government of India.
9. Hussain. Law of Drugs in India.
10. Regulatory Guidelines Related to GMP by
 - a. Australian code of GMP for medicinal products, 16th Aug. 2002.
 - b. 21 Code of Federal Regulation, parts 210, 211 & 58. (US-FDA Guidelines)
 - c. MHRA, UK Guidelines on GMP
 - d. GMP Guidelines by Medicines Control Council of South Africa
 - e. Schedule M of D & C Act
11. WHO Guidelines: Quality Assurance of Pharmaceuticals – A Compendium of Guidelines and Related Materials – Vol. 2; WHO 2007;
12. GMP Guidelines (Websites: www.fda.org; www.wipo.int; www.ich.org; www.cder.org)
13. PICS Guidelines (Website: <http://www.picscheme.org/>)
14. Information on Orange Book [website: www.fda.gov/cder/ob/default.html].
15. Relevant OECD Guidelines (Website: <http://www.ingentaconnect.com/content/oecd/16073/2001/00000001/00000004>)
16. Subrahmanyam CVS, Thimma Setty J Pharmaceutical Regulatory Affairs, Vallabha Prakashan, Delhi 2012.

ADVANCED PHARMACEUTICAL ORGANIC CHEMISTRY - II**Scheme of Instruction**

Total Duration	: 60 Hrs.
Hours/Week	: 4 Hrs.
Credits	: 4
Instruction Mode	: Lecture
Course Code	: PY.09.884.13.T

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 3 Hrs.

Course Objectives:

To inculcate knowledge of advances in applications of synthetic reagents and synthetic strategies, approaches for synthesis of heterocyclics, specific applications named reactions in drug development.

Course Outcomes:

To apply the knowledge and skills of synthetic organic chemistry and reaction mechanisms in the in drug development.

Unit - I :

Reaction Mechanism and Applications: Claisen Ester Condensation; Mannich Reaction; Micheal Addition; Reformatsky Reaction; Perkin Reaction; Birch Reduction; Sharpless Epoxidation;

Unit - II :

Heterocyclic Chemistry: Synthetic Approaches for Building Heteroaromatic Fused Ring Systems (Benzofuran, Benzothiaphene, Benzisoxazole, Benzthiazole, Benzimidazole, Indole, Quinoline, Benzazepine, Quinazoline, Phthalazine, Benzodiazepine, Chromone), Diazines and Triazines (6 - Membered Heterocycles), Azoles (5 - Membered Heterocycles.);

Unit - III :

Pericyclic Reactions: Electrocyclic, Cycloaddition and Sigmatropic Reactions; Molecular Orbitals of Ethene, 1,3-Butadiene and 1,3,5-Hexatriene and their Symmetry Properties, Mechanism of Pericyclic Reactions - Frontier Molecular Orbital Theory, Huckel-Mobius Theory, Woodward Hoffmann Rules; Applications of Pericyclic Reactions - Claisen Rearrangement and Cope Rearrangement;

Unit - IV :

Synthetic Strategies: Disconnection Approach; Consecutive vs Convergent Synthesis; Strategic Approaches in Retro Synthesis; Strategic Bond Approach-Preliminary Scan; Criteria in Disconnection of Strategic Bonds; Identifying Strategic Bonds in Rings;

Unit - V :

Scale up Process for the Pharmaceuticals: Selection, Development and Scale up, Optimization of Synthetic Routes; Yield Improvement, Investigative Approach and Streamlining the Process; Principles and Applications of Green Chemistry; Phase Transfer Catalysis: Principles and Applications;

Books and References:

1. Carruthers W, Coldham I. Modern Methods of Organic Synthesis. 4th Ed. Cambridge University Press; New Delhi: 2007.
2. Clayden J, Greeves N, Warren S, Wothers P. Organic Chemistry. Oxford University Press; New Delhi: 2001.
3. Carey FA, Sundberg RJ. Advanced Organic Chemistry. Part- B: Reactions and Synthesis. 5th Ed. Springer; New York: 2007.

4. Mackie RK. A guide book to Organic Synthesis.: Prentice Hall Pvt. Ltd; New Jersey; 1977.
5. Wuts PGM, Greene TW. Greene's Protective Groups in Organic Synthesis. 4th Ed. John Wiley & Sons; New Jersey; 2007.
6. Smith MB. Organic Synthesis. 2nd Ed. Tata McGraw Hill Publishing New Delhi; 2002.
7. Patrick G. Organic Chemistry. Viva Books Private Limited; New Delhi: 2000.
8. Hansals VAS. Green Chemistry.
9. March J. Advanced Organic Chemistry: Reactions, Mechanisms and Structures. 4th Ed. John Wiley & Sons; Singapore: 2003.
10. Finar IL. Organic Chemistry. 5th Ed. Vol 1. Dorling Kindersley (India) Pvt. Ltd; New Delhi: 2006.
11. Morrison RT, Boyd RN. Organic Chemistry. 6th Ed. Pearson Education; New Delhi: 2007.
12. Skyes P. A Guided Book to Mechanism in Organic Chemistry. 6th Ed. Pearson Education; New Delhi: 2006.
13. Roth HJ, Kleemann A. Pharmaceutical Chemistry. Vol-I. Drug Synthesis. Ellis Horwood Ltd; New York: 1988.
14. Groggins PH. Unit Process in Organic Synthesis. 5th Ed. Tata McGraw Hill Publishing New Delhi; 2004.
15. Hillish A, Hilgenfeld R, editor. Modern Methods of Drug Discovery. Berkhauser Verlag; Berlin: 2003.
16. Ahluwalia VK, Kidwai M, New Trends in Green Chemistry, 2nd Ed, Ananya Publishers; New Delhi: 2007.

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ADVANCED MEDICINAL CHEMISTRY - II**Scheme of Instruction**

Total Duration	: 60 Hrs.
Hours/Week	: 4 Hrs.
Credits	: 4
Instruction Mode	: Lecture
Course Code	: PY.09.884.14.T

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 3 Hrs.

Course Objectives:

To inculcate knowledge of synthetic medicinal compounds, their mechanisms of action and safety.

Course Outcomes:

To develop the ability to effectively apply knowledge of synthetic medicinal products in development of newer drugs, their safety and efficacy.

Unit - I :

Design and Application of Prodrugs: Prodrug Concept, Choice and Function of Pro-moiety, Bio-reversible Derivatives for various Functional groups, Applications of the Prodrug Approach; Targeted Prodrugs

Unit - II :

Design and Application of Soft Drugs: Soft Drug concept, Soft Analogues, Active metabolite based Soft Drugs, Inactive metabolite based Soft Drugs, Activated Soft Compounds, Natural Soft Drugs, Applications of the Soft Drug Approach.

Unit - III :

Rational Design of Enzyme Inhibitors: Cyclooxygenase and Lipoxigenase Inhibitors; Phosphodiesterase (PDE) Inhibitors; HMG Co A Reductase Inhibitors; Angiotensin Converting Enzyme (ACE) Inhibitors; Carbonic Anhydrase Inhibitors;

Unit - IV :

Anti-tubercular Agents: Targets, Therapeutic Approaches, Mechanism of Action; Synthesis, Structural Activity Relationship and Metabolic Consideration of Drugs;

Anti-malarial Agents: Life cycle, Targets, Therapeutic Approaches; Mechanism of Action; Synthesis, Structural Activity Relationship and Metabolic consideration of Different Classes of Drugs;

Unit - V :

Therapeutic Approaches: Targets, Mechanism of Action, Synthesis, Structural Activity Relationship and Metabolic consideration of Drugs used in Alzheimer and Parkinsonism Therapy.

Books and References:

1. Abraham DJ, editor. Burger's Medicinal Chemistry and Drug Discovery, 6th Ed. Vol 1-6, John Wiley & Sons; New Jersey: 2007.
2. Lemke TL, Williams DA, editor. Foye's Principles of Medicinal Chemistry. 6th Ed. Wolters Kluwer and Lippincott Williams & Wilkins; New Delhi: 2008.
3. Ariens EJ, editor. Drug Design vol. I-X. Academic Press; Noida: 2009.
4. Purcell, Strategy of Drug Design.
5. Hansch C, editor. Hansch's Comprehensive Medicinal Chemistry, Rajkamal Elec. Press; New Delhi: 2005.
6. Alagarsamy V, Text Book of Medicinal Chemistry, Elsevier: New Delhi: 2010.
7. Silvermann RB. The Organic Chemistry of Drug Design and Drug Action. 2nd Ed. Academic Press (Elsevier); London: 2004.

8. Smith & Williams. Introduction to Principles of Drug Design; Harwood Academic Press.
9. Gyorgy K, Istvan T. Molecular Path Mechanisms and New Trends in Drug Research. Taylor & Francis; NY; 2003.
10. Thomas Nogardy. Medicinal chemistry. A Biochemical Approach. Oxford University Press.
11. Patrick GL. An introduction to Medicinal Chemistry. 3rd Ed. Oxford University Press; New Delhi:2006.
12. Andrejus K. Essentials of Medicinal Chemistry. 2nd Ed. John Wiley & Sons; New Delhi: 1988.
13. William AP. Strategies of Drug Design: A Guide to Biological Activity, John Wiley & Sons, 1973.
14. Block JH, Beale JM, editor. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry. 11th Ed. Lippincott Williams & Wilkins; Baltimore: 2004.
15. Roth HJ, Kleemann A. Pharmaceutical Chemistry. Vol-I. Drug Synthesis. Ellis Harwood Ltd; New York.; 1988.

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DRUG SCREENING METHODS

Scheme of Instruction

Total Duration	: 60 Hrs.
Hours/Week	: 4 Hrs.
Credits	: 4
Instruction Mode	: Lecture
Course Code	: PY.09.884.24.P

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 3 Hrs.

Course Objectives:

This course offer practical advantages in fine-tuning the understanding of various drug screening techniques by using various Bioassay Methods.

Course Outcomes:

Upon completion of the course the student shall be able to,

- Describe the various newer screening methods involved in the drug discovery process.
- Learn the applicability and importance of bioassays in preclinical research.
- Appreciate and correlate the preclinical data to humans.

Unit - I :

Design of Experiment: Principles of Randomization, Replication and Local Control, Completely Randomized Block of the Above Designs in Pharmaceutical Research, Statistical Quality Control, Process Control, Control Charts, Acceptance Sampling - Sampling Plans.

Unit - II :

High throughput Screening: Introduction, Bioassay Design, and Screen Construction-Assay Design, Assay Construction, Homogenous and Non-homogeneous Biochemical Assays and Cellular Assays.

Unit - III :

Bioassay: Different Types: Dose Effect Relationships, Calculation of LD₅₀, ED₅₀ - Probit Analysis.

Unit - IV :

In vivo Screening Methods: Antihypertensive, Antiarrhythmic, Cardiotonic, and Anticancer and Diuretic Drugs.

Unit - V :

In vivo Screening Methods: Analgesic, Anti-inflammatory, Antiepileptic, CNS Depressants, Antidiabetic, Antifertility and Antiulcer Drugs.

Books and References:

1. Abraham DJ, Burger's Medicinal Chemistry and Drug Discovery, 6th Ed. vol 1- 6. John Wiley & Sons; NJ: 2007.
2. Vogel. WH. Drug Discovery and Evaluations-Pharmacological Assays. 2nd Ed. Springer; Germany: 2002.
3. Seethala R, Fernandes PB. Hand Book of Drug Screening. CBS Publishers & Distributors; New York: 2008.
4. Lewis AE. Biostatistics, 2nd ed. Reinhold Publishers Corporation; New York: 1984.
5. Alder HL, Roessler EB. Introduction to Probability and Statistics. 12th Ed.: WH. Freeman; SF 2006.
6. Gupta SC, Kapoor VK. Fundamentals of applied statistics. 4th ed. Sultan Chand and sons; New Delhi: 2007.
7. Saunders and Fleming. Mathematics and Statistics for use in Pharmacy, Biology and Chemistry.
8. Gupta SK. Drug Screening Methods. Jaypee Brothers Medical Publishers (P) Ltd; New Delhi: 2004.
9. Arora PN, Malhan PK. Biostatistics. Himalaya Publishing House; Mumbai: 2008.
10. Bolton S, Bon C, Pharmaceutical statistics, 4th Ed. Marcel Dekker Inc; New York: 2004.

ELECTIVE

HERBAL DRUG DEVELOPMENT AND STANDARDIZATION

Scheme of Instruction

Total Duration	: 60 Hrs.
Hours/Week	: 3 Hrs.
Credits	: 3
Instruction Mode	: Lecture
Course Code	: PY.09.884.25.T

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 3 Hrs.

Course Objectives:

To make the students understand thoroughly on processing, extraction and drying techniques, standardization of herbal drugs/formulations, monographs on Indian medicinal plants, herbal formulation/cosmetics, GMP of Botanicals and Global regulatory requirements for herbal medicines, bioassay guided fractionation and biomarkers, drug discovery from natural sources and understanding herb-drug interactions.

Course Outcomes:

Upon completion of the course, the student shall be able to

- Know the standardization of herbal drugs/formulations, monographs on Indian medicinal plants
- Understanding the drug discovery from natural sources and herb-drug interactions.

Unit - I :

Herbal drug Industry: Study of infrastructure, staff, plant and equipment requirements. Organizations involved in research and development of natural products and key component of their program.

Documentation: Manufacturing documents, manufacturing formula, batch formula records, standard operating procedures for various operations like cleaning, filling, drying, compression, coating, disinfection.

Unit - II :

Quality Control Methods: Quality control methods for medicinal plant material. Evaluation and standardization of herbal drugs according to WHO guidelines. Preparation of herbarium and herbal database.

Herb Interactions: Interaction of herbs with other herbs, food and allopathic drugs (Herbs-drug interaction, Herb-Herb interaction, Herb-food interaction) with suitable examples.

Unit - III :

Preparation and standardization of Herbal formulations: Shampoos, Ointments, face packs, and tablets.

Unit - IV :

Basic Concepts of Quality Assurance: Quality control and quality assurance, definition, concept, philosophy, concept of total quality management, functions, sources of variation, change control program.

NABL certification and accreditation procedure, quality audits, EQ (DQ, IQ, OQ & PQ), process validation (PV) (prospective, retrospective and concurrent).

Unit - V :

General concepts of pharmacological screening.

CPCSEA guidelines, OECD guidelines, Tests of significance calculation of LD₅₀, ED₅₀.

Screening of natural products for the following biological activities – analgesics, anti-inflammatory, antidiabetic, Immuno modulator, Hepato protective, anti-ulcers and antihypertensive.

Books and References:

1. Vogel HG and Vogel WH, Drug discovery and Evaluation, Pharmacological Assays, Springer – Verlag.
2. Ayurvedic Pharmacopoeia
3. Thin Layer Chromatography by E. Stahl
4. Herbal Pharmacopoeia
5. Herbal Drugs Industry by R.D. Chaudari.
6. Standardization of Botanicals by D. Rajpal, Eastern publishers.
7. General Guidelines on Safety Monitoring of Herbal Medicines in Pharmacovigilance Systems WHO 2004.
8. General Guidelines for Methodologies on Research and Evaluation of Traditional Medicine WHO/EDM/TRM/ 2000.1
9. Herbal Drug Technology by SS Agarwal and M paridhavi, 2nd Edition, Universities Press, 2007.
10. Quality Control of Herbal Drugs by Pulok K Mukherjee, 1st Edition Business Horizons, Pharmaceutical Publisher, New Delhi, 2005.

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ELECTIVE

RESEARCH METHODOLOGY AND BIOSTATISTICS

Scheme of Instruction

Total Duration	: 60 Hrs.
Hours/Week	: 3 Hrs.
Credits	: 3
Instruction Mode	: Lecture
Course Code	: PY.09.884.25.T

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 3 Hrs.

Course Objectives:

To make the student familiar with systematic research methodology and computer applications in development of proper research methodology.

To make the student familiar with different pharmaceutical and statistical tools required for carrying out systematic research.

Course Outcomes:

Upon completion of the course the student shall be able to,

- Plan the research effectively
- Enumerate the data for better interpretation and analysis

Unit - I :

Collection and Organization of Data: Descriptive Data Analysis; Graphical and Pictorial Presentation of Data; Correlation of Data and its Interpretation, Computer Data Analysis; Measures of Central Tendency and Dispersion; Variance and Standard Deviation, Relative Error, Coefficient of Variation, Precision and Accuracy. Sampling Techniques: Simple Random Sampling; Stratification; Estimation of the Mean and Proportion.

Probability: Definition, Conditional Probability and Bayes' Theorem. Probability Distributions: Binomial, Multinomial and Poisson Distributions, Normal and lognormal Distributions. Use of Normal Distribution Tables.

Unit - II :

Regression: Linear regression and correlation, curvilinear regression, method of least squares, curve fitting, Fiducial limits, probit and logit analysis

Parametric tests: Testing hypothesis, Types of error. Level of significance. Significance tests and p-value; Tests of significance based on normal distribution, test of significance for correlation coefficients, confidence interval for mean and regression proportion.

Unit - III :

Non-Parametric Tests: Nonparametric procedures: Chi square goodness of fit test, sign test, Mann-Whitney test; Wilcoxon signed rank test.

Experimental Designs: Randomization, completely randomized, randomized block and Latin square designs, factorial design, cross over and parallel designs; Students should learn use of Minitab / R Software for data summary, correlation, regression analysis, test of hypothesis and experimental design

Unit - IV :

Objectives and Purpose of Research: Types of research – Educational, Clinical, Experimental, Basic, Applied and Patent Oriented Research;

Literature Survey: Use of Library, Books and Journals, e-Journals, Retrieving Patents and Seeking Reprints; Methods and Tools used in Research; Qualitative and Quantitative Studies; Simple Data Organization,

Unit - V :

Scientific Writing and Reporting: Different types of Research Papers; Title and Author Names; Abstract and Key Words; Methodology;

Scientific Presentation: Importance, Types and Different Skills; Content, Format of Model, Introduction and Ending; Skills for Oral Presentation and Types of Visual Aids; Questionnaire

Patents: Product Patents and Process Patent; Patent Search; Patent Analysis; Patent Drafting; Patent Filing;

Books and References:

1. Pharmaceutical Statistics – Practical and Clinical Applications, Bolton S., Marcel Dekker, Inc. N., USA
2. Biostatistics: A Foundation for Analysis in Health Sciences, Wayne W Daniel, John Wiley & Sons, Inc.
3. Introduction to Statistical Analysis, Dixon W. J. and Massey F. J., McGraw Hill, N.Y., USA.
4. Statistical Methods, Snedecor G. W. and Cochran W. G., Iowa State University Press, Ames, Iowa.
5. Research in Education, John W Best and James V Khan, Prentice Hall of India Pvt. Ltd.
6. Effective Business Report Writing, Brown Leland, Prentice Hall Inc. India.
7. Presentation Skills, Michael Hatton, Indian Society for Technical Education, New Delhi.
8. Thesis and Assignment writing, Anderson Jonathan and Durston Berry H, Wiley Eastern Ltd., Bangalore.
9. Writing a Technical Paper, Donald H Menzel, McGraw Hill Book Company, Inc., New York.

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ELECTIVE

BULK DRUG TECHNOLOGY

Scheme of Instruction

Total Duration	: 60 Hrs.
Hours/Week	: 3 Hrs.
Credits	: 3
Instruction Mode	: Lecture
Course Code	: PY.09.884.25.T

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 3 Hrs.

Course Objectives:

Stoichiometry and its Importance in the Manufacture of Bulk Drugs

Course Outcomes:

Upon completion of the course the student shall be able to,

- Ensure the safe manufacture of Bulk Drugs
- Expertise minimizes the damage to environment

Unit - I :

Unit processes: Study of the Following Chemical Processes (with reference to Reagents, Mechanisms, Equipment's. and Manufacture of Drugs); Acetylation, Nitration, Sulphonation, Chloro-sulphonation, Hydrolysis, Oxidation, Reduction, Alkylation, Amination, Halogenation, Carboxylation, Decarboxylation, Esterification, Addition, Epoxidation and Important Rearrangements.

Unit - II :

Unit Operations Important to Drug Synthesis: Mixing, Distillation, Drying, Filtration and Centrifugation, Evaporation, Crystallization, Counter Current Extraction;

Unit - III :

Principles and Design of the Reactors: Factors to be considered (including material selection) construction of flow diagrams- selection of Equipment

Unit - IV :

Detailed Manufacturing Aspects, inclusive of Processes and Operations of the following: Aspirin, Adrenaline, Aneurine, Barbitones, Benzocaine, Chloramphenicol, Sulphathiazole

Unit - V :

Safety and Hazards Concepts: Detailed study of different Industrial hazards, precautions, Monitoring and preventive systems. Industrial effluent testing and treatment. Discussion on Industrial accident case studies;

Environment and Pollution Acts: Effluent Treatment and Pollution Control. Measures;

Books and References:

1. M. Giarians : Fundamentals of Chemicals Engineering Operations
2. W. J. Badger and Banchemo : Introduction to chemical engineering (McGraw Hill Services)
3. L. Lachman - The Theory and Practice of Industrial Pharmacy (Varghese Publishing)
4. Ganderton G ; Unit Processes in Pharmacy
5. Groggin P. K. : Unit Processes in Organic synthesis (McGraw Hill Publication London)
6. Marshall Sitting : Organic Chemical Processes
7. Dryden C. L.: Outlines of Chemical Technology (Affiliated East-West Press Pvt. Ltd.)

ADVANCED PHARMACEUTICAL ORGANIC CHEMISTRY - II**Scheme of Instruction**

Total Duration	: 60 Hrs.
Hours/Week	: 4 Hrs.
Credits	: 2
Instruction Mode	: Practical
Course Code	: PY.09.884.22.P

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 6 Hrs.

Course Objectives:

To introduce different experiments to develop the skills and strategic approaches for organic synthesis.

Course Outcomes:

Develop hands on expertise to design and conduct the experiments independently

List of Experiments (Minimum of 8 Experiments shall be conducted)**1. Synthesis of Following Compounds**

- Benzanilide by bechmann rearrangement
- 4-benzylidene-2-methyloxazol-5-one (or) azalactone
- N-(m-nitrobenzyl) aniline from m- nitrobenzaldehyde
- 2,3-diphenylquinoxaline
- 1H-indole-3-carbaldehyde
- 3,4-dihydropyrimidin-2(1H)-one from benzaldehyde, ethyl acetoacetate and urea in presence of CaCl_2 catalyst
- Schiffbase by microwave irradiation
- Cinnamic acid byperkin reaction
- β -dimethylamino propiophenone hydrochloride (mannich base)
- 2-phenyl indole
- Dimedone (5,5-dimethyl cyclohexane-1,3-dione)
- 3-bromo cyclohexene from cyclohexene using NBS.
- p-amino benzyl alcohol from p-amino bezaldehyde using sodium borohydride.
- Cyclohexane-2,5-dicarboxylic acid from benzoic acid (hydrogenation).

2. Any other relevant experiments based on theory.**Books and References:**

- Roth HJ, Kleemann A. Pharmaceutical Chemistry. Vol-I. Drug Synthesis. NY: Ellis Harwood Ltd; 1988.
- Mann FG, Saunders BC. Practical Organic Chemistry. 4th ed. New Delhi: Orient Longman; 2005.
- Furniss BS, Hanaford AJ, Smith PWG, Tatchell AR. Vogel's Textbook of Practical Organic Chemistry. 5th Ed. Singapore; Longman Singapore: Publishers P Ltd; 1989
- Vogel A, Elementary Practical Organic Chemistry. Part 1 : Small Scale Preparations. 2nd Ed. New Delhi: CBS Publishers and Distributors; 2004.
- Bansal RK. Laboratory Manual of Organic Chemistry. 4th Ed. New Delhi: New Age Int. (P) Ltd; 2005.
- Kar A. Advanced Practical Medicinal Chemistry. New Delhi: New Age International (P) Limited; 2006.

ADVANCED MEDICINAL CHEMISTRY - II

Scheme of Instruction

Total Duration	: 60 Hrs.
Hours/Week	: 4 Hrs.
Credits	: 2
Instruction Mode	: Practical
Course Code	: PY.09.884.23.P

Scheme of Examination

Max. Marks	: 100
Mid Semester	: 20
Quiz	: 05
End Semester	: 75
Exam Duration	: 6 Hrs.

Course Objectives:

To make the student to acquire practical skills in the synthesis and characterization of drugs

Course Outcomes:

The students will be outfitted with hands-on expertise in synthesis and characterization of various drugs

List of Experiments : (Minimum of 8 experiments shall be conducted)

1. Synthesis and characterization of the following drugs
 - a. Phenacetin
 - b. Antipyrine
 - c. Benzocain
 - d. Uramil
 - e. Tolbutamide
 - f. Phenothiazine
 - g. Isoniazid
 - h. Sulphasalazine
 - i. Aspirine from salicylic acid
 - j. Paracetamol from p-aminophenol
2. Determination of partition coefficient of any medicinal compound by shake flask method
3. Any other relevant experiments based on theory.

Books and References:

1. Lednicher D, Mischer LA, The Organic Chemistry of Drug Synthesis, Volume-1-6. New York: A Wiley-Interscience Publication; 2005
2. Mann FG, Saunders BC. Practical Organic Chemistry. 4th Ed. New Delhi: Orient Longman; 2005.
3. Furniss BS, Hannaford AJ, Smith PWG, Tatchell AR. Vogel's Textbook of Practical Organic Chemistry. 5th Ed. Singapore: Longman Publishers and Distributors; 2004
4. Vogel A. Elementary Practical Organic Chemistry. Part 1: Small Scale Preparations 2nd Ed. New Delhi: CBS Publishers and Distributors; 2004.
5. Bansal RK, Laboratory Manual of Organic Chemistry. 4th Ed. New Delhi: New Age Int. (P) Ltd; 2005.
6. Kar A. Advanced Practical Medicinal Chemistry. New Delhi: New Age International (P) Limited; 2006
7. Indian Pharmacopoeia. Controller of Publication. Delhi, 1996
8. British Pharmacopoeia. British Pharmacopoeia Commission Office, London, 2008.
9. United States Pharmacopoeia. United States Pharmacopoeias Convention Inc., USA, 2003.

SAIL

SCIENTIFIC AND TECHNICAL WRITING

Scheme of Instruction

Total Duration	: 30 Hrs.
Hours/Week	: 2 Hrs.
Credits	: 2
Instruction Mode	: Tutorial
Course Code	: PY.09.880.X1.I

Scheme of Examination

Max. Marks	: 50
Assignment	: 20
Attendance	: 05
Seminar	: 25
Exam Duration	: 1 Hr.

Course Objectives:

To be able to appreciate and understand importance of writing scientifically.

- To develop competence in writing and abstracting skills.*
- To write either a draft research proposal or a chapter of dissertation.*

Course Outcomes:

Able to prepare a document with systematic approach

Unit - I :

COLLECTION AND EVALUATION OF INFORMATION: Identification sources, searching information, classifying information under fact/opinion, tabulating information, summarizing a text and presenting sequence of topics in different forms.

WRITING AS A MEANS OF COMMUNICATION: Different forms of scientific and technical writing; Articles in journals, Research notes and reports, Review articles, Monographs, Dissertations, Bibliographies.

How to formulate outlines: The reasons for preparing outlines

(i) as a guide for plan of writing (ii) as skeleton for the manuscript

Outline of topic, concept, sentence and combination of topic and sentence outlines

Unit - II :

DRAFTING TITLES, SUB TITLES, TABLES, ILLUSTRATIONS

- Tables as systematic means of presenting data in rows and columns and lucid way of indicating relationships and results.
- Formatting Tables: Title, Body stub, Stab Column, Column Head, Spanner Head, Box Head
- Appendices: use and guidelines

The Writing process: Getting started, Use outline as a starting device, Drafting, Reflecting and Re-reading

Checking: Organization, Headings, Content, Clarity and Grammar

Brevity and Precision in writing - Drafting and Re-drafting based on critical evaluation

PARTS OF DISSERTATION/RESEARCH REPORT/ARTICLE

Introduction, Review of Literature, Methodology, Results and Discussion

Content, continuity, clarify, validity internal consistency and objectivity during writing each of the above parts.

References:

1. APA (1984): Publication Manual of American Psychological Association 3rd Ed, Washington.
2. Cooper, H.M. (1990): Integrating Research: A Guide for Literature Reviews (2nd Edition). California: Sage.
3. Dunn, F.V & Others. (Ed.) (1984): Disseminating Research: Changing Practice. NY: Sage.

SAIL

RESEARCH METHODOLOGY

Scheme of Instruction

Total Duration	: 30 Hrs.
Hours/Week	: 2 Hrs.
Credits	: 2
Instruction Mode	: Tutorial
Course Code	: PY.09.880.X2.I

Scheme of Examination

Max. Marks	: 50
Assignment	: 20
Attendance	: 05
Seminar	: 25
Exam Duration	: 1 Hr.

Course Objectives:

To give exposure on how to do literature survey for the project work.
To develop technical writing skills in the form of a research report.

Course Outcomes:

To able to organize the research in an effective fashion

Unit – I :

Basics of Research: Definition, objectives, motivation, types of research and approaches; Descriptive research, conceptual, theoretical, applied and experimental.

Formation of Research Problem: Research Process: To determine what type of research to be done, plan of research work; Selection of research area, prioritization of research; Literature review: importance and methods, sources; Objectives and scope of work, developing research plan and schedule; Scheduling constraints, steps, problems in scheduling, limitations.

Experimental Modeling: Definition of experimental design, examples, single factor experiments, blocking and nuisance factors, guidelines for designing experiments; General model of process: Input factors/ variables, Output parameters / variables controllable / uncontrollable variables, dependent / independent variables, experimental validity; Introduction to Risk assessment, reliability, sustainability, and uncertainty.

Unit – II :

Analysis of Data: Types of data: parametric and nonparametric, descriptive and inferential data; Collection of data: normal distribution, calculation of co-relation coefficient; Data processing: analysis, error analysis, meaning, and different methods; analysis of variance, significance of variance, analysis of covariance, multiple regressions, testing linearity/nonlinearity of model, testing adequacy of model; Test to be used in data exploration and their choice; Introduction of software used in data analysis.

Research Deliverables: Various Forms of Publication: Thesis, paper, research proposal; Thesis Writing: Introduction, literature review/state-of-the-art, research approach (methodology), results / findings, discussions, conclusions, scope for future work, references, appendices; Presentation: Poster, thesis, proposal, and paper.

Ethical and Plagiarism issues in research: Historical perspectives, General principles on ethical consideration involving human participation, General ethical evaluation of drugs/ device/ diagnostics/ vaccines/ herbal remedies. Statement of specific principles for human genetics and genomic research. International Conference on Harmonization. Good clinical practices norms, Ethical principles related to animal experiments; Issues related to plagiarism, copyright laws, acknowledging the sources, format for manuscript writing, documentation, organization of reference material, bibliography, end note.

References:

1. C.R. Kothari, 2004. "Research Methodology". 2nd Ed. New Age International (p) Limited, Publishers.
2. D. Montgomery, 2000. "Design of Experiments". 5th Ed. Wiley Interscience.
3. K.P. Willkinson, L. Bhandarkar, "Formulation of Hypothesis". 3rd ed. Himalaya publishing, Mumbai.
4. Schank Fr, 2008. "Theories of Engineering Experiments". 2nd Ed. Tata McGraw Hill.
5. J.W. Best and J.V. Kahn, 2006. "Research in Education". 10th Ed. PHI publication.

SAIL

TEACHING METHODOLOGY

Scheme of Instruction

Total Duration	: 30 Hrs.
Hours/Week	: 2 Hrs.
Credits	: 2
Instruction Mode	: Tutorial
Course Code	: PY.09.880.X3.I

Scheme of Examination

Max. Marks	: 50
Assignment	: 20
Attendance	: 05
Seminar	: 25
Exam Duration	: 1 Hr.

Course Objectives:

To acquaint with the basic tools of teaching to part of teaching profession

Course Outcomes:

Able to practice the teaching techniques for effective dissemination of knowledge

Unit - I :

Learning and Instruction: Principles of Instructional design and learning theory, Merrill's five principles and Gagne's condition of learning. Active learning, group learning, collaborative learning, problem-based learning, team-based learning, Experiential learning model of Kolb.

Curriculum Development: A six step approach. Problem identification and general needs assessment, targeted needs assessment, goals and objectives, educational strategies, implementation, evaluation and feedback. Bloom's Taxonomy, three domains of educational objectives.

Unit - II :

Assessment: Definition and methods, Georges Millers pyramid, assessment, measurement and tests, types of numbers, formative and summative assessment.

Teaching Methods: Activities conducted individually, in pairs and in groups like self-introduction, peer introduction, group poster making, grammar and vocabulary games, etc.

Discussions, Role play activities, Short presentations; Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

References:

1. B.D. John, A.L. Brown and R.R. Cocking, 1999. "How People Learn: brain, mind, experience and school". Washington, DC: National Academy Press.
2. K.E. David, 2009. Curriculum Development for Medical Education: *A Six-Step Approach*, 2nd Ed. The John Hopkins University Press. ISBN 0-8018-9367-4.

SAIL

ENREPRENEURSHIP DEVELOPMENT

Scheme of Instruction

Total Duration	: 30 Hrs.
Hours/Week	: 2 Hrs.
Credits	: 2
Instruction Mode	: Tutorial
Course Code	: PY.09.880.X4.I

Scheme of Examination

Max. Marks	: 50
Assignment	: 20
Attendance	: 05
Seminar	: 25
Exam Duration	: 1 Hr.

Course Objectives:

To provide conceptual inputs regarding entrepreneurship management.

To sensitize and motivate the students towards entrepreneurship management.

To orient and impart knowledge towards identifying and implementing entrepreneurship opportunities.

Course Outcomes:

To develop management skills for entrepreneurship management

Unit - I :

CONCEPTUAL FRAME WORK: 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;

THE ENTREPRENEUR: Dynamics of Entrepreneurial Motivation; Concepts; Developing Entrepreneurial Competencies; Requirements and understanding the process of entrepreneurship development; self-awareness, interpersonal skills, creativity, assertiveness, achievement, factors affecting entrepreneur's role.

Unit - II :

LAUNCHING AND ORGANISING AN ENTERPRISE: Environment scanning – Information, sources, schemes of assistance, problems; Enterprise selection, market assessment, enterprise feasibility study, SWOT Analysis; Resource mobilization – finance, technology, raw material, site and manpower; Costing and marketing management and quality control; Feedback, monitoring and evaluation; Project work – Feasibility report; Planning, resource mobilization and implementation.

GROWTH STRATEGIES AND NETWORKING; 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;

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. Heath & Co., Toronto.
3. Hisrich, R.D. and Peters, M.P. (1995): Entrepreneurship – Starting, Developing and Managing a New Enterprise, Richard D., Irwin, INC, USA.
4. Meredith, G.G. et al (1982): Practice of Entrepreneurship, ILO, Geneva.
5. Patel, V.C.(1987): Women Entrepreneurship – Developing New Entrepreneurs, Ahmedabad EDII.

SAIL

COMPUTATIONAL TECHNIQUES

Scheme of Instruction

Total Duration	: 30 Hrs.
Hours/Week	: 2 Hrs.
Credits	: 2
Instruction Mode	: Tutorial
Course Code	: PY.09.880.X5.I

Scheme of Examination

Max. Marks	: 50
Assignment	: 20
Attendance	: 05
Seminar	: 25
Exam Duration	: 1 Hr.

Course Objectives:

Learn the organization of a digital computer.

Learn to think logically and write pseudo code or draw flow charts for problems.

Course Outcomes:

Be familiar with the use of Office software.

Be exposed to presentation and visualization tools as well as problem solving techniques and flow charts.

Unit - I :

Hardware: Current hardware & their performance, New devices / technology useful in teaching & research like Cameras, Scanner, touch screens, tablets, projection devices etc. Basic idea of computer networking.

Operating systems: Common operating systems used in day to day task & instrumentation like Windows, Linux & Unix (only interface and basic commands).

Language: Evolution of computer languages. Common languages used in scientific fraternity (no specific language detailing is required).

Software: Idea of popular software's like MS Office, structure drawing software's, chemical structure visualizing software's, statistical software's & mathematical software, reference managing software's (only introduction).

Unit - II :

Web page design: Need, concept and use of HTML

Databases: Meaning, Need and creating table, record creating and maintenance.

Internet concept: History, creating internet connection, common problems & solutions.

Important Databases of free domain: Patents, Pub med, Pubchem, Science direct, protein database.

References:

1. W. E. Fassett, 1986. "Computer Applications in Pharmacy", Lea & Febiger Publisher.
2. C.N. Madu, 2003. "Statistics as easy with Microsoft Excel for Windows", 1st Ed. Chi Pub. Inc.
3. <http://pages.stern.nyu.edu/~jsimonof/classes/1305/pdf/excelreg.pdf>
4. www.Pubmed.com
5. www.Pubchem.com
6. www.mdl.com
7. <http://www.vlifesciences.com>
8. <http://spdbv.vital-it.ch>
9. <http://www.winstat.com>
10. www.uspto.gov
11. www.esp.gov

SAIL**Laboratory Design, Safety and Management****Scheme of Instruction**

Total Duration	: 30 Hrs.
Hours/Week	: 2 Hrs.
Credits	: 2
Instruction Mode	: Tutorial
Course Code	: PY.09.880.X6.I

Scheme of Examination

Max. Marks	: 50
Assignment	: 20
Attendance	: 05
Seminar	: 25
Exam Duration	: 1 Hr.

Course Objectives:

*To expose them to existing national safety standards
To acquaint with Laboratory Design and Management*

Course Outcomes:

On Completion of the course the student will be able to perform the Experiments as per cGLP norms.

Unit - I :

Lab Design Criteria; Codes, Standards and References; Architectural Considerations, Walls, Doors, Windows, Security, Ceiling, Flooring, Cleanability, Sinks, Storage, Exit Paths, Engineering Considerations – Electrical, Plumbing, Utilities – Air, Water, Steam and Gases, Heating, Ventilation, Air Conditioning and Fume Hoods;

Laboratory Furniture Design and Location; General Laboratory Safety Practices; Standard Operating Procedures (SOP's);

Unit - II :

Management of Analytical Laboratory: Organization of Laboratories based on their types, staffing, skill development and training, budgeting and financing, purchase of costly equipment, qualities of laboratory manager and management styles.

Laboratory Inspections: Internal inspection, external audit, concepts, preparing for inspections and audits.

Reference standards: Types, preparation, containers, labeling, storage and use.

Documentation-STPs: Certificate of Analysis (COA), Laboratory Note Books: Typical Documents used in a GLP Laboratory including Standard Test Protocols (STP's),

References:

1. Laboratory Design Guidelines – University of North Carolina, USA
2. Laboratory Design Hand Book
3. Designing and Planning of Laboratories (2009)
4. Laboratory Design and Construction Guidelines (2010) – Department of Environment, Health and Safety, University of South Carolina, USA
5. Laboratory Safety Design Guide, (2007) – Department of Environment, Health and Safety, University of California, USA
6. Laboratory Safety Guidance, (2011) – OSHA, USA
7. Safe Lab (2007) Web site at www.cpsc.gov

SAIL
Creativity and Innovation

Scheme of Instruction

Total Duration	: 30 Hrs.
Hours/Week	: 2 Hrs.
Credits	: 2
Instruction Mode	: Tutorial
Course Code	: PY.09.880.X7.I

Scheme of Examination

Max. Marks	: 50
Assignment	: 20
Attendance	: 05
Seminar	: 25
Exam Duration	: 1 Hr.

Course Objectives:

To impart the knowledge of various aspects of Creativity and Innovation

Course Outcomes:

On Completion of the course the student will be able to understand the significance of Creativity and Innovation.

Unit - I :

The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving – brain storming - different techniques.

Unit - II :

Patents - Patent search - Patent laws -International code for patents

References:

1. Twiss, Brian. "Managing Technological Innovation", Pitman Publishing Ltd., 1992.
2. Nystrom, Harry "Creativity and Innovation", John Wiley & Sons, 1979.
3. Khandwalla, N. – "Fourth Eye (Excellence through Creativity) - Wheeler Publishing", 1992.
4. I.P.R. Bulletins, TIFAC, New Delhi, 1997.

SAIL**Employability Skills****Scheme of Instruction**

Total Duration	: 30 Hrs.
Hours/Week	: 2 Hrs.
Credits	: 2
Instruction Mode	: Tutorial
Course Code	: PY.09.880.X8.I

Scheme of Examination

Max. Marks	: 50
Assignment	: 20
Attendance	: 05
Seminar	: 25
Exam Duration	: 1 Hr.

Course Objectives:

To enhance the employability skills of learners with a special focus on presentation skills, group discussion and interview skills.

To enable them to improve their soft skills necessary for workplace contexts.

To equip them with effective communicative competence for a global reach.

Course Outcomes:

Participate in conversations both formal and informal, attend phone calls and interviews successfully.

Read different types of texts and Listen to, and understand foreign accents.

Unit - I :

SPEAKING SKILLS: Conversation skills (formal and informal contexts) - telephonic communication, attending job interviews (responding to FAQs) - taking part in GDs - making presentations.

WRITING SKILLS: Job applications - cover letter - resume - applying online - writing proposals - e-Mails - letters - reports - memos - minutes - blogging - tweeting - writing recommendations and instructions - writing for publications.

READING SKILLS: Vocabulary building - speed reading (skimming - scanning) - reading different genres of texts from newspapers to philosophical treatises - critical reading - effective reading strategies such as reading 'beyond the lines', summarizing, graphic organizers and distinguishing facts from opinions.

Unit - II :

LISTENING/VIEWING SKILLS: Speeches of different nationalities with focus on American and British accent (TED talks, podcasts) - listening to lyrics - lectures - instructions - dialogues - news casting - talk shows - interviews (Hard talk, Devil's Advocate)

SOFT SKILLS: Motivation - persuasive skills - negotiations - time management - emotional intelligence - stress management - creative and critical thinking.

References:

1. Barker, A. **Improve Your Communication Skills**. New Delhi: Kogan Page India Pvt. Ltd., 2006.
2. Craven, Miles. **Listening Extra - A resource book of multi-level skills activities**. Cambridge University Press, 2004.
3. Gammidge, Mick. **Speaking Extra - A resource book of multi-level skills activities**. Cambridge University Press, 2004.
4. Hartley, Peter. **Group Communication**. London: Routledge, 2004.
5. John Seely. **The Oxford Guide to Writing and Speaking**. New Delhi: Oxford University Press, 2004.
6. Naterop Jean & Rod Revell. **Telephoning in English**. Cambridge University Press, 1987.
7. Ramesh, Gopalswamy and Mahadevan Ramesh. **The ACE of Soft Skills**. New Delhi: Pearson, 2010.

Web Sources:

1. www.humanresources.about.com
2. www.careerride.com

SAIL

INFORMATION SEARCH TECHNIQUES

Scheme of Instruction

Total Duration	: 30 Hrs.
Hours/Week	: 2 Hrs.
Credits	: 2
Instruction Mode	: Tutorial
Course Code	: PY.09.880.X9.I

Scheme of Examination

Max. Marks	: 50
Assignment	: 20
Attendance	: 05
Seminar	: 25
Exam Duration	: 1 Hr.

Course Objectives:

To learn the types of information searches and know the importance of search preparation
To establish the formulation of search strategies and understand the types of search techniques and also to make use of the search techniques in information retrieval
To identify the search techniques to various search tools

Course Outcomes:

Able to distinguish between simple, advanced and meta searches
Plan for a search session and formulate search strategies
Select the appropriate search tool for the required information
Apply the use of search techniques to various search tools

Unit - I :

Types of Searches:- Simple searching, Advanced searching and Meta searching, Keywords, Search preparation.

Search Strategy: Steps in developing search strategy, advantages of a search strategy

Unit - II :

Search Techniques: Boolean Logic, Parenthesis, Phrase searching, Truncation, Wildcards and Field searching

Application of Search Techniques: Searching from deep web sources eg Medline/PubMed; Searching from directories and search engines; and Searching in subject portals eg: HINARI

References:

1. Eysers John E. Searching bibliographic databases effectively. Health Policy and Planning. 1998. 13(3): 339
2. Finding Information on the Internet: A Tutorial UC Berkeley- Teaching Library Internet Workshop (2010)
3. Steve Lawrence and C. Lee Giles. Searching the Web: General and Scientific Information Access, NEC Research Institute. IEEE Communications Magazine. January 1999. 116-122p.

Web Sources:

1. HINARI: Health InterNetwork for Access to Research Information. <http://www.who.int/hinari/en/> (May 2010)
2. Indiana University Library: Basic Database Searching Techniques. <http://www.libraries.iub.edu/index.php?pageld=1480> (March 2010)
3. National Library of Medicine. Medline/PubMed. PubMed Tutorial. <http://www.ncbi.nlm.nih.gov/pubmed/> (2010)
4. Open University. Information skills for researchers. <http://www.open.ac.uk/infoskills/researchers/search-techniques.htm> (2010) and <http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/FindInfo.html> (2010)
5. Reitz, Joan M. (2004). Online Dictionary for Library and Information Science. URL: ODLIS - <http://lu.com/odlis/>
6. The search manual - Cochrane Library <http://www.thecochranelibrary.com/view/0/SearchManual.html> (2010)
7. University Of West England. The Cochrane Library <http://www.uwe.ac.uk/library/resources/hea/docs/cochrane.pdf> (2010) and Meta searching. <http://writing.colostate.edu/activities/> (2010)