।। सा विद्या या विमुक्तये ।।

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

ACADEMIC (1-BOARD OF STUDIES) SECTION

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प्रस्तुत विद्यापीठीय संकुलातील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील द्वितीय वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०—२१ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, **दिनांक २० जून २०२० रोजी संपन्न झालेल्या ४७व्या मा. विद्या परिषद बैठकीतील विषय क्र.११/४७—२०२०** च्या ठरावानुसार **प्रस्तुत विद्यापीठीय संकुलातील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील द्वितीय वर्षाचे** खालील विषयांचे **C.B.C.S. (Choice Based Credit System) Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०—२१ पासून लागू करण्यात येत आहेत.

01. M.Sc.-II Year-Botany
02. M.Sc.-II Year-Analytical Chemistry
03. M.Sc.-II Year-Industrial Chemistry
04. M.Sc.-II Year-Medicinal Chemistry
05. M.Sc.-II Year-Organic Chemistry
06. M.Sc.-II Year-Physical Chemistry
07. M.Sc.-II Year-Polymer Chemistry
08. M.Sc.-II Year-Computer Application
09. M.Sc.-II Year-Computer Network
10. M.Sc.-II Year-Computer Science
11. M.C.A.-II Year (Master of Computer Applications)
12. M.Sc.-II Year-Environmental Science
13. M.A./M.Sc.-II Year-Geography
14. M.Sc.-II Year-Geophysics
15. M.Sc.-II Year-Geology
16. M.A./M.Sc.-II Year-Mathematics
17. M.Sc.-II Year-Microbiology
18. M.Sc.-II Year-Physics
19. M.Sc.-II Year-Zoology
20. M.Sc.-II Year-Biotechnology
21. M.A./M.Sc.-II Year-Statistics

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.

जा.क्र.: शैक्षणिक—१/परिपत्रक/पदव्युत्तर(संकुल)—सीबीसीएस अभ्यासक्रम/२०२०—२१/**५१३**

दिनांक : ०८.०८.२०२०.

स्वाक्षरित/—
उपकुलसचिव
शैक्षणिक (१—अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :

१) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) मा. संचालक, सर्व संबंधित संकुले, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

M. Sc. S. Y. Medicinal Chemistry Core papers (Third Semester)

Sr. No.	Paper No.	Title	Contact hours	Credits
Medicinal Chemistry Core Papers				
1.	MCH-331	Drug Design	60	4
2.	MCH-332	Chemotherapy I	60	4
Practical Courses				
1.	LMCH-331	Laboratory Course 1	120	4
2.	LMCH-332	Laboratory Course 2	120	4
1.	SMCH-331	Seminar	15	1

M. Sc. S. Y. Medicinal Chemistry Elective papers (Third Semester)

Sr. No.	Paper No.	Title	Contact hours	Credits
Medicinal Chemistry Elective Papers (any one from the below or courses offered for any other program in school of chemical sciences)				
1.	EMCH-331	Organic Spectroscopy	60	4
2.	EMCH-332	Drug metabolism	60	4
Open elective (any one)				
1.		Open elective from other schools	60	4
2.		MOOCS/SWAYAM/NPTEL courses	60	4
Open electives offered for students from other schools				
1.	OPCH-311	Intellectual property rights	60	4

M. Sc. S. Y. Medicinal Chemistry Core papers (Fourth Semester)

Sr. No.	Paper No.	Title	Contact hours	Credits
Medicinal Chemistry Core papers				
1.	MCH-431	Chemotherapy II	60	4
2.	MCH-432	Advanced Medicinal Chemistry	60	4
Practical Courses				
1	ITCH-401/ RPCH -401	Industrial Training /Research Project	240	8
2	SMCH-431	Seminar	15	1

M. Sc. S. Y. Medicinal Chemistry Elective papers (Fourth Semester)

Sr. No.	Paper No.	Title	Contact hours	Credits
Medicinal Chemistry Elective papers (Any one from the below or courses offered for any other program in school of chemical sciences)				
1.	EMCH-431	Novel Drug delivery	60	4
2.	EMCH-432	Synthetic methods in organic chemistry	60	4
Open elective (any one)				
1.		Open elective from other schools	60	4
2.		MOOCS/SWAYAM/NPTEL courses	60	4
Open electives offered for students from other schools				
1.	OPCH-411	Radiation Chemistry	60	4

Subject code MCH-331: Drug Design (60 Lectures) Credits- 4

Course Objectives:

- Learn basic principles involved in drug discovery and designing process
- To know the role of medicinal chemist in development of medicinal agents
- Learn how to analyze and perform SAR and QSAR

Course contents:

1. **Concepts in drug designing:** Pharmacodynamics, Pharmacokinetics, Drug Metabolism.
2. **Development of new drugs :** Introduction, procedure followed in drug design, the search for lead compounds, Molecular modification of lead compounds,
3. **Prodrugs and Soft Drugs:** Introduction , Prodrug Designing groups, Types of Prodrugs. Drawback of prodrugs approach .Soft Drugs: Design of soft drugs.
4. **Chemical Parameters in Drug Design:** Stereochemistry, biological Isosterism, biological properties of simple functional groups.
5. **Receptor:** Concept of receptor, receptor interaction. Forces involved in drug receptor interactions, drug receptor interaction, Theories of drug receptor and drug activity, Clarks occupation theory (Template theory), Occupation theory, Rate theory, Induced fit theory. Competitive (reversible) inhibitors, non-competitive (irreversible) inhibitors, non-competitive reversible (allosteric) inhibitors.
6. **Design of enzyme inhibitors :** 9-alkylpuriness, 6-mercaptopurine and Allopurinol, active site directed irreversible enzyme inhibition, suicide enzyme in activators, structure based drug design, process of structure based drug design, deactivation of certain drug, necessary for T cell functioning, determination of the structure of the protein, determination of the active site design of Inhibitors.
7. **Quantitative structure activity relationship:** QSAR, introduction, graphs and equation, physiochemical parameters, Fergusson principal and related theories, QSAR methods, Hansch method, Free Wilson method, advantages and disadvantages of Free-Wilson approach, Craig's plot, The Topliss scheme, Batch selection method, batch wise topless operational scheme,

cluster analysis. Planning a QSAR Study.

Home assignment :

Various approaches in drug discovery and related research papers.

Recommended study materials (Books):

1. An Introduction to Drug Design, S. S. Pandeya and J. R. Dimmock, New Age International
2. An Introduction to medicinal chemistry, Graham L. Patrick. Oxford university press.
3. Burger's Medicinal Chemistry and Drug Discovery, John Wiley.
4. The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman, Academic Press.
5. Textbook of drug design and discovery, Third edition Povl Krogsgaard – Larsen, Tommy Liljefors and Ulf Madsen: Tailor and Francis
6. Essentials of Medicinal Chemistry second edition Andrejus Korolkovas: Wiley India edition

Course Outcomes: students will be able to

- Understand key component of drug discovery process in designing
- Understanding the role of medicinal chemist in development of medicinal agents
- Have understanding about functional group modification and their utility in SAR and QSAR.
- Analyze the recent research articles related with drug design.

Subject code MCH-332:Chemotherapy-1 (60 lectures) Credits- 4

Course Objectives:

- Learn basic principles involved Cardiovascular drugs, Psychoactive Drugs, Antibiotics, Antineoplastic agents, Local anti-infective agents, Anti-inflammatory analgesic agents
- To know the role of medicinal chemist in development of medicinal agents for Psychoactive Drugs, Antibiotics, Antineoplastic agents, Local anti-infective agents, Anti-inflammatory analgesic agents
- Learn how to analyze and perform SAR and QSAR of Psychoactive Drugs, Antibiotics, Antineoplastic agents, Local anti-infective agents, Anti-inflammatory analgesic agents

Course contents:

1. **Cardiovascular drugs**: Cardiovascular diseases, arteriolar dilators, diuretics, cardiac output, central intervention of cardiovascular output, -Adrenergic receptor blockers, centrally acting alpha-adrenergic blockers, synthesis mode of action, uses and side effects of cardiovascular drugs, esters of nitrons and nitric acid-amyl nitrate, sorbitrate, calcium channel blockers-diltiazem, verapamn, anti-adrenergic drugs-methyl dopa, sodium channel blockers – quanidine, alpha -adrenergic blockers– Atenolol, Oxprenolol.

2. **Psychoactive Drugs (The chemotherapy of mind) :**
   Introduction, synthesis, uses and side effects of diazepam, chlorazepam, oxazepam, alprazolam, phenyloin, ethosuximide, trimethadione, barbiturates, thiopental sodium, glutethimide, CNS depressants, neurochemistry of mental diseases, serendipity and drug development, stereo chemical aspects of chiral drugs, neurotransmitters, general anesthetics

3. **Antibiotics:** Introduction and classification, synthesis uses and side effects of antibiotics (a) Penicillin-V (b) Penicillin-G (c) Tetracycline (d) Ampicillin, (e) Chloramphenicol (f) Cephalosporin (g) Streptomycin. β -lactam Rings, antibiotics inhibiting protein synthesis, cell-wall biosynthesis, inhibitors of cell-wall biosynthesis, mode of action of penicillin and cephalosporin, microorganisms .

4. **Antineoplastic agents:** Introduction, cancer, classification of antineoplastic agents, role of alkylating agents and antimetabolites in treatment of cancer,

carcinolytic antibiotics, synthesis use and side effects antineoplastic agents: Mechlorethamine, Cyclophosphamide, Melphalan, mustards (mode of action) fluorouracil, 6-mercaptopurine, recent development in cancer chemotherapy, mitotic inhibitors: Natural products, Hormones.

5. **Local anti-infective agents:** Introduction, mode of action, Sulphonamides, synthesis mode of action and side effects of sulpha drugs: Sulphanilamide, Sulphapyridine, Sulphadiazine, Sulphathiazole, Sulphaquanidine, Sulphamerazine. Antileprotic drugs: synthesis, mode of action and side effect of Dapsone . Antitubercular drugs : Synthesis, mode of actions, and side effects of (a) Para- amino salicylic acid, ethionamide, ionized, ethambutol. Antifungal drugs : synthesis, mode of action and side effects of (a) Fluconazole (b) Econazole (c) Griseofulvin. Anti-malarial drugs: synthesis, mode of actions and side effects of (a) Chloroquine (b) Primaquine. Antibiotics : synthesis, mode of actions and side effects of (a) Nalidixic acid (b) liprofloxacin (c) Norfloxacin. Anti-amoebic drugs: synthesis, uses and side effects of Furazolidone.

6. **Anti-inflammatory analgesic agents:** introduction, classification, Salicylic acid derivatives, Para amino phenol derivatives, Pyrazolone derivatives, Indomethacin and other arylctic acid derivatives, Phenyl acetic acid and Propionic acid derivatives, Fenamates, miscellaneous agents, mechanism of action, treatment of Gout.

Home assignment :

Historical development, antifolates, aminoacid antagonists, vitamin antagonists, antagonists directed against nucleic acids, dopa decarboxilase inhibitors and related research paper.

Recommended study materials (Books) :

1. Medicinal chemistry, S. S. Pandeya and J. R. Dimmock, New Age International
2. Burgers medicinal chemistry and drug discovery, John Diley.
3. The organic chemistry drug design and drug action, R. B. Silverman, Academic Press.
4. Introduction to medicinal chemistry A. Gringuage.
5. Principles of medicinal chemistry by S. S. Kadam, K. R. Mahadik and K. G.

Bothra Nirali Prakashan Bol I and II.

6. Textbook of drug design and discovery, Third edition Povl Krogsgaard – Larsen, Tommy Liljefors and Ulf Madsen: Talor and Francis
7. Essentials of Medicinal Chemistry second edition Andrejus Korolkovas: Wiley India edition

Course Outcomes:

- Understand key component of drug discovery of Cardiovascular drugs, Psychoactive Drugs, Antibiotics, Antineoplastic agents, Local anti-infective agents, Anti-inflammatory analgesic agents
- Understanding the role of medicinal chemist in development of medicinal agents for Cardiovascular drugs, Psychoactive Drugs, Antibiotics, Antineoplastic agents, Local anti-infective agents, Anti-inflammatory analgesic agents.
- Analyze the recent research articles related with chemotherapy.

LMCH-331 : Laboratory Course-01 **Credits-4**

Course Objectives:

- To know the isolation of natural products.
- To know the estimation of Drugs.
- How to investigate the properties of drugs.
- To habituate students to handle the uv -spectrophotometer.
- Learn how to analyze purity of given drugs.
- How to determine calcium % from given drugs.
- Determination of chloride ion in lactate solution injection.

Course contents:

1. Two Practicals based on column chromatography
2. Isolation of piperine from black pepper
3. Isolation of lycopene from tomatoes
4. Isolation of eucalyptus oil from leaves
5. To estimate the amount of Aspirin present in given aspirin tablets.
6. To determine the amount of Ibuprofen present in the given Ibuprofen Tablet.
7. To estimate the amount and percentage purity of anlagen in the analog tablet.
8. Determination of calcium ions in Calcium gluconate injection.
9. Determination of Chloride in ringer Lactate solution for Injection.
10. To determine the amount of diazepam in diazepam tablets by U.V .spectrometer.
11. To determine the amount of Riboflavin present in Riboflavin tablets by the use of UV-vis Spectrophotometer.
12. To estimate the amount of ascorbic acid present in the given sample by Colorimetric.
13. To determine the amount of Riboflavin in the tablet s and find out the % purity by means of Colorimeter.

Course Outcome: students will be able to

- Determine the purity of various drugs.
- Isolate various natural products by isolation method.
- Learn how to analyse various table Estimate the amount of ascorbic acid and
- Riboflavin in the tablet by colorimeter.
- Understand the handling of uv-spectrometer.

LMCH-332 : Laboratory Course - 2 **Credits- 4**

Course Objectives:

- Students to interpret spectra
- Carry out multistep preparation
- Understand the physical examination of spectra, deduce structure
- Learn different techniques involved in synthesis.

Course contents:

A. Identification of organic compounds by spectral analysis. Minimum 10 problems based on joint applications of UV, IR, PMR, CMR and mass should be carried out.

B. Two stage preparations of heterocyclic and biologically active molecules: At least 10 preparatives should be carried out on micro scale using 10 mmol of starting material.

1. Acetophenone → Phenacyl bromide → Epoxide
2. Benzaldehyde → Benzalacetophenone → Epoxide
3. Acetophenonephenylhydrazone → 2-Phenyl indole → Bis-indolyl methane
4. Ethylacetoacetate→6-Methyl-4-oxo-1,2,3,4-tetrahydro-2-thiopyrimidine→6-Methyl uracil

4. Acetophenone → Chalcone → Pyrazoline
5. Glycine→Hippuric acid → Azlactone
6. Acetophenone → Phenacylbromide → 2-Benzoyl benzofuran
7. Ethylacetoacetate→ 3,5-diethoxycarbonyl-1,4-dihydro-2,6-dimethyl-4-(m-nitrophenyl)pyridine→3,5-diethoxy carbonyl-2,6-dimethyl-4-(m-nitrophenyl)pyridine
8. 2-Chlorobenzoic → n-Phenylanthranilic → 9-Acridone

   9.2-Aminobiphenyl → o-Formamidobiphenyl → Phenanthridine
9. Fluorenone → Fluorenone oxime → 6-Phenanthridone
10. Anthranilic acid → o-Carboxybenzenediazonium fluoroborate → Xanthone
11. p-Toluidine → 4-(p-tolylamino)pent-3-en-2-one → 2,4,6-Trimethylquinoline
12. Salicylaldehyde → o-Formylphenoxyacetic acid → Benzofuran
13. Diethylmalonate → Barbituric acid → Nitrobarbituric acid

14 o-Phenylenedimine→Diphenyl quinoxaline → 5,6-diphenylpyrazine-2,3-dicarboxylic acid

15 O-Nitrobenzaldehyde → □□□-Diformamido-o-nitrotoluene → Quinazoline

16 O-Hydroxyacetophenone → Chalcone → Flavonone and Flavonol

Preparation should be carried out on micro scale using 10 mmols or 1.0 gm of starting material and reactions should be monitored by TLC.

BOOKS:

1. A Text-Book of Practical Organic Chemistry: Including Qualitative Organic Analysis.
2. Practical books of Medicinal Chemistry. Abhishek Tiwari.
3. A Practical book of Medicinal Chemistry-Pragati Online
4. Advanced practical in Medicinal Chemistry –Ashutosh Kar
5. Advanced Practical Organic Chemistry-Barry Lygo.

Course Outcomes: Students will be able to

- Expertise the various techniques of preparation and analysis of organic substances
- Understand the technique involving drying and crystallization
- Students will Understand TLC technique
- Understand the basic interpretation of spectroscopy.

SMCH-331 : Seminar **Credit -1**

Course Objectives:

- To enhance the presentation skill and stage courage
- To provide the platform to the students to express them
- To be able to prepare the report component and structure
- To increase knowledge of students in the specific subject

Course Outcome: Students will be able to

- The presentation skill and stage courage of the students will be enhances
- This activity will provide the platform to the students to express them
- prepare report component and structure

  The knowledge of students in the specific subject will be enhanced

EMCH-331: Organic Spectroscopy (60 Lectures) Credits- 4

Course objectives:

The students should learn

1. Different spectroscopic principles
2. Their applications like UV,IR and PMR, CMR and Mass.
3. Different 2D techniques
4. Emerging trends in spectroscopy

Course contents:

1. UV, IR and PMR: Elementary ideas (recapitulation)
2. PMR (Advanced ideas)
3. Spin couplings, different spin systems, factors affecting coupling constants, rate processes, different types of couplings, methods used for simplification of PMR spectra. NOE, Two dimensional (2D) NMR techniques (COSY < HETCOR etc.)
4. CMR- elementary ideas, instrumental problems, advanced idea, chemical shift features of hydrocarbons, effect of substituent on chemical shifts, different types of carbons.
5. Mass spectrometry-theory, instrumentation, rules of fragmentation, fragmentations of different functional groups, factors controlling fragmentation.
6. Problems based on joint applications of UV, IR, PMR, CMR and Mass.
   Home assignment: Applications of PMR in biological systems, structural assignments of complex molecules based on given structure and joint applications of UV, IR, PMR, CMR and Mass.

Books:

1. Introduction to spectroscopy by Donald L. Pavia Gary M. Lampman, George S. Kriz (Harcourt college publications) 3rd Edition.
2. Spectrometric Identification of organic compounds by – R. M. Silverstein, T. C. Morril, G. C. Basseler.
3. 13 C-NMR spectroscopy by – G. C. Levy, R. L. Lichter, G. L. Nelson (Wiley).

4. Spectroscopic methods in organic chemistry by –D. H. Williams and Ian flemming.
5. Absorption spectroscopy of organic molecules by-V. M. Parikh.

Course Outcomes:

The learner should be able to

1. Understand the different spectroscopic principles.
2. Interpret different spectra .
3. Elucidate the structure of organic compounds.
4. Apply the knowledge in characterisation of compounds.

EMCH-322: Drug Metabolites (60 Lectures) Credits -4

Course Objectives:

- To learn the importances of drug metabolites.
- How to chemical changes and biochemical changes take place.
- To learn about guide line of safety drug metabolites.

Course contents:

1.Review of drugs metabolism & metabolites: Importance in drug design and discovery, use of software/ study of current available software. Chemical changes / biochemical changes takes place while drugs metabolism along with chemistry of metabolites.

2.Introduction to metabolite identification in body: (urine, serum, organs etc)

a. Various analytical techniques to identify metabolites

b. Chromatography (HPLC, GC), spectroscopic (NMR, MS)

c. Hyphenated (LC-MS, GC -MS) Tandem (MS-MS)

d. Emerging- proteomics, metabolism etc

3. **Metabolites in disease conditions:** .Overview of occurrence of drugs / endogenous metabolite during following disease/disorder conditions along with their physiological/pathological role-

a. Diabetes mellitus
b. Cancer.
c. Epilepsy
d. Infectious conditions like bacterial, fungal & viral
e. Cardiovascular disorders
f. Pregnancy, lactation like special conditions
g. Endogenous metabolite s and diseased condition
   I. Vitamins (Vit- D –cancer, bone health; Vit- E-atherosclerosis, etc)
   II. Enzymes
   III. Hormones

Metabolites of imp category of drugs related to above mentioned conditions

4.Metabolites of important photochemical: like papavarine, nicotine, taxol, iso flavones, omega 3 fatty acids etc

5.Guidelines for Safety Testing of Drug Metabolites

6..Effect of modification of drugs formulation on occurrence/formation of metabolites

Home assignment:

Age and genetic related variation in formation of drugs metabolites and its clinical significance.

Recommended study materials (BOOKS):

1. Metabolomic in Practice: Successful Strategies to Generate and Analyze .. edited by Michael Lämmerhofer, Wolfram Weckwerth
2. Guidance for Industry Safety Testing of Drug Metabolites U.S. Department of Health and Human Services Food and Drug Administration Center for drug Evaluation and Research (CDER) February 2008 Pharmacology and Toxicology.
3. Identification and Quantification of Drugs, Metabolites and Metabolizing Enzymes, by LC-MS Edited by Swapan Choudhary Hardbound, 354 Pages.
4. Identification and Quantification of Drugs, Metabolites and Metabolizing Enzymes Published November 2005 ISBN 13: 978- 0-444-51710-4
5. High Throughput Bioanalytical Sample Preparation By David Wells Hardbound, 640 Pages Published: January 2003 ISBN 13: 978- 0-444-51029-7.
6. Biotransformation And Metabolite Elucidation of Xenobiotics Characterization and Identification Ala F. Nassar (Editor) ISBN978-0-470-50478-9 328 pages November 2010 Copyright © 2000-2014 by John Wiley & Sons, Inc.
7. Reactive Drug Metabolites Volume 55, Amit Kalgutkar, Deepak D alvie, R Scott Obach, Douglas A. Smith, Raimund Mannhold (Series Editor) , Hugo Kubinyi(Series Editor), Gerd Folkers (Series Editor) ISBN: 978-3-527-33085-0, 402 pages October 2012, Copyright © 2000-2014 by John Wiley & Sons, Inc., o r related companies. All rights reserved
8. Mass Spectral and GC Data of Drugs, Poisons, Pesticides, Pollutants and Their Metabolites, 4th Edition Hans H. Maurer, Karl Pfleger, Armin A. Web er ISBN978-3-527-32992-2 1642 page s August 2011 Copyright © 2000-2014 by John Wiley& Sons, Inc., or related compa nies. All rights reserved.
9. Metabolome Analysis An Introduction Silas G Villas Boas-Jens Nielsen Jorn Smedsgaard, Michael A. E. Hansen, Ute Roessner-Tunali ISBN: 9 78-0-471-74344-6 319 pages February2007 Copyright © 2000-2014 by John Wiley & Sons Inc., or related companies. All rights reserved.
10. All related reference books/ journal articles under Pharmacology, Medicinal Chemistry, Pharmaceutical Analysis Pharmacognosy & Photochemistry etc.

Course Outcomes: students will be able to

- Understand the effect of modification of drug formulation and age, genetic related variation.

- Adopt the guideline for safety testing of drug metabolite.
- Understand metabolite diseases conditions.
- To know the chemical and biological changes in drugs metabolites.

OPCH-311: Intellectual property Management (60 lectures) 4 - credits

Course Objectives:

Greatest teacher, philosopher of India ***Chanakya*** has once quoted "*create wealth from knowledge and Knowledge is Power*". Intellectual Property Rights has got importance in the economic development of India. A renewed awakening of the role of intellectual property in the countries of the various regions of the world has led more recently to the adoption of national legislation on Intellectual Property Rights (IPR) as well as to the establishment or modernization of Government structures that administer such legislation. The present module has been designed keeping in view the above opportunities and challenges to give in-depth knowledge of IPR to the postgraduate students. The course is designed to introduce fundamental aspects of Intellectual Property Rights to teachers, students who are going to play a major role in development of modern economy of India.

- University Grants Commission Bahadur Shah Zafar Marg New Delhi. 110 002. letter to Universities about inclusion of intellectual Property rights curriculum in universities.
- Intellectual Property rights (http://www.ipindia.nic.in/#content) Office of the controller general of patents, designs & Trade marks.
- *"What are intellectual property rights?". World Trade Organization. World Trade Organization. Retrieved 2016-05-23.*
- Law Relating to Patents, Trademarks, Copyright, Designs and Geographical Indications. B L Wadehra
- MANUAL OF PATENT OFFICE PRACTICE AND PROCEDURE THE OFFICE OF CONTROLLER GENERAL OF PATENTS, DESIGNS & TRADEMARKS Controller General of Patents, Designs and Trademarks Mumbai.

Course contents:

1) Introduction to Intellectual Property

- What is Intellectual Property (IP)? Types of IP meaning of the concept of Copyright, Trademark, Patent, Industrial Designs, Geographical Indications, traditional Knowledge etc.
- Significance and importance of IP in the business.
- Significance and importance of IP in Teaching Field.

- Patents Overview - What is a patent? – Importance of Patents in the knowledge economy
- Historical evolution of patents, Why protect inventions by patents? Searching a patent, Drafting of a patent specification, Filing of a patent, Types of patents Divisional, and Provisional applications.

2) Legal Aspects of Intellectual Property

- Indian Patent laws, International convention relating to Intellectual Property, Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT) – TRIPS Agreement.
- Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent
- Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.
- What is infringement? – Direct and Indirect infringement.
- What is PCT? PCT provisional or full specification, where to file? PCT application and detailed procedure.

3) Intellectual Property Management

- Patenting in Academics – Why should academics patent?
- What should academics patent? - Do patents affect research quality?
- History of academic patenting and exploitation.
- Land mark patents form academics and exploitation – Are universities abusing patent system?
- Encouraging patenting culture in Indian Academia, particularly in State Universities.

4) Transfer of Technology

- Basic concepts of technology transfer, meaning of know-how and technical expertise technological knowledge for installation, operation and functioning managerial expertise.
- Role of universities (University Teachers and Researchers), research institutions (Scientists) and industries (Industrialist) in international technology transfers.
- Types of technology transfer agreements, difference between license and transfer, types of licenses and transfer agreements, technology transfer agreements and competition Law

Home Assignment:

Research and practical based Home Assignment (Beyond Class Room Activity)

Compilation of report on various case studies related to IPR involving techno-scientific and legal issues therein for patent, trade mark and geographical indicators etc (Referring various case studies and compilation to be done by students) and Open discussion of the report (among the students).

Recommended Study Material (BOOKS):

1) **WIPO Publication** on Intellectual property (refer Chapters 1to 6).
2) **Cornish W & Llewellyn D**, intellectual Property: patents, Copyright, trademarks & Allied Rights, Sweet & Maxwell, 2007.
3) **Susan Sell et.al**, *Who Governs the Globe?*, Cambridge University Press, (2010).
4) **Odagiri et.al***, Intellectual Property Rights, Development, and Catch Up*, Oxford University Press, (2010).
5) **Christopher May & Susan K. Sell,** *Intellectual Property Rights: A Critical History,* Lynne Rienner Publications, (2005).
6) **John Odell (ed.),** *Negotiating Trade: Developing Countries in the WTO and NAFTA*, Cambridge University Press, (2006).
7) **Gustavo Ghidini,** Intellectual Property and competition Law: The Innovation Nexus, Edward Elgar, (2006).
8) **David J. Teece**, *The Transfer and Licensing of Know-how and Intellectual Property*, World Scientific (2008).
9) **Susan K. Sell**, *Private power, public law : The globalisation of IPR*, Cambridge University Press, (2006).
10) **Kenneth L. Port**, Licensing Intellectual Property in the digital age, Carolina Academic Press, (1999).
11) **Merges, Lemley, et.al,** (4th Ed.) Intellectual Property in the new technological age Aspen Publishers, (2007).
12) **Thomas Pogge, Mathew Rimmer, Kim Rubenstein (ed),** Incentives for global public health: Patent law and access to essential medicines, Cambridge University Press (2010).
13) **Debirag E.Bouchoux**: “Intellectual Property”. Cengage learning , New Delhi .

14) **M..Ashok Kumar and Mohd.Iqbal Ali**: “Intellectual Property Right” Serials Pub.
15) **Prabhuddha Ganguli**: ‘ Intellectual Property Rights” Tata Mc-Graw –Hill, New Delhi.
16) **Kerly’s** Law of Trade Marks and Trade Names, 14th Edition, Thomson, Sweet & Maxweel.
17) **A. K. Bansal**, Law of Trade Marks in India (2009 Edition) Institution of Constitutional and Parliamentary Studies and Centre for Law, Intellectual Property and Trade, New Delhi. Christoher Wadlow, The Law of Passing Off, 1995.
18) **Marsha A. Echols**, Geographical Indications for Food Products, International Legal and Regulatory Perspectives (2008), Wolters Kluwer.
19) **N.S. Gopalakrishnan & T.G. Agitha**, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow.
20) **W.R. Cornish**, Intellectual Property, Sweet & Maxwell, London (2000).
21) **P. Narayana**, Patent Law, Wadhwa Publication.
22) **Merges**, Patent Law and Policy: Cases and Materials, 1996.
23) **Brian C. Reid**, A Practical Guide to Patent Law, 2nd Edition, 1993.
24) **Brinkhof (Edited),** Patent Cases, Wolters Kluwer .
25) **Prof. Willem Hoyng & Frank Eijsvogels**, Global Patent Litigation, Strategy and Practice, Wolters Kluwer .
26) **Gregory Stobbs**, Software Patents Worldwide, Wolters Kluwer .
27) **Feroz Ali Khader**, The Law of Patents – with a special Focus on Pharmaceuticals in India, LexisNexis Butterworths Wadhwa, Nagpur.
28) **Ajit Parulekar and Sarita D’ Souza**, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006.
29) **B. L. Wadehra**; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.
30) **P. Narayanan**; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.

Course Outcomes:

Intellectual Property (IP) is one of the most important assets of a leading edge technology company. Whether it be patents, copyrights, trademarks, trade secrets or know-how, it is critically important to identify it, document it, protect it and in some

cases, register it. Good IP management also requires the development of a strategy in order to balance the cost involved in registering IP against the protection that will be required in markets you are in or plan to develop.

Another important part of managing IP is keeping tabs on what your competitors are doing. Any time a competitor is awarded a patent, you should be examining it to ensure that you are not infringing on their IP. If you are familiar with your competitors' IP, you can design around it. Reasons for Patenting Your Inventions Patents provide the exclusive rights**, Strong market position** - Through these exclusive rights, **Higher returns on investments, Opportunity to license or sell the invention, Increase in negotiating power, Positive image for your enterprise.**

The Introduction of an institutional/university/college level elective course aims to facilitate the protection and valorization of intellectual properties generated during the research pursuit in the Institute/university/college and offer scope for wealth generation, alleviation of human sufferings and betterment of human life. University urges all faculty, staff and students to document their IP, so that they can be protected and applied to the gain of the country, the institute/university/college and the concerned inventors. This elective course can facilitate faculties and staff of institute/university/college in a proactive manner in the generation, protection and transaction of Intellectual Properties which offer potential and scope for shared benefits to society, institute/university/college and inventors.

MCH-431 Chemotherapy-II (60 lectures) Credits- 4

Course Objectives:

- Learn basic principles involved antihistaminic, cholinergic, Adrenergic, opium analgesics, Local anesthetics, Combinatorial synthesis.
- To know the role of medicinal chemist in development of medicinal agents for involved antihistaminic, cholinergic, Adrenergic, opium analgesics, Local anesthetics, and Combinatorial synthesis
- Learn how to analyze and perform SAR and QSAR involved antihistaminic, cholinergic, Adrenergic, opium analgesics, Local anesthetics,
- understand Combinatorial synthesis.

Course contents:

1. **Cimetidine A Rational approach** : Introduction, in the beginning-ulcer therapy in 1964, histamine, the theory-two histamine receptors, searching for lead- histamine, searching for a lead- N^{α}-

   Guanylhistamine, developing the lead- a chelation bonding theory, from partial agonist to antagonist- the development of burimammide, development of metiamide, development of cimetidine, cimetidine, recent drugs.
2. **Cholinergics, anticholinergics, and anticholinesterases** : The peripheral nervous system, oxidation, motor nerves of the peripheral nervous system, the neurotransmitters, action of the peripheral nervous system, the cholinergic system, agonist of the cholinergic receptor, acetylcholine-structure, SAR, and receptor binding, the instability of acetylcholine, the design of acetylcholine analogues, the clinical uses of cholinergic agonists, agonist of muscarinic cholinergic receptor, antagonists of nicotinic cholinergic receptor, other cholinergic antagonist, the nicotinic receptor structure, the muscarinic receptor structure, anticholinesterases and acetyl cholinesterase, anticholinesterase drugs, praldioxie- an organophosphate antidote.
3. **Adrenergics :** Adrenergic nervous system, adrenergic receptor, Neurotransmission, adrenergic agonist, adrenergic receptor antagonist, metabolism.
4. **The opium analgesics** : Isolation of morphine, morphine, development of morphine analogues, receptor theory of analgesics. agonists and antagonists, enkephalins and endorphins, receptor mechanism, the future.

5. **Local anesthetics** : Introduction, sites of action of local anesthetics, nerve tissue, mode of action, classification, structure activity relationship.
6. **Combinatorial synthesis** : Introduction, parallel synthesis, planning and designing a combinatial synthesis, testing activity.

Home assignment:

Various approaches in imaging and diagnosis and related research paper

Recommended study materials (BOOKS):

1. Principles of Medicinal chemistry, William O. Foye
2. Burgers medicinal chemistry and drug discovery, John Diley.
3. An Introduction to medicinal chemistry, Graham L Patric. Oxford university press
4. Principles of Medicinal chemistry by Kadam, Mahadik, Bothara. Nirali Prakashan.
5. Essentials of Medicinal Chemistry second edition Andrejus Korolkovas: Wiley India

   Edition
6. An introduction to drug design S. S. Pandeya and J. R. Dimmock (New age international)
7. The organic chemistry of drug design and drug Action - R. B. Silverman (Academic Press)
8. Strategies for organic drug synthesis and design D. Lednicer Wiley
9. Pharmacological basis of therapeutics Goodman and Gilman's

Course Outcomes: After completion of course students will be able to

- Understand key component of drug discovery of involved antihistaminic, cholinergic, Adrenergic, opium analgesics, Local anesthetics, Combinatorial synthesis.
- Understanding the role of medicinal chemist in development of medicinal agents for involved antihistaminic, cholinergic, Adrenergic, opium analgesics, Local anesthetics, Combinatorial synthesis.
- Analyze the recent research articles.

MCH-432 : Advanced Medicinal Chemistry (60 lectures) Credits-4

Course Objectives:

- Learn basic principles involved some endocrine systems, Antiviral, rDNA derived drugs.
- To know the role of medicinal chemist in development of medicinal agents for some endocrine systems, Antiviral, rDNA derived drugs
- Learn how to analyses and perform SAR and QSAR involved some endocrine systems, Antiviral, rDNA derived drugs understand Combinatorial synthesis

Course contents:

1. **Thyroid Function And Thyroid Drugs**: Introduction biochemistry and physiology, thyroid follicular cells, hormones of the Thyroid gland, formation Thyroid hormones, Transport of Thyroid hormones in blood ,metabolism and Excretion, action of thyroid hormone, oxygen consumption and calorigenesis, differentiation and protein synthesis, control of thyroid hormone formation, diseases involving the thyroid gland , therapeutic agents, structure activity relationship.
2. **Hormone Antagonist**: Hormone dependent breast cancer, hormone dependent protest cancer, strategies for antihormonal therapy, inhibition of steroid action inhibition of steroidal biosynthesis, inhibition of gonadotropin release.
3. **Pharmaceutical Biotechnology**: Introduction, impact of biotechnology on pharmaceutical care, techniques of biotechnology, recombinant DNA technology, and general properties of biotechnology produced medicinal agents, handling and storage of Biotechnology–produced product, recombinant DNA produced medicinal agents, recombinant DNA produced pharmaceutical in development, monoclonal antibodies, and hybridoma technique. Influence of Biotechnology on drug discovery, other technologies
4. **Antiviral Agents**: Viral diseases, viral replication and transformation of cells, antiviral agent, agents involving inhibition of early stages of viral replication, agents interfering with viral nucleic acid replication acyclovir, agents affecting translation on cell ribosome's, methisazone, Investigational antiviral agents. Corona outbreak and strategies to control COVID-19.

5. **Anti AIDS**: Structure and life cycle of the4 AIDS virus, potential anti HIV-1 agents ,reverse transcriptase, inhibitors protease inhibitors, inhibitors of gene expression , inhibitors of viral binding, miscellaneous compounds.
6. **Computers in medicinal chemistry**: Introduction, molecular and quantum mechanics, drawing chemical structures, 3D structures, energy minimization, viewing 3D molecules, molecular dimensions, molecular properties, molecular orbital's. Conformational analysis, local and global minima, molecular dynamics, stepwise bond rotation, structure comparison and overlays. Identification of active conformation, 3D pharmacophore identification, docking procedures.

Home assignment: Malarial treatment, lifecycle of plasmodium and related research paper

Recommended study materials (BOOKS):

1. Principles of medicinal chemistry, William O. Foye, Varghese publishing house
2. An Introduction to medicinal chemistry, Graham L Patric. Oxford university press.
3. Essentials of Medicinal Chemistry second edition Andrejus Korolkovas: Wiley India edition
4. An Introduction to medicinal chemistry, Graham L. Patric. Oxford university press.
5. The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman, Academic Press
6. An introduction to drug design S. S. Pandeya and J. R. Dimmock (New age international).

Course Outcomes: After completion of course students will be able to

- Understand key component of drug discovery some endocrine systems, Antiviral, rDNA derived drugs.
- Understanding the role of medicinal chemist in development of medicinal agents for some endocrine systems, antiviral, rDNA derived drugs.
- Analyze the recent research articles

Code: ITCH-401/RPCH-401: Industrial training, research project (Lectures–240)

(Credits – 8)

Course Objectives: Students should design the overall project scope, goals, objective of work, determine what literature review needs to be done. Design the specific experimental procedures, determine what materials need to be obtained, determine all safety issues in advance and obtain the requisite training, MSDS sheets, etc.

Important stages in the dissertation process include:

No	Work plan activity for research proposal
a)	Choosing a topic
b)	Developing a research question & literature survey on topic
c)	Conducting the experiments/data collection from fields/collaborators
d)	Drafting the report as per format & getting approval from teacher
e)	Reporting the research findings (writing the dissertation and presenting in front of committee).

The student(s) can choose a state-of-the-art problem of their own interest based on the recent trends in Polymer Science in consultation with the supervisor. They shall work on the designated problem either individually or in groups (maximum **two** students per group).

The student is required to prepare a **work plan** (for both semesters III & IV) immediately after the allotment of the project. Students should submit a neatly typed and spiral bound ***research proposal*** before the end of the third semester.

A dissertation is a particular kind of academic task. The faculty addresses the task of planning and conducting a small research project, for an undergraduate or masters' level dissertation. It aims to help students to develop a clear sense of direction early on in the project, and to support you in organizing, planning, and monitoring the research project. Student will usually be asked to generate a topic for them self; to plan and execute a project investigating that topic; and to write-up what you did and what your findings were.

- Write a Research Project Report (dissertation), on a computer A4 size paper both sides of paper and must submit soft copy and hand copy. Font Times New Roman, font size 12 and a line spacing of 1.5 lines.
- It will be checked for plagiarism

The dissertation report should be broadly divided into the following sections:

No	Research Project Report (dissertation) format
1)	Project title (include Title, Student Names, Class, Year, Date of Submission)
2)	Declaration & Approval
3)	Acknowledgement
4)	Abstract (Graphical and Text)
5)	Table of Contents
6)	Introduction
7)	Origin of the problem
8)	Literature review of research and development at national & international level
9)	Significance of the problem
10)	Objective of research work
11)	Experimental (Methodology)
12)	Details of collaboration (if any)
13)	Results and Discussion
14)	Conclusions & future scope of research work
15)	References
16)	Conferences/workshop/seminar attended during this period /published or communicated papers on the work

Student(s) can do the research in department or in collaboration with other departments or other university, or research institute or industry within India or abroad. Submit the research dissertation to department and copy to supervisor. Following list of research institutes near-by area (guideline purpose only) students can search other research institutes also.

Course Outcomes: Research Project (dissertation)

Research project is capability to work independently and think critically. Producing your dissertation or project is a much bigger task than writing a typical essay, and is often an unfamiliar exercise in several respects. The expectation is that you, the learner, take responsibility for your own learning and that you produce a literature review, you choose a method for undertaking a study, write up your findings and

discuss the outcomes in a discussion section. The dissertation offers you the opportunity to further develop your subject expertise,, intellectual and organizational skills: The preparation and writing of the dissertation makes you take responsibility, with the support of a tutor, for your own learning, for the whole process of personal, independent study, time management, and the clear and methodical presentation of the results of your research.

SMCH-431 : Seminar **Credit -1**

Course Objectives:

- To enhance the presentation skill and stage courage
- To provide the platform to the students to express them
- To be able to prepare the report component and structure
- To increase knowledge of students in the specific subject

Course Outcomes: Students will be able to

- The presentation skill and stage courage of the students will be enhances
- This activity will provide the platform to the students to express them
- prepare report component and structure
- The knowledge of students in the specific subject will be enhanced

EMCH – 431 : Novel Drug Delivery System (NDDS) (60 lectures) Credits- 4

Course Objectives:

- To study Sustained and controlled release drug delivery systems.
- To understand polymer science release drug delivery systems Sustained and controlled release drug delivery systems Sustained and controlled release drug delivery systems Sustained and controlled release drug delivery systems Sustained and controlled release drug delivery systems Sustained and controlled release drug delivery systems

Course contents:

1. **Sustained and controlled release drug delivery systems** .

   Introduction; Rationale of SRDDS; Advantages and Disadvantages of SRDDS; Factors influencing the design and performances of SRDDS: A) Physicochemical properties of a drug influencing design and performance; B) Biological factors influencing design and performance of SRDDS. Different Micro-encapsulation processes.

   Introduction, Design and Development of oral controlled release drug administration: Dissolution controlled, Diffusion controlled (Reservoir devices, Matrix devices), Membrane permeation controlled, Osmotic pressure controlled, Gel diffusion controlled, pH controlled, Ion - exchange controlled delivery systems.

2. Polymers science.

Introduction, Polymer-classification, Applications of Polymers in formulation of controlled drug delivery systems, Biodegradable and Nonbiodegradable polymers, Properties of following commonly used polymers- Starch, Gelatin, Chitosan, Albumin, Cellulose derivatives and Poloxamers.

3. Transdermal drug delivery systems.

Permeation through skin, Factors affecting permeation, Basic components of TD DS, Formulation approaches used in development of T DDS and their evaluation, Permeation enhancers.

5. Mucoadhesive drug delivery systems.

Introduction, 1) Buccal drug delivery system: Concepts, Advantages and Disadvantage es, Structure of oral mucosa, Trans-mucosal permea bility, Permeability enhancers, *in vitro* and *in vivo* methods for Buccal absorption; 2) Nasal Drug Delivery Systems: Introduction, Physiology of nose, Fundamentals of nasal absorption, Distribution of drug in the nasal cavity, Enhancement in absorption, *in vitro* and *in vivo* methods for determination of nasal absorption.

6. Occular drug delivery systems.

Formulation and evaluation of occular controlled drug delivery systems, ophthalmic inserts and *in situ* gels.

7. Trageted drug delivery systems .

Concepts, Advantages and Disadvantages, Targeting of drugs through nanoparticles, liposome's, resealed erythrocytes, microspheres, magnetic microspheres, monoclonal antibodies, pulsatil e drug delivery. Study on colon targeting. Biosome.

Home assignment:

Protein & Peptide Drug Delivery System

Physical aspects, biochemistry of protein drug (structure, properties & stability), barrier to transport & pharmacokinetics, different routes of delivery.

Intrauterine Drug Delivery Systems

Development of intrauterine devices (IUDs), copper IUDs, hormone-releasing IUDs.

Recommended study materials (Books):

1. Encyclopedia of controlled delivery; By Edith Mathiowitz, Published by Wiley Interscie nce Publication, John Wiley and sons, Inc, New York / C hichester / Weinheim.
2. Controlled and Novel Drug Deliver y; By N.K.Jain, CBS Publishers and Distributors, New Delhi, First edition, 1997 (reprint in 2001).
3. Controlled Drug Delivery - Concepts and Advances; By S.P.Vyas and R.K.Khar, Vallabh Prakashan, New Delhi, First edition, 2002.
4. Remington's Pharmaceutical Sciences.
5. Novel drug delivery system; By Y.M.Chien, Marcel Dekker, Inc.
6. Controlled Drug Delivery - Fundamentals and Applications, 2nd edition; By

Joseph R.Robinson and Vincent H.L. Lee.

7. Pharmaceutical Dosage forms, disperse system: Volume 1, By Herbert A.Liberma nn et.al, Marcel Dekker, Inc.

8. Pharmaceutical Dosage forms: Tablets Volume II, Herbert A.Libermann et.al, Marcer Dekker, Inc.

9. Bentley's Textbook of Pharmaceutics; By E.A.Rawline, ELBS Publications.

10. Microencapsulation and Related Drug Process; By Patric B.Deasy.

Course Outcomes :

- After completion of course students will be able to explain various drug delivery system.
- Targeting of drugs through nanoparticles.
- Biological factors influencing design and performance of SRDDS.
- Buccal drug delivery system.
- Formulation approaches used in development of T DDS.

EMCH-432: Synthetic Methods in Organic Chemistry (60 Lectures) Credits - 4

Course Objectives: The students should

1. Understand synthetic strategies and retro synthesis
2. Apply them for synthesis of new molecules
3. Use different protection and deprotection techniques
4. Know enamines and their applications

Course Contents:

1.Umpolung in organic synthesis.

2. Synthetic Strategies I

Synthetic Strategies; Introduction, Terminology: target, synthon, synthetic equivalent, functional group interconversion (FGI), functional group addition, functional group elimination.Criteria for selection of target. Linear and convergent synthesis. Retrosynthetic analysis and synthesis involving chemoselectivity, regioselectivity, reversal of polarity and cyclizations. .Order of events in synthesis by retrosynthetic approach, explanation with examples Ssalbutamol, Propoxycaine and Dinocap. Introduction to one group C-C and C-X disconnections. One group C-C disconnections, Alcohols and carbonyl compounds. One group C-X disconnections, Carbonyl compounds, alcohols, ethers and sulphides.

3. Synthetic Strategies II

Introduction to two group C-C and C-X disconnections, Two group C-X disconnections; 1,1-difunctionalised, 1,2-difunctionalised and 1,3-difunctionalised compounds. Two group C-C disconnections; Diels-Alder reaction, 1,3-difunctionalised compounds, 1,5- difunctionalised compounds, Michael addition and Robinson annulation. Control in carbonyl condensations, explanation with examples oxanamide and mevalonic acid. Strategic bond: definition, choosing disconnection/ guidelines for disconnection; disconnection of C-X bonds, disconnect to greatest simplification, using symmetry in disconnection, disconnection corresponding to known reliable reaction, high yielding steps and recognizable starting materials. Other approaches to retro.

4. .Protecting and deprotecting groups for hydroxyl, amino carboxyl and aldehyde functions as illustrated in the synthesis of polypeptide and polynucleotide.peptide synthesis: actiation coupling, reversible blocking of amino and carboxylic groups, solid phase peptide synthesis.

5.Enamines in organic synthesis.

Home assignment:New Synthetic reactions

1. Metal mediated C-C and C-X coupling reactions: Suzuki, Heck, Stille, Sonogishira cross
coupling, Buchwald-Hartwig and Negishi-Kumada coupling reactions.
2. C=C Formation Reactions: Shapiro, Bamford-Stevens, McMurrey reactions, Julia-Lythgoe
olefination and Peterson's stereoselective olefination.
3. Multicomponent Reactions: Ugi, Passerini, Biginelli, Hantzsch and Mannich reactions.
4. Ring Formation Reactions: Pausan-Khand reaction, Bergman cyclisation, Nazerov cyclisation.
5. Click Chemistry: Criteria for Click reaction, Sharpless azides cycloadditions.
6.Metathesis: Grubb's 1st and 2nd generation catalyst, Olefin cross coupling metathesis(OCM),
ring closing metathesis(RCM), ring opening metathesis(ROM), applications.
7. Other important synthetic reactions: Baylis-Hilman reaction, Eschenmoser-Tanabe fragmentation, Mitsunobu reaction, .

Books:

1. Modern synthetic reactions By – H. O. House and Benjamin.
2. Organic Chemistry By – Clayden, Greeves, Warren and Wothers (Oxford press).
3. Designing organic synthesis by S. Warren (Wiley).
4. Some Modern methods of organic synthesis by – W. Carruthers (Cambridge)
5. Organic synthesis by – M. B. Smith
6. Organometallics in organic synthesis by – J. M. Swan and D. C. Black (Chapman and Hall).

Course Outcomes : The learner would be able to

1. Perform Retrosynthesis of a given molecule.
2. Design synthesis using suitable building blocks.
3. Confirm the product structure.
4. Apply enamines in organic synthesis.

OPCH-411: Radiation Chemistry Credits- 4 (60 contact hours)

Course Objectives:

- To understand the concepts of radiation chemistry
- To study and understand the nuclear reactions and reactors
- To understand the elements of radiation chemistry
- To understand effects of radiation on matter
- To understand the applications of radioisotopes in different fields

Course contents:

1. Radioactivity and radioactive decay

Introduction, neutron-proton ratio and nuclear stability, nuclear stability and binding energy, various modes of decay, natural radioactivity, successive radioactivity decay, growth kinetics, radioactive equilibrium, half life, half life of mixed radioisotopes, decay scheme, its determination by experimental methods decay kinetics, units of radioactivity, parent daughter growth relationship.

2. Nuclear Reactions and Reactors

Nuclear Reactions: Definition and Bethes notation, threshold energy of nuclear reaction, energetic of nuclear reactions, conservation in nuclear reactions, conservation of protons and neutrons, conservation of momentum and conservation of energy, various types nuclear reactions, special nuclear reactions, photonuclear, thermonuclear reaction.

Nuclear Reactors: Three stage nuclear program of India, mass and charge distribution, release of energy and neutrons, spontaneous fission, nuclear reactors and their use for power production, Thermal and fast breeder nuclear reactors, nuclear fusion.

3. Interaction of radiations with matter and detectors

Interaction of gamma radiation with matter by photoelectric, Crompton and pair production, Interaction of beta particles, neutrons and heavy charged particles with matter. Units of measuring radiation absorption.

Gas filled counter, Ionization chamber, Proportional and G. M. Counter, Scintillation counter, and solid state detector Ge(Li), Si(Li) and HPGe.

4. Effects of radiation on matter

Measurement of dose, units of dose, chemical dosimeter (Fricke dosimeter and Ceric sulphate dosimeter), experimental determination of dose, radiolysis of water and aqueous solution, redox reactions due to irradiated crystals, radiation induced colour centers in crystal, radiation effect on organic compound, polymer and nitrate, Thermoluminence.

5. Application of radioactivity

Typical reactions involved in the preparation of radioisotopes: Scillard Chalmers reactions. Typical application of radioisotopes as tracers in: Chemical investigation, physio-chemical research, analytical applications, medical applications, agricultural applications, industrial applications, radioisotopes as a source of electricity and carbon dating.

Home assignment:

a) Discovery of radioactivity, properties of nucleons and nuclei, nuclear models, shell model, liquid drop model, Fermi gas model, collective model and optical model b) Nuclear fusion and nuclear fission c) Nuclear reactors, classification of nuclear reactors and waste management d) detection and measurement of radioactivity, ionization chamber, GM counter.

Recommended study materials (BOOKS):

1. Source of atomic energy, S. Glasstone, D. Van Nestrated Co. Inc.
2. Essentials of Nuclear Chemistry, H. J. Arnikar, New Age International P. Ltd
3. Introduction to Nuclear Physics and Chemistry, B. G. Harvey.
4. Nuclear Chemistry, M. G. Arora & M. Singh Anmol Publications.
5. Elements of Nuclear Chemistry, A. K. Srivastav, P. C. Jain, S. Chand & Co.
6. A Text book of nuclear chemistry, C. V. Shekar, Eminent publications & Distributions, New Delhi.
7. Radiochemistry & Nuclear Chemistry, G. R. Chpppin, J. Liljenzin, J. Rydberg, Butterwerth-Heinemann.
8. Nuclear chemistry, M. N. Shastri.
9. Modern Nuclear Chemistry, W. Loveland, DJ Morrissey, GT Seaborg, John Wiley and Sons.

Course Outcomes:

- The student will be able to understand the different concepts of radiation chemistry.

- The student can distinguish different nuclear reactions and explain construction and working of the nuclear reactor.
- The student will be able to describe the elements of radiation chemistry.
- The students will understand the details of the effects of radiation on matter
- The students will be able to discuss application of radioisotopes in different fields
- The students can apply their knowledge in the nuclear reactions if selected in such institutions.